

# T3AFG200-350-500

## Function / Arbitrary Waveform Generators Quick Start Guide



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# Contents

General Safety Summary .....	1
Adjustment Handle .....	2
The Front Panel .....	3
Back Panel .....	8
Touch Screen Display .....	11
Built-In Help System .....	12
Introduction to EasyWaveX .....	13
Introduction to EasyIQ .....	13

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# General Safety Summary

Read the following precautions carefully to avoid any personal injuries, or damage to the instrument or products connected to it. Use the instrument only as specified.

**Use only the power cord supplied for the instrument.**

**Ground the instrument.** The instrument is grounded through the ground conductor of the power cord. To avoid electric shock, always connect to grounded outlets. Make sure the instrument is grounded correctly before connecting its input or output terminals.

**Do not connect external signals.** The BNC connector is used to output the generated waveforms only. No external signals should be connected to the BNC, or the instrument may be damaged.

**Observe all terminal ratings and signs on the instrument to avoid fire or electric shock.** Before connecting to the instrument, read the manual to understand the input/output ratings.

**Do not operate with suspected failures.** If you suspect that the instrument is damaged, contact the Teledyne LeCroy service department immediately.

**Do not operate in wet/damp conditions.**

**Do not operate in an explosive atmosphere. Keep the surface of the instrument clean and dry.**

**Avoid touching exposed circuits or wires.** Do not touch exposed contacts or components when the power is on.

**Do not operate without covers.** Do not operate the instrument with covers or panels removed.

**Use only the fuse specified for the instrument.**

**Use proper overvoltage protection.**

**Observe ventilation requirements.** Ensure good ventilation. Check the vent and fan regularly to prevent overheating.

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## Safety Terms and Symbols

The following terms may appear on the instrument:

**DANGER:** Direct injury or hazard may occur.

**WARNING:** Potential injury or hazard may occur.

**CAUTION:** Potential damage to instrument/property may occur.

The following symbols may appear on the instrument:



**CAUTION**  
Risk of injury or damage. Refer to manual.



**WARNING**  
Risk of electric shock or burn



Earth Ground Terminal



Protective Conductor Terminal



Frame or Chassis Terminal



ON/Standby Power



Alternating Current

## Operating Environment

**Temperature:** 0 °C to 40 °C

**Relative Humidity:** 5 to 90% RH at  $\leq 30$  °C

**Altitude:**  $\leq 3048$  m at  $\leq 30$  °C

**Use indoors only.**

**Pollution degree 2.** Use in an operating environment where normally only dry, non-conductive pollution occurs. Temporary conductivity caused by condensation should be expected.

## AC Power

**Input Voltage & Frequency:** 100-120 V at 400 Hz or 100-240 V at 50/60 Hz

**Automatic AC selection.**

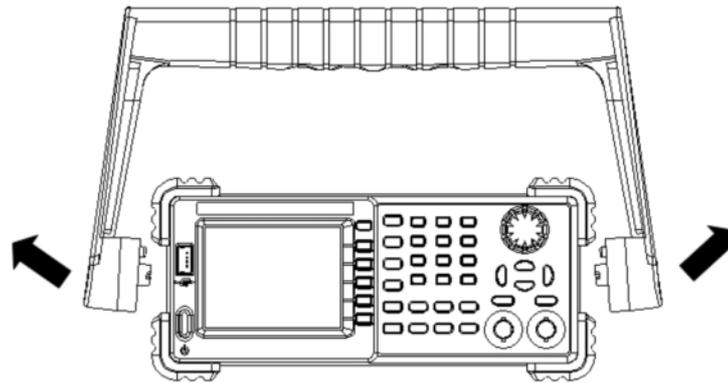
**Power Consumption:** 50 W maximum

**Mains Supply Connector:** CAT II per IEC/EN 61010-1:2010, instrument intended to be supplied from the building wiring at utilization points (socket outlets and similar).

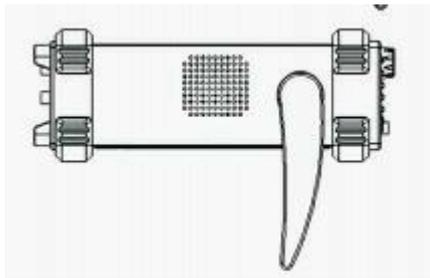
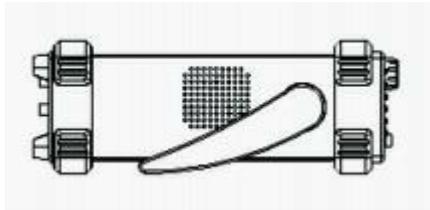
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# Handle Adjustment

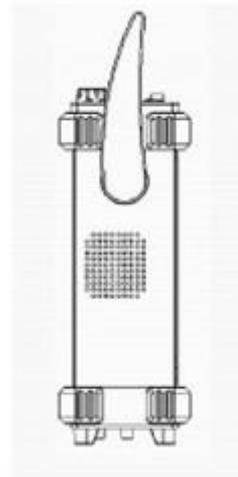
Users can adjust the handle to the required position by pulling the mounting points outward and adjusting the handle position.



**Handle Adjustment**



**Horizontal Position**



**Carrying Position**

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# Front Panel



- |                        |                               |
|------------------------|-------------------------------|
| 1 Power Button         | 7 CH1/CH2 Control/Output Port |
| 2 USB Host Port        | 8 Channel Select Key          |
| 3 Touch Screen Display | 9 Function Keys               |
| 4 Numeric Keypad       | 10 Waveform Selection Key     |
| 5 Adjust Knob          | 11 Menu Keys                  |
| 6 Arrow Keys           |                               |

## 1. Power Button

Used to turn on/off the waveform generator. When the power button is off, the generator is under power off state.

## 2. USB Host Port

Used to read waveforms or status files from a USB drive or save current instrument status to a USB drive. Firmware can be updated through the USB port. The waveform generator supports a FAT formatted USB drive.

## 3. Touch Screen Display

The waveform generator has a 4.3 inch TFT color LCD display, which can display the current function menu, parameter settings, system state, and help.

## 4. Numeric Keypad

Consists of numbers from 0 to 9, radix points "." and symbol keys "+/-", which are used to input parameters.

**Note:** To enter a negative number enter a "-" symbol before the numbers.

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## 5. Adjust Knob

- Used to increase (clockwise) or decrease (anticlockwise) the current numerical value when setting parameters.
- Also used to change characters when inputting a file name.
- When saving or reading files, rotate the knob to choose a position to save a file or choose a file to be read; press the knob to open a selected folder or file.

## 6. Arrow Keys

- Used to adjust digits in numeric values when using the knob to set parameters.
- Also used to position the cursor when inputting a file name.
- When saving or reading files, the arrow keys are used to choose a position to save a file or choose a file to be read.

## 7. CH1 Control Port/Output Button

- The **Output** button on the left is used to turn on/off CH1 output.
- The nominal output impedance of the BNC connector is 50  $\Omega$ .
- When pressing **Output** the key backlight turns on, and the connector outputs waveforms according to the current configuration of CH1.

## CH2 Control Port/Output Button

- The **Output** button on the right is used to turn on/off CH2 output.
- The nominal output impedance of the BNC connector is 50  $\Omega$ .
- When pressing **Output**, the backlight turns on, and the connector outputs waveforms according to the current configuration of CH2.
- A long press of the **Output** key switches the output load between 50  $\Omega$  and Hi-Z



### CAUTION:

Over voltage protection of CH1 and CH2 will take effect once any of the following conditions is met. When over voltage protection occurs, a message will be displayed and the output is disabled.

- The absolute value of input voltage is higher than  $11\text{ V} \pm 0.5\text{ V}$  when the amplitude of the generator is higher than or equal to  $3.2\text{Vpp}$  or the DC offset is higher than or equal to  $|2\text{VDC}|$ .
- The absolute value of input voltage is higher than  $4\text{ V} \pm 0.5\text{ V}$  when the amplitude of the generator is lower than  $3.2\text{ Vpp}$  or the DC offset is lower than  $|2\text{ VDC}|$ .

Choose **Utility** →Page 1/2 → OverVoltage Protection to turn on/off the function.

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## **8. Channel Select Key**

Used to switch the current selected channel between CH1 and CH2.

## **9. Function Keys**

### **Mod ----Modulation**

Used to enable the modulation screen and allow for modulation selection. The selection is AM, DSB-AM, FM, PM, ASK, FSK and PWM modulated signals.

- It supports “Internal” and “External” modulation sources.
- The corresponding backlight will turn on when this function is selected.

### **Sweep ----Sweep**

Used to generate sweeping frequency signals of Sine, Square, Ramp and Arbitrary.

- It supports “Linear” and “Log” sweep profiles.
- It supports “Internal”, “External” and “Manual” trigger sources.
- The corresponding backlight will turn on when this function is selected.

### **Burst ----Burst**

Used to generate burst signals of Sine, Square, Ramp, Noise and Arbitrary.

- It supports “NCycle”, “Gated” and “Infinite” burst modes.
- Noise can only be used to generate gated burst.
- It supports “Internal”, “External” and “Manual” trigger sources.
- The corresponding backlight will turn on when this function is selected.

### **Parameter ----Parameter Setting**

Used to switch directly to the parameter setting interface.

- The corresponding backlight will turn on when this function is selected.

### **Utility ----Utility Functions and System Settings**

Used to set system parameters and check version information.

- Press this key and then press the help key to obtain built-in help information about the product.
- The corresponding backlight will turn on when this function is selected.

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## **Store/Recall ----Store and Recall**

Used to store/recall the instrument's setup or arbitrary waveform data edited by users.

- Can be used to perform general file operations.
- In addition to the built-in nonvolatile memory (C disk), an external USB drive (D disk) can be used to store data.
- The corresponding backlight will turn on when this function is selected.

## **10.Waveform Selection Key**

### **Waveforms ---- Sine**

Provides sine wave output which ranges from 1  $\mu$ Hz to 200 MHz, 350 MHz or 500 MHz, depending on the model.

- Enabling the "harmonic" function permits adding sinewave harmonics up to the 16th order to the basic frequency.
- The **Waveforms** backlight will turn on when this function is selected.
- The sine wave "Frequency/Period", "Amplitude/High level", "Offset/Low level" and "Phase" can be adjusted.

### **Waveforms ---- Square**

Provides square wave output which ranges from 1  $\mu$ Hz to 120 MHz.

- The Waveforms backlight will turn on when this function is selected.
- The square wave "Frequency/Period", "Amplitude/High level", "Offset/Low level", "Phase" and "Duty" can be adjusted.

### **Waveforms ---- Ramp**

Provides ramp waveform output which ranges from 1  $\mu$ Hz to 5 MHz.

- The Waveforms backlight will turn on when this function is selected.
- The ramp waveform "Frequency/Period", "Amplitude/High level", "Offset/Low level", "Phase" and "Symmetry" can be adjusted.

### **Waveforms ---- Pulse**

Provides pulse waveform output which ranges from 1  $\mu$ Hz to 150 MHz.

- The Waveforms backlight will turn on when this function is selected.
- The pulse waveform "Frequency/Period", "Amplitude/High level", "Offset/Low level", "Pulse width/Duty", "Rise/Fall" and "Delay" can be adjusted.

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### Waveforms ---- Noise

Provides White Gauss Noise output with a bandwidth of the waveform generator model.

- The Waveforms backlight will turn on when this function is selected.
- “Stdev” and “Mean” of the noise signal can be adjusted.

### Waveforms ---- Arb

Provides arbitrary waveform output which ranges from 1μHz to 50MHz.

- The Waveforms backlight will turn on when this function is selected.
- Supports two output modes: “DDS” and “TrueArb”.
- Built-in **waveforms** include Cardiac, Gausspuls, ExpRise and ExpFall, etc. In addition, it can output waveforms stored on a USB drive.
- Users can edit arbitrary waveforms through PC software and download them to the instrument.
- Arbitrary waveforms can be adjusted for “Frequency/Period”, “Amplitude/High level”, “Offset/Low level” and “Phase”.

### Waveforms ---- IQ

Provide IQ waveform output with center frequencies ranging from 0 Hz to 500 MHz.

- Support modulation types including 2ASK, 4ASK, 8ASK, BPSK, QPSK, 8PSK, DBPSK, DQPSK, D8PSK, 8QAM, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM, 2FSK, 4FSK, 8FSK, 16FSK, MSK, Multi-tone
- Support data patterns including PN7, PN9, PN15, PN23, User file and Custom
- Built-in waveforms can be recalled by pressing I/Q Data.
- Users can edit IQ waveforms through EasyIQ and download them to the instrument.
- “Fsymb/Fs”, “Amplitude” and “Center Frequency” of the IQ waveform can be adjusted.

### Waveforms ---- PRBS

Provide PRBS output which ranges from 1μbps to 300Mbps.

- Support patterns from PRBS3 to PRBS32
- Supports setting the logic level quickly to TTL/CMOS, LVTTTL/LVCMOS, ECL, LVPECL, LVDS
- Supports setting the two channels to differential mode quickly.
- “Bit Rate/Period”, “Amplitude/High level”, “Offset/Low level” and “Length” of the PRBS waveform can be adjusted.

## 11. Menu Keys

These keys correspond to the menu displayed above them on the display. Press any button to activate the corresponding menu.

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# Back Panel



## 1. Counter

BNC connector. The input impedance is  $1\text{M}\ \Omega$ . This connector is used to accept the signal measured by the frequency counter.

## 2. Aux In/Out

BNC connector. The function of this connector is determined by the mode of the instrument.

- Sweep/Burst trigger signal input port of external trigger.
- Sweep/Burst trigger signal output port of internal/manual trigger.
- Burst gating trigger input port.
- ASK/FSK external modulation signal input port.
- Synchronization output port. When synchronization is on, the port can output a CMOS signal with the same frequency as basic waveforms (except Noise and DC), arbitrary waveforms, and modulated waveforms (except external modulation).
- AM, DSB-AM, FM, PM and PWM external modulation signal input port.

## 3. 10 MHz Clock Input Port

BNC connector. If the instrument uses an external clock source, the connector accepts an external 10 MHz clock source.

## 4. 10 MHz Clock Output Port

BNC connector. If the instrument uses an internal clock source, the connector outputs the 10 MHz clock signal generated by the crystal oscillator inside the generator. If an external clock is being used as a clock input, the instrument will pass-through the external clock.

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## **5. Earth Terminal**

Used to ground the instrument.

## **6. AC Power Supply Input**

The generator can accept two different types of AC input power:  
100-240 V at 50/60 Hz, or 100-120 V at 400 Hz

## **7. USB Device**

Used when connecting the instrument to an external computer to allow waveform editing (such as EasyWaveX and EasyIQ) and remote control.

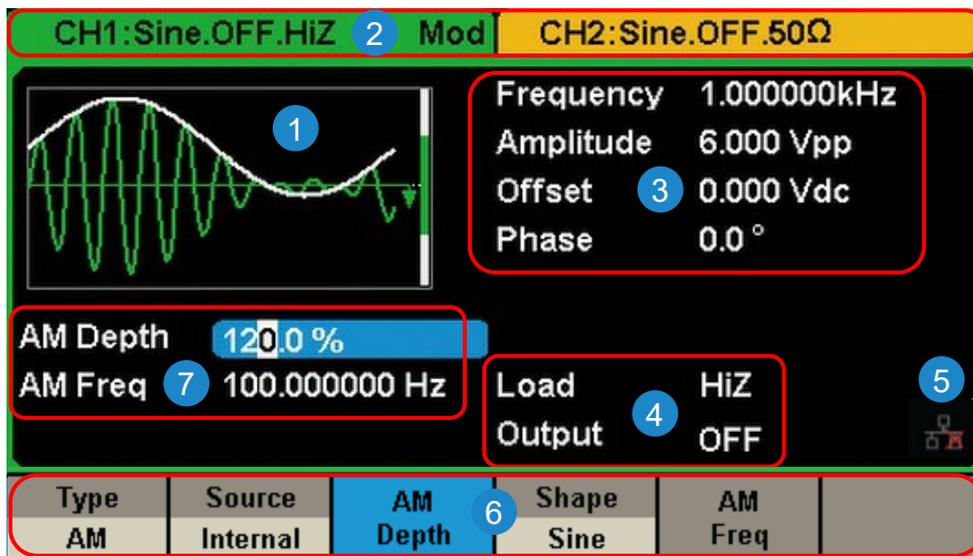
## **8. LAN Interface**

Through this interface, the generator can be connected to your computer or network for remote control. An integrated testing system may be built, as the generator conforms to the VXI-11 class standard of LAN-based instrument control.

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# Touch Screen Display

The generator can only display parameters and waveform of one channel at a time. The picture below shows the interface when CH1 chooses AM modulation of sine waveform. The information displayed may vary depending on the function selected. The entire screen of the generator is a touch screen. You can use your finger or touch pen to control the instrument. Most functions and selections can be chosen using the touch screen in a similar manner to the front panel keys and knob.



## 1.Waveform Display Area

Shows the currently selected waveform of each channel. The key backlight will turn on when this area of the touch screen is clicked.

## 2.Channel Status Bar

Indicates the selected status and output configuration of the channels. Touch this area of the screen to switch to the corresponding channel. If touched again, the shortcut menus for the function keys will be recalled: Mod, Sweep, Burst, Parameter, Utility and Store/Recall.

## 3.Basic Waveform Parameters Area

Shows the current waveform's parameters of each channel. Touch this area of the screen to highlight the parameter you want to configure, use number keys or knob to change the parameter value.

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#### 4. Channel Parameters Area

Displays the current selected channel's load and output settings.

**Load** ----Value of the output load, as selected by the user.

- After choosing the parameter to highlight it, use the softkeys, number keys or knob to change the parameter value.
- High Impedance: display HiZ.
- Load: display impedance value (the default is 50  $\Omega$  and the range is 50  $\Omega$  to 100 k $\Omega$ ).

**Note:** This setting does not actually change the instrument's output load impedance of 50 $\Omega$  but rather is used to maintain amplitude accuracy into different load values.

**Output** ----Channel output state.

After touching this area of the screen or pressing corresponding channel output control port, you can turn on/off the current channel.

#### 5. LAN Status Icon

The generator will show different prompt messages based on the current network status.

 This diagram indicates LAN connection is successful.

 This diagram indicates there is no LAN connection or LAN connection is unsuccessful.

#### 6. Menu

Touch here for the menu corresponding to the displayed function. For example, the screen image shows the parameters of "AM modulation". After touching the menu on the touch screen to choose the corresponding parameter, use number keys or knob to change the parameter value.

#### 7. Modulation Parameters Area

Shows the parameters of the current modulation function. After touching this area of the screen or pressing corresponding menu, use number keys or the knob to change the parameter value.

## Using the Built-In Help System

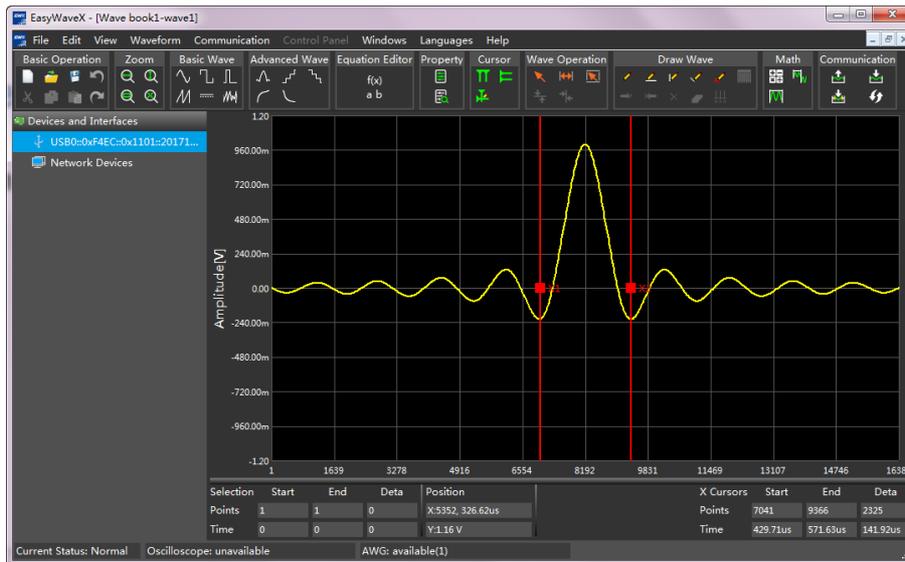
To access the built-in help system of the product, first press the **Utility** key, then press **Page 1/2** and **Help**. Use the Adjust knob to choose the help item you want, and finally press **Select** to obtain help.

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# Introduction to EasyWaveX

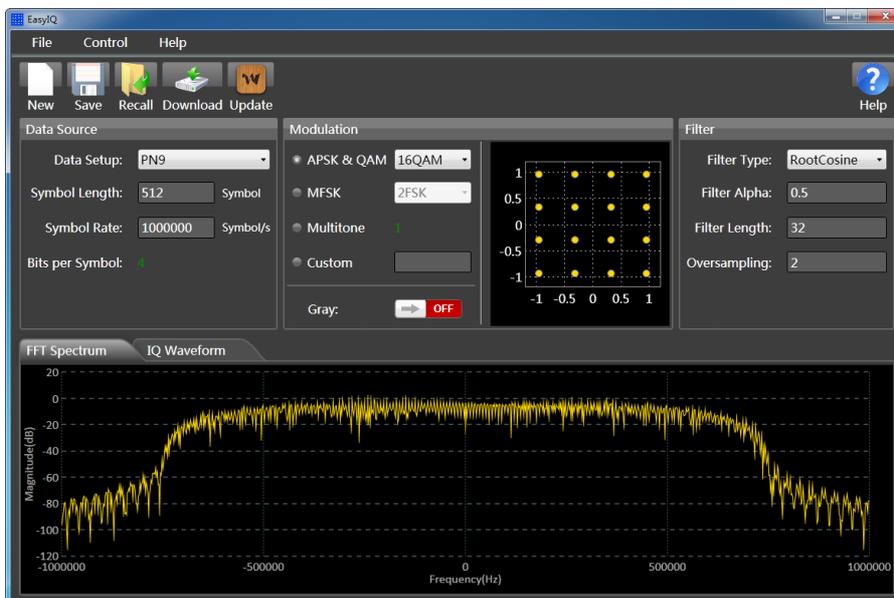
The T3AFG200-350-500 series includes arbitrary waveform editing software called EasyWaveX. This software is a platform for easily creating, editing, and transferring waveforms to the generator. It provides 11 standard waveforms such as Sine, Square, Ramp, Pulse, Noise and DC, which meets most engineers' basic needs. In addition, it provides several ways of manual drawing, point-to-point line drawing and arbitrary point drawing. EasyWaveX allows for fast and easy creation of complex waveforms.

The main interface of EasyWaveX is shown in the following figure:



# Introduction to EasyIQ

The IQ waveform editing software EasyIQ supports generating IQ data with 2ASK, 4ASK, 8ASK, BPSK, QPSK, 8PSK, DBPSK, DQPSK, D8PSK, 8QAM, 16QAM, 32QAM, 64QAM, 128QAM, 256QAM, 2FSK, 4FSK, 8FSK, 16FSK, MSK, Multi-tone modulation, **and** custom data to the instrument.





## 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 expands on the Teledyne LeCroy product portfolio by adding a comprehensive range of test equipment solutions for its customers. The new range of product solutions deliver engineers with a broad range of quality test solutions that enables speed to market product validation and design. More and more designers, engineers and lecturers are relying on Teledyne Test Tools to meet their testing, education and electronics validation needs with confidence and within budget.

### Location and Facilities

Headquartered in Chestnut Ridge, New York, Teledyne Test Tools and Teledyne LeCroy have 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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