

# PatternPro® Error Detector

## PED3200 and PED4000 Series Datasheet



The PED3200 and PED4000 series programmable error detectors offer effective multi-channel BER for stressed receiver testing of data communications designs. Now available with the choice of AC or DC coupled inputs, as well as full or half-rate clock inputs.

### Key performance specifications

- Data rate range:
  - PED3200 series: 3 Gb/s to 32 Gb/s
  - PED4000 series: 4 Gb/s to 40 Gb/s

### Key features

- Available with 1 or 2 input channels (independent data on each channel)
- PRBS and user defined patterns
- High input sensitivity and bandwidth
- Auto-adjustment or manual adjustment of data to clock phase and threshold
- Auto-synchronization to input pattern
- PC GUI software:
  - Remote instrument control
  - Bathtub and Contour Analysis
  - JTOL measurements
  - J2/J9 measurements
- Front panel touch screen GUI or USB TMC computer control

### Applications

- 25 Gb/s testing for 100G Ethernet
- 32 Gb/s DPQPSK testing
- Semiconductor and component testing
- Design validation and production testing
- Transmitter testing and validation up to 40 Gb/s

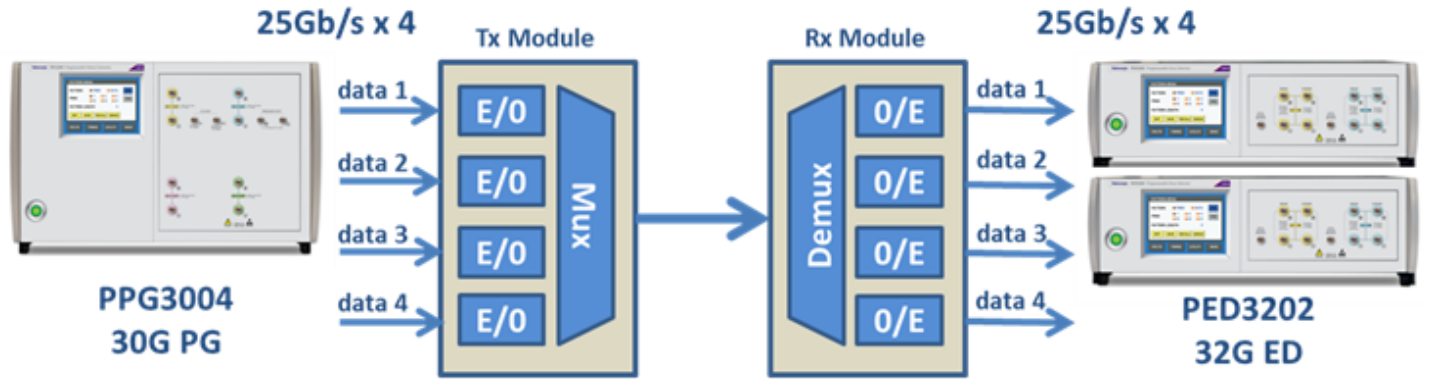
### Product description

The Tektronix PED line of high sensitivity and high bandwidth error detectors offer single and two-channel standalone configurations capable of BER measurement at data rates up to 40 Gb/s. The PED products support either PRBS or user-defined data patterns, with simple to use automatic or manual alignment of input clock and data, and pattern synchronization. The PED product makes an ideal companion for the Tektronix PPG pattern generator product family.

The PED line of error detectors are offered in two data input configurations:

- The DC coupled input option can be used either as AC or DC coupled as long as the resulting input falls within the allowed voltage window of -0.6 to 0.2 V. A DC threshold output is provided and, when connected to the unused /data input, allows operation with single ended data input signals.
- The AC coupled input option allows larger amplitude AC coupled inputs and has built-in differential and single ended programmable threshold adjustments.

Also, either half rate or full rate clock options are available.



100G Ethernet four lane end-to-end test using PED3200 series error detector and PPG3000 series pattern generator

## Specifications

All specifications are guaranteed unless noted otherwise. All specifications apply to all models unless noted otherwise.

### Data input

#### Data rate

Range (PED3200)	3 Gb/s to 32 Gb/s
Range (PED4000)	4 Gb/s to 40 Gb/s

**DC coupled input option** Ground referenced CML like input. AC coupled data input permitted within allowed voltage window.

<b>Differential amplitude</b>	25 mV to 1.0 V <sub>p-p</sub>
<b>Single-ended amplitude</b>	25 mV to 750 mV <sub>p-p</sub>
<b>Voltage window</b>	-0.6 V to +0.2 V
<b>Termination voltage</b>	0.0 V
<b>Input impedance</b>	50 Ω
<b>Connector</b>	2.4 mm

**AC coupled input option** AC coupled input with broadband bias tees featuring a 3 dB bandwidth of 10 kHz to >50 GHz.

<b>Differential amplitude</b>	6 mV to 1.0 V <sub>p-p</sub>
<b>Single-ended amplitude</b>	6 mV to 750 mV <sub>p-p</sub>
<b>Termination voltage</b>	0.0 V
<b>Input impedance</b>	50 Ω
<b>Connector</b>	2.4 mm

**ESD sensitivity** 250 V, Human body model (HBM)

### Threshold output

<b>Output voltage</b>	DC voltage terminated 50 Ω to ground
<b>Range</b>	-0.5 V to 0.125 V

---

### Sampling point set points

<b>Eye edge BER threshold</b>	
<b>Range</b>	1e-1 to 1e-11
<b>Resolution</b>	1e-1

---

<b>Sync BER threshold</b>	
<b>Range</b>	1e-1 to 1e-8
<b>Resolution</b>	1e-1

---

### Full rate clock input option

<b>Amplitude</b>	AC coupled, full rate
<b>Differential range</b>	300 mV <sub>P,P</sub> to 1.0 V <sub>P,P</sub>
<b>Single-ended range</b>	300 mV <sub>P,P</sub> to 1.0 V <sub>P,P</sub>
<b>Connector</b>	2.4 mm

---

<b>Clock to data phase adjustment</b>	100 ps (-50 ps to +50 ps)
---------------------------------------	---------------------------

---

<b>ESD sensitivity</b>	1000 V, Human body model (HBM)
------------------------	--------------------------------

---

### Half rate clock input option

<b>Amplitude</b>	AC coupled, half rate
<b>Differential range</b>	300 mV <sub>P,P</sub> to 1.0 V <sub>P,P</sub>
<b>Single-ended range</b>	300 mV <sub>P,P</sub> to 1.0 V <sub>P,P</sub>
<b>Connector</b>	2.4 mm

---

<b>Clock to data phase adjustment</b>	100 ps (-50 ps to +50 ps)
---------------------------------------	---------------------------

---

<b>ESD sensitivity</b>	1000 V, Human body model (HBM)
------------------------	--------------------------------

---

### Data patterns

<b>Pattern type</b>	Data (from memory) or PRBS. Length and type are individually settable on each channel.
---------------------	---

---

<b>PRBS pattern lengths</b>	
<b>2<sup>7</sup> - 1 bits</b>	Polynomial = X <sup>7</sup> + X <sup>6</sup> + 1
<b>2<sup>9</sup> - 1 bits</b>	Polynomial = X <sup>9</sup> + X <sup>5</sup> + 1
<b>2<sup>11</sup> - 1 bits</b>	Polynomial = X <sup>11</sup> + X <sup>9</sup> + 1
<b>2<sup>15</sup> - 1 bits</b>	Polynomial = X <sup>15</sup> + X <sup>14</sup> + 1
<b>2<sup>23</sup> - 1 bits</b>	Polynomial = X <sup>23</sup> + X <sup>18</sup> + 1
<b>2<sup>31</sup> - 1 bits</b>	Polynomial = X <sup>31</sup> + X <sup>28</sup> + 1

---

## Data patterns

User-defined pattern depth	Number of channels	Single bit pattern resolution
	1 channel	4 Mbit
	2 channels	2 Mbit

## Mechanical

Front panel width (with mounting tabs)	48.3 cm (19.0 in)
Height	13.3 cm (5.25 in)
Width	45.1 cm (17.75 in)
Depth (rack mount)	34.3 cm (13.5 in)
Weight (1 channel)	11.1 kg (24.5 lbs)
Operating temperature	0 °C to 40 °C (32 °F to 104 °F)

## Ordering information

### Models

PED3201	32 Gb/s Programmable error detector, 1 channel
PED3202	32 Gb/s Programmable error detector, 2 channels
PED4001	40 Gb/s Programmable error detector, 1 channel
PED4002	40 Gb/s Programmable error detector, 2 channels

### Options

#### Instrument options

PED3201 AC	AC coupled input option for PED3201
PED3201 DC	DC coupled input option for PED3201
PED3201 HCLK	Half rate clock input option for PED3201
PED3201 FLCLK	Full rate clock input option for PED3201
PED3202 AC	AC coupled input option for PED3202
PED3202 DC	DC coupled input option for PED3202
PED3202 HCLK	Half rate clock input option for PED3202
PED3202 FLCLK	Full rate clock input option for PED3202
PED4001 AC	AC coupled input option for PED4001
PED4001 DC	DC coupled input option for PED4001
PED4001 HCLK	Half rate clock input option for PED4001
PED4001 FLCLK	Full rate clock input option for PED4001

PED4002 AC	AC coupled input option for PED4002
PED4002 DC	DC coupled input option for PED4002
PED4002 HCLK	Half rate clock input option for PED4002
PED4002 FLCLK	Full rate clock input option for PED4002

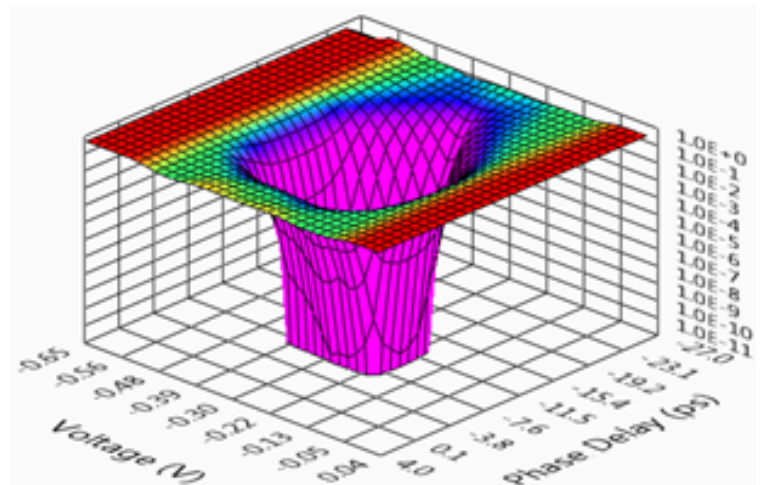
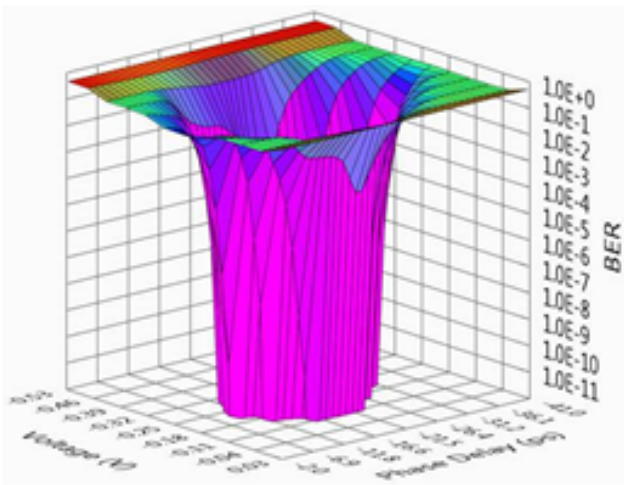
**Power plug options**

Opt. A0	North America power plug (115 V, 60 Hz)
Opt. A1	Universal Euro power plug (220 V, 50 Hz)
Opt. A2	United Kingdom power plug (240 V, 50 Hz)
Opt. A6	Japan power plug (100 V, 50/60 Hz)
Opt. A10	China power plug (50 Hz)
Opt. A11	India power plug (50 Hz)
Opt. A99	No power cord

**Manuals**

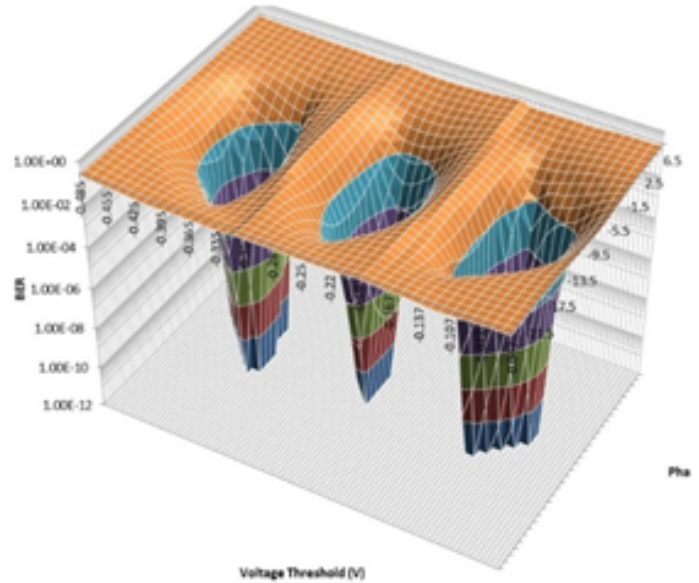
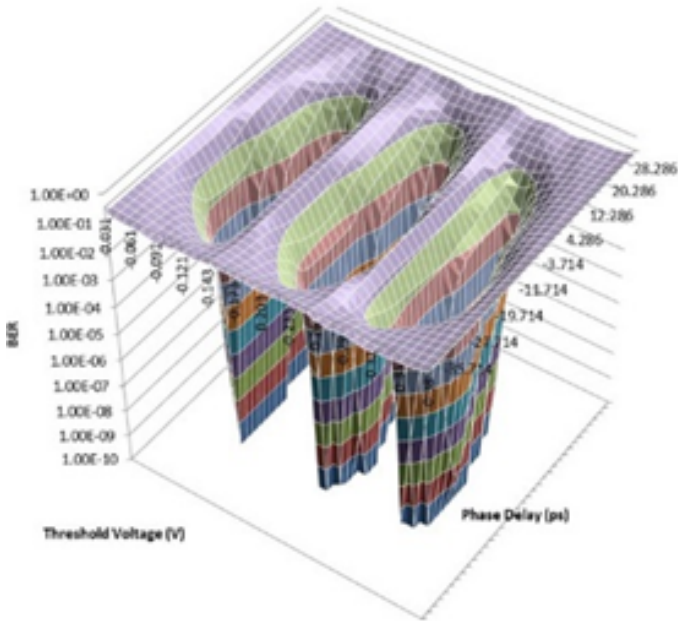
071-3413-xx	Printed PPG/PED Installation & Safety Instructions
077-1095-xx	PED3200/PED4000 Series Programmable Error Detector User Manual, PDF-only, downloadable from Tektronix.com

**PC Software GUI and Analysis Tool**



25 Gb/s and 32 Gb/s NRZ Signal Contour Analysis

A PC-based software tool for remotely controlling the instrument, gathering and saving data (such as bathtub and contour plots), and performing data systems analysis (J2/J9 and JTOL measurements) is available for use with both PED3200 and PED4000 error detectors. The tool is an executable file and is available upon request from Tektronix.



14 Gb/s and 25 Gb/s PAM4 Signal Contour Analysis



Tektronix is registered to ISO 9001 and ISO 14001 by SRI Quality System Registrar.



Product(s) complies with IEEE Standard 488.1-1987, RS-232-C, and with Tektronix Standard Codes and Formats.

ASEAN / Australasia (65) 6356 3900  
 Belgium 00800 2255 4835\*  
 Central East Europe and the Baltics +41 52 675 3777  
 Finland +41 52 675 3777  
 Hong Kong 400 820 5835  
 Japan 81 (3) 6714 3010  
 Middle East, Asia, and North Africa +41 52 675 3777  
 People's Republic of China 400 820 5835  
 Republic of Korea +822 6917 5084, 822 6917 5080  
 Spain 00800 2255 4835\*  
 Taiwan 886 (2) 2656 6688

Austria 00800 2255 4835\*  
 Brazil +55 (11) 3759 7627  
 Central Europe & Greece +41 52 675 3777  
 France 00800 2255 4835\*  
 India 000 800 650 1835  
 Luxembourg +41 52 675 3777  
 The Netherlands 00800 2255 4835\*  
 Poland +41 52 675 3777  
 Russia & CIS +7 (495) 6647564  
 Sweden 00800 2255 4835\*  
 United Kingdom & Ireland 00800 2255 4835\*

Balkans, Israel, South Africa and other ISE Countries +41 52 675 3777  
 Canada 1 800 833 9200  
 Denmark +45 80 88 1401  
 Germany 00800 2255 4835\*  
 Italy 00800 2255 4835\*  
 Mexico, Central/South America & Caribbean 52 (55) 56 04 50 90  
 Norway 800 16098  
 Portugal 80 08 12370  
 South Africa +41 52 675 3777  
 Switzerland 00800 2255 4835\*  
 USA 1 800 833 9200

\* European toll-free number. If not accessible, call: +41 52 675 3777

**For Further Information.** Tektronix maintains a comprehensive, constantly expanding collection of application notes, technical briefs and other resources to help engineers working on the cutting edge of technology. Please visit [www.tek.com](http://www.tek.com).

Copyright © Tektronix, Inc. All rights reserved. Tektronix products are covered by U.S. and foreign patents, issued and pending. Information in this publication supersedes that in all previously published material. Specification and price change privileges reserved. TEKTRONIX and TEK are registered trademarks of Tektronix, Inc. All other trade names referenced are the service marks, trademarks, or registered trademarks of their respective companies.

