TGF3000 Series
Dual Channel Arbitrary Function Generators

Frequency up to 160MHz, 15 digits or 1µHz resolution
Arbitrary waveforms up to 16 bits at 800MS/s
Wideband noise generator | high resolution pulse generator
Comprehensive internal/external digital and analog modulations
Two identical channels with phase control, coupling and tracking
USB and LXI compliant LAN interfaces, plus optional GPIB interface

aimtti.com | aimtti.us
The TGF3000 series is the latest function/arbitrary generator series from Aim-TTi offering class-leading performance and unrivalled value for money. A frequency capability of up to 160MHz is combined with two identical full performance channels that can operate as independent generators or in coupled or tracking modes. Precise channel to channel phase control with a resolution of 0.001° is provided.

A wide range of built-in waveforms is included and custom arbitrary waveforms can be used at sample speeds up to 800MS/s and replay rates up to 80MHz. PC based arbitrary waveform generation and editing software is provided.

High resolution, low jitter pulses can be generated as can wide bandwidth white noise.

A extensive array of modulations is provided using internal and external sources. Gated, burst and sweep modes can use internal or external trigger sources.

Remote control via USB and LXI compliant LAN (standard) can be supplemented by optional GPIB if required.
Features Summary

- 0.001mHz to 80MHz (TGF3082) or 160MHz (TGF3162) sine frequency range
- High sine wave purity with low phase noise and jitter, audio band THD down to 0.05%
- Square waves up to 50MHz with variable duty cycle, edge speeds down to 5ns
- Resolution of up to 15 digits or 1µHz, high stability TCXO timebase
- Two identical channels - independent or linked with coupled and tracking modes *
- Inter-channel phase offset of -360° to +360° with 0.001° resolution
- Pulse generation with 100ps width resolution, <30ps jitter, and variable rise/fall times
- Wideband noise generator with up to 100MHz noise bandwidth
- PRBS pseudo-random bit sequence generation with 8 sequence lengths *
- Harmonics generation using up to 16 harmonics *
- Wide range of standard and arbitrary waveforms built-in
- Arbitrary waveforms of 14-bits / 400MS/s (TGF3082) or 16-bits / 800MS/s (TGF3162)
- Waveform Manager Plus for Windows editing software included
- Front USB host socket for waveform storage and file transfers using Flash drives
- Comprehensive internal/external digital and analog modulation set including Sum * modulation
- Modulation frequencies up to 10MHz internal and 5MHz external
- Gate and Burst modes with internal and external triggering
- Bi-directional linear and logarithmic sweep using internal or external triggering
- 125MHz frequency counter/timer with five measurement modes
- Compact half-rack 2U casing with protective buffers and handle
- Programmable via USB and LAN (LXI) interfaces; GPIB optional

* The four features listed as model specific can be added to the TGF3082 by software unlocking (option GU3082). Most other features and specifications are common to both models (see technical specifications section for full details).
**HIGHER FREQUENCIES**

The TGF3000 Series out-performs other generators in its price range by offering sine waves up to 160MHz and square waves up to 50MHz.

**Exceptional frequency precision**

The frequency of these waveforms can be set with up to 15 digits or one micro hertz of resolution.

The DDS based frequency generation system uses a high stability TCXO timebase oscillator.

**Waveform quality**

The TGF3000 Series generates high purity sine waves with low harmonic distortion and low phase noise. Audio band THD is significantly better than similar generators at just 0.05%.

**Built-in Waveforms**

A large number of standard and pre-built arbitrary waveforms are built into the generator. These include triangles, ramps, sinc, logarithmics, exponentials, gaussians and cardiac (among others).

High sampling rate allows higher repetition rates than other generators.

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**CUSTOM ARBITRARY WAVEFORMS**

Custom arbitrary waveforms of 16 bit vertical resolution and up to 8192 points can be defined and replayed at sampling rates up to 800MS/s and repetition rates up to 80MHz.

**Waveform Editing**

Basic waveform creation and editing is built into the generator. However for complex waveforms Waveform Manager Plus software is included.

This Windows based package enables almost any waveform shape to be created using mathematical expressions, freehand drawing, waveform libraries, and import of waveforms using the Clip Board.

**Waveform Transfer and Storage**

Waveforms can be stored on Flash drives using the front panel mounted USB host interface.

Waveforms can be transferred from or to a PC either using a Flash drive, or via the digital interfaces (USB, LAN or GPIB).

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**WIDEBAND NOISE GENERATOR**

The Noise function provides wideband gaussian noise at bandwidths up to 100MHz and crest factor of more than five.

Noise can be used both as a carrier waveform and as a modulating waveform for AM, FM, PM, PWM and SUM modulation types.

As a carrier it can be AM, ASK or SUM modulated.
HIGH RESOLUTION PULSE GENERATOR
The pulse generator function offers an exceptionally high pulse width resolution of 100ps over a period range from 50ns to 1000s.
The pulse edge speed is fully variable from 10ns to 1ms. Pulse jitter is dramatically lower than any comparable generator at only 30ps.

FREQUENCY COUNTER/TIMER
The frequency counter function allows external signals to be measured in terms of frequency, period, pulse width or duty cycle.
The frequency range is 0.1Hz to 125MHz with a measurement resolution of up to seven digits.
Both generator channels remain operational when the counter is in use.

PRBS GENERATOR *
PRBS (Pseudo-Random Bit Sequence) is a binary waveform type that is widely used within secure communications systems.
PRBS is offered with a choice of 8 sequence lengths at rates between 1mbps and 50Mbps.
PRBS can be used as both a carrier waveform and a modulation.

HARMONICS GENERATOR *
The harmonics generator function built into the TGF3162 enables waveform to be created by the addition of sine wave harmonics.
Up to 16 harmonics can be used, chosen from up to the 50th order. The amplitude and phase can be individually set for each harmonic.

NOTE: Features marked * are standard on the TGF3162 and optional on the TGF3082.
TWO CHANNEL OPERATION
The two channels are identical with no performance limitations giving maximum flexibility and value for money.

Independent Channel Operation
The two channels can be operated completely independently as if they were two separate generators. (Note that external trigger and external modulation inputs are shared).

Relative Phase
The relative phase can be set from -360 degrees to +360 degrees with 0.001° resolution. Pressing the ‘align’ key phase synchronises the two channels with the specified phase offset.

Coupled Operation *
The frequencies of the two channels can be coupled such that changes on one are applied to the other.
Amplitudes (and DC offsets) of the two channels can be coupled such that changes are applied to both simultaneously.
Outputs can be coupled such that the output on/off switches both channels simultaneously.

Tracking Operation *
When in tracking mode both channels behave as one channel. If inverse tracking is selected, both channel still behave as one channel except that the output of channel 2 is inverted.

EXTENSIVE DIGITAL & ANALOG MODULATIONS
A large set of modulation types are built-in including AM, FM, PM, FSK, ASK, BPSK, PWM and SUM.
All standard and arbitrary waveforms can be modulated as the carrier, although Noise, Pulse and PRBS are limited to AM and SUM modulations plus PWM for Pulse.

Internal Digital Modulations
AM, FM, PM, PWM and SUM modulations can use an internal modulation source based upon any standard or arbitrary waveform type or Noise. A very wide modulation frequency range of 1µHz to 10MHz can be used.
FSK, ASK, and BPSK use a square wave modulation signal adjustable between 2mHz and 10MHz.

External Analog Modulation and Triggering
All modulation types can use an external modulation signal, either analog (AM, FM, PM, PWM and SUM) or digital triggering (FSK, ASK, and BPSK).
The analog modulation input bandwidth is DC to 5MHz.

SUM Modulation *
SUM modulation, not offered by most other products, enables the modulation waveform to be added to the carrier at any percentage.
All waveform types including Pulse and PRBS can be SUM modulated. This is particularly useful using Noise as the modulator to test circuit resilience with noisy signals.

NOTE: Features marked * are standard on the TGF3162 and optional on the TGF3082.
GATE, BURST & SWEEP

Comprehensive facilities for gating, burst triggering and frequency sweeping of signals is provided.

Trigger Signal

The trigger signal can be manual from the front panel key, internal from the internal trigger generator, external from the trigger-in socket, or remote via a bus command. It can be used for gating, triggered burst or triggered sweep.

The internal trigger generator is adjustable between 2mHz and 50MHz.

Gating

In gated mode Waveform will run while the gate signal is true and stop while false. The start/stop phase is settable between -360.0° to +360.0° to 0.001° resolution.

Triggered Burst

In Burst mode, each active edge of the trigger will produce one burst of the waveform.

The number of cycles in a burst can be set between 1 and 2,147,483,647 (or infinite). The burst start/end phase angle is settable between -360.0° to +360.0° to 0.001° resolution.

Sweep

Phase continuous sweep is available for all standard and arbitrary waveforms except for Pulse, PRBS and Noise. The sweep range is from 1µHz through to the maximum for the chosen carrier waveform. Start and stop frequencies can be set independently.

The sweep can be linear or logarithmic, triggered or continuous with a period between 1µHz and 500s.

WAVEFORM/SETUP STORAGE

USB Flash Drive Interface

A front mounted USB host socket enables the use of flash memory disk drives which can store up to 1,000 waveforms and 1,000 setups.

Unlimited Waveform Storage

These drives can be used both to store waveforms permanently and to transfer waveforms from or to a PC.

Arbitrary waveform storage within the instrument is limited to four waveforms, however each flash drive can store up to 1000 waveforms which can be accessed using the instruments file handling utilities.

Storage of Instrument Set-ups

Up to nine complete set-ups of the instrument can be stored within its own non-volatile memory. Up to 1000 further set-ups can be stored on each flash drive.
FREQUENCY REFERENCE
The generators use a high quality TCXO crystal as the internal frequency reference providing 1ppm accuracy and stability. If a higher accuracy or stability is required, an external 10MHz reference signal (from an off-air standard for example) can be applied to the Ref. Clock input. The internal 10MHz clock is available as a rear panel output for synchronisation with external equipment.

FULL REMOTE CONTROL
All functions of the generators can be controlled from the digital interfaces. Arbitrary waveform data can also be loaded using these interfaces. An IVI driver for Windows is supplied. This provides support for common applications such as LabView*, LabWindows* and HP-VEE*.

OTHER INPUTS
In addition to the Reference Clock input and output sockets, rear panel inputs for Modulation and Trigger are provided. These are used both for the modulation and triggering/gating functions and for the external frequency counter function.

SYNC OUTPUT
Channel 2 can be configured to be a Sync output for channel 1. Sync can be chosen to perform a variety of tasks depending upon the waveform type and the application.

LAN (Ethernet)
The LAN interface uses a standard 10/100 base-T Ethernet hardware connection with ICMP and TCP/IP Protocol for connection to a Local Area Network or direct connection to a single PC. This interface supports LXI and is the most appropriate for larger system use because of its scalable nature.

LXI Compliance
The LAN interface is compliant with LXI (LAN eXTensions for Instrumentation). LXI is the next-generation, LAN-based modular architecture standard for automated test systems managed by the LXI Consortium, and is expected to become the successor to GPIB in many systems.

USB
USB provides a simple and convenient means of connection to a PC and is particularly appropriate for small system use. USB has effectively replaced RS232 in many applications. The interface uses a standard USB 2.0 hardware connection and is implemented as virtual-COM port. A Windows* USB driver is provided. As well as the rear mounted USB device interface connector, a front mounted USB Host interface connector allows USB Flash memory to be connected.

GPIB
An optional GPIB (IEEE-488) interface is available. When fitted, the instruments retain the USB and LAN interfaces giving them even greater flexibility.

OTHER INPUTS
In addition to the Reference Clock input and output sockets, rear panel inputs for Modulation and Trigger are provided. These are used both for the modulation and triggering/gating functions and for the external frequency counter function.

SYNC OUTPUT
Channel 2 can be configured to be a Sync output for channel 1. Sync can be chosen to perform a variety of tasks depending upon the waveform type and the application.

MAIN OUTPUTS
The main outputs can provide up to 10V pk-pk into 50Ω (20V pk-pk EMF) for frequencies up to 50MHz. Maximum amplitude is reduced for higher frequencies (sine and arbitrary waveforms only).

High levels of DC offset can be set in conjunction with low signal levels, and the attenuator can be fixed to prevent glitches when changing levels.

Amplitudes can be entered as peak to peak voltage plus offset or in terms of high level and low level.

The amplitudes are shown relative to a 50Ω load impedance or as the open circuit EMF values.

Alternatively the user can enter any load value between 1Ω to 10kΩ and the amplitude will be calculated accordingly.

* LabView and LabWindows are trademarks of National Instruments.
* HP-VEE (Agilent/Keysight VEE) is a trademark of Keysight Technologies Inc.
* USB interface is supported for all versions of Windows from 2000 onwards
* Windows is a trademark of Microsoft Inc.
BENCH-TOP OPERATION

The generators are highly compact and use a minimum of bench space. Protective mouldings guard against knock damage and a multi-position stand angles the instrument conveniently as well as providing a carry handle.

RACK MOUNTING

For system applications the generators can be rack mounted. With the protective mouldings and handle removed the size is half rack width by 2U high.

A 2U rack mounting kit is available suitable for one or two instruments.

WAVEFORM SOFTWARE

Both generators are supplied with Waveform Manager Plus software for Windows. This PC software enables complex arbitrary waveforms to be created and edited. Waveforms can be built in any number of sections using any combination of standard waveforms, mathematical expressions, drawn waveforms, uploaded waveforms, imported waveforms and existing stored waveforms. Waveforms can be transferred to the generator using either the Flash drive interface or the bus interfaces.
General specifications apply for the temperature range 5°C to 40°C. Accuracy specifications apply for the temperature range 18°C to 28°C after 30 minutes warm-up, at maximum output into 50Ω. Typical specifications are determined by design and are not guaranteed. Information is subject to change without notice.

### Technical Specifications - TGF3162 | TGF3082

#### WAVEFORMS

<table>
<thead>
<tr>
<th>Type</th>
<th>TGF3162</th>
<th>TGF3082 (where different)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Standard Waveforms</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SINE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency Range</td>
<td>1µHz to 160MHz</td>
<td>1µHz to 80MHz</td>
</tr>
<tr>
<td>Frequency Resolution</td>
<td>1µHz, 15 digits</td>
<td>1µHz, 14 digits</td>
</tr>
<tr>
<td>Output Level</td>
<td>≤ 50MHz 10mVp-p to 10Vp-p into 50Ω</td>
<td>≤ 100MHz 10mVp-p to 5Vp-p into 50Ω</td>
</tr>
<tr>
<td></td>
<td>≤ 100MHz 10mVp-p to 2.5Vp-p into 50Ω</td>
<td>≤ 160MHz 10mVp-p to 5Vp-p into 50Ω</td>
</tr>
<tr>
<td>Amplitude Flatness</td>
<td>≤10MHz: ±0.1dB</td>
<td></td>
</tr>
<tr>
<td>(1V p-p relative to 1kHz)</td>
<td>≤100MHz: ±0.2dB</td>
<td>≤80MHz: ±0.2dB</td>
</tr>
<tr>
<td>Harmonic Distortion (1V p-p)</td>
<td>≤ 10MHz: -60dBc</td>
<td></td>
</tr>
<tr>
<td></td>
<td>≤ 50MHz: -50dBc</td>
<td>≤ 160MHz: -36dBc</td>
</tr>
<tr>
<td>Non-Harmonic Spurii</td>
<td>≤ 65dBc</td>
<td></td>
</tr>
<tr>
<td>Phase Noise</td>
<td>-113dBc/Hz (10MHz, 1 V p-p, 10kHz offset)</td>
<td></td>
</tr>
<tr>
<td><strong>SQUARE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency Range</td>
<td>1µHz to 50MHz</td>
<td></td>
</tr>
<tr>
<td>Frequency Resolution</td>
<td>1µHz, 13 digits</td>
<td></td>
</tr>
<tr>
<td>Output Level</td>
<td>10mVp-p to 10Vp-p into 50Ω</td>
<td></td>
</tr>
<tr>
<td>Aberrations (Typical)</td>
<td>±0.05% of amplitude</td>
<td>≤0.07% of amplitude</td>
</tr>
<tr>
<td>Jitter (RMS)</td>
<td>&lt;30ps (cycle to cycle)</td>
<td></td>
</tr>
<tr>
<td><strong>RAMP</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency Range</td>
<td>1µHz to 5MHz</td>
<td></td>
</tr>
<tr>
<td>Frequency Resolution</td>
<td>1µHz, 11 digits</td>
<td></td>
</tr>
<tr>
<td>Output Level</td>
<td>10mVp-p to 10Vp-p into 50Ω</td>
<td></td>
</tr>
<tr>
<td>Aberrations (Typical)</td>
<td>&lt;3% of amplitude</td>
<td>≤5% of amplitude</td>
</tr>
<tr>
<td>Jitter RMS</td>
<td>&lt;30ps (cycle to cycle)</td>
<td></td>
</tr>
<tr>
<td>Rise and Fall Times</td>
<td>Range: 10ns to 1ms (10% to 90%)</td>
<td></td>
</tr>
<tr>
<td>(Rise time = Fall time)</td>
<td>Resolution: 100ps Accuracy: ±500ps ±0.01% of period</td>
<td></td>
</tr>
<tr>
<td>Width</td>
<td>Range: 25ns to 999.999999975s</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Resolution: 100ps Accuracy: ±200ps ±0.01% of period</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Duty: 0.01% to 99.99%, 0.01% resolution</td>
<td></td>
</tr>
<tr>
<td><strong>Pulse</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency Range</td>
<td>1µHz to 20MHz</td>
<td></td>
</tr>
<tr>
<td>Frequency Resolution</td>
<td>1µHz, 14 digits</td>
<td></td>
</tr>
<tr>
<td>Output Level</td>
<td>10mVp-p to 10Vp-p into 50Ω</td>
<td></td>
</tr>
<tr>
<td>Aberrations (Typical)</td>
<td>&lt;3% of amplitude</td>
<td>≤5% of amplitude</td>
</tr>
<tr>
<td>Jitter RMS</td>
<td>&lt;30ps (cycle to cycle)</td>
<td></td>
</tr>
<tr>
<td>Rise and Fall Times</td>
<td>Range: 5ns to 1ms (10% to 90%)</td>
<td></td>
</tr>
<tr>
<td>(Rise time = Fall time)</td>
<td>Resolution: 100ps Accuracy: ±500ps ±0.01% of period</td>
<td></td>
</tr>
<tr>
<td>Width</td>
<td>Range: 999.999999975s</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Resolution: 100ps Accuracy: ±200ps ±0.01% of period</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Duty: 0.01% to 99.99%, 0.01% resolution</td>
<td></td>
</tr>
<tr>
<td><strong>Arbitrary</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waveform Memory Size</td>
<td>8192 points</td>
<td></td>
</tr>
<tr>
<td>Vertical Resolution</td>
<td>16 bits</td>
<td>14 bits</td>
</tr>
<tr>
<td>Frequency Range</td>
<td>1µHz to 80MHz</td>
<td>1µHz to 40MHz</td>
</tr>
<tr>
<td>Frequency Resolution</td>
<td>1µHz, 14 digits</td>
<td></td>
</tr>
<tr>
<td>Output Level</td>
<td>10mVp-p to 10Vp-p into 50Ω</td>
<td></td>
</tr>
<tr>
<td>Sampling rate</td>
<td>400MHz/s</td>
<td></td>
</tr>
<tr>
<td>Point to Point Jitter</td>
<td>1.25ns Typical</td>
<td>2.5ns Typical</td>
</tr>
<tr>
<td>Rise and Fall Times</td>
<td>&lt;5ns</td>
<td>&lt;8ns</td>
</tr>
<tr>
<td>Effective Analogue Bandwidth (-3dB)</td>
<td>100MHz</td>
<td>62.5MHz</td>
</tr>
</tbody>
</table>

In built arbitrary waveforms (Sin(x)/x, Exponential Rise, Exponential Fall, Logarithmic Rise, Logarithmic Fall, Haverson, Cardiac, Gaussian, Lorentz and D-Lorentz). Up to 4 user-defined waveforms may be stored in non-volatile memory. Waveforms can be defined by downloading of waveform data via remote interfaces or from the instrument’s front panel.
## Technical Specifications (continued)

### NOISE

<table>
<thead>
<tr>
<th>TGF3162</th>
<th>TGF3082 (where different)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gaussian White Noise: Noise can also be used as modulating waveform.</td>
<td></td>
</tr>
<tr>
<td>Bandwidth (-3dB)</td>
<td>100MHz</td>
</tr>
<tr>
<td>Noise crest factor (Vp/Vrms)</td>
<td>5.16</td>
</tr>
<tr>
<td>Output Level:</td>
<td>10mVp-p to 10Vpp into 50Ω</td>
</tr>
</tbody>
</table>

### PRBS

<table>
<thead>
<tr>
<th>TGF3162</th>
<th>TGF3082 (where different)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bit Rate:</td>
<td>1mbps to 50Mbps, 1bps resolution</td>
</tr>
<tr>
<td>Sequence Length:</td>
<td>$2^{m} - 1$, where $m = 7, 9, 11, 15, 20, 23, 29$ or $31$</td>
</tr>
<tr>
<td>Rise and Fall Times</td>
<td>5ns Fixed</td>
</tr>
<tr>
<td>Output Level:</td>
<td>10mVp-p to 10Vpp into 50Ω</td>
</tr>
</tbody>
</table>

### Harmonic Waveforms

<table>
<thead>
<tr>
<th>TGF3162</th>
<th>TGF3082 (where different)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harmonic waveforms can be defined and stored in user-defined arbitrary waveform locations</td>
<td></td>
</tr>
<tr>
<td>Frequency Range:</td>
<td>1µHz to 80MHz</td>
</tr>
<tr>
<td>Frequency Resolution:</td>
<td>1µHz, 14 digits</td>
</tr>
<tr>
<td>Harmonic Order:</td>
<td>1 to 50, Up to 16 different harmonics order can be defined</td>
</tr>
<tr>
<td>Harmonic Amplitude:</td>
<td>-360.0% to +360.0% of output amplitude, 0.1% resolution</td>
</tr>
<tr>
<td>Harmonic Phasor:</td>
<td>-360.0 to +360.0 degrees, 0.1 degree resolution</td>
</tr>
<tr>
<td>Output Level:</td>
<td>10mVp-p to 10Vpp into 50Ω, (5V p-p max above 50MHz)</td>
</tr>
</tbody>
</table>

### Internal Frequency Reference

<table>
<thead>
<tr>
<th>TGF3162</th>
<th>TGF3082 (where different)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Setting Error:</td>
<td>&lt;± 1ppm</td>
</tr>
<tr>
<td>Oscillator Ageing Rate:</td>
<td>&lt;± 1ppm first year</td>
</tr>
<tr>
<td>Temperature Stability:</td>
<td>&lt;± 1ppm over the specified temperature range</td>
</tr>
</tbody>
</table>

### MODULATION

#### AM (Amplitude Modulation) Normal & Suppressed Carrier

<table>
<thead>
<tr>
<th>TGF3162</th>
<th>TGF3082 (where different)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carrier Waveforms:</td>
<td>Sine, Square, Ramp, Pulse, Noise, Arb, PRBS* (max. carrier frequency 50MHz)</td>
</tr>
<tr>
<td>Max. Carrier Frequency</td>
<td>50MHz</td>
</tr>
<tr>
<td>Internal Modulating Waveforms:</td>
<td>Sine, Square, Positive Ramp, Negative Ramp, Triangle, Gaussian Noise, DC, Sinc, Exponential Rise, Exponential Fall, Logarithmic Rise, Logarithmic Fall, Haversine, Gaussian, Lorentz, D-Lorentz, Cardiac, User Defined Arbs, PRBS*</td>
</tr>
<tr>
<td>Amplitude Depth:</td>
<td>0.00% to 100.00%, 0.01% resolution</td>
</tr>
</tbody>
</table>

#### FM (Frequency Modulation)

<table>
<thead>
<tr>
<th>TGF3162</th>
<th>TGF3082 (where different)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carrier Waveforms:</td>
<td>Sine, Square, Ramp, Arb</td>
</tr>
<tr>
<td>Modulation Source:</td>
<td>Internal/External</td>
</tr>
<tr>
<td>Internal Modulating Waveforms:</td>
<td>Sine, Square, Positive Ramp, Negative Ramp, Triangle, Gaussian Noise, DC, Sinc, Exponential Rise, Exponential Fall, Logarithmic Rise, Logarithmic Fall, Haversine, Gaussian, Lorentz, D-Lorentz, Cardiac and User Defined Arbs, PRBS*</td>
</tr>
<tr>
<td>Internal Modulating Frequency:</td>
<td>1µHz to 10MHz, 1µHz resolution</td>
</tr>
<tr>
<td>Frequency Deviation:</td>
<td>DC to Fmax/2, 1µHz resolution</td>
</tr>
</tbody>
</table>

#### PM (Phase Modulation)

<table>
<thead>
<tr>
<th>TGF3162</th>
<th>TGF3082 (where different)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carrier Waveforms:</td>
<td>Sine, Square, Ramp, Arb</td>
</tr>
<tr>
<td>Modulation Source:</td>
<td>Internal/External</td>
</tr>
<tr>
<td>Internal Modulating Waveforms:</td>
<td>Sine, Square, Positive Ramp, Negative Ramp, Triangle, Gaussian Noise, DC, Sinc, Exponential Rise, Exponential Fall, Logarithmic Rise, Logarithmic Fall, Haversine, Gaussian, Lorentz, D-Lorentz, Cardiac and User Defined Arbs, PRBS*</td>
</tr>
<tr>
<td>Internal Modulating Frequency:</td>
<td>1µHz to 10MHz, 1µHz resolution</td>
</tr>
<tr>
<td>Phase Deviation:</td>
<td>-360.000 to +360.000 degrees, 0.001 degree resolution</td>
</tr>
</tbody>
</table>

#### ASK (Amplitude Shift Keying)

<table>
<thead>
<tr>
<th>TGF3162</th>
<th>TGF3082 (where different)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carrier Waveforms:</td>
<td>Sine, Square, Ramp, Pulse, Noise, Arb, PRBS* (max. carrier frequency 50MHz)</td>
</tr>
<tr>
<td>Source:</td>
<td>Internal/External (via TRIG IN)</td>
</tr>
<tr>
<td>Internal Modulation:</td>
<td>2mHz to 10MHz (50% duty cycle square)</td>
</tr>
</tbody>
</table>

#### FSK (Frequency Shift Keying)

<table>
<thead>
<tr>
<th>TGF3162</th>
<th>TGF3082 (where different)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carrier Waveforms:</td>
<td>Sine, Square, Ramp, Arb</td>
</tr>
<tr>
<td>Max. Carrier Frequency</td>
<td>2MHz</td>
</tr>
<tr>
<td>Source:</td>
<td>Internal/External (via TRIG IN)</td>
</tr>
<tr>
<td>Internal Modulation:</td>
<td>2mHz to 10MHz (50% duty cycle square)</td>
</tr>
</tbody>
</table>
## Technical Specifications (continued)

### BPSK (Binary Phase Shift Keying)
- **Carrier Waveforms**: Sine, Square, Ramp, Arb
- **Internal Modulation**: 2mHz to 10MHz (50% duty cycle square)

### PWM (Pulse Width Modulation)
- **Carrier Waveforms**: Pulse
- **Internal Modulating Waveforms**: Sine, Square, Positive Ramp, Negative Ramp, Triangle, Gaussian Noise, DC, Sinc, Exponential Rise, Exponential Fall, Logarithmic Rise, Logarithmic Fall, Haversine, Gaussian, Lorentz, D-Lorentz, Cardiac and User Defined Arbs, PRBS*
- **Internal Modulating Frequency**: 1µHz to 10MHz, 1µHz resolution
- **Pulse Width Deviation**: 0% to 100% of pulse width, 0.01% resolution

### SUM (Additive Modulation)
- **Carrier Waveforms**: Sine, Square, Ramp, Pulse, Noise, Arb, PRBS*
- **Max. Carrier Frequency**: 50MHz  |  25MHz
- **Internal Modulating Waveforms**: Sine, Square, Positive Ramp, Negative Ramp, Triangle, Gaussian Noise, DC, Sinc, Exponential Rise, Exponential Fall, Logarithmic Rise, Logarithmic Fall, Haversine, Gaussian, Lorentz, D-Lorentz, Cardiac, and User Defined Arbs, PRBS*
- **Internal Modulating Frequency**: 1µHz to 10MHz, 1µHz resolution
- **Ratio**: 0% to 100%, 0.01% resolution

*NOTE: References to PRBS within the Modulations section refer only to the TGF3162 or TGF3082 with option GU3082*

### TRIGGERED BURST
- **TGF3162**  |  **TGF3082 (where different)**
  - Each active edge of the trigger signal will produce one burst of the waveform.
  - **Carrier Waveforms**: Sine, Square, Ramp, Pulse, Noise, Arb, PRBS*
  - **Maximum Carrier Frequency**: 50MHz (finite cycles), Fmax(infinite)  |  25MHz (finite cycles), Fmax(infinite)
  - **PRBS**: A fixed number of bits, specified as number of cycles are generated at every trigger event.
  - **Noise**: Noise is reset to its start condition at every trigger event. Allows generating same random noise sequence.
  - **Number of Cycles**: 1 to 2147483647 and infinite.
  - **Trigger Repetition Rate**: 2mHz to 50MHz internal, dc to 1MHz external  |  2mHz to 25MHz internal, dc to 1MHz external.
  - **Trigger Start/Stop Phase**: -360.000 to +360.000 degrees, 0.001 degree resolution. Phase offset cannot be set for Noise and PRBS waveforms.

### GATED
- **TGF3162**  |  **TGF3082 (where different)**
  - Waveform will run while the Gate signal is true and stop while false.
  - **Maximum Carrier Frequency**: 50MHz (finite cycles), Fmax(infinite)  |  25MHz (finite cycles), Fmax(infinite)
  - **Trigger Repetition Rate**: 2mHz to 50MHz internal, dc to 1MHz external  |  2mHz to 25MHz internal, dc to 1MHz external.
  - **Gate Start/Stop Phase**: -360.000 to +360.000 degrees, 0.001 degree resolution. Phase offset cannot be set for Noise and PRBS waveforms.

### SWEEP
- **Frequency sweep capability is provided for both standard and arbitrary waveforms.**
- **Carrier Waveforms**: Sine, Square, Ramp, Arb
- **Sweep Mode**: Linear or logarithmic, triggered or continuous.
- **Sweep Range**: From 1µHz to Fmax. Phase continuous. Independent setting of the start and stop frequency.
- **Sweep Source**: 1µs to 500s (9 digit resolution).
- **Sweep Time**: 2mHz to 50MHz internal, dc to 1MHz external.
- **Sweep Trigger Source**: The sweep may be free run or triggered from the following sources: Internal from keyboard or trigger generator. Externally from TRIG IN or remote interface.

### TRIGGER GENERATOR
- **TGF3162**  |  **TGF3082 (where different)**
  - Internal source square wave source adjustable in 10ns steps, 11 digit resolution. Each channel has its own trigger generator. Channel 1 trigger is available for external use from the MAIN OUT 2 socket when Channel 2 is configured to output Channel 1 sync waveform and sync source is set to trigger.
  - **Frequency/Period Range**: 2mHz to 50MHz / 20ns to 500s  |  2mHz to 25MHz / 40ns to 500s
FREQUENCY COUNTER/TIMER

External signals can be measured using the TRIG IN or REF IN Sockets.

Functions:
- Frequency
- Period
- Positive Width
- Negative Width
- Duty Cycle

Frequency Range:
- AC coupled: 3Hz to >125MHz
- DC coupled: 100MHz to >125MHz

Input Source:
- AC coupled: REF IN / COUNT (AC) IN socket
- DC coupled: TRIG IN / COUNT (DC) IN socket

Measurement Time: Automatic

Input Range and Sensitivity:
- AC coupled: 100mVpp – 5Vpp, maximum input ±10V
- DC coupled: Threshold typically 1.2V; sensitivity 100mVpp; maximum input +5V/-1V

Accuracy: ±1 digit ± timebase accuracy.

INTER-CHANNEL OPERATIONS

Inter Channel Characteristics

Relative phase: -360.000 to 360.000 degrees, 0.001 degree resolution (Phase offset cannot be set for Noise)

Channel to channel Skew (typical): <1ns (when performing identical operations)

Crosstalk (typical): <80db

Channel Tracking
- Standard on TGF3162
- Optional on TGF3082 with GU3082

Equal (Off): The channels are independent of each other.

Equal: The two channels are identical and behave identically.

Output coupling:
- Output On/Off can be coupled. Switching the output On/Off on one channel switches the output On/Off on both channels.

OUTPUTS

MAIN OUTPUTS

Output Impedance: 50Ω

Amplitude:
- ≤ 50MHz: 20mV to 20Vp-p open circuit (10mV to 10Vp-p into 50Ω)
- ≤ 125MHz: 20mV to 10Vp-p open circuit (10mV to 5Vp-p into 50Ω)
- ≤ 160MHz: 20mV to 5Vp-p open circuit (10mV to 2.5Vp-p into 50Ω)

Amplitude can be specified open circuit (hi Z) or into an assumed load of 1Ω to 10kΩ in Vp-p.

Amplitude Accuracy: 1.5% ±5mV at 1kHz into 50Ω.

DC Offset Range:
- ≤ 50MHz: ±10V
- ≤ 125MHz: ±5V, DC offset plus signal peak limited to ±5V from 50Ω.
- ≤ 160MHz: ±2.5V, DC offset plus signal peak limited to ±2.5V from 50Ω.

DC Offset Accuracy: Typically 1% ±50mV.

Resolution: 3 digits or 1mV for both Amplitude and DC Offset.

SYNC OUTPUT

Channel 2 can be configured to output Channel 1 sync from its MAIN OUT 2 socket. Sync is a multifunction output which is automatically selected to be any of the following. Alternatively, user can choose Sync to always be carrier referenced, to output the currently used trigger signal or turn it off.

Carrier Waveform Sync:
- Sine ≤ 50MHz: A square wave with 50% duty cycle at the waveform frequency.
- Sine >50MHz ≤ 160MHz: A sine wave at the waveform frequency.
- Square / Ramp / Pulse / Arbs: A square wave with 50% duty cycle at the waveform frequency.
- Pattern: A positive pulse which is 1 bit rate wide at the beginning of the sequence
- Noise: No sync associated with noise

Modulation Sync:
- AM/FM/PM/SUM/PWM: A square wave with 50% duty cycle referenced to the internal modulation waveform when modulation source is internal, or a square wave referenced to the carrier waveform when modulation source is external.
- FSK: A square wave referenced to the trigger rate. The sync is a TTL high when hop frequency is the output frequency and TTL low when carrier frequency is the output frequency for positive slope and vice versa for negative slope.
- BPSK: A square wave referenced to the trigger rate. The sync is a TTL high when the hop phase is the output phase and TTL low when carrier phase is the output phase for positive slope and vice versa for negative slope.
- Sweep: A square wave referenced to the waveform as the external source.
- Burst: A square wave referenced to the trigger rate. The sync is a TTL high when the hop phase is the output phase and TTL low when carrier phase is the output phase for positive slope and vice versa for negative slope.
- Internal Trigger: A square wave with 50% duty cycle at the trigger frequency.
- External Trigger: A square wave with same duty cycle and frequency as the external source.
- Manual Trigger: A positive pulse which is approximately 18us wide at the beginning of the event.

Output Signal Level: Logic level nominally 3V

Output Impedance: 50Ω
## Technical Specifications (continued)

### REF CLOCK OUTPUT
Buffered version of the 10MHz clock currently in use (internal or external)
- **Output Level:** Nominally 3V logic level from 50\ohm

### INPUTS
#### TRIG IN / COUNT (DC IN)
For ASK, FSK, BPSK, triggered sweep, gated burst, triggered burst and DC coupled external frequency measurement
- **Minimum Trigger Pulse Width:** 50ns
- **Trigger Polarity:** Selectable as high/rising edge or low/falling edge.
- **Input Impedance:** 10\ohm

#### EXTERNAL MODULATION INPUT
For AM, FM, PM, SUM and PWM
- **Voltage Range:** ±2.5V full scale
- **Input Impedance:** 5k\ohm typical
- **Bandwidth:** DC to 5MHz

#### REF IN / COUNT (AC IN)
Input for an external 10MHz reference clock and AC coupled external frequency measurement
- **Minimum Voltage:** -1V

### INTERFACES
Full digital remote control facilities are available through LAN, USB and optional GPIB interfaces.
- **LAN Interface:** Ethernet 100/10base – T hardware connection. 1.4 LXI Core 2011
- **USB Interface:** Standard USB 2.0 hardware connection. Implemented as virtual-COM port.
- **USB Flash Drive:** For waveform and set-up storage/recall.
- **GPIB (optional):** Conforming with IEEE488.1 and IEEE488.2

### GENERAL
- **Display:** 256 x 112 pixel monochrome graphics display. White LED backlight with adjustable brightness and contrast.
- **Data Entry:** Keyboard selection of mode, waveform etc.; value entry direct by numeric keys or by rotary control.
- **Stored Settings:** Up to 9 complete instrument set-ups may be stored and recalled from non-volatile memory.
- **Size:** Bench Top: 97mm height; 250mm width; 295mm long
  - Rack mount: 86.5mm (2U) height; 213.5mm (½-rack) width; 269mm long
- **Weight:** 3.2kg
- **Environmental:** Indoor use at altitudes up to 2000m, Pollution Degree 2.
- **Options:** 19 inch rack mounting kit.
- **Safety & EMC:** Complies with EN61010-1 & EN61326-1.

For details, request the EU Declaration of Conformity for this instrument via http://www.aimtti.com/support (serial no. needed).

### OPTIONS
- **GPIB Interface TG-GPIB:** User installable GPIB (IEEE-488) interface module.
- **Features Upgrade GU3082:** User installable software enhancement that adds inter-channel functions, PRBS generator, Harmonics generator and sum modulation to the TG3082
- **Rack Mount Kit RM200A:** 2U high rack mount for one or two generators.
TGF3000 Series - Ordering Information

<table>
<thead>
<tr>
<th>Product Reference</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TGF3162</td>
<td>160MHz two channel generator 110V to 240V AC input, supplied with: AC power cable appropriate to country of sale, Printed quick-start manual in English, French, German, Italian and Spanish, Printed full operating manual in English, Waveform Manager Plus software on CD, Large number of pre-built arbitrary waveform on CD, IVI driver, combined LabView/LabWindows CVI driver, and USB driver on CD</td>
</tr>
<tr>
<td>TGF3082</td>
<td>80MHz two channel generator 110V to 240V AC input, supplied with: AC power cable appropriate to country of sale, Printed quick-start manual in English, French, German, Italian and Spanish, Printed full operating manual in English, Waveform Manager Plus software on CD, Large number of pre-built arbitrary waveform on CD, IVI driver, combined LabView/LabWindows CVI driver, and USB driver on CD</td>
</tr>
<tr>
<td>TG-GPIB</td>
<td>User installable GPIB interface module</td>
</tr>
<tr>
<td>GU3082</td>
<td>User installable features upgrade for TFG3082 only</td>
</tr>
<tr>
<td>RM200A</td>
<td>2U high rack mount kit for one or two instruments</td>
</tr>
</tbody>
</table>

OTHER WAVEFORM GENERATORS FROM AIM-TTI

The TGF3000 Series is just part of an extensive range of generators from Aim-TTi ranging from simple analog function generators through to four channel true variable clock arbitrary generators. RF signal generators are also available.

Function Generators

- **TG300 Series**: 3MHz analog function generators with digital display of frequency and level
- **TG1006**: 10MHz DDS function generator with sweep, modulation and counter
- **TG2000 Series**: 10MHz/20MHz DDS function generators with full digital control

Arbitrary Function Generators

- **TGxx11/12A**: 25MHz/50MHz generators with one and two channel and extensive features

Pulse Generators

- **TGP110**: 10MHz analog pulse generator
- **TGP3100 Series**: 25MHz/50MHz digital pulse and universal generators with one or two channel and jitter free asynchronous operation

True Arbitrary Generators

- **TGA1240 Series**: 40MHz variable clock Arbs with 1, 2 or 4 channels
- **TGA12100 Series**: 100MHz variable clock Arbs with 1, 2 or 4 channels
- **TGA12200 Series** (coming 2018): 2 or 4 channel true Arbs with up to 500MS/s clock rate and very extensive features

Available from: [Supplier Information]

Designed and built in Europe by: [Thurlby Thandar Instruments Ltd.]

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Email: sales@aimtti.com Web: www.aimtti.com