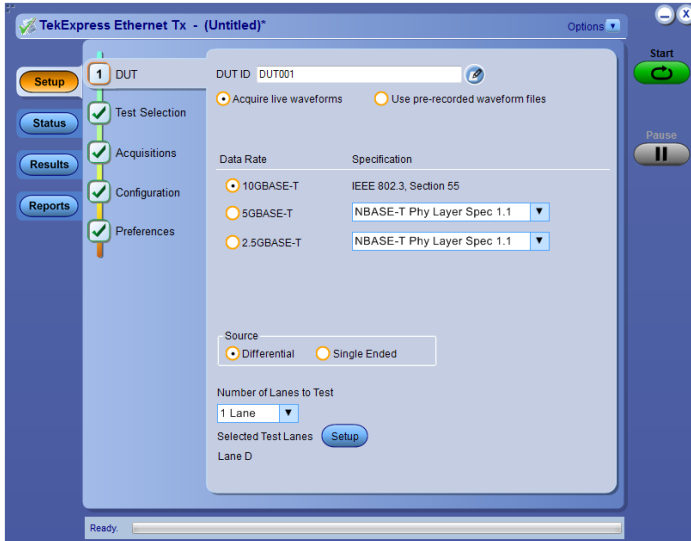


# Ethernet Transmitter Test Application Software

## TekExpress 10GBASE-T and NBASE-T Datasheet



The Ethernet Transmitter Test Application automates 10GBASE-T, NBASE-T, and IEEE802.3bz (2.5G/5G) physical medium attachment (PMA) physical-layer (PHY) electrical testing to provide a fast and accurate way of testing your Ethernet designs.

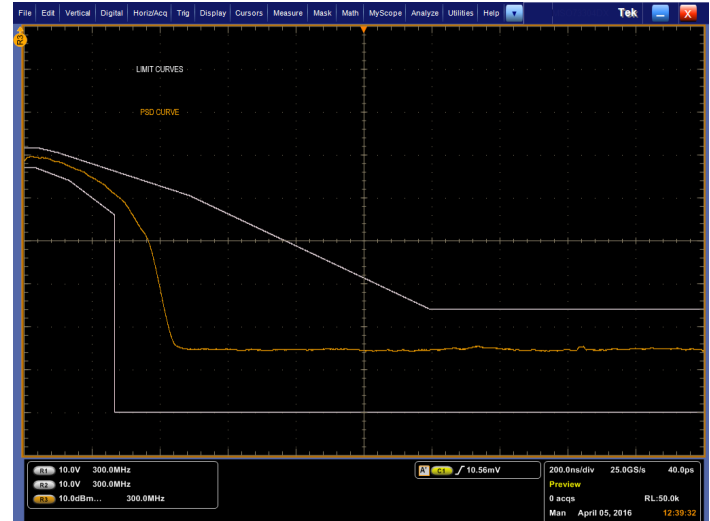
### Features and benefits

- Comprehensive automated solution for 2.5GBASE-T, 5GBASE-T and 10GBASE-T PHY testing
- One-button selection of multiple tests and four-channel support
- Detailed test reports with margin and statistical information aid analysis
- User-defined mode enables flexible parameter control for characterization and margin analysis
- Efficient test execution on oscilloscopes with instrument remote control
- Single instrument analysis of time- and frequency-domain measurements
- Signal acquisition and analysis support for differential probes or direct SMA cabling

### Product description

Based on the TekExpress test automation framework, the Ethernet Transmitter Test Application performs all of the PMA electrical measurements as specified by the 802.3an standard, the 802.3bz standard, and the NBASE-T specification. This allows you to quickly and efficiently test Ethernet devices running at 2.5G, 5G, and 10G data rates.

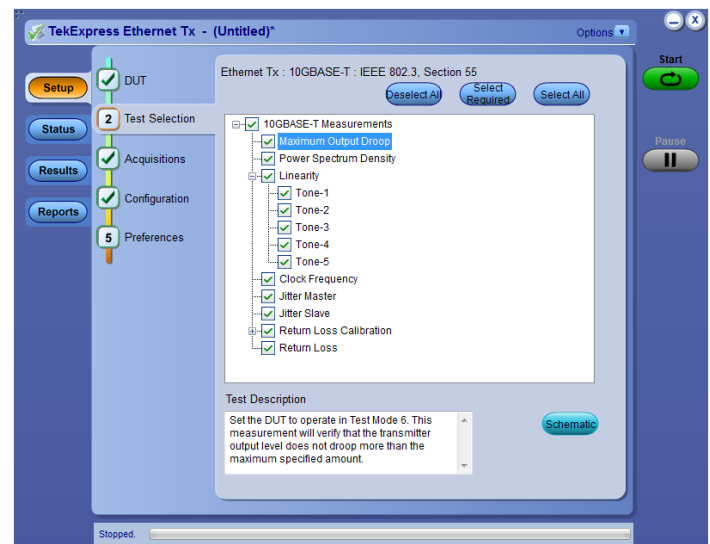
To accurately make these measurements, the Tektronix TF-XGBT test fixture is also needed. The test fixture allows you to reliably and easily access the device under test (DUT) using either differential probes or matched SMA cables.



*Power spectral density measurement.*

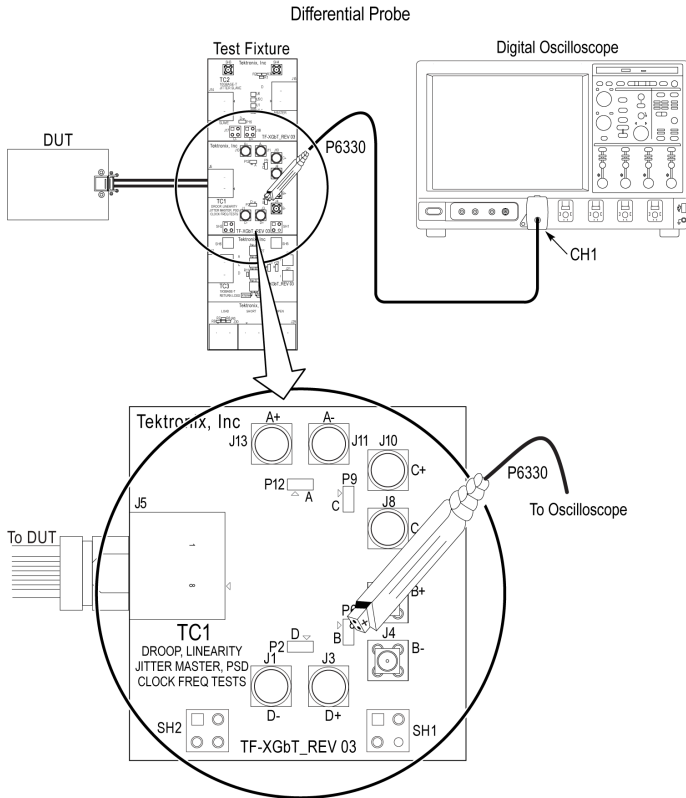
### Test selection and instrument setup

Test selection is easy and straight-forward through the intuitive TekExpress workflow. Simply check the measurements you want to perform.



For each measurement selected, the Ethernet Transmitter application will then automatically set up and configure the oscilloscope saving time and ensuring repeatable, reliable results.

As each test is performed, the application will also show you with detailed diagrams how to properly make the needed connections.



Note: When using high input impedance differential probe, ensure that each of the single ended lanes is terminated with 50  $\Omega$ .

#### Connection diagram

## Reports

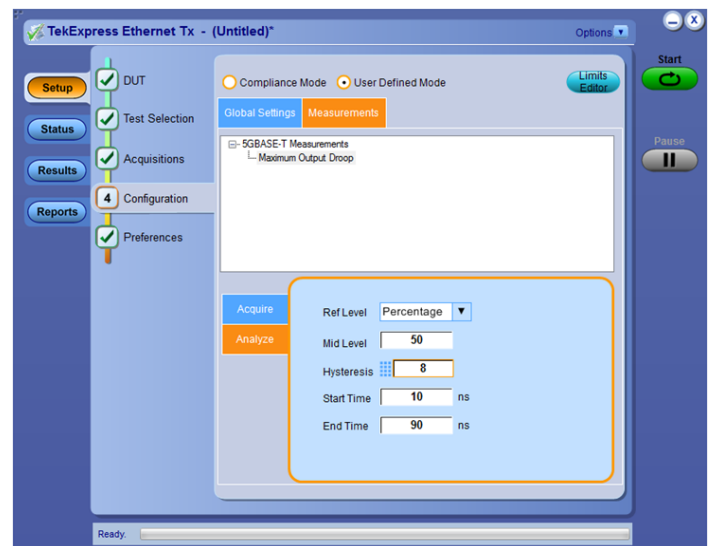
A summary report with Pass/Fail status for each test is created after the tests are complete. This report includes test configuration details, waveform plots, and margin analysis to provide more insight into your design.

TekExpress Ethernet Tx 10GBASE-T Test Report			
Setup Information			
DUT ID	DUT001	Scope Information	MSO73304DX, B260657
Date/Time	2016-03-31 08:38:30	SPC, FactoryCalibration	PASS,PASS
Device Type	Ethernet Tx	Scope F/W Version	7.6.0 Build 7
TekExpress Ethernet Tx Version	1.0.0.143	Channel1 Probe	P7330, B025431
TekExpress Framework Version	4.0.0.266	Return-Loss Probe1	P7330, B025431
Execution Mode	Live	Return-Loss Probe2	P7330, B025531
Probing Type	Differential		
Compliance Mode	True		
Overall Test Result	Pass		
Overall Execution Time	0:11:51		
DUT COMMENT: General comment			
Test Name Summary Table			
Maximum Output Droop	Pass		
Power Spectrum Density	Pass		
Tone-1	Pass		
Tone-2	Pass		
Tone-3	Pass		
Tone-4	Pass		
Tone-5	Pass		
Clock Frequency	Pass		
Jitter Master	Pass		
Open Termination	Pass		
Short Termination	Pass		
Load Termination	Pass		
Return Loss	Pass		

#### Pass/Fail report

## Margin testing

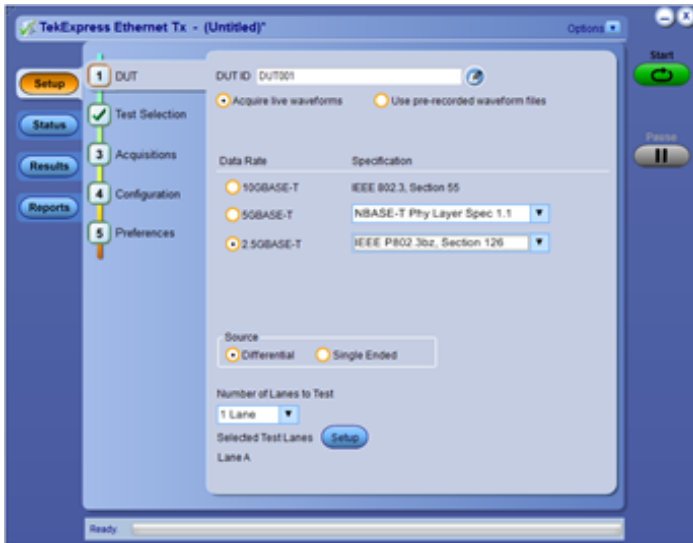
You can also make changes to test limits and other test parameters in order to do margin analysis to see how well your device is performing.



#### Droop configuration parameters

## Differential single-ended acquisition support

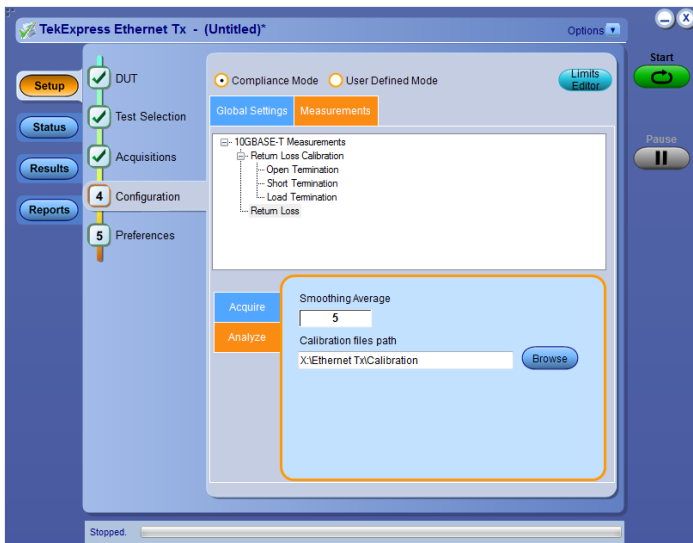
The application allows signal acquisition and analysis with either matched-pair SMA cables or differential probes.



Differential and single-ended support.

## Return loss

The Ethernet Transmitter Test Application simplifies Return Loss testing and eliminates the need for a Vector Network Analyzer by using a patented oscilloscope-based measurement along with a Tektronix AWG. Calibration data for Open, Load, and Short can be stored in a file and recalled.



Return loss

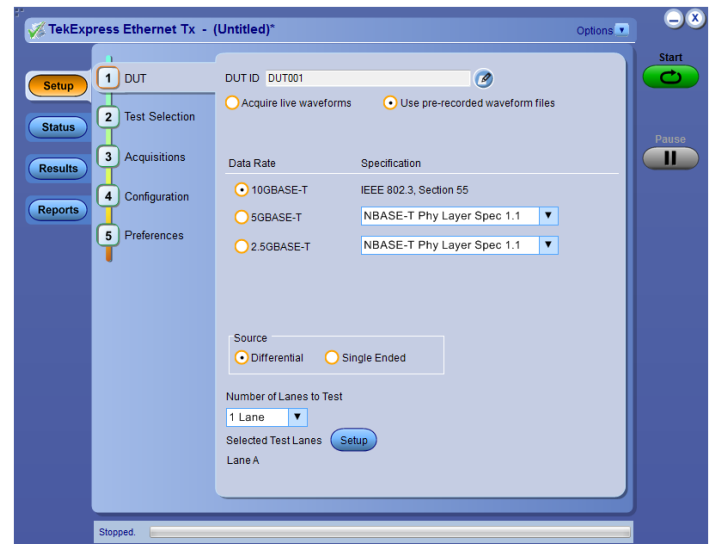
## Complete programming interface

The programmatic interface seamlessly integrates the Ethernet Transmitter Test application with a high-level automation layer such as Visual Basic, MicrosoftNet, C#, C++, Python, or a Web application. This lets you control the state of the TekExpress application running on a local or a remote computer.

Programming examples are found in the application examples folder.

## Prerecorded waveform

Prerecorded Waveform support will provide customers an option to use prerecorded waveforms when an oscilloscope is not available. This feature allows waveforms to be shared across multiple locations and removes end-user dependency from using scopes all the time.



Prerecorded waveform

## Specifications

### 10GBASE-T Measurements

The following tests are performed per the IEEE802.3-2012 standard. The device under test (DUT) must be able to provide the test mode signals as indicated in IEEE802.3-2012 Subclause 55.5.2.

Measurement	Standard reference and Test mode
Maximum Output Droop	IEEE802.3-2012 Subclause 55.5.3.1
Transmitter Timing Jitter - Master	IEEE802.3-2012 Subclause 55.5.3.3
Transmit Clock Frequency	IEEE802.3-2012 Subclause 55.5.3.5
Transmitter Timing Jitter - Slave	IEEE802.3-2012 Subclause 55.5.3.3
Transmitter Linearity	IEEE802.3-2012 Subclause 55.5.3.2
Transmitter Power Spectral Density (PSD) and Power	IEEE802.3-2012 Subclause 55.5.3.4
Return Loss	IEEE802.3-2012 Subclause 55.8.2.1

### 2.5GBASE-T and 5GBASE-T Measurements (requires NBASET option)

The following tests are performed per IEEE802.3bz/D3.3 draft standard. The device under test (DUT) must be able to provide the test mode signals as indicated in IEEE802.3bz/D3.3 Subclause 126.5.2.

Measurement	Test mode
Maximum Output Droop	IEEE80.bz/D3.3 Subclause 126.5.3.1
Transmitter Timing Jitter - Master	IEEE80.bz/D3.3 Subclause 126.5.3.3
Transmit Clock Frequency	IEEE80.bz/D3.3 Subclause 126.5.3.5
Transmitter Timing Jitter - Slave	IEEE80.bz/D3.3 Subclause 126.5.3.3
Transmitter Nonlinear Distortion	IEEE80.bz/D3.3 Subclause 126.5.3.2
Transmitter Power Spectral Density (PSD) and Power	IEEE80.bz/D3.3 Subclause 126.5.3.4
Return Loss	IEEE80.bz/D3.3 Subclause 126.8.2.1

### NBASE-T Measurements (requires NBASET option)

The following tests are performed per the NBASE-T Physical Layer Specification. The device under test (DUT) must be able to provide the test mode signals as indicated in NBASE-T Physical Layer Specification version 1.1 Subclause 2.9.

Measurement	Test mode
Maximum Output Droop	Subclause 55.5.3.1, Test Mode 6
Transmitter Timing Jitter - Master	Subclause 55.5.3.3, Test Mode 2
Transmit Clock Frequency	Subclause 55.5.3.5, Test Mode 2
Transmitter Timing Jitter - Slave	Subclause 55.5.3.3, Test Mode 1 and Mode 3
Transmitter Nonlinear Distortion	Subclause 55.5.3.2, Test Mode 4, Tones 1-5
Transmitter Power Spectral Density (PSD) and Power	Subclause 55.5.3.4, Test Mode 5
Return Loss	Subclause 55.8.2.1, Test Mode 5

## Ordering information

### 10GBASE-T

#### New instrument orders

Product	Option	Description
DPO/MSO70000	XGBT2	TekExpress Automated 10GBASE-T Solution
Table continued...		

Product	Option	Description
DPO7354C	XGBT2	TekExpress Automated 10GBASE-T Solution

For users with existing  
DPO/DSA/MSO70000C/D/DX/SX  
Series Oscilloscope or  
DPO7354C Oscilloscope

Product	Option	Description
DPO-UP	XGBT2	TekExpress Automated 10GBASE-T Solution Upgrade
DPOFL-XGBT2	-	TekExpress Automated 10BASE-T Solution - Floating License
DPOFT-XGBT2	-	TekExpress Automated 10BASE-T Solution - Floating Trial

## NBASE-T and IEEE802.3bz

New instrument orders

Product	Option	Description
DPO/MSO70000	NBASET	TekExpress Automated NBASE-T and IEEE802.3bz Solution
DPO7354C	NBASET	TekExpress Automated NBASE-T and IEEE802.3bz Solution
DPO7254C	NBASET	TekExpress Automated NBASE-T and IEEE802.3bz Solution

For users with existing  
DPO/DSA/MSO70000C/D/DX/SX  
Series Oscilloscope  
or DPO7254C/DPO7354C  
Oscilloscope

Product	Option	Description
DPO-UP	NBASET	TekExpress Automated NBASE-T and IEEE802.3bz Solution Upgrade
DPOFL-XGBT2	-	TekExpress Automated NBASE-T and IEEE802.3bz Solution - Floating License
DPOFT-XGBT2	-	TekExpress Automated NBASE-T and IEEE802.3bz Solution - Floating Trial

## Supported probes

Oscilloscopes	For Droop, PSD, Linearity, Clock Frequency, Jitter-Master, and Jitter-Slave measurements	For Return Loss measurement
DPO7254C/DPO7354C	P6300 - Minimum of one and maximum of four required	P6300 - Minimum of two required
	TDP3500 - Minimum of one and maximum of four required	TDP3500 - Minimum of two required
	SMA Cables - Minimum of two required	NA

Table continued...

Oscilloscopes	For Droop, PSD, Linearity, Clock Frequency, Jitter-Master, and Jitter-Slave measurements	For Return Loss measurement
DPO/DSA/MSO70000C/D/DX/SX Series	P6300 - Minimum of one and maximum of four required	P6300 - Minimum of two required
	P7330, P7340A, P7350, P7360A, P7380A, and P7313 - Minimum of one and maximum of four required	P7330, P7340A, P7350, P7360A, P7380A, and P7313 - Minimum of two required
	TriMode Probes (P7504, P7506, P7508, P7513A, P7516, and P7520) - Minimum of one and maximum of four required	TriMode Probes (P7504, P7506, P7508, P7513A, P7516, and P7520) - Minimum of two required
	P7350SMA, P7380SMA, and P7313SMA - Minimum of one and maximum of four required	NA
	SMA Cables - Minimum of two required	NA

## Oscilloscope compatibility

10GBASE-T	Recommended bandwidth
DPO7354C	3.5 GHz
DPO/DSA/MSO70000C/D/DX/SX Series	≥ 4 GHz

NBASE-T and IEEE802.3bz (2.5G and 5G)	Recommended bandwidth
DPO7000C	≥ 2.5 GHz
DPO/DSA/MSO70000C/D/DX/SX Series	≥ 4 GHz

## AWG compatibility (for Return Loss Measurements)

An AWG7122C is required to perform return loss measurements at all data rates.

## IEEE 2.5GBASE-T Transmitter Nonlinear Distortion Test (Section 126.5.3.2)

When performing this test, the IEEE specification requires a 45 MHz sine wave to be injected. This is only required for 2.5GBASE-T. It is not required for 5GBASE-T. Supported signal sources are:

- AWG5202 with option 250, 2HV and 2DC is recommended for NBaseT (2.5G/5G/10G) compliance testing.

The recommended power splitter is: PSPL5331.

## TF-XGbt 10GBASE-T, NBASE-T, and IEEE802.3bz Transmitter Electrical test fixture

The TF-XGbt test fixture is required to perform all measurements and is designed to meet the test fixture requirements in each of the applicable specifications/standards.

TF-XGbt contains	Quantity	Description
Test fixture main board	1	Main test fixture consists of 3 sections, namely TC1, TC2, and TC3

Table continued...

TF-XGbt contains	Quantity	Description
Test fixture main board	1	<b>Test Fixture TC1:</b> For Droop, Transmitter Timing Jitter - Master, Transmit Clock Frequency, Transmitter Linearity, Transmitter Power Spectral Density (PSD), and Power Level Compliance test measurements  <b>Note:</b> Includes SMA Male-to-Female Adapter × 8 and 50 Ω SMA Terminator × 8 mounted on the SMA connectors
		<b>Test Fixture TC2:</b> Transmitter Timing Jitter – Slave compliance test measurement  <b>Note:</b> Includes SMA Male-to-Female Adapter × 2 mounted on the SMA connectors
		<b>Test Fixture TC3:</b> Return Loss compliance test measurement  <b>Note:</b> Includes SMA Male-to-Female Adapter × 2 mounted on the SMA connectors
Test fixture calibration board	1	For Return Loss calibration
RJ45 patch cord	2	0.08 meter, shielded RJ45 cable to connect the test fixture to the Return Loss calibration board and device under test



TF-XGbt test fixture



Tektronix is ISO 14001:2015 and ISO 9001:2015 certified by DEKRA.



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 (120) 441 046  
 Middle East, Asia, and North Africa +41 52 675 3777  
 People's Republic of China 400 820 5835  
 Republic of Korea +82 2 565 1455  
 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.

30 May 2023 61W-24430-11  
[tek.com](http://tek.com)

**Tektronix®**