

# T3AFG5/T3AFG10 Data Sheet

## Function/Arbitrary Waveform Generators

### Debug with Confidence

#### 5 MHz – 10 MHz



### Tools for Improved Debugging

- Deep Memory – 16 kpts. ✔ Generate complex arbitrary waveforms.
- Wide Range of Modulation Types – AM, DSB-AM, FM, PM, FSK, ASK, PWM, Sweep, Burst. ✔ Quickly set up modulated waveforms.
- High Resolution – 14 Bit. ✔ Generate waveforms with low noise and spurious signal content.
- 5 MHz and 10 MHz Bandwidth Models ✔ Other models are available with bandwidths up to 120 MHz.
- Single Waveform Output Channel ✔ Alternative dual channel models are available.
- Built In Arbitrary Waveforms ✔ Load and replay built in Arbitrary Waveforms.
- User Defined Waveforms ✔ Store and recall user defined waveforms.

### Key Specifications

Bandwidth	5 MHz, 10 MHz
Channels	1
Memory	16 kpts
Sample Rate	125 MS/s
Display	3.5"
Connectivity	USB Host, USB Device, LAN

# PRODUCT OVERVIEW

## Key Features

- DDS technology, Single-channel output.
- 125 MSa/s sample rate, 14 bit vertical resolution.
- 5 types of standard output waveform, built-in 46 arbitrary waveforms (include DC).
- Complete set of modulation functions: AM, DSB-AM, FM, PM, FSK, ASK, PWM, Sweep, Burst.
- input/output: waveform output, Synchronous signal output, external trigger input.
- Standard interfaces: USB Device, USB Host.
- Supports remote control.



## Outstanding price/performance

Teledyne Test Tools T3AFG5 and T3AFG10 series Function/Arbitrary Waveform Generators are a new family of low cost, high performance, single channel Function/Arbitrary waveform generators offering a high level of functionality and an excellent specification at a very competitive price point.

## Application fields

- Education
- Product Research, design and validation
- Automotive
- Simulation environment signals
- Circuit functional test
- Analog sensor

## Arbitrary waveform output

46 Built-in arbitrary waveforms (include DC), including math, engineering and other commonly-used waveforms.

## Complete set of modulation functions, swept and burst output

- Complete set of modulation functions: AM, DSB-AM, FM, PM, FSK, ASK, PWM. The modulation waveform characteristics can be viewed on the built-in display.
- Sweep output: change the output frequency between two frequencies.
- Sweeping time range: 1 ms ~ 500 s. The carrier can be Sine, Square, Triangle and Arbitrary waveforms.
- Burst output: An internal counter or external control signal can be used to control / gate the burst output.

## Models and key Specification

Model	T3AFG5	T3AFG10
Max. output frequency	5 MHz	10 MHz
Output channels	1	
Sample rate	125 MSa/s	
Arbitrary waveform length	16 kpts	
Frequency resolution	1 $\mu$ Hz	
Vertical resolution	14 bits	
Waveform	Sine, Square, Ramp, Pulse, Gaussian Noise, 46 built-in arbitrary waveforms (include DC)	
Modulation	AM, DSB-AM, FM, PM, FSK, ASK, PWM, Sweep, Burst	
Standard interface	USB Host & USB Device	
Dimension	W x H x D = 229 mm x 105 mm x 281 mm	

# SPECIFICATIONS

All specifications apply to the Teledyne Test Tools T3AFG5 and T3AFG10 Series Function/Arbitrary Waveform Generator unless otherwise stated. The specifications apply under the following conditions:

1. The instrument has been operating continuously for more than 30 minutes within the specified operating temperature range (18 °C ~ 28 °C).
2. The temperature variation does not exceed +/- 5 °C from it's calibration temperature.

**Note: all specifications are guaranteed unless where noted 'typical'.**

## Frequency Specification

Model	T3AFG5	T3AFG10
Waveform	Sine, Square, Ramp, Pulse, Noise, Arbitrary	
Sine	1 µHz ~ 5 MHz	1 µHz ~ 10 MHz
Square	1 µHz ~ 5 MHz	1 µHz ~ 10 MHz
Pulse	500 µHz ~ 5 MHz	
Ramp/Triangular	1 µHz ~ 300 kHz	
Gaussian white noise	> 5 MHz (-3 dB)	> 10 MHz (-3 dB)
Arbitrary	1 µHz ~ 5 MHz	
Resolution	1 µHz	
Accuracy	Within 90 days ± 50 ppm within 1 year ± 100 ppm	
Temperature coefficient	< 5 ppm/°C	

## Sine Wave

Harmonic Distortion	DC ~ 1 MHz <- 60 dBc 1 MHz ~ 10 MHz <- 55 dBc
Total harmonic waveform distortion	DC ~ 20 kHz, 1 Vpp < 0.2 %
Spurious signal (non-harmonic)	DC ~ 1 MHz <- 70 dBc 1 MHz ~ 10 MHz <- 60 dBc
Phase noise	10 kHz Offset, -108 dBc/Hz (typical value)

## Square Wave

Rise/fall time	< 24 ns (10 % ~ 90 %)
Overshoot	< 5 % (typical, 1 kHz, 1 Vpp)
Duty Cycle	20 % ~ 80 %
Asymmetric (50 % Duty Cycle)	1 % of period + 20 ns (typical, 1 kHz, 1 Vpp)
Jitter	500 ps + 0.001% of period

## Ramp/Triangle Wave

Linearity	< 0.1 % of Vpp (typical, 1 kHz, 1 Vpp, 100 % symmetric)
Symmetry	0 % ~ 100 %

## Pulse Wave

Pulse width	16 ns, Min. 1 ns resolution
Rise/Fall time (10%~90%, typical)	20 ns ~ 1.6 ks
Duty Cycle	0.1 % Resolution
Overshoot	< 5 %
Jitter (pk-pk)	500 ps + 0.001 % of period

## Arbitrary Wave

Waveform length	16 k points
Vertical resolution	14 bits
Sample rate	125 MSa/s
Min. Rise/Fall time	8 ns (typical)
Jitter (pk-pk)	8 ns (typical)
Storage in non-volatile RAM memory (10 in total)	10 waveforms

# SPECIFICATIONS

## Output Specification

Amplitude	2 mVpp ~ 10 Vpp (50 Ω) 4 mVpp ~ 20 Vpp (High impedance)
Vertical accuracy (100 kHz sine)	± (1 mVpp + 0.3 dB of setting value)
Amplitude flatness (compared to 100 kHz sine, 5 Vpp)	± 0.3 dB
Impedance	50 Ω
Protection	short-circuit protection

## DC Offset

Range (DC)	± 5 V (50 Ω) ± 10 V (High-Z)
Offset accuracy	± ( setting offset value  * 1% + 3 mV)

## AM Modulation

Carrier	Sine, Square, Ramp, Arbitrary (except DC)
Modulation waveform	Sine, Square, Ramp, Noise, Arbitrary (2 mHz ~ 20 kHz)
Modulation depth	0% ~ 120%

## DSB-AM Modulation

Carrier	Sine, Square, Ramp, Arbitrary (except DC)
Modulation waveform	Sine, Square, Ramp, Noise, Arbitrary (2 mHz ~ 20 kHz)
Modulation depth	0% ~ 120%

## FM Modulation

Carrier	Sine, Square, Ramp, Arbitrary (except DC)
Modulation waveform	Sine, Square, Ramp, Noise, Arbitrary (2 mHz ~ 20 kHz)
Frequency deviation	0 ~ 0.5 * bandwidth 1 mHz resolution

## PM Modulation

Carrier	Sine, Square, Ramp, Arbitrary (except DC)
Modulation waveform	Sine, Square, Ramp, Noise, Arbitrary (2 mHz ~ 20 kHz)
Phase Deviation	0 ~ 360°, 0.1° Resolution

## FSK Modulation

Carrier	Sine, Square, Ramp, Arbitrary (except DC)
Modulation waveform	50% duty-cycle square waveform (2 mHz ~ 50 kHz)

## ASK Modulation

Carrier	Sine, Square, Ramp, Arbitrary (except DC)
Modulation waveform	50% duty-cycle square waveform (2 mHz ~ 50 kHz)

## PWM Modulation

Frequency	500 μHz ~ 20 kHz
Modulation waveform	Sine, Square, Ramp, Arbitrary (except DC)

## Sweep

Carrier	Sine, Square, Ramp, Arbitrary (except DC)
Type	linear/logarithmic
Direct	Up/down
Sweep time	1 ms ~ 500 s
Trigger source	Manual, external, internal

## Burst

Waveform	Sine, Square, Ramp, Pulse, Arbitrary (except DC)
Type	Count (1 ~ 50,000 periods), infinite, Gated
Start/Stop phrase	0° ~ 360°
Internal period	1 μs ~ 500 s
Gated source	External trigger
Trigger source	Manual, External or Internal

## Trigger Input

Input Level	TTL compatible
Slope	Up or down
Pulse width	> 100 ns
Input impedance	> 5 k $\Omega$ , DC coupling

## SYNC Output

Voltage level	TTL compatible
Pulse width	> 50 ns
Output impedance	50 $\Omega$ (typical)
Max. frequency	2 MHz

## General Specification

Display	
Display type	3.5 inch TFT-LCD
Resolution	320 x 240
Color depth	24 bit
Contrast Ratio	350 : 1 (typical)
Luminance	300 cd/m <sup>2</sup> (typical)
Power	
Voltage	100 ~ 240 VAC <sub>RMS</sub> , 50/60 Hz 100 ~ 120 VAC <sub>RMS</sub> , 440 Hz
Consumption	< 30 W
Fuse	1.25 A, 250 V
Environment	
Temperature	Operation: 0 °C ~ 40 °C Storage: -20 °C ~ 60 °C
Humidity range	Below +35 : $\leq$ 90 % relative humidity +35 ~ +40 : $\leq$ 60 % relative humidity
Altitude	Operation: below 3,000 meters Storage: below 15,000 meters
Electromagnetic Compatibility	2004/108/EC Directive Applicable standards EN 61326-1:2006 EN 61000-3-2:2006 + A2:2009 EN 61000-3-3:2008
Safety	2006/95/EC Low Voltage Directive EN 61010-1:2010
Others	
Dimension	Width: 229 mm Height: 105 mm Depth: 281 mm
Weight	N.W: 2.6 Kg G.W: 3.4 Kg
IP protection	IP2X
Calibration Cycle	1 year

## Ordering information

<b>Product Name</b>	<b>T3AFG Series Function/Arbitrary Waveform Generator</b>
<b>Models</b>	<b>T3AFG5</b> 5 MHz
	<b>T3AFG10</b> 10 MHz
<b>Standard Accessories</b>	Quick Start
	Calibration Certificate
	Power Cord
	USB Cable

# 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.



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