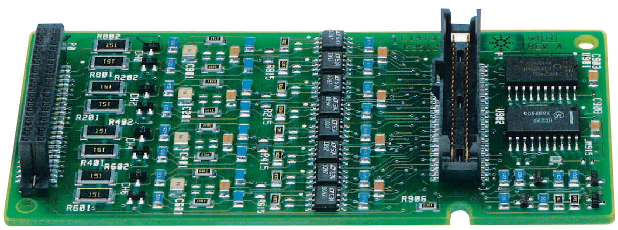
Agilent E1502A
8-Channel Low-Pass Filter SCP
Data Sheet

- Use with Agilent E1413C/E1415A/E1419A
- Fixed, 2-pole low-pass 7 Hz filter
- ± 16 V maximum sensor voltage with over-voltage protection
- Open transducer detection



Agilent E1502A

Description

The Agilent E1502A 8-Channel Low-Pass Filter SCP provides eight fixed, 2-pole, low-pass filters with a 3 dB cutoff frequency of 7 Hz. It also provides input over-voltage protection and open transducer detection on each channel.

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

Use the E1502A 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

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

Voltage Measurements

The E1502A is ideal for measuring signals from sensors with full-scale voltage outputs from 62 mV to 16 V. The 2-pole, low pass filter reduces sensor-based noise in the measurement.

Temperature Measurements

The E1502A can be used to make temperature measurements with thermocouples, thermistors, or RTDs. The E1502A can directly read thermocouples, however, the E1503A/E1508A/E1509A SCPs provide higher resolution thermocouple measurements.

Temperature measurements with thermistors or RTDs require the E1505A 8-Channel Current Source SCP. Engineering units conversion to degrees C are made on-card at full speed.

Resistance Measurements

Resistance is measured using the Agilent E1505A 8-Channel Current Source SCP with the E1502A SCP. Measurements are made by applying a dc current to the resistance and measuring the voltage drop across the unknown. The current source is provided through the E1505A. The recommended application is as shown here using 4-wire Ω connections. Two-wire Ω measurement is possible but not recommended since two 150 Ω series resistors protecting the input FET multiplexer are included in the measurement.

Strain Measurements

The E1502A can be used to make strain measurements when combined with either of the E1506A/E1507A Strain Completion SCPs. However, the E1503A, E1508A and E1509A SCPs provide higher accuracy strain measurements. Refer to the E1506A/E1507A *Technical Specifications* for more information.

Product Specifications

These specifications for the E1502A reflect the combined performance of the scanning A/D and the E1502A SCP.

Measurement Ranges

DC Volts:	± 62.5 mV to ± 16 V Full Scale
Temperature:	
Thermocouples:	–200 to + 1700 °C
Thermistors: *	–80 to + 160 °C
RTD's: *	–200 to + 850 °C
Resistance: *	128 Ω to 131K Ω FS
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
Damage level:	>± 42 V peak
Maximum common mode voltage:	
Operating:	<± 16 V peak
Damage level:	>± 42 V peak
Input impedance:	Greater than 100 MΩ differential

Maximum Tare Cal Offset

Maximum tare offset depends on A/D range and SCP gain.

A/D Range ±V F. Scale	Maximum Offset
16	3.2213
4	.82101
1	.23061
0.25	.07581
0.0625	.03792

Measurement Accuracy DC Volts

If autoranging is ON, add ± .02% FS to accuracy specifications.

A/D Range ±V F. Scale	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 additional error
	30-40 °C	0.1 µV/°C
	40-55 °C	0.27 µV/°C + 2.4 µV

Normal Mode Rejection

10 Hz LP filter:

10 Hz:	– 6 dB
50 Hz:	>– 23 dB
60 Hz:	>– 25 dB

Common Mode Rejection

0 to 60 Hz:

Typical:	>– 108 dB
Minimum:	>– 100 dB

Temperature Measurement Accuracy

The thermocouple graphs 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 or 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.

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

NOTES:

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.

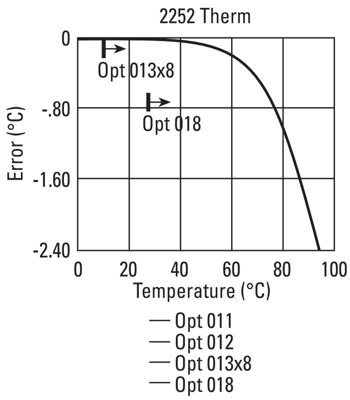
2) When using the Agilent E1586A Rack Mount Terminal Panel as the isothermal reference, add ± 0.2 °C to the thermocouple accuracy specs to account for temperature gradients across the E1586A. The E1586A should be mounted in the bottom part of the rack, below and away from other heat sources, for best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

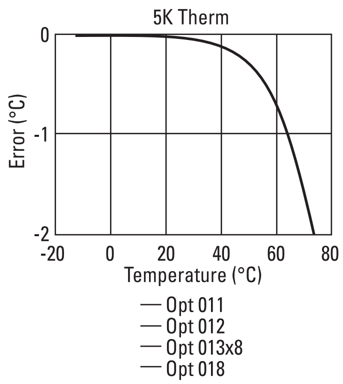
All specifications for the following were measured with the A/D filter off.

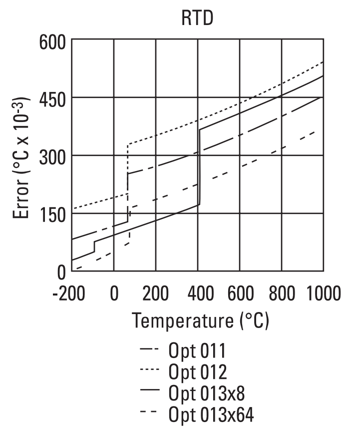
The following temperature accuracy graphs include instrument and firmware linearization errors. The linearization algorithm used is based on the ITS-90 transducer curves. Add your transducer accuracy to determine total measurement error.

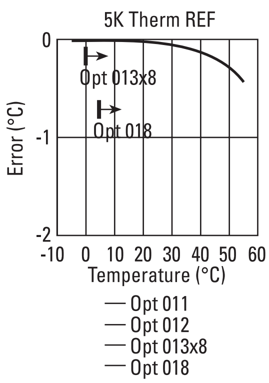
Conversion Chart

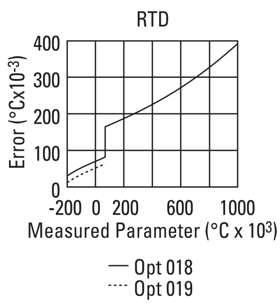
Opt 011	=	E1501A
Opt 012	=	E1502A
Opt 013	=	E1503A
Opt 015	=	E1505A
Opt 016	=	E1506A
Opt 017	=	E1507A
Opt 018	=	E1508A
Opt 019	=	E1509A
Opt 020	=	E1510A
Opt 021	=	E1511A

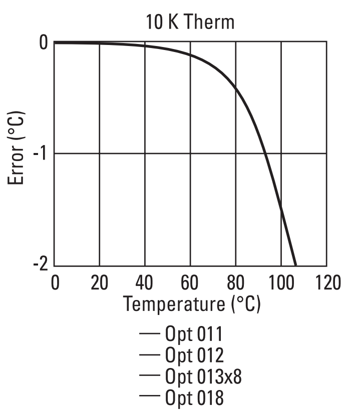


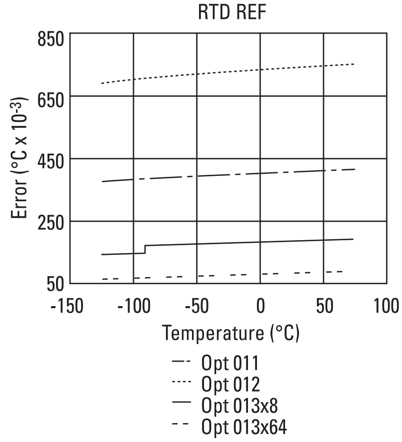

5K Therm
Error (°C)
0
-1
-2
-20
0
20
40
60
80
Temperature (°C)
— Opt 011
— Opt 012
— Opt 013x8
— Opt 018

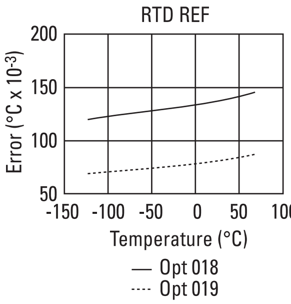

RTD
Error (°C x 10-3)
600
450
300
150
0
-200
0
200
400
600
800
1000
Temperature (°C)
Opt 011
Opt 012
Opt 013x8
Opt 013x64

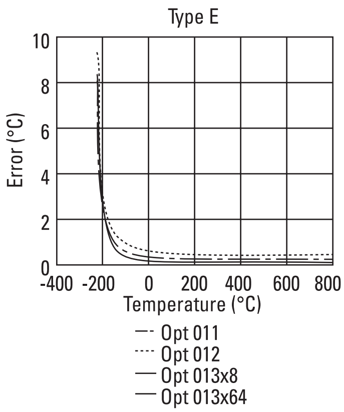

5K Therm REF
Error (°C)
0
-1
-2
Opt 013x8
Opt 018
-10
0
10
20
30
40
50
60
Temperature (°C)
— Opt 011
— Opt 012
— Opt 013x8
— Opt 018

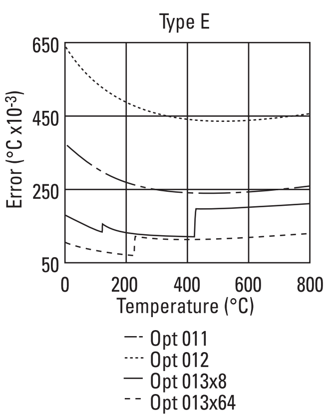

RTD
Error (°Cx10-3)
400
300
200
100
0
-200
0
200
600
1000
Measured Parameter (°C x 103)
— Opt 018
Opt 019

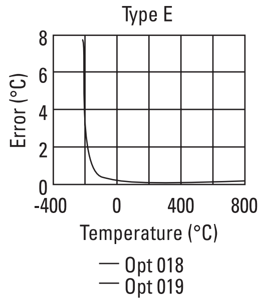

10 K Therm
Error (°C)
0
-1
-2
0
20
40
60
80
100
120
Temperature (°C)
— Opt 011
— Opt 012
— Opt 013x8
— Opt 018

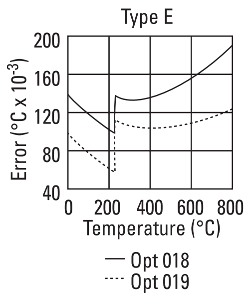

RTD REF
Error (°C x 10-3)
850
650
450
250
50
-150
-100
-50
0
50
100
Temperature (°C)
Opt 011
Opt 012
Opt 013x8
Opt 013x64

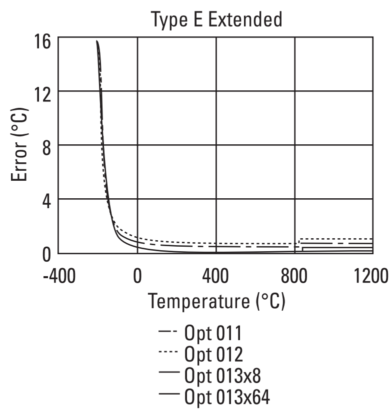

RTD REF
Error (°C x 10-3)
200
150
100
50
-150 -100 -50 0 50 100
Temperature (°C)
Opt 018
Opt 019

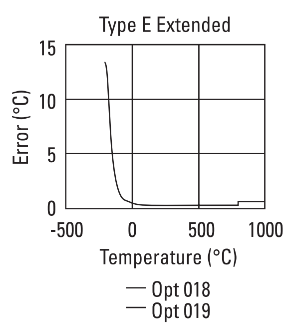

Type E
Error (°C)
10
8
6
4
2
0
-400 -200 0 200 400 600 800
Temperature (°C)
Opt 011
Opt 012
Opt 013x8
Opt 013x64

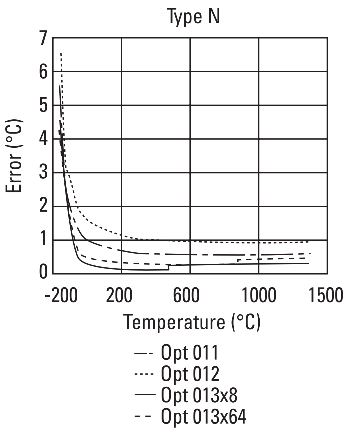

Type E
Error (°C x10-3)
650
450
250
50
0 200 400 600 800
Temperature (°C)
Opt 011
Opt 012
Opt 013x8
Opt 013x64

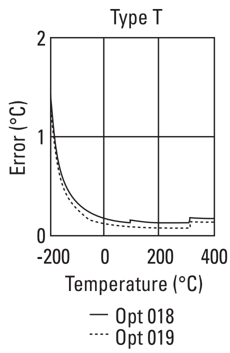

Type E
Error (°C)
8
6
4
2
0
-400 0 400 800
Temperature (°C)
Opt 018
Opt 019

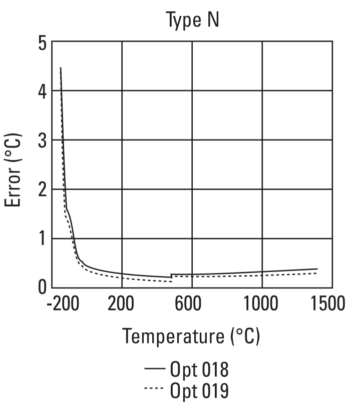

Type E
Error (°C x 10-3)
200
160
120
80
40
0 200 400 600 800
Temperature (°C)
Opt 018
Opt 019

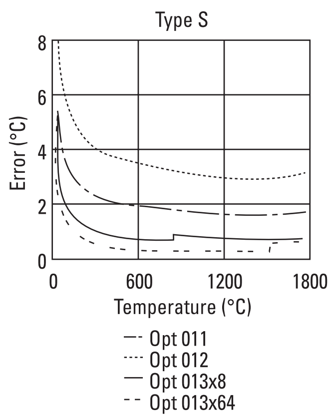

Type E Extended
Error (°C)
16
12
8
4
0
-400 0 400 800 1200
Temperature (°C)
Opt 011
Opt 012
Opt 013x8
Opt 013x64

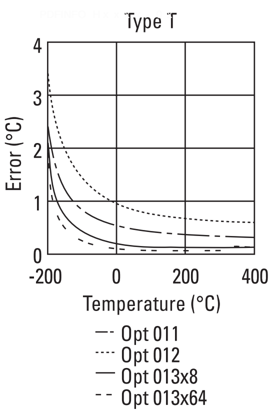

Type E Extended
Error (°C)
15
10
5
0
-500 0 500 1000
Temperature (°C)
Opt 018
Opt 019

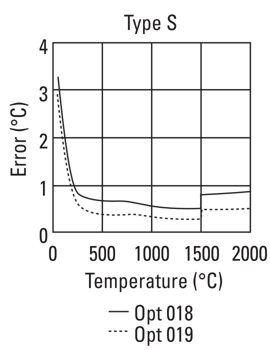

Type N
7
6
5
4
3
2
1
0
Error (°C)
-200
200
600
1000
1500
Temperature (°C)
Opt 011
Opt 012
Opt 013x8
Opt 013x64

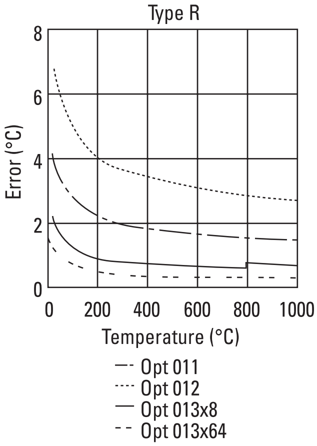

Type T
2
1
0
Error (°C)
-200
0
200
400
Temperature (°C)
Opt 018
Opt 019

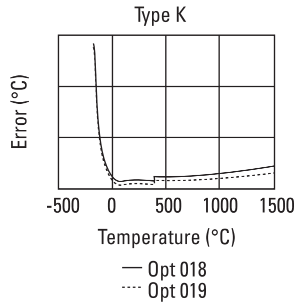

Type N
5
4
3
2
1
0
Error (°C)
-200
200
600
1000
1500
Temperature (°C)
Opt 018
Opt 019

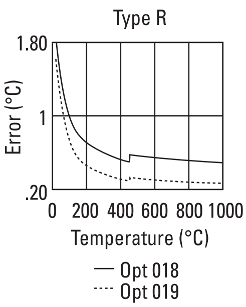

Type S
8
6
4
2
0
Error (°C)
0
600
1200
1800
Temperature (°C)
Opt 011
Opt 012
Opt 013x8
Opt 013x64

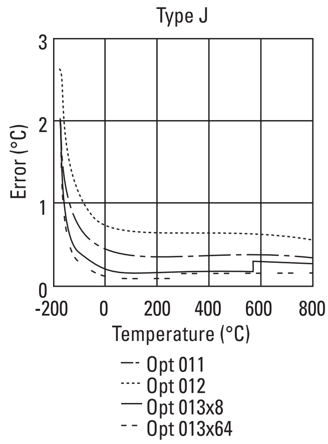

Type T
4
3
2
1
0
Error (°C)
-200
0
200
400
Temperature (°C)
Opt 011
Opt 012
Opt 013x8
Opt 013x64

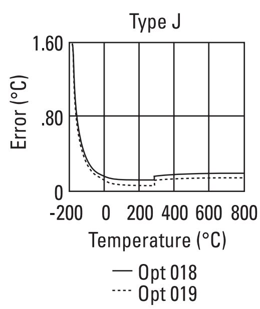

Type S
4
3
2
1
0
Error (°C)
0
500
1000
1500
2000
Temperature (°C)
Opt 018
Opt 019

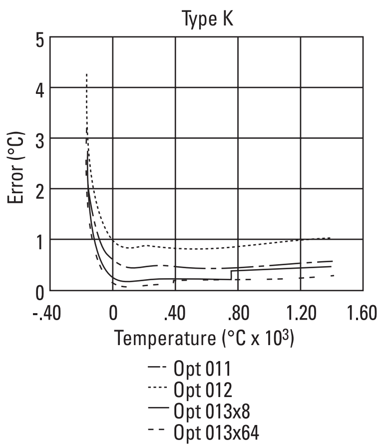












Current Requirements (Amps)

5 V typ	5 V max	24 V typ	24 V max	-24 V typ	024 V max
0.01	0.01	0.015	0.02	0.015	0.02

Ordering Information

Description	Product No.
8-Channel 7 Hz Low-pass Filter SCP	E1502A

Related Literature

2000 Test System and VXI Catalog CD-ROM,
Agilent Pub. No. 5980-0308E (detailed specifications for VXI products)

2000 Test System and VXI Catalog,
Agilent Pub. No. 5980-0307E (overview of VXI products)

1998 Test System and VXI Products Data Book,
Agilent Pub. No. 5966-2812E

Online

Internet access for Agilent product information, services and support
www.agilent.com/find/tmdir

VXI product information
www.agilent.com/find/vxi

Defense Electronics Applications
www.agilent.com/find/defense_ATE

Agilent Technologies VXI Channel Partners
www.agilent.com/find/vxichanpart

Agilent Technologies' HP VEE Application Website
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