

# Electrical Sampling Modules

▶ 80E01 • 80E02 • 80E03 • 80E04 • 80E06



## 80E01 Sampling Module

The 80E01 is a single-channel, 50 GHz bandwidth sampling module. The 80E01 has a measured bandwidth  $\geq 50$  GHz and a calculated rise time  $\leq 7.0$  ps. Displayed noise is typically  $1.8 \text{ mV}_{\text{RMS}}$ . The front-panel connector is female 2.4 mm and an SMA adapter is provided (2.4 mm male to 2.92 mm female) to maintain compatibility with SMA connector systems.

## 80E02 Low-noise Sampling Module

The 80E02 is a dual-channel, 12.5 GHz sampling module specifically designed for low-noise measurements in digital communications and device characterization applications. It provides an acquisition rise time of 28 ps and typically  $400 \mu\text{VRMS}$  of displayed noise.

The 80E02 is the ideal instrument for low-noise applications. Common applications for the 80E02 are capturing and displaying switching characteristics of high-speed communications circuits, making accurate statistical measurements of signal noise and signal timing jitter, or obtaining stable timing measurements of fast digital ICs.

## ▶ Features & Benefits

### ALL MODULES

Dual Channel (Except 80E01 and 80E06)

Probe Support (Except 80E06)

### 80E01

50 GHz Bandwidth

Single Channel

2.4 mm Precision Connector

### 80E02

12.5 GHz Bandwidth

Dual Channel

Low Noise

### 80E03

20 GHz Bandwidth

Dual Channel

### 80E04

20 GHz Bandwidth

Dual Channel

35 ps TDR Reflected Rise Time

True Differential TDR

### 80E06

70+ GHz Electrical Bandwidth (typical)

Single Channel

$2.0 \text{ mV}_{\text{RMS}}$  Noise (typical)

1.85 mm Precision Connector

## ▶ Applications

### 80E01

High Frequency Acquisition, Fast Rise Time

### 80E02

Low-level Signals

### 80E03

Device Characterization, Transmission Quality, Waveform Parameters

### 80E04

Transmission Line Quality, Impedance Measurements, Crosstalk Measurements

### 80E06

High-speed Electrical Device Characterization Waveform Parameters

Acquisition of Ultra-fast Rise Time Signals

COMPUTING

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VIDEO

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### 80E03 Sampling Module

The 80E03 is a dual-channel, 20 GHz sampling module. This sampling module provides an acquisition rise time of 17.5 ps or less.

### 80E04 TDR Sampling Module

The 80E04 is a dual-channel Time Domain Reflectometry (TDR) sampling module. This sampling module provides an acquisition rise time of 17.5 ps or less, with a typical 20 GHz equivalent bandwidth.

Each channel of the 80E04 is capable of generating a fast step for use in TDR mode and the acquisition portion of the sampling module monitors the incident step and any reflected energy. The reflected rise time of the TDR step is 35 ps or less and the polarity of each channel's step can be selected independently. This allows for differential or common-mode testing of two coupled lines, in addition to the independent testing of isolated lines.

The 80E04 characterizes crosstalk by using the TDR step to drive one line while monitoring a second line with the other channel.

The "filter" function on the CSA8000/TDS8000 can be used with TDR or crosstalk measurements to characterize expected system performance with slower edge rates.

### 80E06 Electrical Sampling Module

8000 Series Sampling Oscilloscopes configured with the 80E06 – 70+ GHz Electrical Sampling Module – allow users to characterize high-speed devices and circuits. This module's ultra-high bandwidth, coupled with its low noise, provides world-class signal fidelity in the acquired signal. The front panel connector is female 1.85 mm which includes a precision adapter to 2.92 mm with a 50  $\Omega$  SMA termination.

## ▶ Characteristics

### ▶ Electrical Sampling Module Characteristics

	Application Type	Channels	Input Impedance	Channel Input Connector	Bandwidth*1
80E01	Microwave General Purpose	1	50 ±0.5 Ω	2.4 mm female Precision adapter to 2.92 mm included with 50 Ω SMA termination	50 GHz
80E02	Low-level Signals	2	50 ±0.5 Ω	3.5 mm female	12.5 GHz*2
80E03	Device Characterization	2	50 ±0.5 Ω	3.5 mm female	20 GHz*2
80E04	TDR Impedance Characterization with single-ended, common, differential TDR capability	2	50 ±0.5 Ω	3.5 mm female	20 GHz*2
80E06	High-speed Electrical Device Characterization	1	50 ±0.5 Ω	1.85 mm female Precision adapter to 2.92 mm included with 50 Ω SMA termination	70+ GHz

	Rise Time (10% to 90%)	Dynamic Range	Offset Range	Maximum Input Voltage	Vertical Number of Digitized Bits
80E01	7 ps (typical)*2	1.0 V <sub>p-p</sub>	±1.6 V	±2.0 V	14 bits full scale
80E02	≤28 ps	1.0 V <sub>p-p</sub>	±1.6 V	±3.0 V	14 bits full scale
80E03	≤17.5 ps	1.0 V <sub>p-p</sub>	±1.6 V	±3.0 V	14 bits full scale
80E04	≤17.5 ps	1.0 V <sub>p-p</sub>	±1.6 V	±3.0 V	14 bits full scale
80E06	5.0 ps*3	1.0 V <sub>p-p</sub>	±1.6 V	±2.0 V	14 bits full scale

\*1 Values shown are warranted unless printed in an italic typeface which represents a non-warranted characteristic value that the instrument will typically perform to.

\*2 Calculated from 0.35 bandwidth rise time product.

\*3 80E06 rise time is calculated from formula rise time = 0.35/(typical bandwidth).

# Electrical Sampling Modules

► 80E01 • 80E02 • 80E03 • 80E04 • 80E06

## ► Electrical Sampling Module Characteristics (continued)

	Vertical Sensitivity Range	DC Vertical Voltage Accuracy, Single Point, Within $\pm 2$ °C of Compensated Temperature	Typical Step Response Aberrations**4	RMS Noise**4
80E01	10 mV to 1.0 V full scale	$\pm [2 \text{ mV} + 0.007 \text{ (Offset)} + 0.02 \text{ (Vertical Value - Offset)}]$	<i><math>\pm 3\%</math> or less over the zone 10 ns to 20 ps before step transition; +12%, -5% or less for the first 300 ps following step transition; +5.5%, -3% or less over the zone 300 ps to 3 ns following step transition; <math>\pm 1\%</math> or less over the zone 3 ns to 100 ns following step transition; <math>\pm 0.5\%</math> after 100 ns following step transition</i>	1.8 mV $\leq 2.3$ mV (maximum)
80E02	10 mV to 1.0 V full scale	$\pm [2 \text{ mV} + 0.007 \text{ (Offset)} + 0.02 \text{ (Vertical Value - Offset)}]$	<i><math>\pm 3\%</math> or less over the zone 10 ns to 20 ps before step transition; +10%, -5% or less for the first 300 ps following step transition; <math>\pm 3\%</math> or less over the zone 300 ps to 5 ns following step transition; <math>\pm 1\%</math> or less over the zone 5 ns to 100 ns following step transition; <math>\pm 0.5\%</math> after 100 ns following step transition</i>	400 $\mu\text{V}$ $\leq 800$ $\mu\text{V}$ (maximum)
80E03	10 mV to 1.0 V full scale	$\pm [2 \text{ mV} + 0.007 \text{ (Offset)} + 0.02 \text{ (Vertical Value - Offset)}]$	<i><math>\pm 3\%</math> or less over the zone 10 ns to 20 ps before step transition; +10%, -5% or less for the first 300 ps following step transition; <math>\pm 3\%</math> or less over the zone 300 ps to 5 ns following step transition; <math>\pm 1\%</math> or less over the zone 5 ns to 100 ns following step transition; <math>\pm 0.5\%</math> after 100 ns following step transition</i>	600 $\mu\text{V}$ $\leq 1.2$ mV (maximum)
80E04	10 mV to 1.0 V full scale	$\pm [2 \text{ mV} + 0.007 \text{ (Offset)} + 0.02 \text{ (Vertical Value - Offset)}]$	<i><math>\pm 3\%</math> or less over the zone 10 ns to 20 ps before step transition; +10%, -5% or less for the first 300 ps following step transition; <math>\pm 3\%</math> or less over the zone 300 ps to 5 ns following step transition; <math>\pm 1\%</math> or less over the zone 5 ns to 100 ns following step transition; 0.5% after 100 ns following step transition</i>	600 $\mu\text{V}$ $\leq 1.2$ mV (maximum)
80E06	10 mV to 1.0 V full scale	$\pm [2 \text{ mV} + 0.007 \text{ (Offset)} + 0.02 \text{ (Vertical Value - Offset)}]$	<i><math>\pm 5\%</math> or less for first 300 ps following step transition</i>	1.8 mV $\leq 2.4$ mV (maximum)

\*\*Values shown are warranted unless printed in an italic typeface which represents a non-warranted characteristic value that the instrument will typically perform to.

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### ► TDR System (80E04 only)

	80E04
Channels	2
Input Impedance	50 ±0.5 Ω
Channel Input Connector	3.5 mm
Bandwidth	20 GHz
TDR Step Amplitude	250 mV (polarity of either step may be inverted)
TDR System Reflected Rise Time	≤35 ps each polarity
TDR System Incident Rise Time	28 ps (typical)
TDR Step Maximum Repetition Rate	200 kHz
TDR System Step Response Aberrations	±3% or less over the zone 10 ns to 20 ps before step transition; +10%, -5% or less typical for the first 400 ps following step transition; ±3% or less over the zone 400 ps to 5 ns following step transition; ±1% or less after 5 ns following step transition

### Physical Characteristics for Electrical Sampling Modules

	Dimensions (mm/in.)			Weight (kg/lbs.)
	Width	Height	Depth	Net
80E01	79/3.1	25/1.0	135/5.3	0.4/0.87
80E02	79/3.1	25/1.0	135/5.3	0.4/0.87
80E03	79/3.1	25/1.0	135/5.3	0.4/0.87
80E04	79/3.1	25/1.0	135/5.3	0.4/0.87
80E06	79/3.1	25/1.0	135/5.3	0.4/0.87

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## ▶ Ordering Information

### 80E01

Single Channel, 50 GHz Sampling Module.

**Includes:** User manual, Calibration data report, precision adapter to 2.92 mm included with 50  $\Omega$  SMA termination.

**80E01X2** – Bundled ordering configuration provides two 80E01 modules.

### 80E02

Dual Channel, 12.5 GHz Low-noise Sampling Module.

**Includes:** User manual, Calibration data report, two 50  $\Omega$  SMA terminations.

### 80E03

Dual Channel, 20 GHz Sampling Module.

**Includes:** User manual, Calibration data report, two 50  $\Omega$  SMA terminations.

### 80E04

Dual Channel, 20 GHz TDR Sampling Module.

**Includes:** User manual, Calibration data report, two 50  $\Omega$  SMA terminations.

### 80E06

70+ GHz Electrical Sampling Module.

**Includes:** User manual, Calibration data report, precision adapter to 2.92 mm with 50  $\Omega$  SMA termination.

**80E06X2** – Bundled ordering configuration provides two 80E06 modules.

## Service Options

**Opt. C3** – Three years of Calibration Service.

**Opt. C5** – Five years of Calibration Service.

**Opt. D1** – Calibration data reports.

**Opt. D3** – Three years of Calibration data reports.

**Opt. D5** – Five years of Calibration data reports.

**Opt. R3** – Extended repair warranty to three years.

**Opt. R5** – Extended repair warranty to five years.

### Other Accessories

#### Calibration Step Generator with Power Cords –

**Standard US** – Order 067-1338-00.

**A1** – Universal Euro: Order 067-1338-01.

**A2** – UK: Order 067-1338-02.

**A3** – Australian: Order 067-1338-03.

**A4** – North American: Order 067-1338-04.

**A5** – Switzerland: Order 067-1338-05.

**A6** – Japanese: Order 067-1338-06.

**Sampling Module Extender Cable  
(1 meter length)** – Order 012-1568-00.

**Sampling Module Extender Cable  
(2 meter length)** – Order 012-1569-00.

**2X Attenuator (SMA male-to-female)** –  
Order 015-1001-01.

**5X Attenuator (SMA male-to-female)** –  
Order 015-1002-01.

**Adapter (2.4 mm male to 2.92 mm female)** –  
Order 011-0157-00.

**Power Divider** – Order 015-1014-00.

**P6209** – 4 GHz Active FET Probe.

**P6150** – 9 GHz Passive Probe.

### Interconnect Cables

Tektronix recommends using quality high performance interconnect cables with these high bandwidth products in order to minimize measurement degradation and variations. The W.L. Gore & Associates' cable assemblies listed below are compatible with the 2.92 mm, 2.4 mm, and 1.85 mm connector interface of the 80E0x modules. Assemblies can be ordered by contacting Gore by phone at (800) 356-4622, or on the Web at [www.goreelectronics.com](http://www.goreelectronics.com) (click on "Contact Us").

#### Benchtop Test Cable Assemblies

**TEK40PF18PP** – Frequency: 40 GHz. Connectors:  
2.92 mm male. Length: 18.0 in.

**TEK50PF18PP** – Frequency: 50 GHz. Connectors:  
2.4 mm male. Length: 18.0 in.

**TEK65PF18PP** – Frequency: 65 GHz. Connectors:  
1.85 mm male. Length: 18.0 in.

### High-frequency Interconnect Cables for Electrical Sampling Modules

**TEK40HF06PP** – Frequency: 40 GHz. Connectors:  
2.92 mm male. Length: 6.0 in.

**TEK40HF06PS** – Frequency: 40 GHz. Connectors:  
2.92 mm male, 2.92 mm female. Length: 6.0 in.

**TEK50HF06PP** – Frequency: 50 GHz. Connectors:  
2.4 mm male. Length: 6.0 in.

**TEK50HF06PS** – Frequency: 50 GHz. Connectors:  
2.4 mm male, 2.4 mm female. Length: 6.0 in.

**TEK65HF06PP** – Frequency: 65 GHz. Connectors:  
1.85 mm male. Length: 6.0 in.

**TEK65HF06PS** – Frequency: 65 GHz. Connectors:  
1.85 mm male, 1.85 mm female. Length: 6.0 in.

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▶ 80E01 • 80E02 • 80E03 • 80E04 • 80E06

### Contact Tektronix:

**ASEAN / Australasia / Pakistan** (65) 6356 3900

**Austria** +43 2236 8092 262

**Belgium** +32 (2) 715 89 70

**Brazil & South America** 55 (11) 3741-8360

**Canada** 1 (800) 661-5625

**Central Europe & Greece** +43 2236 8092 301

**Denmark** +45 44 850 700

**Finland** +358 (9) 4783 400

**France & North Africa** +33 (0) 1 69 86 80 34

**Germany** +49 (221) 94 77 400

**Hong Kong** (852) 2585-6688

**India** (91) 80-2275577

**Italy** +39 (02) 25086 1

**Japan** 81 (3) 3448-3010

**Mexico, Central America & Caribbean** 52 (55) 56666-333

**The Netherlands** +31 (0) 23 569 5555

**Norway** +47 22 07 07 00

**People's Republic of China** 86 (10) 6235 1230

**Poland** +48 (0) 22 521 53 40

**Republic of Korea** 82 (2) 528-5299

**Russia, CIS & The Baltics** +358 (9) 4783 400

**South Africa** +27 11 254 8360

**Spain** +34 (91) 372 6055

**Sweden** +46 8 477 6503/4

**Taiwan** 886 (2) 2722-9622

**United Kingdom & Eire** +44 (0) 1344 392400

**USA** 1 (800) 426-2200

**USA** (Export Sales) 1 (503) 627-1916

For other areas contact Tektronix, Inc. at: 1 (503) 627-7111

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