

T3SA3100 / T3SA3200 Data Sheet

2.1 GHz and 3.2 GHz Spectrum Analyzers

Broad Measurement Range

Frequency Range: 9 kHz to 2.1 GHz / 3.2 GHz



Tools for Improved Debugging

- Frequency Range from 9 kHz to 3.2 GHz. ✔ More application coverage from a single Spectrum Analyzer.
- -161 dBm/Hz Displayed Average Noise Level (Typ.) ✔ View and measure very small signals.
- -98 dBc/Hz @10 kHz Offset Phase Noise (1 GHz, Typ.) ✔ Improved specification gives more accurate measurement results.
- Optional Tracking Generator
Optional EMI Pre-compliance Test Kit
Optional Reflection Measurement Kit ✔ Make fast and simple transmission measurements
Make EMI Receiver measurements to CISPR 16-1-1
Measure VSWR, Return Loss, Reflection Coefficient
- Built-in switchable pre-amplifier. ✔ Integrated pre-amplifier allows higher sensitivity measurements.
- 10.1 inch (25.65 cm) color WVGA 1024 x 600 display. ✔ Clear and flexible display aids ease of use.
- USB Device, USB Host and LAN support. ✔ Remote control your measurements.

Key Specification

| Model | T3SA3200 | T3SA3100 |
|-------------------------------|---------------------------------------|---------------------------------------|
| Frequency Range | 9 kHz ~ 3.2 GHz | 9 kHz ~ 2.1 GHz |
| Resolution Bandwidth | 1 Hz ~ 1 MHz, in 1-3-10 sequence | 1 Hz ~ 1 MHz, in 1-3-10 sequence |
| Displayed Average Noise Level | -161 dBm/Hz, Normalize to 1 Hz (typ.) | -161 dBm/Hz, Normalize to 1 Hz (typ.) |
| Phase Noise | < -98 dBc/Hz@1 GHz, 10 kHz offset | < -98 dBc/Hz@1 GHz, 10 kHz offset |
| Amplitude Precision | < 0.7 dB | < 0.7 dB |

PRODUCT OVERVIEW

Teledyne Test Tools T3SA3000 Spectrum Analyzer range consists of models with frequency ranges from 9 kHz to 2.1 GHz or 9 kHz to 3.2 GHz. The small footprint and easy user interface is augmented by a high performance specification with many advanced measurement functions and capabilities.

The high performance Spectrum Analysis capability can be enhanced further with options to extend it's measurement capability.

- Optional Tracking Generator: Adds tracking generator capabilities to your Spectrum Analyzer to make transmission measurements on back planes, cables, filters, amplifiers, etc.
- Optional EMI Pre-compliance test kit: Add EMI Receiver Measurements following CISPR 16-1-1.
- Optional Reflection Measurement Kit: Adds VSWR, Return Loss and Reflection Coefficient measurements.
- Optional Advanced Measurement kit: Adds channel power, adjacent channel power ratio, time domain power, occupied bandwidth, third order intercept, etc, to further enhance the measurement capability of your spectrum analyzer.

Teledyne Test Tools spectrum analyzers offer comprehensive measurement capabilities even in the base units. The enhancement options support the user when conducting more complex measurements and make daily measurement tasks easier and faster.

Typical Applications

- Research Laboratory
- Development Laboratory
- Repair and Maintenance
- Calibration Laboratory
- Automatic Production Test
- General bench-top use

User-friendly Design

- 10.1 inch (25.65 cm) 1024*600 display
- Intuitive, easy to use menu system
- "Preset" and "Auto Tune" for quick set up
- Built-in front panel accessible help system
- File management (support for U-disc and local storage)
- Lightweight, small footprint, easy to transport

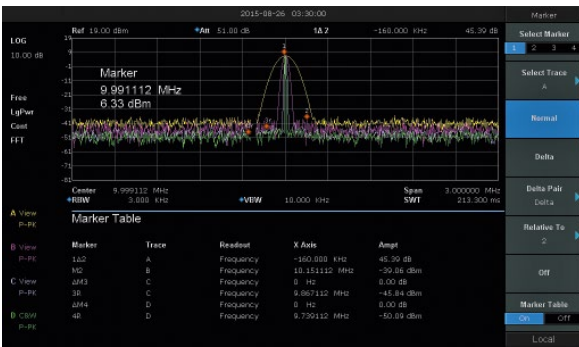
Features and Benefits

- Frequency Range from 9 kHz up to 3.2 GHz
- -161 dBm/Hz Displayed Average Noise Level (Typ.)
- -98 dBc/Hz @10 kHz Offset Phase Noise (1 GHz, Typ.)
- Total Amplitude Accuracy < 0.7 dB
- 1 Hz Minimum Resolution Bandwidth (RBW)
- All-Digital IF Technology
- Standard Preamplifier
- Up to 3.2 GHz Tracking Generator Kit (Opt.)
- Reflection Measurement Kit (Opt.)
- Advanced Measurement Kit (Opt.)
- EMI Pre-compliance Test Kit (Opt.)
- 10.1 Inch WVGA (1024 x 600) Display

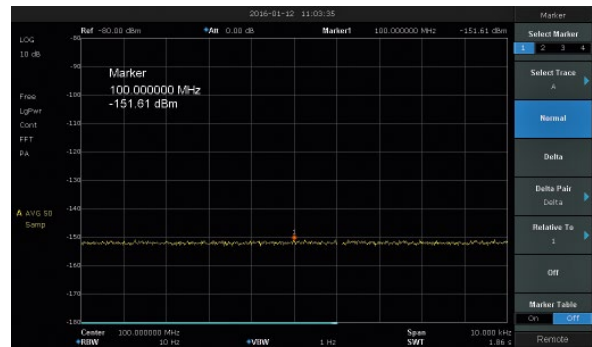


DESIGN FEATURES

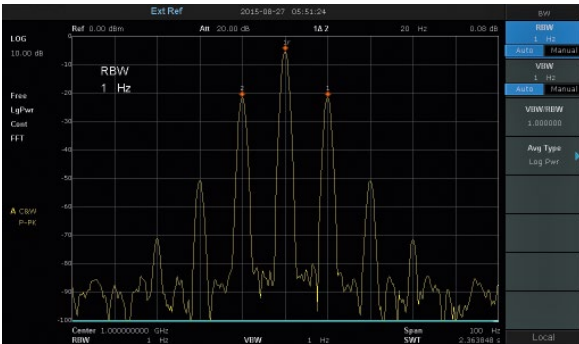
Supports four independent traces and cursors



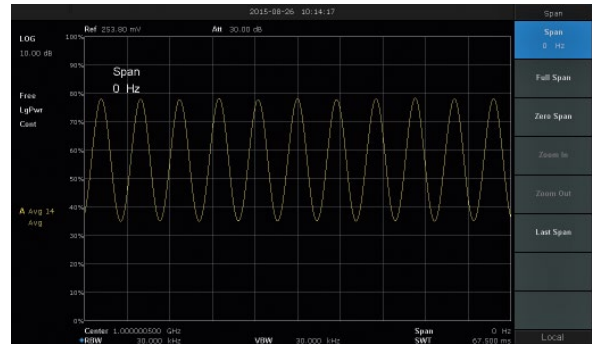
-151 dBm Displayed Average Noise Level (RBW = 10 Hz)



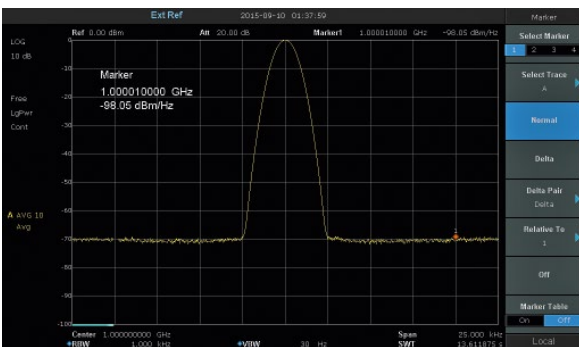
1 Hz Minimum Resolution Bandwidth (RBW)



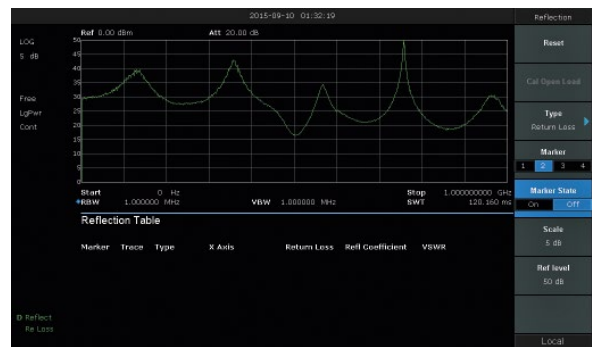
Zero span and demodulation capabilities



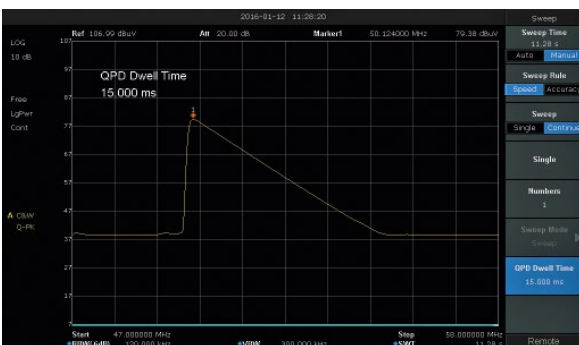
Phase noise -98 dBc/Hz @ 1 GHz, offset 10 kHz



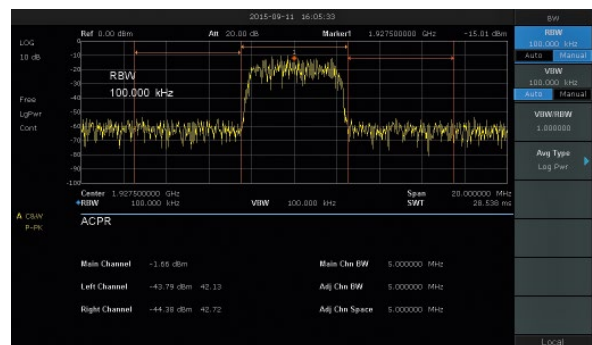
On-screen VSWR/Return Loss measurements with the reflection measurement option (T3SA3000-RFM)



EMI filter and Quasi-Peak detector following CISPR 16-1-1 (T3SA3000-EMI)



Advanced measurement kit (T3SA3000-ADM) includes on-screen ACPR measurements



SPECIFICATIONS

Specifications are valid under the following conditions: The instrument is within the calibration period, has been stored between 0 and 50°C for at least 2 hours prior to use, and has been powered on and warmed up for at least 40 minutes. The specifications include the measurement uncertainty, unless otherwise noted.

Specifications: All products are guaranteed to meet published specifications when operating in temperatures from 5 to 45°C, unless otherwise noted.

Typical: Performance deemed typical implies that 80 percent of the measurement results will meet the typical published performance with a 95th percentile confidence level at room temperature (approximately 25°C). Typical performance is not warranted and does not include measurement uncertainty.

Nominal: The expected performance or design attribute.



Frequency Characteristic

| | T3SA3200 | T3SA3100 |
|--|----------|----------|
|--|----------|----------|

Frequency

| | | |
|----------------------|-----------------|-----------------|
| Frequency range | 9 kHz – 3.2 GHz | 9 kHz – 2.1 GHz |
| Frequency resolution | 1 Hz | 1 Hz |

Frequency Span

| | | |
|----------|---|-------------------------|
| Range | 0 Hz, 100 Hz to 3.2 GHz | 0 Hz, 100 Hz to 2.1 GHz |
| Accuracy | \pm Span / (number of sweep points - 1) | |

Internal Reference Source

| | |
|------------------------------|---|
| Reference frequency | 10.000000 MHz |
| Frequency reference accuracy | \pm [(time since last adjustment \times frequency aging rate) + temperature stability + calibration accuracy] |
| Initial calibration accuracy | < 1 ppm |
| Temperature stability | < 1 ppm/year, 0°C ~ 50°C |
| Frequency aging rate | < 0.5 ppm/first year, 3.0 ppm/20 years |

Marker

| | |
|-------------------------------|--|
| Marker resolution | Span / (number of sweep points - 1) |
| Marker uncertainty | \pm [frequency indication \times frequency reference uncertainty + 1% \times span + 10% \times resolution bandwidth + marker resolution] |
| Frequency counter resolution | 1 Hz |
| Frequency counter uncertainty | \pm [frequency indication \times frequency reference accuracy + counter resolution] |

Bandwidths

| | |
|--------------------------------|---|
| Resolution bandwidth (-3 dB) | 1 Hz ~ 1 MHz ¹⁾ , in 1-3-10 sequence |
| Resolution filter shape factor | < 4.8:1 (60 dB:3 dB), Gaussian-like |
| RBW uncertainty | < 5% |
| Video bandwidth (-3 dB) | 1 Hz ~ 3 MHz, in 1-3-10 sequence |
| VBW uncertainty | < 5% |

¹⁾ The DANL with RBW set to 1 or 3 Hz will be similar to 10 Hz.

Amplitude Characteristic

| | T3SA3200 | T3SA3100 | |
|---|---|---------------------------|---------------------------|
| Amplitude and Level | | | |
| Measurement range | DANL to +10 dBm, 100 kHz ~ 1 MHz, preamplifier off DANL to +20 dBm, 1 MHz ~ 3.2 GHz, preamplifier off | | |
| Reference level | -100 dBm to +30 dBm, 1 dB steps Preamplifier 20 dB (nom.), 9 kHz ~ 3.2 GHz Input attenuation 0 ~ 51 dB, 1 dB steps | | |
| Maximum input DC voltage | ±50 VDC | | |
| Maximum average RF power damage level | 30 dBm, 3 minutes, $f_c \geq 10$ MHz, attenuation > 20 dBm, preamp off Maximum 33 dBm, $f_c \geq 10$ MHz, attenuation > 20 dBm, preamp off | | |
| Displayed Average Noise Level (DANL) | | | |
| | 20°C ~ 30°C, attenuation = 0 dB, sample detector, trace average > 50 | | |
| Preamp off | RBW = 10 Hz | Normalization to 1 Hz | |
| | 9 kHz ~ 100 kHz | -100 dBm (nom.) | -110 dBm (nom.) |
| | 100 kHz ~ 1 MHz | -97 dBm, -101 dBm (typ.) | -107 dBm, -111 dBm (typ.) |
| | 1 MHz ~ 10 MHz | -122 dBm, -126 dBm (typ.) | -132 dBm, -136 dBm (typ.) |
| | 10 MHz ~ 200 MHz | -127 dBm, -131 dBm (typ.) | -137 dBm, -141 dBm (typ.) |
| | 200 MHz ~ 2.1 GHz | -125 dBm, -129 dBm (typ.) | -135 dBm, -139 dBm (typ.) |
| | 2.1 GHz ~ 3.2 GHz | -116 dBm, -122 dBm (typ.) | -126 dBm, -132 dBm (typ.) |
| Preamp on | 9 kHz ~ 100 kHz | -107 dBm (nom.) | -117 dBm (nom.) |
| | 100 kHz ~ 1 MHz | -122 dBm, -127 dBm (typ.) | -132 dBm, -137 dBm (typ.) |
| | 1 MHz ~ 10 MHz | -138 dBm, -144 dBm (typ.) | -148 dBm, -154 dBm (typ.) |
| | 10 MHz ~ 200 MHz | -146 dBm, -151 dBm (typ.) | -156 dBm, -161 dBm (typ.) |
| | 200 MHz ~ 2.1 GHz | -145 dBm, -148 dBm (typ.) | -155 dBm, -158 dBm (typ.) |
| | 2.1 GHz ~ 3.2 GHz | -135 dBm, -139 dBm (typ.) | -145 dBm, -149 dBm (typ.) |
| Phase Noise | | | |
| | 20°C ~ 30°C, $f_c = 1$ GHz | | |
| Phase Noise | <-95 dBc/Hz @10 kHz offset, <-98 dBc/Hz (typ.) | | |
| | <-96 dBc/Hz @100 kHz offset, <-97 dBc/Hz (typ.) | | |
| | <-115 dBc/Hz @1 MHz offset, <-117 dBc/Hz (typ.) | | |
| Level Display | | | |
| Logarithmic level axis | 10 dB to 200 dB | | |
| Linear level axis | 0 to reference level | | |
| Units of level axis | dBm, dBmV, dBμV, dBμA, V, W | | |
| Number of display points | 751 | | |
| Number of traces | 4 | | |
| Trace detectors | Positive-peak, Negative-peak, Sample, Normal, Average (Voltage/RMS/Video), Quasi-peak (with EMI option) | | |
| Trace functions | Clear write, Max Hold, Min Hold, View, Blank, Average | | |
| Frequency Response | | | |
| | 20°C to 30°C, 30 % to 70 % relative humidity, attenuation = 20 dB, reference frequency 50 MHz | | |
| Preamp off | ±0.8 dB | | |
| | ±0.4 dB, (typ.) | | |
| Preamp on | ±0.9 dB | | |
| | ±0.5 dB, (typ.) | | |

SPECIFICATIONS

Amplitude Characteristic

| | T3SA3200 | T3SA3100 |
|--|--|----------|
| Error and Accuracy | | |
| Resolution bandwidth switching uncertainty | 10 kHz RBW Logarithmic resolution ± 0.2 dB, liner resolution ± 0.01 , nominal | |
| Input attenuation switching uncertainty | 20 to 30 , $f_c = 50$ MHz, preamp off, Relative to 20 dB, 1 to 51 dB attenuation ± 0.5 dB | |
| Absolute amplitude accuracy | 20°C to 30°C, $f_c = 50$ MHz, RBW = 1 kHz, VBW = 1 kHz, peak detector, attenuation = 20 dB, 95th percentile reliability | |
| | preamp off ± 0.4 dB, input signal -20 dBm | |
| | preamp on ± 0.5 dB, input signal -40 dBm | |
| Total amplitude accuracy | 20°C to 30°C, $f_c > 100$ kHz, input signal -50 dBm ~ 0 dBm, RBW = 1 kHz, VBW = 1 kHz, peak detector, attenuation = 20 dB, preamp off, 95th percentile reliability ± 0.7 dB | |
| RF input VSWR | input attenuation 10 dB, 1 MHz ~ 3.2 GHz <1.5, nominal | |

Distortion and Spurious Responses

| | | |
|----------------------------|--|--|
| Second harmonic distortion | $f_c \geq 50$ MHz, mixer level -30 dBm, attenuation = 0 dB, preamp off, 20°C to 30°C, typ. -65 dBc | |
| Third-order intercept | $f_c \geq 50$ MHz, two -20 dBm tones at input mixer spaced by 100 kHz, attenuation = 0 dB, preamp off, 20°C to 30°C, typ. +10 dBm | |
| 1dB Gain Compression | $f_c \geq 50$ MHz, attenuation = 0 dB, preamp off, 20°C to 30°C, nom. >-5 dBm | |
| Residual response | input terminated = 50 Ω , attenuation = 0 dB, 20°C to 30°C, typ. <-90 dBm | |
| Input related spurious | Mixer level = -30 dBm, 20°C to 30°C <-65 dBc | |

Sweep and Trigger

| | | |
|------------------|---|---------------------|
| Sweep time | 1 ms to 3000 s | |
| Sweep accuracy | Accuracy, Speed | |
| Sweep mode | Sweep | FFT |
| | RBW = 30 Hz ~ 1 MHz | RBW = 1 Hz ~ 10 kHz |
| Sweep rule | Single, Continuous | |
| Trigger source | Free, Video, External | |
| External trigger | 5 V TTL level, rising edge/falling edge | |

Tracking Generator (Option T3SA3000-TG)

| | | |
|------------------------------|--------------------------------------|-----------------|
| Frequency range | 100 kHz ~ 3.2 GHz | 100 kHz~2.1 GHz |
| RBW | 30 Hz ~ 1 MHz, only sweep mode | |
| Output level | -20 dBm ~ 0 dBm | |
| Output level resolution | 1 dB | |
| Output flatness | ± 3 dB | |
| Output maximum reverse level | Mean power: 30 dBm, DC: ± 50 VDC | |

EMI Receiver Measurement (Option T3SA3000-EMI)

| | |
|-----------------------------|-------------------------------------|
| Resolution bandwidth (6 dB) | 200 Hz, 9 kHz, 120 kHz |
| Detector | Quasi-peak (following CISPR 16-1-1) |
| Dwell time | 0 μ s ~ 10 s |

Reflection Measurement (Option T3SA3000-RFM-KIT)

| | |
|----------|--|
| Function | VSWR, Return loss, Reflection coefficient (The T3SA3000-RFM-KIT option REQUIRES the T3SA3000-TG Option) |
|----------|--|

Advanced Measurement (Option T3SA3000-ADM)

| | T3SA3200 | T3SA3100 |
|----------|---|----------|
| Function | Channel power, Adjacent channel power ratio, Time domain power, Occupied bandwidth, Third-order intercept, Spectrum monitor | |

External input and external output

| | |
|-------------------------|---|
| Front panel RF input | 50 Ω, N-female Front |
| panel TG output | 50 Ω, N-female |
| 10 MHz reference output | A 10 MHz, >0 dBm, 50 Ω, BNC-female |
| 10 MHz reference input | B 10 MHz, -5 dBm ~ +10 dBm, 50 Ω, BNC-female |
| External Trigger input | C 1 kΩ, 5 V TTL, BNC-female |
| Security | D Kensington Lock point |

Communication Interface

| | |
|----------|--|
| USB Host | USB-A 2.0 + USB |
| Device | E USB-B 2.0 |
| LAN | F LAN (VXI11), 10/100 Base, RJ-45 |

General Specification

| | |
|-------------|--|
| Display | TFT LCD, 1024 × 600 (waveform area 751 × 501), 10.1 inch (25.65 cm) |
| Storage | Internal (Flash) 256 MByte, External (USB storage device) 32 GByte |
| Source | Input voltage range (AC) 100 V ~ 240 V, AC frequency supply 45 Hz ~ 440 Hz, Power consumption 30 W |
| Temperature | Working temperature 0°C to 50°C, Storage temperature -20°C to 70°C |
| Humidity | 0°C to 30°C, ≤ 95 % Relative humidity; 30°C to 50°C, ≤ 75 % Relative humidity |
| Dimensions | 393 mm × 207 mm × 116.5 mm (W × H × D) |
| Weight | Including the tracking generator 4.60 kg (10.1 lb) |

Electromagnetic Compatibility and Safety

| | |
|-------------------|-----------------|
| EMC | EN 61326-1:2013 |
| Electrical safety | EN 61010-1:2010 |



Ordering Information

| Product Description | T3SA3000 Spectrum Analyzer | Order Number | |
|------------------------------------|--|------------------|---|
| Product code | Spectrum Analyzer, 9 kHz ~ 3.2 GHz | T3SA3200 | |
| | Spectrum Analyzer, 9 kHz ~ 2.1 GHz | T3SA3100 | |
| Standard configurations | A Quick Start, A USB Cable, A Calibration Certificate Power cord | | |
| | Tracking Generator Kit | T3SA3000-TG | |
| | Advanced Measurement Kit | T3SA3000-ADM | |
| Utility Options | Utility Kit: N(M)-SMA(M) cable N(M)-N(M) cable N(M)-BNC(F) adaptor (2 pcs) N(M)-SMA(F) adaptor (2 pcs) 10 dB attenuator | T3SA3000-UTL | |
| | | | |
| EMI Options | EMI Measurement Kit: EMI Filter and Quasi Peak Detector | T3SA3000-EMI | |
| | Near Field Probe: H field probe sets (25 mm, 10 mm, 5 mm, 2 mm), 30 MHz ~ 3.0 GHz | T3SA3000-NFP | |
| | Tracking Generator Kit | T3SA3000-TG | The T3SA3000-RFM-KIT option REQUIRES the T3SA3000-TG to be installed to work correctly. |
| Reflect Measurement Options | Reflection Measurement Kit software only. This is the software installed on the T3SA3000 spectrum analyzer | T3SA3000-RFM | T3SA3000-RFM REQUIRES a VSWR Reflection measurement bridge and the T3SA3000-TG Tracking Generator to work correctly. |
| | Reflection Measurement Kit hardware only. This is the hardware VSWR Bridge (1 MHz ~ 2 GHz), N(M)-N(M) adaptor (2 pcs) for use with the T3SA3000 spectrum analyzer | T3SA3000-RLB | T3SA3000-RLB REQUIRES the T3SA3000-RFM and the T3SA3000-TG Tracking Generator to work correctly. |
| | Reflect Measurement Kit: This kit comprises of the T3SA3000-RFM Software, and the T3SA3000-RLB hardware: VSWR Bridge (1 MHz ~ 2 Ghz), N(M)-N(M) adaptor (2 pcs) | T3SA3000-RFM-KIT | The T3SA3000-RFM-KIT comprises both the T3SA3000-RFM and the T3SA3000-RLB. This kit does not include the T3SA3000-TG option. The T3SA3000-TG option should be ordered separately. |



ABOUT TELEDYNE TEST TOOLS



Company Profile

Teledyne LeCroy is a leading provider of oscilloscopes, protocol analyzers and related test and measurement solutions that enable companies across a wide range of industries to design and test electronic devices of all types. Since our founding in 1964, we have focused on creating products that improve productivity by helping engineers resolve design issues faster and more effectively. Oscilloscopes are tools used by designers and engineers to measure and analyze complex electronic signals in order to develop high-performance systems and to validate electronic designs in order to improve time to market.

The Teledyne Test Tools brand extends the Teledyne LeCroy product portfolio with a comprehensive range of test equipment solutions. This new range of products delivers a broad range of quality test solutions that enable engineers to rapidly validate product and design and reduce time-to-market. Designers, engineers and educators rely on Teledyne Test Tools solutions to meet their most challenging needs for testing, education and electronics validation.

Location and Facilities

Headquartered in Chestnut Ridge, New York, Teledyne Test Tools and Teledyne LeCroy has sales, service and development subsidiaries in the US and throughout Europe and Asia. Teledyne Test Tools and Teledyne LeCroy products are employed across a wide variety of industries, including semiconductor, computer, consumer electronics, education, military/aerospace, automotive/industrial, and telecommunications.

Distributed by:

Teledyne LeCroy (US Headquarters)

700 Chestnut Ridge Road
Chestnut Ridge, NY, USA 10977-6499

Phone: 800-553-2769 or 845-425-2000
Fax Sales: 845-578-5985
Phone Support: 1-800-553-2769
Email Sales: contact.corp@teledynelecroy.com
Email Support: support@teledynelecroy.com
Web Site: <http://teledynelecroy.com/>

Teledyne LeCroy (European Headquarters)

Teledyne LeCroy GmbH
Im Breitenspiel 11c
D-69126 Heidelberg, Germany

Phone: +49 6221 82700
Fax: +49 6221 834655
Phone Service: +49 6221 8270 85
Phone Support: +49 6221 8270 28
Email Sales: contact.gmbh@teledynelecroy.com
Email Service: service.gmbh@teledynelecroy.com
Email Support: tlc.t3.appsupport.eu@teledyne.com
Web Site: <http://teledynelecroy.com/germany>

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T3 stands for Teledyne Test Tools.