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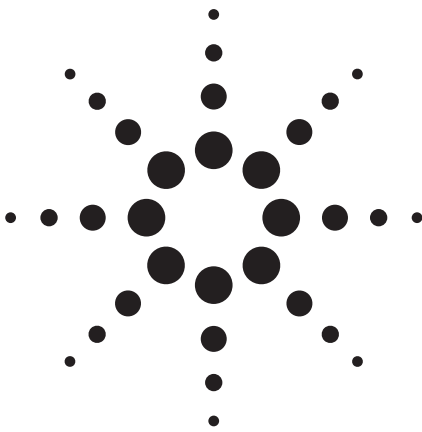
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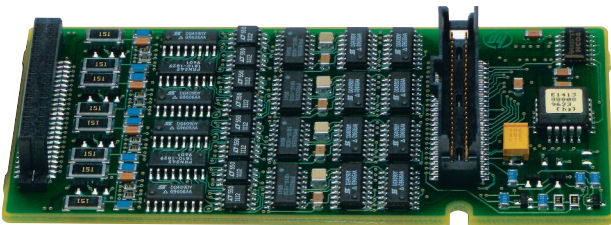
Find the Keysight / Agilent E1503A at our website: [Click HERE](#)



# Agilent E1503A 8-Channel Programmable Filter/Gain SCP

## Data Sheet

- Use with Agilent E1413C/E1415A/E1419A
- Programmable low-pass filter per channel
- Programmable input amplifier per channel
- $\pm 0.25/2/16$  V maximum sensor voltage
- Maximum flexibility for low-level and high-level sensors



Agilent E1503A

### Description

The Agilent E1503A 8-Channel Programmable Filter and 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). The eight programmable input amplifiers provide input voltage ranges of  $\pm 0.25$  V,  $\pm 2$  V, and  $\pm 16$  V. The E1503A SCP also provides input over-voltage protection and open transducer detection on each channel.

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

Use the E1503A 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)

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

### Voltage Measurements

The E1503A is ideal for measuring signals from sensors with full-scale voltage outputs from 3.9 mV to 16 V. The programmable, 2-pole, low-pass filters reduce sensor-based noise in the measurement.

### Temperature Measurements

The E1503A can be used to make temperature measurements with thermocouples, thermistors, or RTDs.



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 E1505A Current Source SCP with the E1503A SCP. 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 application is as shown here using 4-wire  $\Omega$  connections. Two-wire  $\Omega$  measurement is possible but not recommended since two 150  $\Omega$  series resistors protecting the input FET multiplexer are included in the measurement.

## Strain Measurements

The E1503A can be used to make strain measurements when combined with either the E1506A or E1507A Strain Completion SCPs. Refer to the E1506A/E1507A *Technical Specifications* for more information.

## Product Specifications

These specifications for the E1503A reflect the combined performance of the scanning A/D and the E1503A SCP.

### Measurement Ranges

<b>DC Volts:</b>	$\pm 3.9$ mV to $\pm 16$ V Full Scale
<b>Temperature:</b>	
<b>Thermocouples:</b>	-200 to + 1700 °C
<b>Thermistors: *</b>	-80 to + 160 °C
<b>RTD's: *</b>	-200 to + 850 °C
<b>Resistance: *</b>	8 $\Omega$ to 131K $\Omega$ FS
<b>Strain: **</b>	25,000 $\mu\epsilon$ 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):

<b>Operating:</b>	$< \pm 16$ V peak
<b>Damage level:</b>	$\geq \pm 42$ V peak

#### Maximum common mode voltage:

<b>Operating:</b>	$< \pm 16$ V peak
<b>Damage level:</b>	$\geq \pm 42$ V peak

#### Common mode rejection:

<b>0 to 60 Hz:</b>	
<b>Gain x1:</b>	$> 100$ dB
<b>Gain x8:</b>	$> 116$ dB
<b>Gain x64:</b>	$> 132$ dB
<b>Input impedance:</b>	Greater than 100 M $\Omega$ differential

### Maximum Tare Cal Offset

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

A/D Range $\pm$ V F. Scale	Offset V Gain x1	Offset V Gain x8	Offset V Gain x64
16	3.2213	.40104	.04970
4	.82101	.10101	.01220
1	.23061	.02721	.00297
0.25	.07581	.00786	.00055
0.0625	.03792	.00312	n/a

### Measurement Accuracy DC Volts

If autoranging is ON, add  $\pm .02\%$  FS to accuracy specifications.

Gain x1 A/D Range $\pm$ V F. Scale	Linearity % of Reading	Offset Error				Noise 3 $\sigma$	Noise* 3 $\sigma$
		2 Hz	10 Hz	100 Hz	Filt Off		
.0625	0.01%	13 $\mu$ V	9.5 $\mu$ V	6.8 $\mu$ V	6.3 $\mu$ V	45 $\mu$ V	26 $\mu$ V
.25	0.01%	15 $\mu$ V	12.5 $\mu$ V	11.2 $\mu$ V	10.8 $\mu$ V	63 $\mu$ V	31 $\mu$ V
1	0.01%	33 $\mu$ V	31.8 $\mu$ V	31.3 $\mu$ V	31.2 $\mu$ V	112 $\mu$ V	93 $\mu$ V
4	0.01%	123 $\mu$ V	122 $\mu$ V	122 $\mu$ V	122 $\mu$ V	450 $\mu$ V	366 $\mu$ V
16	0.01%	488 $\mu$ V	488 $\mu$ V	488 $\mu$ V	488 $\mu$ V	1.8 mV	1.5 mV

\*A/D filter ON (min sample period  $\geq 145$   $\mu$ s:  $\leq 100$  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
<b>Gain:</b>		15 ppm/°C				
<b>Offset:</b>	0-30 °C	0.16 $\mu$ V/°C	0 $\mu$ V	0 $\mu$ V	0 $\mu$ V	0 $\mu$ V
	30-40 °C	0.18 $\mu$ V/°C	13 $\mu$ V	9 $\mu$ V	1.1 $\mu$ V	0.2 $\mu$ V
	40-55 °C	0.39 $\mu$ V/°C	31 $\mu$ V	22 $\mu$ V	6.4 $\mu$ V	1.1 $\mu$ V

### Gain x8

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

\*A/D filter ON (min sample period  $\geq 145$   $\mu$ s:  $\leq 100$  Hz scan rate 64 ch).

\*\* 7.4  $\mu$ V and 6.3  $\mu$ V when temperature  $\geq 40$  °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
<b>Gain:</b>		15 ppm/°C				
<b>Offset:</b>	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

**Gain x64**

A/D Range ±V F. Scale	Linearity % of Reading	Offset Error	Noise 3σ	Noise* 3σ
.0039	0.01%	2.9 μV	2.3 μV	2.1 μV
.0156	0.01%	3 μV	2.4 μV	2.2 μV
.0625	0.01%	3.5 μV	3 μV	2.9 μV
.25	0.01%	8.2 μV	8 μV	8 μV

		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
<b>Gain:</b>		15 ppm/°C				
<b>Offset:</b>	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

**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.

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

**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.

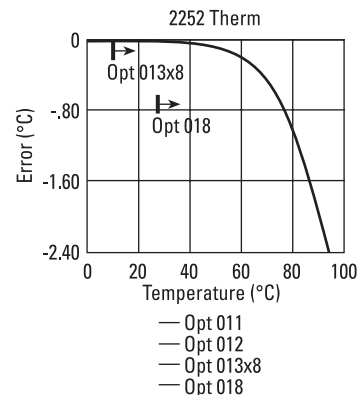
2) When using the Agilent E1586A Rack Mount Terminal Panel as the isothermal reference, add ± 0.2 °C to the thermocouple accuracy specs to account for temperature gradients across the E1586A. The E1586A should be mounted in the bottom part of the rack, below and away from other heat sources, for best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

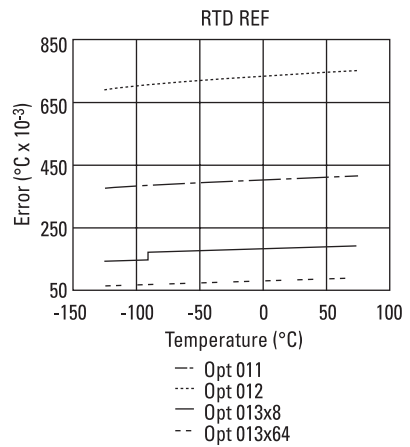
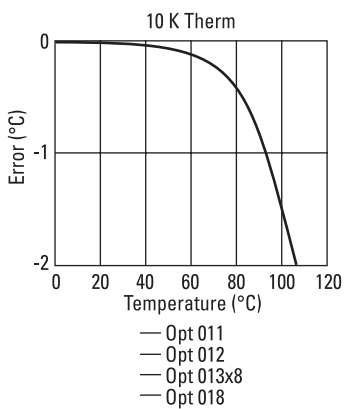
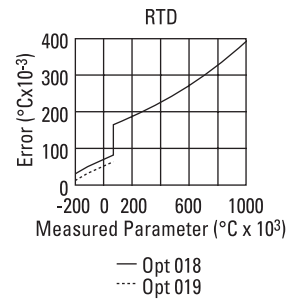
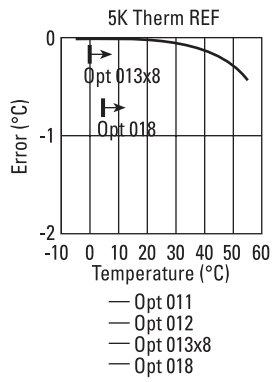
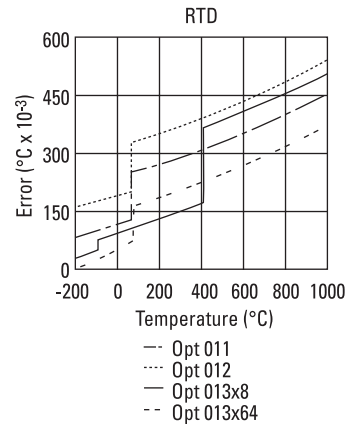
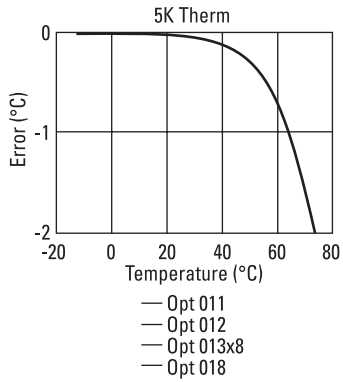
All specifications for the following were measured with the A/D filter off.

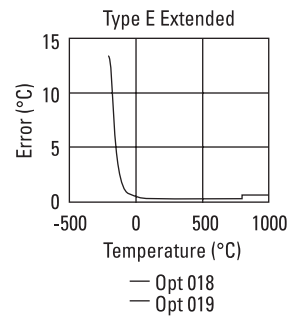
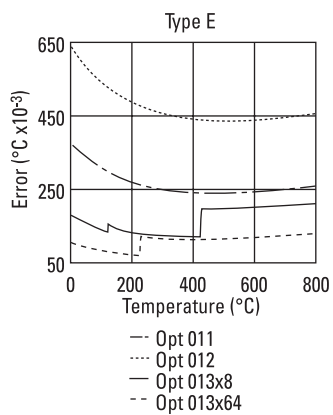
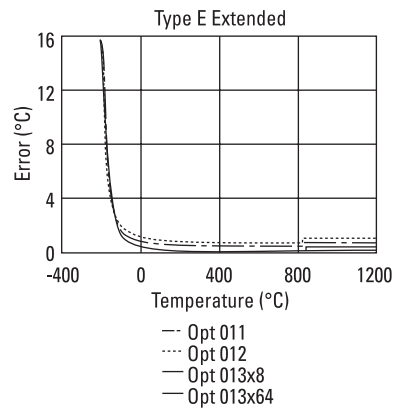
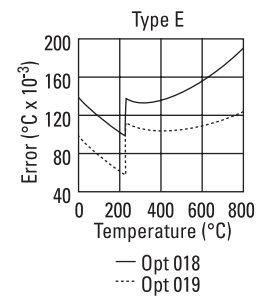
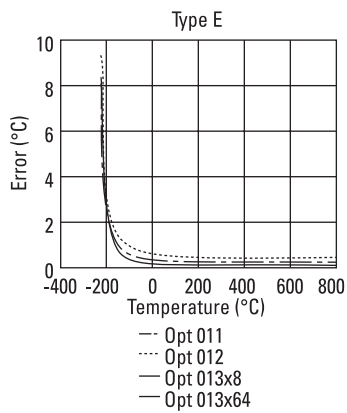
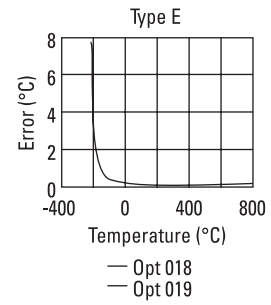
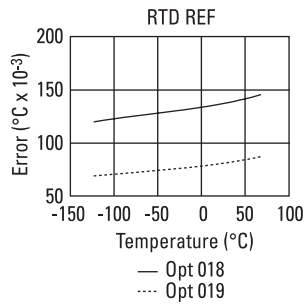
The following temperature accuracy graphs include instrument and firmware linearization errors. The linearization algorithm used is based on the ITS-90 transducer curves. Add your transducer accuracy to determine total measurement error.

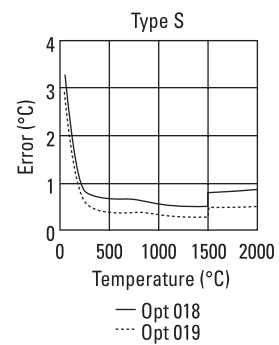
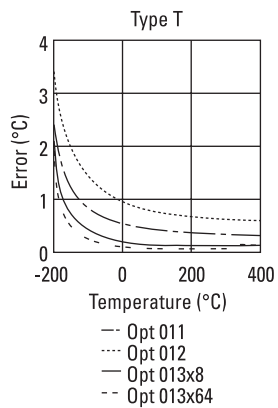
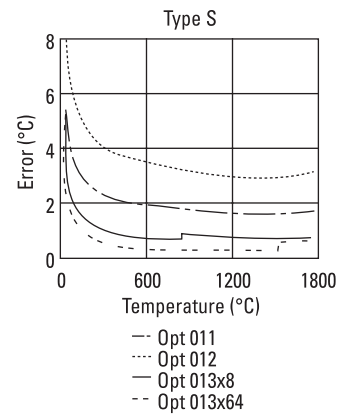
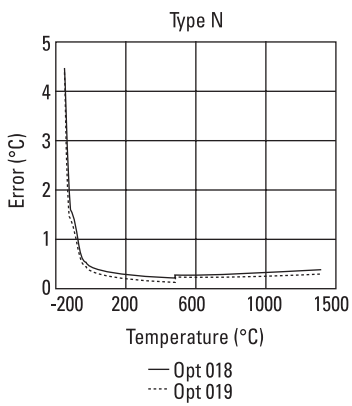
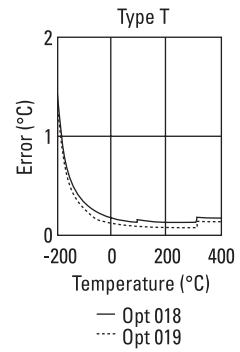
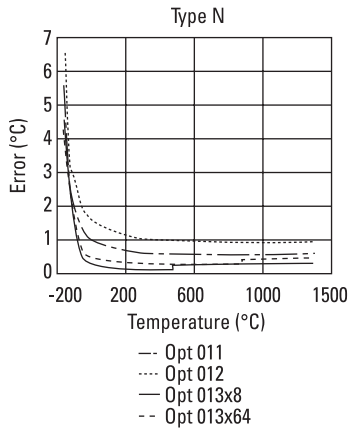
**Conversion Chart**

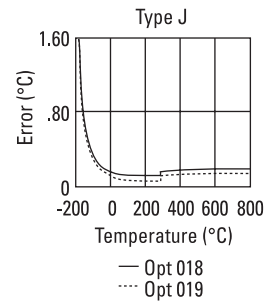
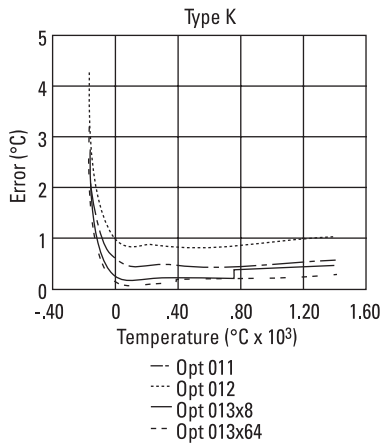
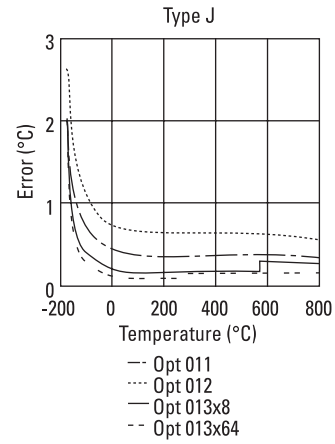
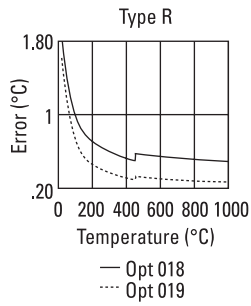
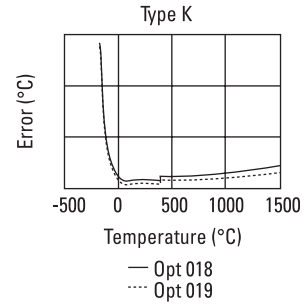
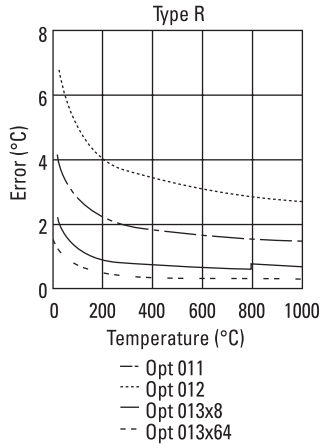
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Opt 013	=	E1503A
Opt 015	=	E1505A
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Opt 017	=	E1507A
Opt 018	=	E1508A
Opt 019	=	E1509A
Opt 020	=	E1510A
Opt 021	=	E1511A











**Current Requirements (Amps)**

5 V typ	5 V max	24 V typ	24 V max	-24 V typ	-24 V max
0.01	0.01	0.04	0.06	0.04	0.06

**Ordering Information**

Description	Product No.
8-Channel Programmable Filter/Gain SCP	E1503A



## 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](http://www.agilent.com/find/tmdir)

VXI product information  
[www.agilent.com/find/vxi](http://www.agilent.com/find/vxi)

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(fax) (81) 426 56 7840

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(fax) (64 4) 802 6881

Asia Pacific:  
Agilent Technologies, Hong Kong  
(tel) (852) 3197-7777  
(fax) (852) 2506-9284

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