TELEDYNE TEST TOOLS
Everywhereyoulook™

T3AFG40 / T3AFG80 / T3AFG120 Data Sheet

Function/Arbitrary Waveform Generators

Debug with Confidence

40 MHz – 120 MHz

Teledyne Test Tools T3AFG40 / T3AFG80 / T3AFG120 range of function/arbitrary generators are a series of dual-channel waveform generators with specifications of up to 120 MHz maximum bandwidth, 1.2 GSa/s maximum sampling rate and 16-bit vertical resolution. The proprietary Arbitrary & Pulse techniques used in the T3AFG40 / T3AFG80 / T3AFG120 models helps to solve the weaknesses inherent in traditional DDS generators when generating arbitrary, square and pulse waveforms. With the above advantages the T3AFG40 / T3AFG80 / T3AFG120 generators can provide users with a variety of high fidelity and low jitter signals, which can meet the growing requirements of a wide range of complex applications.



Tools for Improved Debugging

• **Deep Memory** – 8 Mpts/Ch.	✓ Generate complex arbitrary waveforms.
• **Wide Range of Modulation Types** – AM, DSB-AM, FM, PM, FSK, ASK, PWM, Sweep, Burst, and PSK.	✓ Quickly set up modulated waveforms.
• **High Resolution** – 16 bit resolution.	✓ Generate waveforms with low noise, low spurious signal content and high dynamic range.
• **Bandwidth Models up to 120 MHz.**	✓ Wide choice of bandwidths.
• **Built In Arbitrary Waveforms.**	✓ Load and replay built in Arbitrary Waveforms.
• **User Defined Waveforms.**	✓ Store and recall user defined waveforms.
• **Lower cost 5 MHz and 10 MHz single channel models are also available.**	✓ Enquire about the T3AFG5 and T3AFG10.

Key Specifications

Bandwidth	40 MHz, 80 MHz, 120 MHz
Channels	2 Independent Channels
Memory	8 Mpts/Ch
Sample Rate	1.2 GS/s
Display	4.3 inch Touch Screen TFT LCD
Connectivity	USB Host, USB Device, LAN

Ordering Information

Model	Bandwidth	Channel	Memory per Ch	Sample Rate per Ch
T3AFG40	40 MHz	2	8 Mpts	1.2 GS/s
T3AFG80	80 MHz	2	8 Mpts	1.2 GS/s
T3AFG120	120 MHz	2	8 Mpts	1.2 GS/s

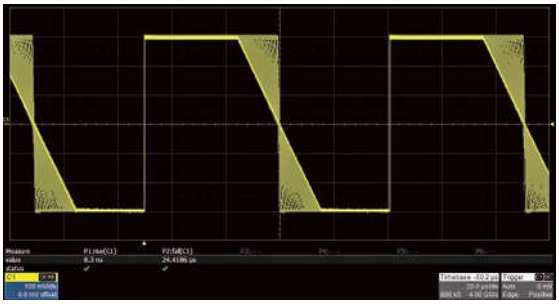
Function	T3AFG40, T3AFG80, T3AFG120
Built-in Waveforms	5 Standard, 196 Arbitrary
Input/Output	2 Waveform Outputs, Counter Input, Aux In/Out, 10 MHz Clock In/Out
Modulation Functions	AM, DSB-AM, FM, PM, FSK, ASK, PSK, PWM, Sweep, Burst, Harmonic
TrueArb and EasyPulse	Yes
Maximum Amplitude Output	< 20 MHz: 10 Vpp at 50 Ohms, 20 Vpp at HiZ > 20 MHz: 5 Vpp at 50 Ohms, 10 Vpp at HiZ
Vertical D/A Resolution	16 Bits
Display Size	4.3" Touch Screen

Excellent Performance

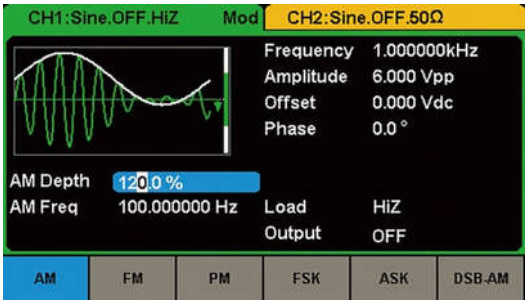
- Bandwidths from 40 MHz to 120 MHz
- All Models have 2 Channels
- 8 Mpts/Channel memory

Great Connectivity

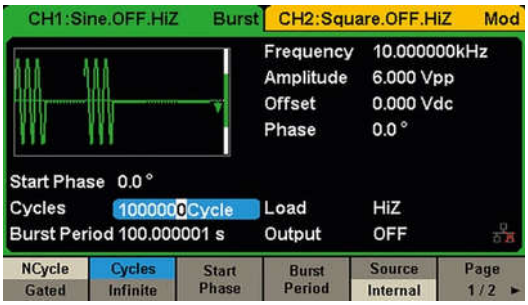
- USB host port for mass storage
- USB device port (USBTMC)
- LAN port on 2 channel models



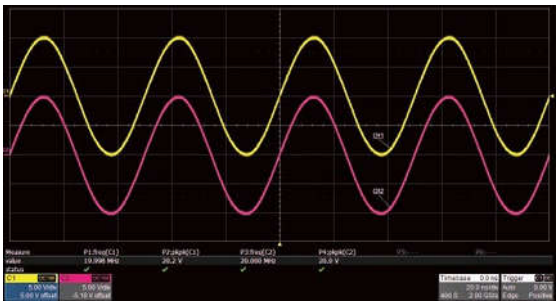
The rise/fall times can be set independently to a minimum of 8.4 ns at any frequency and to a maximum of 22.4s.



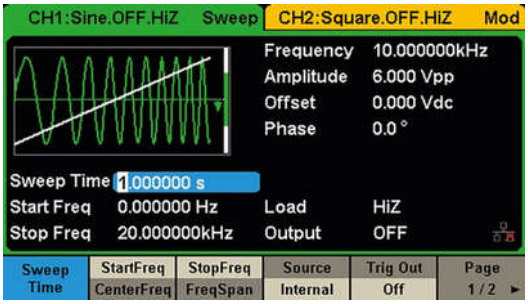
The T3AFG range of Function/Arbitrary Waveform Generators support a wide range of modulation types including AM, FM, PM, FSK, ASK, PSK and DSB-AM.



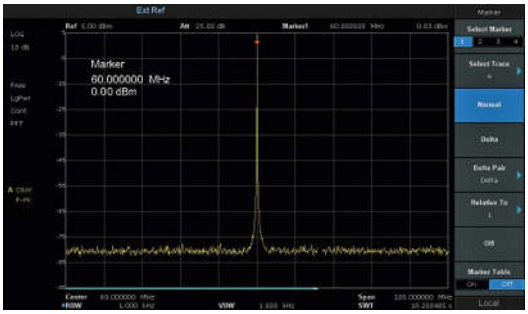
Burst mode supports 'N Cycle' and 'Gated' modes with the Burst source being configured as 'Internal', 'External' or 'Manual'.



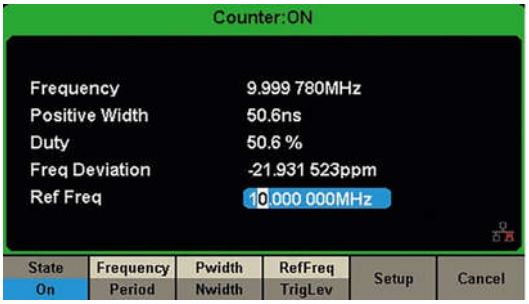
Output amplitude into a high impedance load can be as high 20 Vpp at frequencies up to 20 MHz, and 10 Vpp for frequencies greater than 20 MHz.



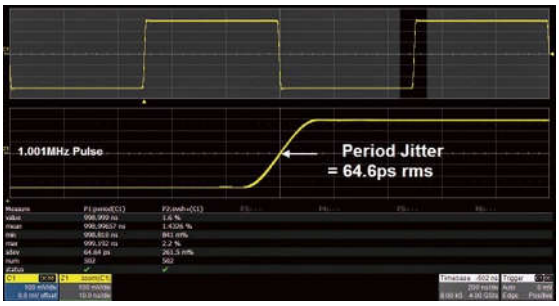
Sweep mode supports 'Linear' and 'Log' sweep, with 'Up' and 'Down' direction, and Sweep source can be configured as 'Internal', 'External' or 'Manual'.

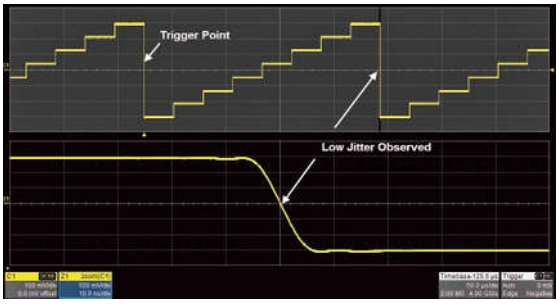


Sine wave output exhibits almost no spurious artefacts at 60 MHz and 0 dBm.



The counter functionality, accessed via the rear panel BNC, gives a DC or AC coupled counter capability from 100 mHz to 200 MHz.





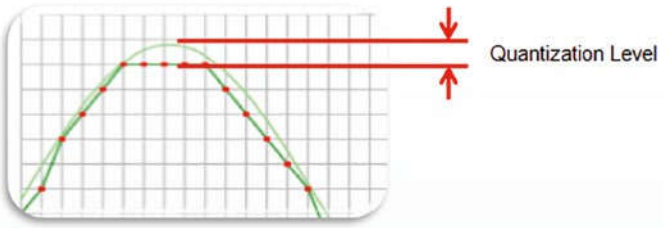
The Teledyne Test Tools T3AFG40 / T3AFG80 and T3AFG120, with its low jitter design, can generate waveforms with exceptional edge stability. With better jitter performance comes better edge stability, and higher confidence in your circuit design.

Smart Capabilities

- Sweep output carrier can be Sine, Square, Triangle and Arbitrary waveforms
- Burst output under internal or external signal control
- Waveforms types include DC
- Frequency Resolution 1 µHz
- DSB-AM: Double Sideband AM modulation Function
- Harmonic Function on 2 channel models
- Multi-Language User Interface



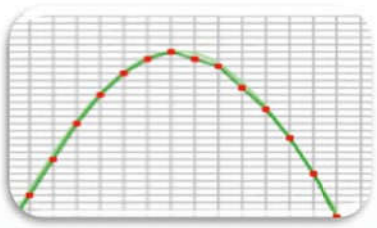
14 Bit Resolution



14 Bit Resolution

Less accurate waveform generation

16 Bit Resolution



16 Bit Resolution

- T3AFG40 / T3AFG80 / T3AFG120 are all 16 bit resolution
- 4 x higher resolution than 14 bit systems
- Lower levels of Harmonic Distortion
- Lower levels of non-harmonic spurious signals
- Improved dynamic range
- Enhanced signal fidelity



I/O Connectivity

- LAN and USB connection
- 10 MHz Reference Input/Output
- Aux Input/Output
- External modulation input
- External burst/sweep trigger input
- External gate input
- The Aux Input/Output will output a trigger pulse when an internal source is used
- External Counter input

SPECIFICATIONS

Frequency Specification

Model	T3AFG40	T3AFG80	T3AFG120
Waveform	Sine, Square, Ramp, Pulse, Noise, Arbitrary		
Sine	1 μHz ~ 40 MHz	1 μHz ~ 80 MHz	1 μHz ~ 120 MHz
Square	1 μHz ~ 25 MHz		
Pulse	1 μHz ~ 25 MHz		
Ramp/Triangular	1 μHz ~ 1 MHz		
Gaussian white noise	> 40 MHz (-3 dB)	> 80 MHz (-3 dB)	120 MHz (-3 dB)
Arbitrary	1 μHz ~ 20 MHz		
Resolution	1 μHz		
Accuracy	10-year aging +/- 3.5 ppm at 25 Degrees C		

Sine Wave

Harmonic Distortion	DC ~ 10 MHz <- 65 dBc 10 MHz ~ 20 MHz <- 60 dBc 20 MHz ~ 40 MHz <- 55 dBc 40 MHz ~ 60 MHz <- 50 dBc 60 MHz ~ 80 MHz <- 45 dBc 80 MHz ~ 100MHz <- 40 dBc 100 MHz ~ 120 MHz <- 38 dBc
Total harmonic distortion.	0.075 %, 0 dBm, 10 Hz ~ 20 kHz
Spurious signal (non-harmonic)	DC < 50 MHz <- 70 dBc > 50 MHz <- 65 dBc

Square Wave

Rise/fall time	9 ns (10 % ~ 90 %)
Overshoot	3 % (typical, 100 kHz, 1 Vpp, 50 Ohm Load)
Duty Cycle	0.001 % ~ 99.999 % Limited By Frequency
Jitter	150 ps, 1 Vpp, 50 Ohm Load

Pulse

Pulse width	16.3 ns, Min. Accuracy +/- (0.01% + 0.3 ns)
Rise/Fall time (10 % ~ 90 %,typical)	8.4 ns ~ 22.4 s
Duty Cycle	0.001 % ~ 99.999 %, 0.001 % Resolution, Limited by Pulse Width
Overshoot	3 % (typical, 100 kHz, 1 Vpp, 50 Ohm Load)
Jitter(pk-pk)	150 ps, 1 Vpp, 50 Ohm Load

Ramp / Triangle Wave

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

Harmonic Output

Order	10 Maximum
Type	Even, Odd, All

Arbitrary Wave

Waveform length	8 M points
Vertical resolution	16 bits
Sample rate	75 MSa/s Arb Mode, 300 MSa/s DDS Mode
Min. Rise/Fall time	8 ns (typical)
Jitter(pk-pk)	150 ps, 1 Vpp, 50 Ohm Load, TrueArb Mode
Storage in non-volatile RAM memory (10 in total)	10 waveforms

Noise Characteristics

-3 dB bandwidth	Bandwidth of the waveform generator

SPECIFICATIONS

DC Characteristics

Range	-10 V to +10 V HiZ Load -5 V to +5 V 50 Ohm Load
Accuracy	+/- (1 % + 2 mV) HiZ Load

Harmonic Output Characteristics

Order	10
Type	All, Even, Odd

Output Characteristics

Range	2 mV – 20 Vpp ≤ 20 MHz HiZ load, 2 mV – 10 Vpp >20 MHz HiZ load. Values are halved into 50 Ω load
Accuracy	+/- (1 % + 1 mVpp) 10 kHz sine wave, 0 V offset
Amplitude Flatness	+/- 0.3 dB, 0 – 100 MHz, 50 Ω load, 2.5 Vpp (reference 10 kHz Sine wave) +/- 0.4 dB, 100 MHz – 120 MHz 50 Ω load, 2.5 Vpp (reference 10 kHz Sine wave)
Output impedance	50 Ω +/- 0.5 Ω at 10 kHz sine wave.
Output current	+/- 200 mA
Channel to channel Crosstalk	-60 dBc

Modulation Characteristics – AM

Carrier	Sine, Square, Ramp, Arb
Modulation Source	Internal/External
Modulation Wave	Sine, Square, Ramp, Noise, Arb
Modulation Depth	0 – 120 %
Modulation Frequency	1 mHz – 1 MHz, Modulation source “internal”

Modulation Characteristics – FM

Carrier	Sine, Square, Ramp, Arb
Modulation Source	Internal/External
Modulation Wave	Sine, Square, Ramp, Noise, Arb
Modulation Depth	0 – 0.5 * BW BW is the max output frequency limited by the frequency settings
Modulation Frequency	1 mHz – 1 MHz, Modulation source “internal”

Modulation Characteristics – PM

Carrier	Sine, Square, Ramp, Arb
Modulation Source	Internal/External
Modulating Waveform	Sine, Square, Ramp, Arb, Noise
Phase Deviation	0 Deg – 360 Deg
Modulation Frequency	1 mHz to 1 MHz with ‘internal’ modulation source

Modulation Characteristics – ASK

Carrier	Sine, Square, Ramp, Arb
Modulation Source	Internal/External
Modulating Waveform	Square with 50 % duty cycle
Keying Frequency	1 mHz to 1 MHz Limited by frequency setting with ‘internal’ modulation source

Modulation Characteristics – FSK

Carrier	Sine, Square, Ramp, Arb
Modulation Source	Internal/External
Modulating Waveform	Square with 50 % duty cycle
Modulation Frequency	1 mHz to 1 MHz with ‘internal’ modulation source

Modulation Characteristics – PSK

Carrier	Sine, Square, Ramp, Arb
Modulation Source	Internal/External
Modulating Waveform	Square with 50 % duty cycle
Modulation Frequency	1 mHz to 1 MHz with ‘internal’ modulation source

Modulation Characteristics – PWM

Carrier	Pulse
Modulation Source	Internal/External
Modulating Waveform	Sine, Square, Ramp, Noise, Arb
Modulation Frequency	1 mHz to 1 MHz with 'internal' modulation source
Pulse Width Deviation Resolution	Minimum 6.67 ns

Burst Characteristics

Carrier	Sine, Square, Ramp, Noise, Pulse, Arb
Type	Count (1–1 M cycles), Infinite, Gated
Carrier Frequency	2 mHz – Maximum output frequency
Stop/Start phase	0 Deg to 360 Deg
Internal Period	1 µs – 1000 seconds
Trigger Source	Internal, External, Manual
Gated Source	Internal, External
Trigger Delay	Maximum of 100 seconds

Sweep Characteristics

Carrier	Sine, Square, Ramp, Arb
Type	Linear, Log
Direction	Up, Down
Carrier Frequency	1 µHz – Maximum output frequency
Sweep Time	1 ms – 500 seconds
Trigger Source	Internal, External, Manual

Frequency Counter Characteristics

Function	Frequency, Period, Positive / Negative Pulse Width, Duty Cycle
Coupling	DC, AC, HF REJ
Frequency Range	DC: 100 mHz – 200 MHz, AC: 10 Hz – 200 MHz
DC Input Amplitude	100 mV rms – +/- 2.5 V < 100 MHz 200 mV rms – +/- 2.5 V 100 MHz – 200 MHz
AC Input Amplitude	100 mV rms – 5Vp-p < 100 MHz 200 mV rms – 5Vp-p 100 MHz – 200 MHz
Input Impedance	1 M Ohm

Reference Clock Input

Frequency	10 MHz
Amplitude	Minimum 1.4 Vp-p
Input Impedance	5 kOhm AC coupled

Reference Clock Output

Frequency	10 MHz Synchronised to the internal reference clock
Amplitude	Minimum 2 Vp-p into high impedance load
Output Impedance	50 Ohms

External Trigger Input

V in Low	-0.5 V to +0.8 V
V in High	2 V to 5.5 V
Direction	Up, Down
Input Impedance	100 kOhms
Minimum Pulse Width	100 ns
Maximum Response Time	100 ns – Sweep, 600 ns – Burst

Trigger Output

V out Low	Maximum 0.44 V at 8 mA
V out High	Mimimum 3.8 V at -8 mA
Output Impedance	100 Ohms
Maximum Frequency	1 MHz

SPECIFICATIONS

Sync Output

V out Low	Maximum 0.44 V at 8 mA
V out High	Mimimum 3.8 V at -8 mA
Output Impedance	100 Ohms
Maximum Frequency	10 MHz
Pulse Width	50 ns

Modulation Input

Frequency	0 Hz to 50 kHz
Input Impedance	10 kOhm
Amplitude at 100 % Modulation Depth	Min 11 Vp-p, Typ 12 Vp-p, Max 13 Vp-p

General Characteristics

Power	
Voltage	100 V to 240 V (+/-10 %) at 50 Hz / 60Hz 100 V to 120 V (+/-10 %) at 400 Hz
Power Consumption	Typical 25.5 W, Maximum 50 W
Display	
Color Depth	24 bit
Contrast Ratio	350:1
Luminance	300 cd/m^2
Touch panel type	Resistive
Environment	
Operating Temperature	0 Deg C to 40 Deg C
Storage Temperature	-20 Deg C to 60 Deg C
Operating Humidity	5 % to 90 % < 30 Deg C | 5 % to 50 % >30 Deg C
Non-Operating Humidity	5 % to 95 %
Maximum Operating Altitude	3048 m < 30 Deg C
Maximum Non-Operating Altitude	15000m
Calibration	
Calibration Interval	Annually
Mechanical	
Dimensions	W x D x H = 260.3 mm x 107.2 mm x 295.7 mm
Net Weight	3.43 kg
Gross Weight	4.42 kg
Compliance	
LVD	IEC 61010-2:2010
EMC	EN61326-1:2013

Ordering information

Models	**T3AFG40** 40 MHz
	T3AFG80 80 MHz
	T3AFG120 120 MHz
Standard Accessories	Quick Start Guide
	USB Cable
	BNC Cable
	Calibration Certificate
	Power Cord

ABOUT TELEDYNE TEST TOOLS

TELEDYNE TEST TOOLS
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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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