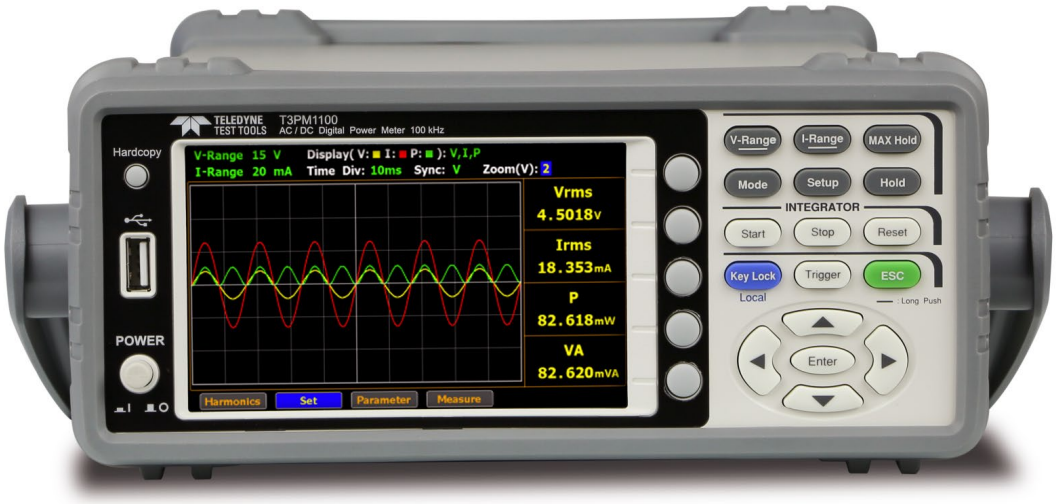
TELEDYNE TEST TOOLS
Everywhereyoulook™

T3PM1100 Data Sheet

Digital Power Meter



Tools for Improved Debugging

• 5" Large TFT LCD Display.	✓ Clear visibility of your measurement results.
• Two numerical display modes along with a waveform display of various parameters.	✓ Choose the best display mode for your measurement requirements.
• Automatic Level-changing feature for integration function.	✓ Achieve faster measurement results without worrying about power level changes.
• External Current Sensor Input Terminal.	✓ Extends the current measurement capability for various application requirements.
• Standard interfaces: USB, LAN, RS-232C.	✓ Remote control of your measurements.
• 3 Years Warranty as standard.	✓ Reliable product gives peace of mind.

Key Specifications

Specification	T3PM1100
Input Type	Voltage: Floating input through resistive voltage divider Current: Floating input through shunt
Measurement Range	Voltage: 15 V, 30 V, 60 V, 150 V, 300 V, 600 V Current: Direct input: 5 mA, 10 mA, 20 mA, 50 mA, 100 mA, 200 mA, 0.5 A, 1 A, 2 A, 5 A, 10 A, 20 A Sensor input EXT 1: 2.5 V, 5 V, 10 V EXT 2: 50 mV, 100 mV, 200 mV, 500 mV, 1 V, 2 V
Input Bandwidth	DC, 0.1 Hz to 100 kHz

PRODUCT OVERVIEW

Teledyne Test Tools T3PM1100 is a digital power meter for single-phase (1P/2W) AC power measurement. The T3PM1100 offers DC, 0.1 Hz ~ 100 kHz test bandwidth, 16 bits ADC, and 300 kHz sampling rate. The T3PM1100 features a 5" TFT LCD screen with a five-digit measurement display. It also has options to display waveform (voltage/current/power), the integration measurement function, harmonic measurement and analysis of each order (meeting the IEC 61000-4-7 harmonics measurement requirements at 50/60 Hz), external sensor input terminals, and various communication interfaces to help users to make convenient and accurate power measurements.

The rated direct input voltage of T3PM1100 is 600 V and the input current is 20 A. The minimum current level is 5 mA (resolution up to 0.1 µA) and the power measurement resolution is 0.1 µW. The crest factor can reach 3 (half measurement range can reach 6 or 6 A), and the voltage/current/power measurement capability can reach ±0.05 % reading ±0.1 % level. Different measurement modes can be selected and offers up to 25 relevant parameters for power measurement. The T3PM1100 can be used to measure power consumption of general products as well as to measure standby power consumption of low power devices which requires greater range and accuracy.

In addition, the T3PM1100 has rich set of auxiliary measurement functions. High voltage measurements can be done using VT rate setting along with an external voltage Potential Transformer. To measure currents above 20 A, a Current Transformer (CT) can be used and the type of CT determines the instrument settings. When a voltage output type CT is used, measurement can be conducted through the external current sensor input terminals EXT1/EXT2. When a current output type CT is used, the CT can be directly connected to current input terminal on the rear panel and setting the appropriate CT ratio state in the Ratio configuration menu.

T3PM1100 provides RS-232C, USB device (virtual COM) and LAN communication interfaces for remote control applications. USB host supports screen capture, accessing data stored in internal memory, and firmware update.

Features

- 5" TFT LCD
- DC, 0.1 Hz to 100 kHz Voltage/Current test bandwidth
- Two numerical display modes
- General Mode: Displays 2 main test items + 8 secondary test items
- Simple Mode: Displays the test values of 4 main test items
- Waveform Display: V (Voltage), I (Current), P (Power)
- The Current/Voltage can be measured to a deformed wave with CF of 3, and the half-range CF can reach 6 or 6 A
- Meets the IEC 61000-4-7 harmonics measurement requirements (50/60 Hz)
- 50th order of harmonic measurement and analysis (value and bar graph)
- Integration function supports automatic level-changing
- External current sensor input terminals (EXT1/EXT2)
- Standard Interfaces: RS-232C, USB Device/Host, LAN

PANEL INTRODUCTION

1. Hardcopy key & USB Host
2. 5" TFT LCD
3. Operation & Navigator Key
4. Current Input Terminal
5. External Current Sensor Input Terminal (EXT1/EXT2)
6. Voltage Input Terminal
7. Standard Interfaces : RS-232C, LAN, USB Device
8. General Power Input AC 100 V – 240 V

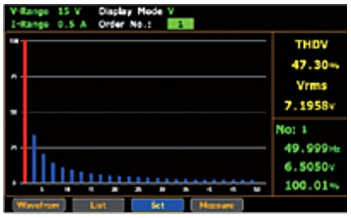
VARIOUS DISPLAY MODES

Numerical (General) Mode

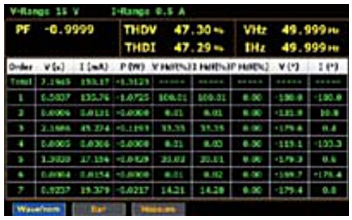
Numerical (Simple) Mode

Waveform Mode

The results of parameter measurement are displayed in numerical as well as graphical formats. Numerical format offers general and simple mode to display various parameters. The general mode can display 10 measurement parameters (2 main measurements + 8 monitoring measurements), and the simple mode can display four measurement parameters. These displayed parameters can be arbitrarily selected from 25 power parameters according to user requirements. The graphical format can display waveforms of voltage, current and power. The horizontal scale can be adjusted from 25 µs/div to 1 s/div (depends on data update rate). Three magnification levels for waveform are also provided for users to select.



Harmonic (Bar Graph) Measurement



Harmonic (Table Column) Measurement

In the harmonic measurement, the measurement result of each order of harmonics can be displayed by bar graphs, and a specific order can be specified for observation. The relevant values of each order of harmonics such as voltage, current, power, voltage distortion ratio, current distortion ratio, power distortion ratio, voltage phase angle, current phase angle can be recorded and displayed.

RICH MEASUREMENT PARAMETERS

Measurement Items	Symbols
Voltage	Vrms, V+pk, V-pk, Vac*, Vdc*, Vmn*
Current	Irms, I+pk, I-pk, Iac*, Idc*
Power	P, P+pk, P-pk, VA, VAR
Power Factor	PF
Crest Factor	CFV, CFI
Phase Angle	DEG
Frequency	VHz, IHz
Total Harmonic Distortion	THDV, THDI
Maximum Current Ratio	MCR
Integration	WP, WP+, WP-, q, q+, q-, Vac, Iac

Note: "*" Only applicable to specific measurement modes

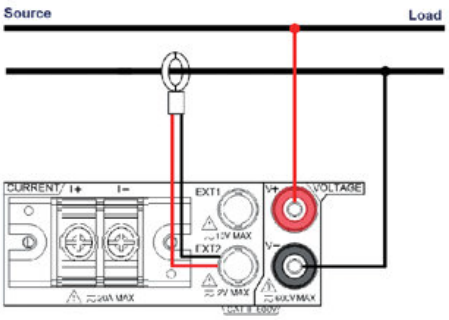
T3PM1100 provides various measurement functions such as voltage, current, frequency, effective power, apparent power, reactive power, power factor, crest factor, total harmonic distortion, and maximum current ratio.

T3PM1100 is also equipped to measure time integral of power or current for the DUT. Users can set a time window to perform instantaneous power integration at specified intervals and then divide value by total time period to obtain the average power of the DUT.

During integration measurement, T3PM1100 supports automatic level-changing function according to DUT power level in order to obtain accurate results.

AUXILIARY MEASUREMENT FUNCTIONS

Ratio Configuration



External Current Sensor Input

The T3PM1100 has rich set of auxiliary measurement functions. High voltage measurements can be done using VT rate setting along with an external voltage Potential Transformer. To measure currents above 20 A a Current Transformer (CT) can be used and the type of CT determines the instrument settings. When a voltage output type CT is used, measurement can be conducted through the external current sensor input terminals EXT1/EXT2. When a current output type CT is used, the CT can be directly connected to current input terminal on the rear panel and setting the appropriate CT ratio state in the Ratio configuration menu.

In addition, T3PM1100 provides 4 sets of panel settings for storage/recall and memory for storing 10,000 sets of measurement values. The measurement storage can log the measurement results based upon the update rate or a self-defined time interval to facilitate the subsequent analysis. The USB host on the front panel supports screen capture, measurement value storage, and T3PM1100 firmware update.

Input

Input Type	Voltage Current	Floating input through resistive voltage divider Floating input through shunt
Measure Range	Voltage Current Direct input Sensor input	15 V, 30 V, 60 V, 150 V, 300 V, 600 V 5 mA, 10 mA, 20 mA, 50 mA, 100 mA, 200 mA, 0.5 A, 1 A, 2 A, 5 A, 10 A, 20 A EXT 1: 2.5 V, 5 V, 10 V EXT 2: 50 mV, 100 mV, 200 mV, 500 mV, 1 V, 2 V
Input Impedance	Voltage Current Direct input range 5 mA ~ 200 mA Direct input range 0.5 A ~ 20 A Sensor input Input range 2.5 V ~ 10 V (EXT1) Input range 50 mV ~ 2 V (EXT2)	Input resistance: 2 MΩ Input resistance: 505 mΩ Input resistance: 5 mΩ Input resistance: 100 kΩ Input resistance: 20 kΩ
Continuous Maximum Allowable Input	Voltage Current Direct input range 5 mA ~ 200 mA Direct input range 0.5 A ~ 20 A Sensor input	peak value of 1.5 kV or RMS value of 1 kV, whichever is less peak value of 30 A or RMS value of 20 A, whichever is less peak value of 100 A or RMS value of 30 A, whichever is less peak value less than or equal to 5 times of the rated range
Input Bandwidth	DC, 0.1 Hz ~ 100 kHz	
Continuous Maximum Common-mode Voltage	600 Vrms, CAT II	
Line Filter	select OFF or ON (cut off frequency of 500 Hz)	
Frequency Filter	select OFF or ON (cut off frequency of 500 Hz)	
A/D Converter	Simultaneous conversion voltage and current inputs Resolution 16 bits Maximum conversion rate Approx. 300 kHz	

Voltage and Current Accuracy

Requirements	Temperature Humidity Input waveform common-mode voltage Number of displayed digits Frequency filter Warm-up Time Update interval	23 ± 5 °C 30 ~ 75 % RH Sine wave crest factor = 3 0 V 5 digits Turn on to measure voltage or current of 200 Hz or less 30 Minutes 250 ms
Accuracy	DC 0.1 Hz ≤ f < 45 Hz 45 Hz ≤ f ≤ 66 Hz 66 Hz < f ≤ 1 kHz 1 kHz < f ≤ 10 kHz 10 kHz < f ≤ 100 kHz	± (0.1 % of reading + 0.2 % of range) ± (0.1 % of reading + 0.2 % of range) ± (0.1 % of reading + 0.05 % of range) ± (0.1 % of reading + 0.2 % of range) ± (0.07 *f) % of reading + 0.3 % of range) ± (0.5 % of reading + 0.5 % of range) ± [{0.04 x (f-10)} % of reading]
Temperature Coefficient	Add	± 0.03 % of reading/°C within the range 5 to 18 °C or 28 to 40 °C.
When the Line Filter is Turned ON	45 ~ 66 Hz < 45 Hz	Add 0.2 % of reading Add 0.5 % ofreading
Accuracy when the Crest Factor is set to 6 or 6 A	Accuracy obtained by doubling the measurement range error for the accuracy when the crest factor is set to 3	
Accuracy Changes Caused by Data Update Interval	When the data update interval is 100 ms, and Auto, add 0.05 % of readingto the 0.1 Hz to 1 kHz accuracy.	
Influence of Temperature Changes After Zero-level Compensation or Range Change	DC voltage accuracy DC current accuracies: 5 mA/10 mA/20 mA/50 mA/100 mA/200 mA ranges 0.5 A/1 A/2 A/5 A/10 A/20 A ranges External current sensor input (/EXT 1) External current sensor input (/EXT2)	Add 0.02 % of range/°C Add 5 µA/°C Add 500 µA/°C Add 1 mV/°C Add 50 µV/°C
Accuracy when the Crest Factor is set to 6 or 6 A	Accuracy obtained by doubling the measurement range error for the accuracy when the crest factor is set to 3	
Accuracy Changes Caused by	When the data update interval is 100 ms, and Auto, add 0.05 % of reading to the 0.1 Hz to 1 kHz	

Active Power Accuracy

Requirements	Same as the conditions for voltage and current. Power factor	1
Accuracy	DC 0.1 Hz ≤ f < 45 Hz 45 Hz ≤ f ≤ 66 Hz 66 Hz < f ≤ 1 kHz 1 kHz < f ≤ 10 kHz 10 kHz < f ≤ 100 kHz	(0.1 % of reading + 0.2 % of range) ± (0.3 % of reading + 0.2 % of range) ± (0.1 % of reading + 0.05 % of range) ± (0.2 % of reading + 0.2 % of range) ± (0.1 % of reading + 0.3 % of range) ± [{0.067 x (f-1)} % of reading] ± (0.5 % of reading + 0.5 % of range) ± [{0.09 x (f-10)} % of reading]
Influence of Power Factor	When power factor (λ) = 0 (S: apparent power) ± 0.1 % of S for 45 Hz ≤ f ≤ 66 Hz ± {(0.1 + 0.15 x f) % of S} for up to 100 kHz as reference data •f is frequency of input signal in kHz when 0 < λ < 1 (Φ: phase angle of the Voltage and current) (power reading) x [(power reading error %) + (power range %) x (power range / indicated apparent power value) + {tanΦ x (influence when λ = o) %}]	
When the Line Filter is Turned ON	45 ~ 66 Hz < 45 Hz	Add 0.3 % of reading Add 1 % of reading
Temperature Coefficient	same as the temperature coefficient for voltage and current	
Accuracy when the Crest Factor is set to 6 or 6 A	accuracy obtained by doubling the measurement range error for the accuracy when the crest factor is set to 3	
Accuracy of Apparent Power S	voltage accuracy + current accuracy	
Accuracy of Reactive Power Q	accuracy of apparent power + (√1.0004 - λ2) - (√1 - λ2) x 100 %	
Accuracy of Power Factor Λ	± [(λ-λ/1.0002) + [λcosø-cos{ø+sin-1 (influence from the power factor when λ = 0 %/100)} I] ±1 digit when voltage and current are at the measurement range rated input	
Accuracy of Phase Difference Φ	± [I ø-cos-1 (λ/1.0002) I + sin-1 (influence from the power factor when λ = 0 % / 100)] ± 1 digit when voltage and current are at the measurement range rated input	
Accuracy when the Crest Factor is Set to 6 or 6 A	accuracy obtained by doubling the measurement range error for the accuracy when the crest factor is set to 3	
Accuracy Changes caused by data update interval	When the data update interval is 100 ms, and Auto, add 0.05 % of reading to the 0.1 Hz to 1 kHz accuracy.	

Voltage, Current and Active Power Measurements

Measurement Method	Digital sampling method	
Crest Factor	3 or 6 (6 A)	
Wiring System	Single-phase, two-wire (1 P2 W)	
Range Select	Select manual or auto ranging	
Auto Range	**Auto-range increase** The range is increased when any of the following conditions are met.	
	Crest factor 3	Urms or Irms exceeds 130 % of the currently set measurement range. Upk, Ipk value of the input signal exceeds 300 % of the currently set measurement range.
	Crest factor 6	Urms or Irms exceeds 130 % of the currently set measurement range. Upk, Ipk value of the input signal exceeds 600% of the currently set measurement range.
	Crest factor 6 A	Urms or Irms exceeds 260 % of the currently set measurement range. Upk, Ipk value of the input signal exceeds 600 % of the currently set measurement range.
	Auto-range decline The range is decreased when any of the following conditions are met.	
	Crest factor 3	Urms or Irms is less than or equal to 30 % of the measurement range. Urms or Irms is less than or equal to 125 % of the next lower measurement range. Upk, Ipk value of the input signal exceeds 300 % of the currently set measurement range.
	Crest factor 6 or 6 A	Urms or Irms is less than or equal to 30 % of the measurement range. Urms or Irms is less than or equal to 125 % of the next lower measurement range. Upk, Ipk value of the input signal exceeds 600 % of the currently set

Display Mode Switching	Vrms (the true RMS value of voltage and current) VOLTAGE MEAN (the rectified mean value calibrated to the RMS value of the voltage and the true RMS value of the current) AC DC	
Measurement Synchronization Source	Select voltage, current, or off In the case of Auto Update Rate, select the voltage or current from the equipped element.	
Line Filter	Select OFF or ON (cutoff frequency at 500 Hz).	
Peak Measurement	Measures the peak (max, min) value of voltage, current or power from the instantaneous voltage, instantaneous current or instantaneous power that is sampled.	
Zero-level Compensation	Removes the internal offset of the measure unit (After measurement range is changed)	
Measurement Parameters	Voltage	Vrms, Vmn, Vdc, Vac
	Current	Irms, Idc, Iac
	Active Power	P
	Apparent Power	VA
	Reactive power	VAR
	Power Factor	PF
	Crest Factor	CFI, CFV
	Phase Angle	DEG
	Frequency	IHz and VHz
	Voltage Peak	V+pk and V-pk
	Current Peak	I+pk and I-pk
	Active Power Peak	P+pk and P-pk
	Total Harmonic Distortion	THDI and THDV
	Maximum Current Ratio	MCR

Frequency Measurement

Measurement parameter	Voltage and current	
Measurement Frequency Range	Data update interval	Measurement Frequency Range
	0.1 s	20 Hz ≤ f ≤ 100 kHz
	0.25 s	10 Hz ≤ f ≤ 100 kHz
	0.5 s	5 Hz ≤ f ≤ 100 kHz
	1 s	2.0 Hz ≤ f ≤ 100 kHz
	2 s	1.0 Hz ≤ f ≤ 100 kHz
	5 s	0.5 Hz ≤ f ≤ 100 kHz
	10 s	0.2 Hz ≤ f ≤ 100 kHz
	20 s	0.1 Hz ≤ f ≤ 100 kHz
	Auto (*)	0.1 Hz ≤ f ≤ 100 kHz
	(*) Lower frequency measurement limit is defined by Timeout setting	
	Timeout	lower frequency limit
	1 s	2.0 Hz
	5 s	0.5 Hz
	10 s	0.2 Hz
	20 s	0.1 Hz
Measurement Range	Auto switching between six frequencies: 100 mHz, 1 Hz, 10 Hz, 100 Hz, 1 kHz, 10 kHz, and 100 kHz.	
Frequency Filter	Select OFF or ON (cut off frequency of 500 Hz)	
Accuracy	Requirements	• Input signal level should be greater than 30% of the measurement range if the crest factor is set to 3. (60 % or more if the crest factor is set to 6 or 6A) • Frequency filter should be ON when the frequency of the signal is less than 200 Hz.
	± (0.06 % of reading)	

Integration

Mode	Selectable manual integration mode, standard integration mode, or repetitive integration mode.
Timer	Automatically stop integration by setting a timer. Selectable range: 0 hours 00 minutes 00 seconds to 9999 hours 59 minutes 59 seconds
Accuracy	± (Power accuracy (or current accuracy) + 0.1 % of reading) (fixed range)
Range Setting	Auto range or fixed range is available for Integration
Timer Accuracy	± 0.02 %

Harmonic Measurement

Measured Item	Voltage, Current, Power			
Measured Method	Zero-cross simultaneous calculation method			
Frequency Range	10 Hz to 1.2 kHz.			
FFT Data Length	1024 4096 (Auto switch when both 50 Hz/60 Hz and update rate > 0.1 s conditions are met)			
Sample Rate, Window Width, and Upper Limit of Analysis Orders*	**Fundamental Frequency**	**Sample rate**	**Window Width**	**upper limit of Analysis orders**
	10 Hz to 44 Hz	f x 1024	1	50
	45 Hz to 55 Hz	f x 512	10	50
	54 Hz to 66Hz	f x 512	12	50
	67 Hz to 150 Hz	f x 512	2	32
	150 Hz to 300 Hz	f x 256	4	16
	300 Hz to 600 Hz	f x 128	8	8
	600 Hz to 1200 Hz	f x 64	16	4
Accuracy	**Frequency**	**Voltage**	**Current**	**Power**
	10 Hz ≤ f < 45 Hz	0.15 % of reading + 0.35 % of range	0.15 % of reading + 0.35 % of range	0.35 % of reading + 0.50 % of range
	45 Hz ≤ f < 440 Hz	0.15 % of reading + 0.35 % of range	0.15 % of reading + 0.35 % of range	0.25 % of reading + 0.50 % of range
	440 Hz ≤ f < 1.2 kHz	0.20 % of reading + 0.35 % of range	0.20 % of reading + 0.35 % of range	0.40 % of reading + 0.50 % of range

* 50 Hz/60 Hz Compliant IEC61000-4-7

General

Note	The below are the basic conditions required to operate the T3PM1100 within specifications: • Calibration: Yearly • Operating Environment: 18 ~ 28 °C (64.4 ~ 82.4 °F) • Humidity: < 80 %RH, • Accuracy: ± (% of reading + % of range) • The specifications apply when the unit is warmed up for at least 30 minutes and operated in slow rate. • The power supply cable must be grounded to ensure accuracy. • Input voltage and current must be standard sine wave. • The power factor must be 1. • The crest factor must be 3. • The common-mode voltage must be zero.
Specification Condition	Temperature: 23 °C ± 5 °C Humidity: < 80 % RH (non-condensing)
Operation Condition	Temperature 0 °C ~ 40 °C, • 30 ~ 40 °C, Relative Humidity < 70 % RH (non-condensing) • > 40 °C, Relative Humidity < 50 % RH (non-condensing) Indoor use only Altitude: < 2000 meters Pollution degree 2
Storage Condition	Temperature -40°C ~ 70 °C Humidity: < 90 % RH (non-condensing)
Power Source	AC 100 – 240 V, 50 – 60 Hz; Consumption Max. 30 VA
Dimensions	268 (W) x 107 (H) x 379 (D) mm (w/t bumpers)
Weight	Approx. 2.9 kg

Specifications subject to change without notice.

Ordering information

Models	**T3PM1100**	AC/DC Single Phase Digital Power Meter 100 kHz

ABOUT TELEDYNE TEST TOOLS

TELEDYNE TEST TOOLS
Everywhereyoulook™

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.

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