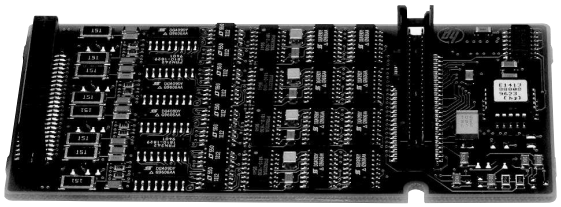
Agilent E1501A, E1502A, E1503A, E1508A, E1509A, E1512A, E1513A 8-Channel Voltage Input SCPs

Data Sheet

- **Different signal gains to match different input signal levels**
- **Signal filtering to reduce sensor-based noise**
- **SCPs provide over-voltage protection**
- **SCPs provide open transducer detection**
- **Use any of these SCPs with the Agilent E1413C/E1415A/ E1419A/E1422A Scanning A/Ds**



Agilent E1503

Description

You can choose different Signal Conditioning Plug-ons (SCPs) for different groups of signals, based on the signal levels and characteristics. Each SCP is optimized for different input levels, and some of these SCPs have filtering to reduce sensor-based noise. Each SCP has eight input channels. Multiple SCPs can be combined on the Scanning A/D to provide the proper signal conditioning for a wide variety of inputs. Each of these SCPs provides input over-voltage protection. Each SCP, except for the E1513A, provides open transducer detection on each channel.

Measurement applications of these SCPs include voltage, temperature, resistance, and strain measurements, and general measurements of voltage output sensors.

Refer to the Agilent Technologies Website for recent product updates, if applicable.

Agilent E1501A	Direct Input
Agilent E1502A	7 Hz Low-Pass Filter
Agilent E1503A	Programmable Filter/Gain
Agilent E1508A	x16 Gain & 7 Hz Low-Pass Filter
Agilent E1509A	x64 Gain & 7 Hz Low-Pass Filter
Agilent E1512A	25 Hz Low-Pass Filter
Agilent E1513A	Divide-by-16 Attenuator & 7 Hz Low-Pass Filter

Agilent Technologies

Voltage Input SCP Selection Guide

E1501A Direct Input (>100 kHz BW) SCP	**•provides eight hardwired paths that directly connect the input signal to the FET MUX of the scanning A/D (the most basic SCP)**
E1502A 8-Channel Low-Pass Filter SCP	**•provides eight fixed, 2-pole, low-pass filters with a 3 dB cutoff frequency of 7 Hz**
E1503A 8-Channel Programmable Filter/Gain SCP	**•provides eight programmable, 2-pole, low-pass filters with cutoff frequency settings of 2, 10, and 100 Hz, as well as a 1.5 kHz "pass-through" mode (filter OFF)•eight programmable input amplifiers provide input voltage ranges of ±0.25 V, ±2 V, and ±16 V**
E1508A 8-Channel x16 Gain & 7 Hz Fixed Filter SCP	**•provides eight fixed, 2-pole, low-pass filters with a 3 dB cutoff frequency of 7 Hz •eight amplifiers with a fixed gain of 16**
E1509A 8-Channel x64 Gain & 7 Hz Fixed Filter SCP	**•provides eight fixed low-pass filters with a 3 dB cutoff frequency of 7 Hz •eight amplifiers with a fixed gain of 64**
E1512A 8-Channel 25 Hz Fixed Filter SCP	**•provides eight fixed low-pass filters with a 3 dB cutoff frequency of 25 Hz (no gain)**
E1513A 8-Channel ÷ 16 Attenuator & 7 Hz Fixed Filter SCP	**•provides eight fixed low-pass filters with a 3 dB cutoff frequency of 7 Hz •eight attenuators with a fixed attenuation of 16**

Use the E1501/02/03/08/09/12/13A SCPs with the following VXI modules:

Model	Description
E1413C	64-Channel Scanning A/D Converter
E1415A	Algorithmic Closed Loop Controller
E1419A	Multifunction Measurement and Control Module (only in SCP positions 5 - 8)
E1422A	Remote Channel Multi-function DAC Module

Voltage Measurements

Each SCP is optimized for different input voltage levels, with some SCPs providing filtering to reduce sensor-based noise.

E1501A	Measure wide bandwidth signals (no filtering, no gain) from sensors with full-scale voltage outputs from 62 mV to 16 V.
E1502A	Measure signals from sensors with full-scale voltage outputs from 62 mV to 16 V. Fixed 2-pole, 7 Hz low-pass filter (no gain) per channel.
E1503A	Measure signals from sensors with full-scale voltage outputs from 3.9 mV to 16 V. Programmable 2-pole, low-pass filters (3 dB BWs of 2, 10, or 100 Hz) can be switched into each channel. Each channel can have a gain of x1, x8, or x64.
E1508A	Measure signals from sensors with full-scale voltage outputs from 3.9 mV to 1 V. Fixed 2-pole 7 Hz low-pass filter and x16 gain per channel.
E1509A	Measure signals from sensors with full-scale voltage outputs from 3.9 mV to 256 mV. Fixed 2-pole, 7 Hz low-pass filter and x64 gain per channel.
E1512A	Measure signals from sensors with full-scale voltage outputs from 62 mV to 16 V. Fixed 2-pole, 25 Hz low-pass filter (no gain) per channel.
E1513A	Measure voltages from ±1 Vdc to ±60 Vdc. Fixed ÷ 16 attenuator and fixed 2-pole, 7 Hz low-pass filter per channel.

Temperature Measurements

The E1501/02/03/08/09/12A can be used to make temperature measurements with thermocouples, thermistors, or RTDs. Engineering units conversion to degrees C are made on-card at full speed. While the E1501/02/12A can directly read thermocouples, the E1503A/E1508A/E1509A SCPs provide higher accuracy thermocouple measurements due their on-board signal gain. **(Note:** The 256 mV maximum voltage input of the E1509A is not high enough to measure the on-board thermistor reference temperature. A higher-voltage SCP must be used for this thermistor measurement.)

Temperature measurements with thermistors or RTDs require one E1505A 8-Channel Current Source SCP to be used with each voltage input SCP. The E1513A is not recommended for temperature measurements with low-output-level transducers such as thermocouples, thermistors, and RTDs.

Resistance Measurements

Resistance is measured using the E1505A Current Source SCP with the E1501/02/03/08/09/12A SCPs. Measurements are made by applying a dc current to the unknown and measuring the voltage drop across the unknown resistance. The current source is provided through the E1505A. The recommended 4-wire Ω configuration is shown in the description of the E1505A Current Source SCP. Two-wire measurements are possible but not recommended since two 150 Ω series resistors protecting the scanning A/D's input FET multiplexer are included in the measurements.

Strain Measurements

These SCPs can be used to make strain measurements when combined with either the E1506A or E1507A Strain Completion SCPs. While the E1501/02/12A SCPs can be used for strain gage measurements, the E1503A, E1508A and E1509A SCPs provide higher accuracy strain measurements due to their on-board signal gain.

Product Specifications

These specifications for the E1501/02/03/08/09/12/13A reflect the combined performance of the scanning A/D and the E1501/02/03/08/09/12/13A SCP.

Measurement Ranges

dc Volts:	
E1501/02/12A:	±62.5 mV to ±16 V full scale
E1503A:	±3.9 mV to ±16 V full scale
E1508A:	±3.9 mV to ±1 V full scale
E1509A:	±3.9 mV to ±256 mV full scale
E1513A:	±1 V to ±60 V full scale
Resistance:*	
E1501A:	512 Ω to 131 kΩ FS
E1502/09/12A:	128 Ω to 131 kΩ FS
E1503A:	8 Ω to 131 kΩ FS
E1508A:	8 Ω to 32.7 kΩ FS
Temperature:	
Thermocouples:	-200 to +1700° C
Thermistors:*	-80 to +160° C
RTDs:*	-200 to +850° C
Strain:**	25,000 με or limit of linear range of strain gage

* Requires Agilent E1505A.
** Requires Agilent E1506A/E1507A

Input Characteristics

Maximum input voltage (normal mode plus common mode):	
Operating:	<±16 V peak (E1513A: ±60 Vdc)
Damage level:	>±42 V peak (E1513A: ±60 Vdc*)
Maximum common mode voltage	
Operating:	<±16 V peak (E1513A: ±60 Vdc)
Damage level:	>±42 V peak (E1513A: ±60 Vdc*) (* 60 Vdc is the max. voltage allowed by Agilent safety guidelines for the SCP connector pin spacing at max. operating temperature and humidity.)
Normal mode rejection:	
E1501A:	0 dB
E1502/08A (10 Hz LPF) 10 Hz:	-6 dB
E1502/08A (10 Hz LPF) 50 Hz:	> -23 dB
E1502/08A (10 Hz LPF) 60 Hz:	> -25 dB
E1512A (25 Hz LPF) 25 Hz:	-3 dB
E1512A (25 Hz LPF) 60 Hz:	> -20 dB
E1513A (7 Hz LPF) 7 Hz:	-3 dB
E1513A (7 Hz LPF) 50 Hz:	> -24 dB
E1513A (7 Hz LPF) 60 Hz:	> -27 dB
Common mode rejection, 0 to 60 Hz:	
E1501A:	> -105 dB
E1502/08/12A min.:	> -100 dB
E1502/08/12A typ.:	> -108 dB
E1503A Gain x1:	> -100 dB
E1503A Gain x8:	> -116 dB
E1503A Gain x64:	> -132 dB
E1509A:	> -100 dB
E1513A:	> -60 dB
Input impedance:	> 100 MΩ differential (E1513A: 1 MΩ differential)
Input capacitance:	
E1501A:	80 pF typical

Measurement Accuracy dc Volts

Total dc Voltage Error =
$[(\text{Linearity error})^2 + (\text{Offset error})^2 + (\text{Noise})^2]^{1/2}$

- For the E1501/02/03/08/09/12A, if autoranging is ON, add ± .02% of Full Scale to accuracy specifications.
- For the E1513A, if autoranging is ON, add ± .05% of reading for input voltages > ±4 Vdc.

E1501A (x1 Gain)

A/D Range ±V FS	Linearity % of Reading	Offset Error	Noise 3σ	Noise* 3σ
.0625	0.01%	5.3 μV	18 μV	8 μV
.25	0.01%	10.3 μV	45 μV	24 μV
1	0.01%	31 μV	110 μV	90 μV
4	0.01%	122 μV	450 μV	366 μV
16	0.01%	488 μV	1.8 mV	1.5 mV

* A/D filter ON (min sample period ≥145 μs; ≤100 Hz scan rate 64 ch).

Temperature Coefficients

	Temp Range	Tempco
Gain:		10 ppm/° C
Offset:	0-40° C	0.14 µV/° C
	40-55° C	0.38 µV/° C + 0.8 µV

E1502A/E1512A (x1 Gain)

A/D Range ±V FS	Linearity % of Reading	Offset Error	Noise 3σ	Noise* 3σ
.0625	0.01%	7.2 µV	34 µV	15 µV
.25	0.01%	12.2 µV	60 µV	28 µV
1	0.01%	33 µV	110 µV	92 µV
4	0.01%	122 µV	450 µV	366 µV
16	0.01%	488 µV	1.8 mV	1.5 mV

* A/D filter ON (min sample period ≥145 µs; ≤100 Hz scan rate 64 ch).

Temperature Coefficients

	Temp Range	Tempco
Gain:		10 ppm/° C
Offset:	0-30° C	No added error
	30-40° C	0.1 µV/° C
	40-55° C	0.27 µV/° C + 2.4 µV + 2.4 µV

E1503A (x1 Gain)

A/D Range ±V FS	Linearity % of Reading	Offset Error				Noise 3σ	Noise* 3σ
		2 Hz	10 Hz	100 Hz	Filt Off		
.0625	0.01%	13µV	9.5 µV	6.8 µV	6.3 µV	45 µV	26 µV
.25	0.01%	15 µV	12.5 µV	11.2 µV	10.8 µV	63 µV	31 µV
1	0.01%	33 µV	31.8 µV	31.3 µV	31.2 µV	112 µV	93 µV
4	0.01%	123 µV	122 µV	122 µV	122 µV	450 µV	366 µV
16	0.01%	488 µV	488 µV	488 µV	488 µV	1.8 mV	1.5 mV

*A/D filter ON (min sample period ≥145 µs; ≤100 Hz scan rate 64 ch).

Temperature Coefficients

For offset, add Tempco and fixed offset to the offset above.

	Temp Range	Tempco	2 Hz	10 Hz	100 Hz	Filt Off
Gain:		15 ppm/° C				
Offset:	0-30° C	0.16 µV/° C	0 µV	0 µV	0 µV	0 µV
	30-40° C	0.18 µV/° C	13 µV	9 µV	1.1 µV	0.2 µV
	40-55° C	0.39 µV/° C	31 µV	22 µV	6.4 µV	1.1 µV

E1503A (x8 Gain)

A/D Range ±V FS	Linearity % of Reading	Offset Error				Noise 3σ	Noise* 3σ
		2 Hz	10 Hz	100 Hz	Filt Off		
.0078	0.01%	4.6 µV	4.2 µV	3.8 µV	3.7 µV	5.8 µV	4.9 µV
.031	0.01%	4.8 µV	4.6 µV	4.4 µV	4.3 µV	6.9 µV**	5.9 µV**
.125	0.01%	6 µV	5.3 µV	5 µV	4.9 µV	14 µV	12 µV
.5	0.01%	16 µV	16 µV	16 µV	16 µV	56 µV	46 µV
2	0.01%	61 µV	61 µV	61 µV	61 µV	225 µV	188 µV

*A/D filter ON (min sample period ≥145 µs; ≤100 Hz scan rate 64 ch).
** 7.4 µV and 6.3 µV when temperature ≥40° C

Temperature Coefficients

For offset, add Tempco and fixed offset to the offset above.

	Temp Range	Tempco	2 Hz	10 Hz	100 Hz	Filt Off
Gain:		15 ppm/° C				
Offset:	0-30° C	0.16 µV/° C	0 µV	0 µV	0 µV	0 µV
	30-40° C	0.18 µV/° C	4.3 µV	2.7 µV	1 µV	0.2 µV
	40-55° C	0.39 µV/° C	13 µV	10 µV	6.2 µV	0.8 µV

E1503A (x64 Gain)

A/D Range ±V FS	Linearity % of Reading	Offset Error				Noise 3σ	Noise* 3σ
		2 Hz	10 Hz	100 Hz	Filt Off		
.0039	0.01%	2.9 µV	2.3 µV	2.1 µV	2.1 µV	1.6 µV**	1.3 µV**
.0156	0.01%	3 µV	2.4 µV	2.2 µV	2.2 µV	2.2 µV***	1.9 µV***
.0625	0.01%	3.5 µV	3 µV	2.9 µV	2.9 µV	7 µV	5.7 µV
.25	0.01%	8.2 µV	8 µV	8 µV	8 µV	28 µV	23 µV

*A/D filter ON (min sample period ≥145 µs; ≤100 Hz scan rate 64 ch).
** 1.9 µV and 1.7 µV for 100 Hz filter
*** 2.5 µV and 2.2 µV when temperature ≥40° C

Temperature Coefficients

For offset, add Tempco and fixed offset to the offset above

	Temp Range	Tempco	2 Hz	10 Hz	100 Hz	Filt Off
Gain:		15 ppm/° C				
Offset:	0-30° C	0.16 µV/° C	0 µV	0 µV	0 µV	0 µV
	30-40° C	0.18 µV/° C	1.1 µV	0.2 µV	0.1 µV	0.1 µV
	40-55° C	0.39 µV/° C	6 µV	1.4 µV	0.6 µV	0.6 µV

E1508A (x16 Gain)

Fixed Gain x16 Range ±V FS	Linearity % of Reading	Offset Error	Noise 3σ	Noise* 3σ
.0039	0.01%	3.8 μV	3.4 μV	2.9 μV
.0156	0.01%	4.2 μV	4.4 μV	3.8 μV
.0625	0.01%	4.9 μV	7.5 μV	6.3 μV
.256	0.01%	8 μV	28 μV	23 μV
1.0	0.01%	31 μV	113 μV	64 μV

*A/D filter ON (min sample period ≥145 μs; ≤100 Hz scan rate 64 ch).

Temperature Coefficients

	Temp Range	Tempco
Gain:		15 ppm/° C
Offset:	0-30° C	0.16 μV/° C
	30-40° C	0.18 μV/° C
	40-55° C	0.39 μV/° C

E1509A (x64 Gain)

Fixed Gain x64 Range ±V FS	Linearity % of Reading	Offset Error	Noise 3σ	Noise* 3σ
.0039	0.01%	2.3 μV	1.7 μV	1.4 μV
.0156	0.01%	2.4 μV	2.5 μV	2.2 μV
.0625	0.01%	3.0 μV	7.0 μV	5.7 μV
.256	0.01%	8.0 μV	28 μV	23 μV

*A/D filter ON (min sample period ≥145 μs; ≤100 Hz scan rate 64 ch).

Temperature Coefficients

	Temp Range	Tempco
Gain:		15 ppm/° C
Offset:	0-30° C	0.16 μV/° C
	30-40° C	0.18 μV/° C
	40-55° C	0.39 μV/° C

E1513A (÷16 Attenuation)

A/D Range ±V FS	Linearity % of Reading	Common Mode Error % of Vcm	Offset Error	Noise 3σ	Noise* 3σ
0.0625** (1 V)	0.02%	0.1%	100 μV	700 μV	280 μV
0.25** (4 V)	0.02%	0.1%	175 μV	860 μV	430 μV
1 (16 V)	0.02%	0.1%	500 μV	1.8 mV	1.4 mV
4 (60 V)	0.02%	0.1%	1.95 mV	7.0 mV	5.8 mV

*A/D filter ON (min sample period ≥145 μs; ≤100 Hz scan rate 64 ch).
** These ranges are not recommended.

Temperature Coefficients

	Temp Range	Tempco
Gain:		0.001/° C
Offset:	0-40° C	0.14 mV/° C
	40-55° C	0.8 mV +0.38 mV/° C

Maximum Tare Cal Offset

This is the maximum voltage offset the effect of which can be eliminated by the Tare Cal D/A on the Scanning A/D. Maximum tare cal offset depends on A/D range and SCP gain.

A/D Range ±V FS	E1501A E1502A E1503A E1512A	E1503A	E1508A	E1503A E1509A	E1513A
	Gain x1	Gain x8	Gain x16	Gain x64	Atten ÷16
0.0625V	0.03792V	0.00312V	0.00112V	n/a	0.606V
0.25V	0.07581V	0.00786V	0.00349V	0.00055V	1.212V
1V	0.23061V	0.02721V	0.01317V	0.00297V	3.689V
4V	0.82101V	0.10101V	0.05007V	0.01220V	13.13V
16V	3.2213V	0.40104V	0.20009V	0.04970V	49.95V

Temperature Measurement Accuracy

The thermocouple graphs and tables following this description include the errors due to measuring the voltage output of the thermocouple, and the algorithm errors due to converting the thermocouple voltage to temperature; this is the Measurement/Conversion Error (MCE). To this error the Reference Junction Measurement Error (RJME) must be added due to measuring the reference junction temperature with an RTD or thermistor (this measurement requires an E1505A). Also, the Isothermal Reference Gradient Errors (IRGE) must be added due to gradients across the isothermal reference. If an external isothermal reference panel is used, consult the manufacturer's specifications. If Agilent terminal blocks are used as the isothermal reference, see the notes below.

$$\text{Total Temperature Error} = [(\text{MCE})^2 + (\text{RJME})^2 + (\text{IRGE})^2]^{1/2}$$

The following temperature accuracy graphs and tables include instrument and firmware linearization errors. The linearization algorithm used is based on the ITS-90 transducer curves. Add your transducer accuracy to determine total measurement error.

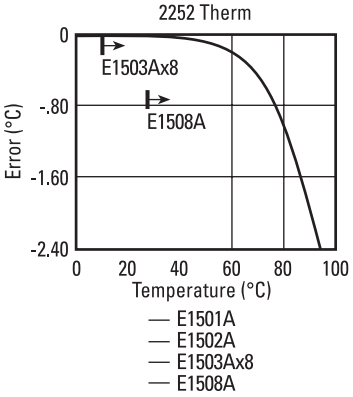
Most of the following temperature accuracy graphs and tables show the Measurement Conversion Error (MCE) for the applicable combination of SCP and transducer. The graphs and tables marked "REF" show the Reference Junction Measurement Error (RJME) for the combination of SCP and either Thermistor or RTD reference junction measurement.

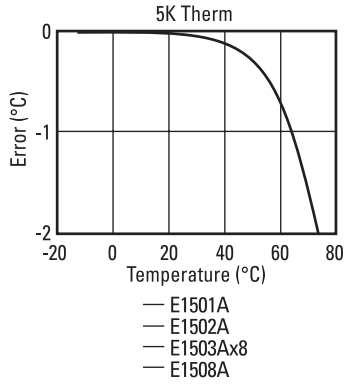
All specifications for the following graphs are with the A/D filter off.

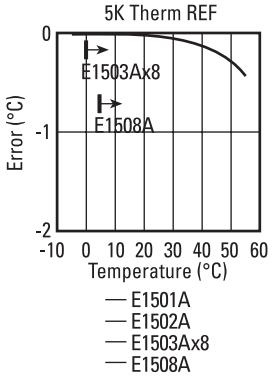
For Isothermal Reference Gradient Errors (IRGE), use the following guidelines.

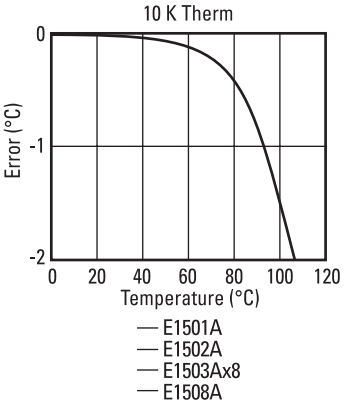
1. When using the Terminal Block as the isothermal reference, add ±0.6° C to the thermocouple accuracy specs to account for temperature gradients across the Terminal Block. The ambient temperature of the air surrounding the Terminal Block must be within ±2° C of the temperature of the inlet cooling air to the VXI mainframe.

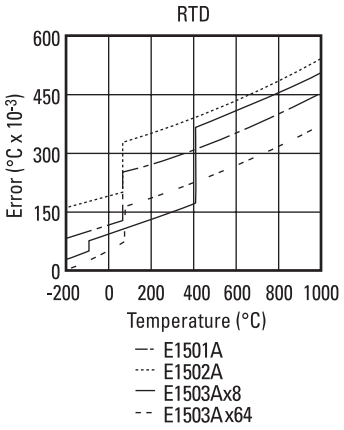
2. When using the Agilent E1586A Rack Mount Terminal Panel as the isothermal reference, add ±0.2° C to the thermocouple accuracy specs to account for temperature gradients across the E1586A. The E1586A should be mounted in the bottom part of the rack, below and away from other heat sources, for best performance.

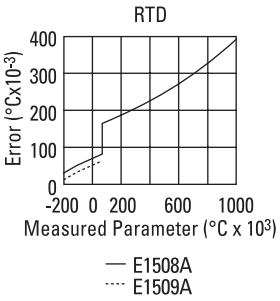


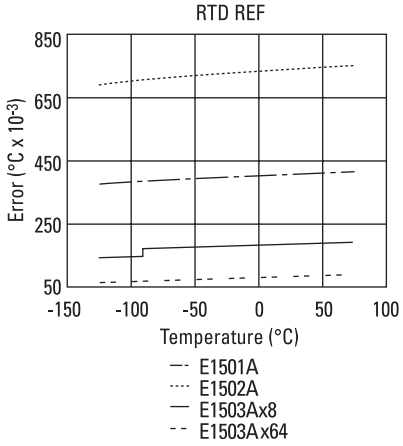


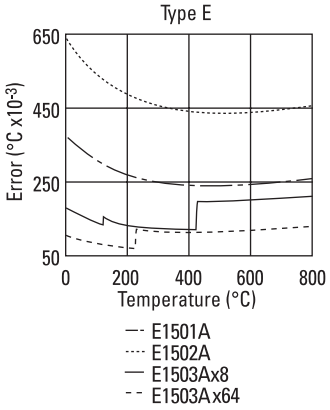


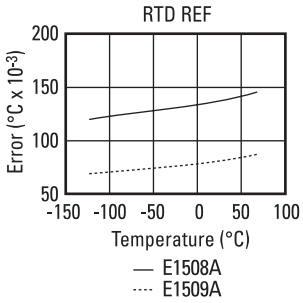


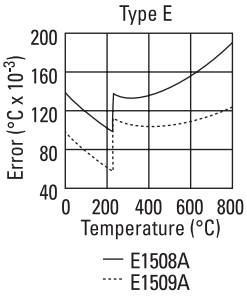





RTD REF
Error (°C x 10-3)
850
650
450
250
50
-150 -100 -50 0 50 100
Temperature (°C)
E1501A
E1502A
E1503Ax8
E1503Ax64


Type E
Error (°C x10-3)
650
450
250
50
0 200 400 600 800
Temperature (°C)
E1501A
E1502A
E1503Ax8
E1503Ax64


RTD REF
Error (°C x 10-3)
200
150
100
50
-150 -100 -50 0 50 100
Temperature (°C)
E1508A
E1509A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Error (°C x 10-3)
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120
80
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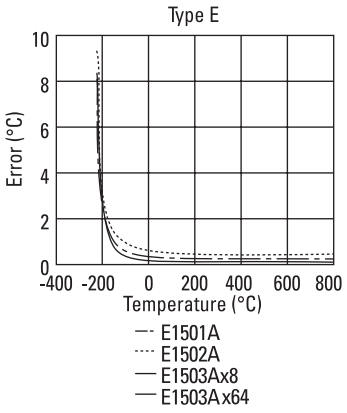
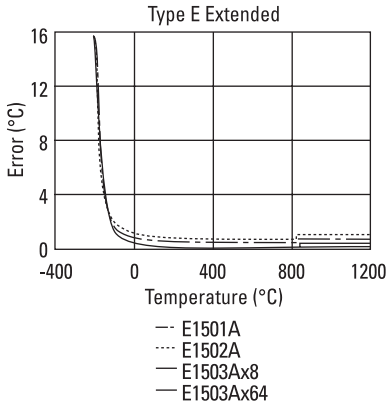
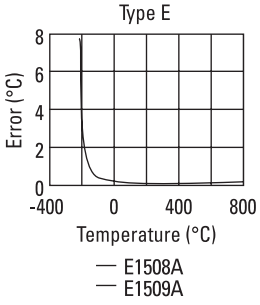
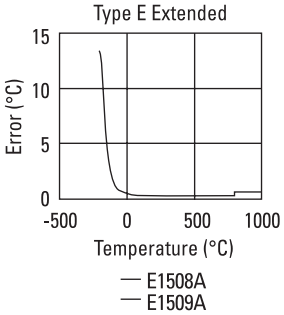
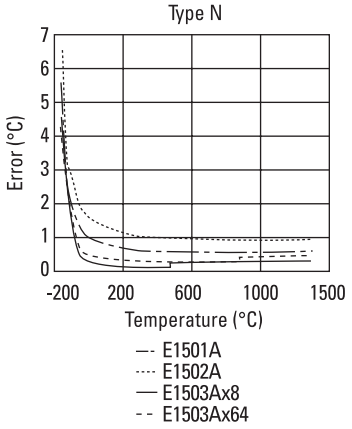
Temperature (°C)
E1508A
E1509A

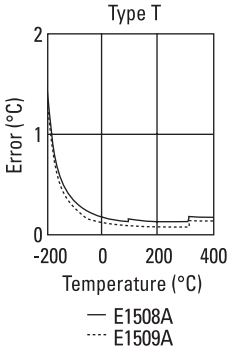

Type E
Error (°C)
10
8
6
4
2
0
-400 -200 0 200 400 600 800
Temperature (°C)
E1501A
E1502A
E1503Ax8
E1503Ax64

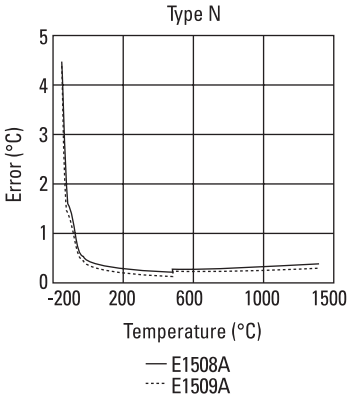

Type E Extended
Error (°C)
16
12
8
4
0
-400 0 400 800 1200
Temperature (°C)
E1501A
E1502A
E1503Ax8
E1503Ax64

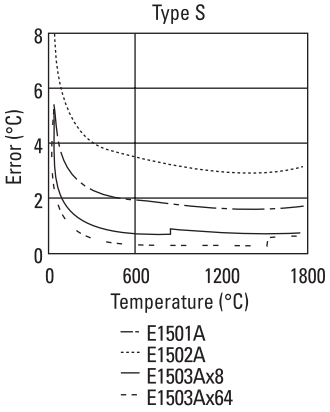

Type E
Error (°C)
8
6
4
2
0
-400 0 400 800
Temperature (°C)
E1508A
E1509A

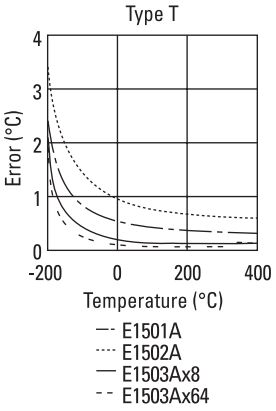

Type E Extended
Error (°C)
15
10
5
0
-500 0 500 1000
Temperature (°C)
E1508A
E1509A

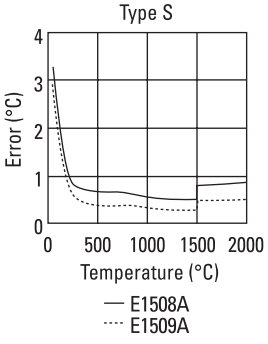

Type N
Error (°C)
7
6
5
4
3
2
1
0
-200
200
600
1000
1500
Temperature (°C)
E1501A
E1502A
E1503Ax8
E1503Ax64

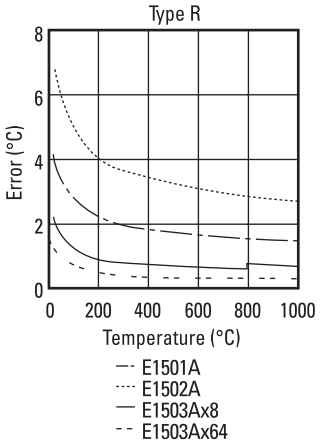

Type T
Error (°C)
2
1
0
-200
0
200
400
Temperature (°C)
E1508A
E1509A

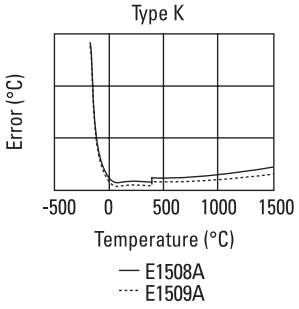

Type N
Error (°C)
5
4
3
2
1
0
-200
200
600
1000
1500
Temperature (°C)
E1508A
E1509A

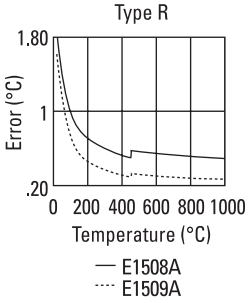

Type S
Error (°C)
8
6
4
2
0
0
600
1200
1800
Temperature (°C)
E1501A
E1502A
E1503Ax8
E1503Ax64

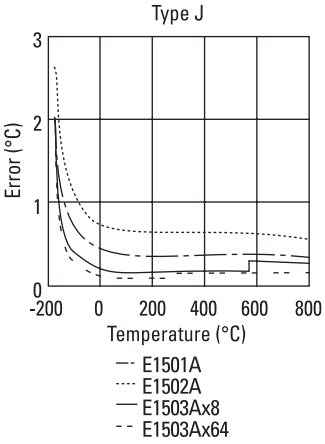

Type T
Error (°C)
4
3
2
1
0
-200
0
200
400
Temperature (°C)
E1501A
E1502A
E1503Ax8
E1503Ax64

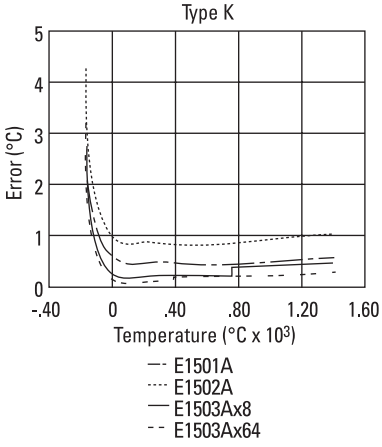

Type S
Error (°C)
4
3
2
1
0
0
500
1000
1500
2000
Temperature (°C)
E1508A
E1509A

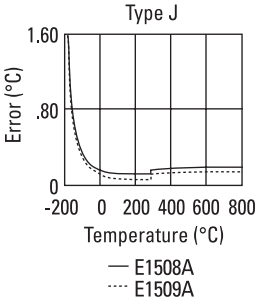

Type R
Error (°C)
8
6
4
2
0
0 200 400 600 800 1000
Temperature (°C)
E1501A
E1502A
E1503Ax8
E1503Ax64


Type K
Error (°C)
-500 0 500 1000 1500
Temperature (°C)
E1508A
E1509A


Type R
Error (°C)
1.80
1
.20
0 200 400 600 800 1000
Temperature (°C)
E1508A
E1509A


Type J
Error (°C)
3
2
1
0
-200 0 200 400 600 800
Temperature (°C)
E1501A
E1502A
E1503Ax8
E1503Ax64


Type K
Error (°C)
5
4
3
2
1
0
-.40 0 .40 .80 1.20 1.60
Temperature (°C x 10³)
E1501A
E1502A
E1503Ax8
E1503Ax64


Type J
Error (°C)
1.60
.80
0
-200 0 200 400 600 800
Temperature (°C)
E1508A
E1509A

E1512A Thermistor Measurement Accuracy

2252Ω

A/D Filter:	0 to 30° C	30 to 70° C	70 to 80° C	80 to 100° C:
OFF:	0.012° C	0.013° C	0.014° C	0.024° C
ON*:	0.010° C	0.012° C	0.010° C	0.014° C

5 kΩ

A/D Filter:	0 to 30° C	30 to 70° C	70 to 85° C:
OFF:	0.014° C	0.027° C	0.048° C
ON*:	0.011° C	0.017° C	0.027° C

5 kΩ Reference

A/D Filter:	-10 to 65° C	65 to 85° C:
OFF:	0.011° C	0.021° C
ON*:	0.0095° C	0.0115° C

10 kΩ

A/D Filter:	0 to 30° C	30 to 60° C	60 to 90° C	90 to 115° C:
OFF:	0.015° C	0.024° C	0.034° C	0.059° C
ON*:	0.013° C	0.016° C	0.021° C	0.032° C

E1512A RTD Measurement Accuracy

100Ω

A/D Filter:	-200 to 75° C	75 to 300° C	300 to 600° C	600 to 970° C
OFF:	0.19° C	0.37° C	0.43° C	0.53° C
ON*:	0.11° C	0.21° C	0.36° C	0.46° C

100Ω Reference

A/D Filter:	-125 to 75° C
OFF:	0.75° C
ON*:	0.36° C

E1512A Thermocouple Measurement Accuracy

Type E

A/D Filter:	-200 to 0° C	0 to 200° C	200 to 400° C	400 to 800° C
OFF:	2.25° C	0.65° C	0.50° C	0.45° C
ON*:	1.65° C	0.34° C	0.24° C	0.23° C

Type E Extended

A/D Filter:	-200 to 0° C	0 to 200° C	200 to 600° C	600 to 800° C
OFF:	14.7° C	0.80° C	0.50° C	0.80° C
ON*:	13.8° C	0.49° C	0.30° C	0.45° C

Type T

A/D Filter:	-200 to -100° C	-100 to 0° C	0 to 200° C	200 to 400° C
OFF:	3.40° C	1.90° C	0.90° C	0.70° C
ON*:	2.25° C	0.78° C	0.46° C	0.33° C

Type S

A/D Filter:	0 to 100° C	100 to 200° C	200 to 800° C	800 to 1750° C
OFF:	8.00° C	5.60° C	4.45° C	3.30° C
ON*:	5.20° C	3.25° C	2.40° C	1.60° C

Type R

A/D Filter:	0 to 100° C	100 to 200° C	200 to 600° C	600 to 1000° C
OFF:	6.90° C	5.00° C	4.00° C	3.10° C
ON*:	3.80° C	2.60° C	1.95° C	1.70° C

Type K

A/D Filter:	-200 to 0° C	0 to 400° C	400 to 800° C	800 to 1400° C
OFF:	4.30° C	0.90° C	0.85° C	1.10° C
ON*:	3.35° C	0.50° C	0.40° C	0.52° C

Type J

A/D Filter:	-200 to 0° C	0 to 200° C	200 to 600° C	600 to 775° C
OFF:	2.65° C	0.75° C	0.63° C	0.63° C
ON*:	2.00° C	0.38° C	0.32° C	0.32° C

* [SENSe:]FILTer[:LPASs][:STATe] ON (max scan rate > 100 rdgs/sec/channel)

Current Requirements (Amps)

	5 V typ	5 V max	24 V typ	24 V max	-24 V typ	-24 V max
E1501A:	0.01	0.01	0.006	0.01	0.006	0.01
E1502A:	0.01	0.01	0.015	0.02	0.015	0.02
E1503A:	0.01	0.01	0.04	0.06	0.04	0.06
E1508A:		0.01		0.02		0.02
E1509A:		0.01		0.02		0.02
E1512A:		0.01		0.02		0.02
E1513A:		0.0054		0.02		0.02

Ordering Information

Description	Product No.
8-Channel Direct Input SCP	E1501A
8-Channel 7 Hz Low-pass Filter SCP	E1502A
8-Channel Programmable Filter/Gain SCP	E1503A
8-Channel x16 Gain & 7 Hz Fixed Filter SCP	E1508A
8-Channel x64 Gain & 7 Hz Fixed Filter SCP	E1509A
8-Channel 25 Hz Fixed Filter SCP	E1512A
8-Channel ÷ 16 Fixed Attenuator & 7 Hz Low-pass Filter SCP	E1513A

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