

## WAVEFORMS

### Standard Waveforms

Sine, square, triangle, DC, positive ramp, negative ramp, sin(x)/x, pulse, pulse train, cosine, haversine and havercosine.

Frequency Accuracy: Better than 10 ppm for 1 year.

Temperature Stability: Typically <1 ppm/°C

### Sine, Cosine, Haversine, Havercosine

Range (Resolution): 0.1 mHz to 40 MHz. (0.1mHz or 10 digits)

Harmonic Distortion: <0.15% THD to 100kHz; <-60dBc to 20kHz, <-50dBc to 1MHz, <-40dBc to 10MHz, <-30dBc to 40MHz.

Non-harmonic Spurious: <-60dBc to 1MHz, +6dB/octave 1MHz to 40MHz.

### Square

Range (Resolution): 1 mHz to 50 MHz. (1mHz or 7 digits)

Rise and Fall Times: <8ns

### Triangle

Range (Resolution): 0.1 mHz to 500 kHz. (0.1mHz or 7 digits)

Linearity Error: <0.1% to 30 kHz

### Ramps and Sin(x)/x

Range (Resolution): 0.1 mHz to 100 kHz. (0.1mHz or 10 digits)

Linearity Error: <0.1% to 30 kHz (ramps)

### Pulse and Pulse Train

Rise and Fall Times: <8ns

Period: Range 40ns to 100s. Resolution 7 digits or 10ns.

Delay and Width: Range -99.9s to +99.99s. Resolution 0.001% period or 10ns.

Trains of up to 10 pulses may be specified, each having independently defined width, delay and level. The baseline voltage is separately defined and the sequence repetition rate is set by the pulse train period.

## ARBITRARY

Up to 4 user defined waveforms may be stored. Arbitrary waveforms can be defined by downloading of waveform data via RS232 or USB (or GPIB if fitted)

Waveform Size: 65536 (64K) points maximum, 8 points minimum.

Vertical Resolution: 12 bits

Sample Clock Range: 100mHz to 100MHz. Resolution 7 digits or 0.1 mHz

Output Filter: Selectable between 40MHz Elliptic, 20MHz Bessel or none.

### Noise Function:

Digital noise generated by a 35-bit linear feedback register clocked at 100MHz.

User's external filter defines bandwidth and response.

## ARBITRARY WAVEFORM CREATION / EDITING

Waveform Manager Plus software for Windows is supplied.

Full details of its capabilities are on our website or within the Waveform Manager Plus brochure.

## MODULATION MODES

### Sweep

Capability provided for both standard and arbitrary waveforms. Linear or logarithmic sweep, continuous or triggered, directions of up, down, up/down or down/up.

Sweep range of 1mHz to 40 MHz in one range, phase continuous with independent setting of start/stop. Sweep time variable 1ms to 999s (3 digit resolution).

One Marker is provided, variable during the sweep.

The sweep may be free run or triggered from the following sources: Manually from keyboard. Externally from TRIG IN input or remote interface.

### Other Modulation Modes

Modes of Triggered Burst, Gated, and Tone Switching (gated, triggered, or FSK switching from a list of up to 16 frequencies).

**NOTE:** The full specification of these modulation modes is provided on our website.

### Trigger Generator

Internal source 0.005 Hz to 100kHz squarewave adjustable in 10us steps. 3 digit resolution. Available for external use from the SYNC OUT socket.

## DIGITAL INTERFACES

Full remote control and waveform download facilities are available through the RS-232 and USB interfaces. GPIB is available as an option.

RS-232: Variable Baud rate, 9600 Baud maximum. 9-pin D-connector. (Also compatible with TTI ARC system)

USB: Conforming with USB 1.1

GPIB (Optional): Conforming with IEEE488.1 and IEEE488.2

## OUTPUTS

### Main Output

Output Impedance: 50Ω

Amplitude: 5mV to 20V pk-pk open circuit (2.5mV to 10V pk-pk into 50Ω). Amplitude can be specified open circuit (Hi Z) or into an assumed load of 50Ω or 600Ω, in Vpk-pk, Vrms or dBm.

Amplitude Accuracy: Better than 2% ±1mV at 1kHz into 50Ω.

Amplitude Flatness: ±0.2dB to 1MHz; ±0.4dB to 40MHz.

DC Offset Range: ±10V. DC offset plus signal peak limited to ±10V from 50Ω.

DC Offset Accuracy: Typically within ±3% ±10mV, unattenuated.

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

### Sync Out

Multifunction output user definable or automatically selected to be any of the following: Waveform Sync, Burst Done, Sweep Sync, Sweep Marker, Phase Lock Out.

**NOTE:** The full specification of the Sync Out signal is provided on our website.

## INPUTS

### Trig In

Frequency Range: DC - 1MHz.

Signal Range: Threshold nominally TTL level; max. input ±10V.

Min. Pulse Width: 50ns for Trigger and Gate modes; 50µs for Sweep mode; 20ms for Tone mode.

Input Impedance: 10kΩ

### Modulation In

Frequency Range: DC - 500kHz.

Signal Range: VCA: - approximately 1V pk-pk for 100% level change at maximum output. SCM: - approximately ±1Vpk for max. output.

Input Impedance: Typically 1kΩ.

### Sum In

Frequency Range: DC - 30MHz.

Signal Range: Approximately 2Vpk-pk input for 20Vpk-pk output.

Input Impedance: Typically 1kΩ.

### Ref Clock In/Out

Set to Input: Input for an external 10MHz reference clock. TTL/CMOS threshold level.

Set to Output: Buffered version of the internal 10MHz clock. Output levels nominally 1V and 4V from 50Ω.

Set to Phase Lock: Used together with SYNC OUT on a master and the TRIG IN on a slave to synchronise (phase lock) multiple instruments.

## GENERAL

Display: 20 character x 4 row alphanumeric LCD.

Data Entry: Keyboard selection of mode, waveform etc.; value entry by numeric keys or by rotary control.

Stored Settings: Up to 9 complete instrument set-ups may be stored and recalled.

Size: 3U (130mm) height; half-rack (212mm) width; 335mm deep.

Weight: 4.1kg. (9lb.)

Power: 230V, 115V or 100V nominal 50/60Hz, adjustable internally; operating range ±14% of nominal; 60VA max. Installation Category II.

Operating Range: +5°C to 40°C, 20-80% RH.

Storage Range: -20°C to +60°C.

Environmental: Indoor use at altitudes to 2km, Pollution Degree 1.

Safety: Complies with EN61010-1.

EMC: Complies with EN61326.

## SUPPLIED ITEMS

AC Line Cable

User Manual: Printed Manual plus PDF multi-language manual on CD.

Waveform Software: Waveform Manager Plus for Windows on CD.

Driver Software: Drivers for LabWindows CVI and Labview on CD.

## OPTIONS

Rack Mount: 19 inch rack mounting kit for one or two units.

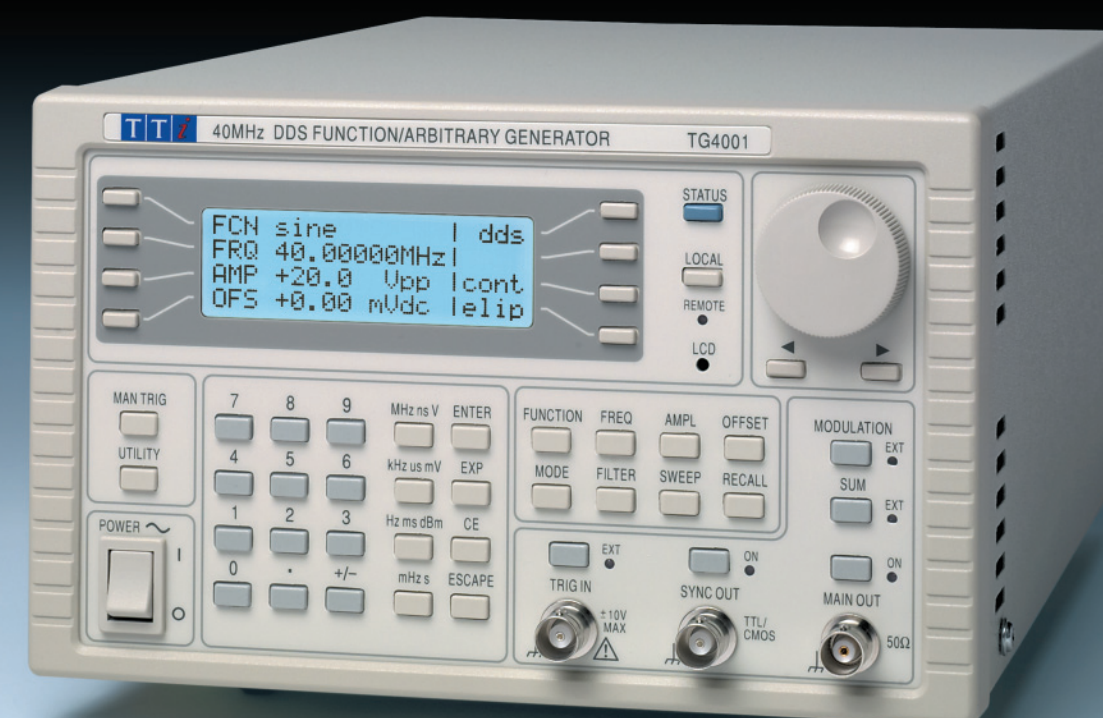
GPIB Interface: Retro-fit interface board conforming to IEEE-488.2

Thurlby Thandar Instruments Ltd. operates a policy of continuous development and reserves the right to alter specifications without prior notice.



# AIM & THURLBY THANDAR INSTRUMENTS

## TG4001



## 40MHz DDS Function / Arbitrary Generator

High resolution, high purity standard waveforms

Arbitrary waveforms up to 64K words and 100MS/s

Designed and built in Europe by:



Thurlby Thandar Instruments Ltd.

Glebe Road, Huntingdon. Cambs. PE29 7DR United Kingdom (UK)

Tel: +44 (0)1480 412451 Fax: +44 (0)1480 450409

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



## A high performance 40MHz function generator

with arbitrary waveform capability up to 100MS/s

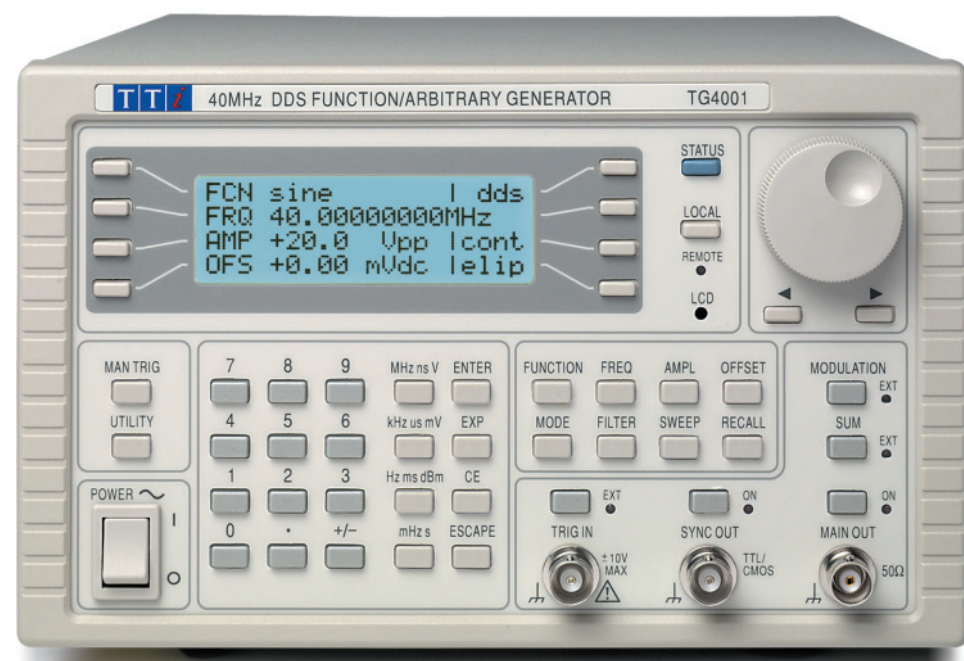
### 40MHz sinewaves from a low cost DDS generator

The TG4001 provides high purity sine waves at up to 40MHz and square waves at up to 50MHz. No other DDS generator offers this performance at this price.

The output amplifier has a bandwidth approaching 100MHz ensuring that waveform quality is excellent right up to the frequency limits.

Amplitude flatness is better than  $\pm 0.2\text{dB}$  to 1MHz and  $\pm 0.4\text{dB}$  to 40MHz.

Low noise design ensures minimum waveform aberrations and provides high waveform quality even at minimum output amplitude.



- ▶ 0.1mHz to 40MHz range, 10 digits or 0.1mHz resolution.
- ▶ 1ppm stability and <10 ppm absolute accuracy for one year.
- ▶ 11 standard waveforms including sine, square, triangle, haversine, ramp, pulse,  $\sin(x)/x$ .
- ▶ Low distortion, high spectral purity sine waves.
- ▶ Pulse train pattern generation for up to 10 pulses.
- ▶ Arbitrary waveforms of up to 64K points at up to 100MS/s.
- ▶ Internal sweep, linear or logarithmic, phase continuous, 0.1mHz to 40MHz in one range.
- ▶ Modulations modes of burst, gated and tone switching; built-in trigger generator.
- ▶ 5mV to 20V pk-pk output from 50  $\Omega$ ; plus multi function auxiliary output.
- ▶ Storage for nine instrument set-ups in non-volatile memory.
- ▶ Programmable via RS-232 or USB interfaces; GPIB optional.

### High speed arbitrary waveforms

In addition to its eleven 'standard' waveforms, the TG4001 can generate arbitrary waveforms of any length between 4 and 65,536 points at speeds of up to 100MS/s.

Up to four arbitrary waveforms can be stored within the instrument.

Waveform Manager Plus software for Windows is supplied for waveform creation and editing on a PC. Waveforms are downloaded to the generator using RS232, USB or GPIB.

### Pulse train generation

As well as standard and arbitrary waveforms, the TG4001 can generate pulse trains.

A pattern of up to 10 pulses can be quickly defined with each pulse having its own amplitude, width and delay. The whole pulse train pattern can then be re-played at a user defined repetition rate.

### RS-232, USB or GPIB interfaces

The TG4001 includes both an RS-232 interface and USB interface as standard.

These interfaces can be used for remote control of all of the instrument functions and for storing instrument set-ups as well as downloading arbitrary waveforms.

A GPIB (IEEE-488) interface is also available as a retro-fittable option.

### Synchronisation

The auxiliary output socket can provide any one of six different Synchronisation signals.

Waveform Sync provides square wave at the frequency of the main output.

Burst Done produces a pulse coincident with the last cycle of a burst.

Sweep Sync outputs a pulse at the start of each sweep to synchronise an oscilloscope or recorder.

Sweep Marker provides an additional output pulse for use as a marker in sweep mode.

Phase Lock Out can be used to phase lock two or more generators. Produces a positive edge at the  $0^\circ$  phase point.

Trigger Out provides a replica of the trigger signal which can originate from the trigger input socket, the internal trigger/gate generator, the manual trigger key, or the bus interface.

### Wide range sweep

All waveforms can be swept over their full frequency range at a rate variable between 1 millisecond and 15 minutes.

Sweep can be linear or logarithmic, single or continuous. Single sweeps can be triggered from the front panel, the trigger input, or the digital interfaces.

A sweep marker is provided that is adjustable whilst sweep is running. The markers can provide a visual indication of frequency points on a 'scope or chart recorder.

### Amplitude modulation and signal summing

Amplitude modulation (VCA) and suppressed carrier modulation (SCM) are available for all waveforms using the rear panel modulation input.

A separate signal summing input is also provided, allowing waveforms from another signal source to be amplified and summed with the main output.

### Triggered & gated modes, built-in trigger generator

All waveforms are available as a triggered burst whereby each trigger edge will produce one burst of the carrier. Start and stop phase is fully variable.

Both Triggered and Gated modes can be operated from the internal trigger generator, from an adjacent channel, an external source or a key press or remote bus command.

The trigger generator is variable between 0.005 Hz and 100kHz, and the signal is available as a separate output if required.

### Tone switching & FSK

The TG4001 can provide triggered switching between up to 16 frequencies of standard or arbitrary waveforms.

Tone switching modes can be gated, triggered or FSK using any trigger source.

Frequency Shift Keying provides phase coherent switching between two selected frequencies at a rate defined by the switching signal source.

In tone switching mode the generator is set to switch between a number of different frequencies in response to a trigger signal.

### Quick recall of settings

The TG4001 provides nine memories for storing settings (plus one memory for automatically storing the settings at switch off).

Because all parameters are controlled electronically, the memories store the complete set-up of the instrument.

### Ease of use

The TG4001 is particularly easy to use. All of the main information is clearly displayed on a backlit LCD with 4 rows of 20 characters. Sub menus are used for the modulation modes and other complex functions.

All parameters can be entered directly from the numeric keypad. Alternatively most parameters can be incremented or decremented using the rotary encoder for quasi-analogue control.

### Frequency or period entry

The generator frequency can be set in terms of either frequency or period.

Numeric entry can be floating point using whatever units the operator prefers, or can be done in exponent format.

### Flexible amplitude entry

Amplitudes can be entered in terms of peak to peak voltage, RMS voltage or dBm.

The output amplitude can be set in terms of either the voltage into a 50 $\Omega$  or 600 $\Omega$  termination, or in terms of the source EMF (for a high impedance load).

### Waveform Manager Plus

Waveform Manager Plus (supplied) provides all of the features needed for the creation, manipulation and management of arbitrary waveforms within a single Windows-based program.

#### Choice of interfaces

The program supports RS232, USB and GPIB interfaces for download and upload.

#### Upload from DSOs

The program can read several file formats and supports waveform import via the clipboard allowing it to accept waveform files from most DSOs and digitisers.

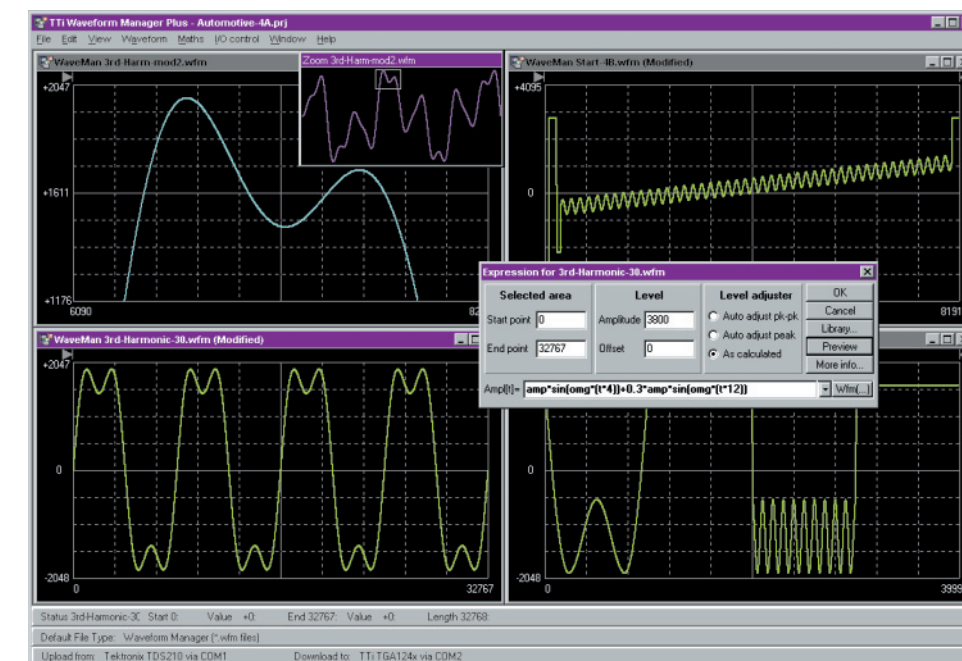
#### A full suite of tools

Powerful mathematical functions are combined with on-screen drawing tools and clipboard functions to enable virtually any waveform to be created either from scratch, or from the editing of existing waveforms.

Waveforms can be built in any number of sections using any combination of the following: Standard waveforms, mathematical expressions, drawn waveforms, uploaded waveforms, imported waveforms (using clipboard), existing stored waveforms.

Waveforms can be viewed with variable zoom and printed with annotation. Waveform management tools include Projects and Libraries for professional organisation.

The full specifications for Waveform Manager Plus are listed on the rear page.



## A high performance 40MHz function generator

with arbitrary waveform capability up to 100MS/s

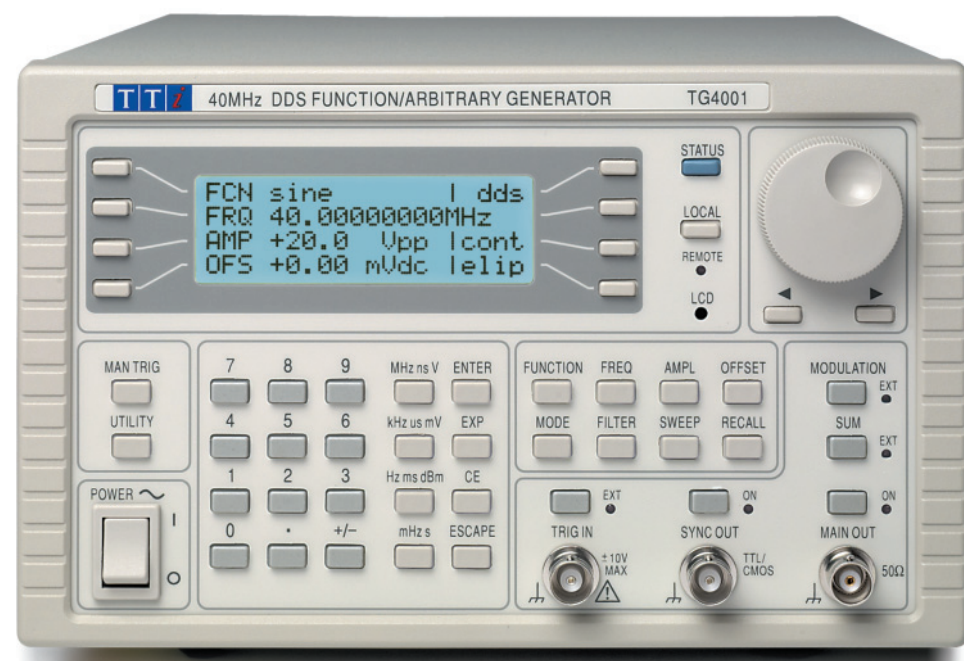
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Amplitude flatness is better than  $\pm 0.2\text{dB}$  to 1MHz and  $\pm 0.4\text{dB}$  to 40MHz.

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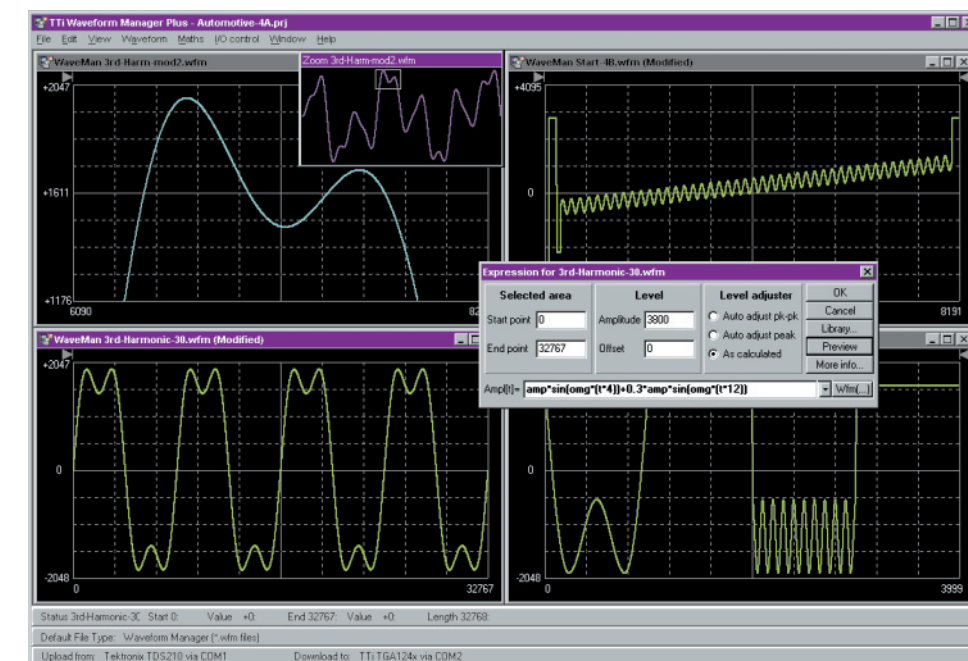
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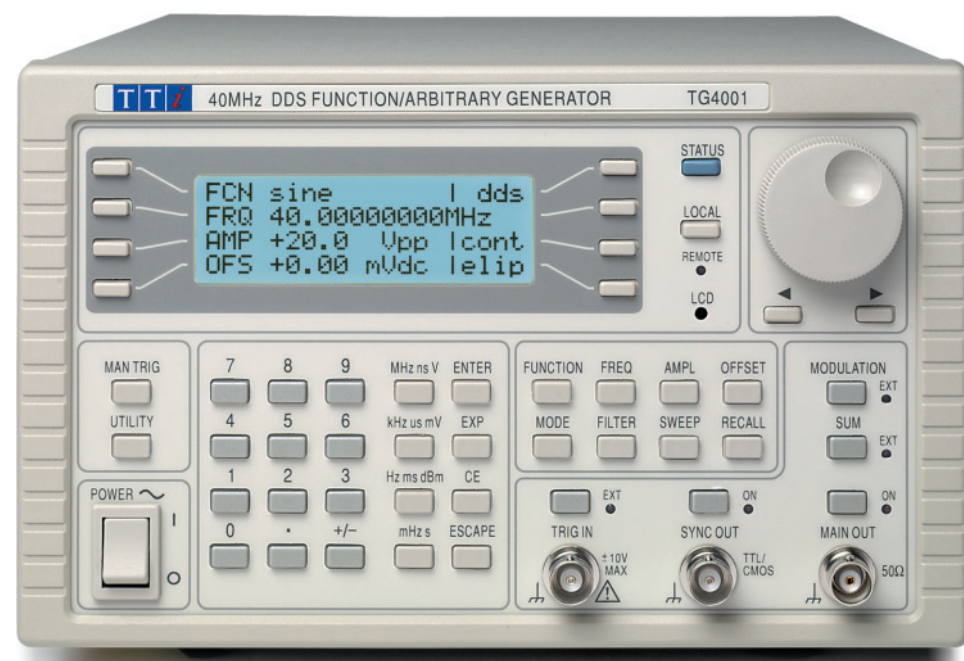
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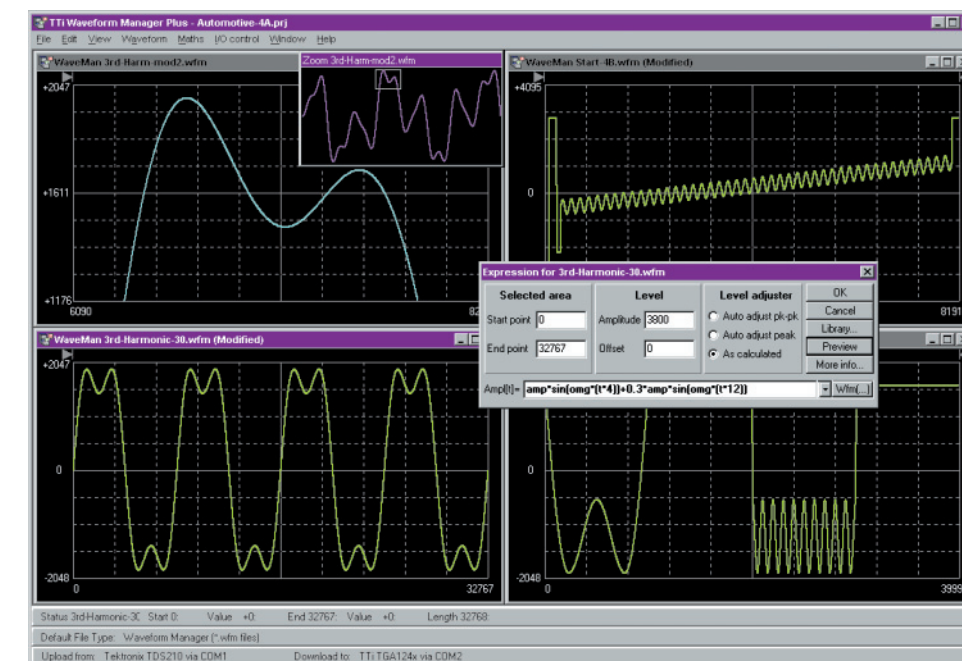
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### Standard Waveforms

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Frequency Accuracy: Better than 10 ppm for 1 year.

Temperature Stability: Typically <1 ppm/°C

### Sine, Cosine, Haversine, Havercosine

Range (Resolution): 0.1 mHz to 40 MHz. (0.1mHz or 10 digits)

Harmonic Distortion: <0.15% THD to 100kHz; <-60dBc to 20kHz, <-50dBc to 1MHz, <-40dBc to 10MHz, <-30dBc to 40MHz.

Non-harmonic Spurious: <-60dBc to 1MHz, +6dB/octave 1MHz to 40MHz.

### Square

Range (Resolution): 1 mHz to 50 MHz. (1mHz or 7 digits)

Rise and Fall Times: <8ns

### Triangle

Range (Resolution): 0.1 mHz to 500 kHz. (0.1mHz or 7 digits)

Linearity Error: <0.1% to 30 kHz

### Ramps and Sin(x)/x

Range (Resolution): 0.1 mHz to 100 kHz. (0.1mHz or 10 digits)

Linearity Error: <0.1% to 30 kHz (ramps)

### Pulse and Pulse Train

Rise and Fall Times: <8ns

Period: Range 40ns to 100s. Resolution 7 digits or 10ns.

Delay and Width: Range -99.9s to +99.99s. Resolution 0.001% period or 10ns.

Trains of up to 10 pulses may be specified, each having independently defined width, delay and level. The baseline voltage is separately defined and the sequence repetition rate is set by the pulse train period.

## ARBITRARY

Up to 4 user defined waveforms may be stored. Arbitrary waveforms can be defined by downloading of waveform data via RS232 or USB (or GPIB if fitted)

Waveform Size: 65536 (64K) points maximum, 8 points minimum.

Vertical Resolution: 12 bits

Sample Clock Range: 100mHz to 100MHz. Resolution 7 digits or 0.1 mHz

Output Filter: Selectable between 40MHz Elliptic, 20MHz Bessel or none.

### Noise Function:

Digital noise generated by a 35-bit linear feedback register clocked at 100MHz.

User's external filter defines bandwidth and response.

## ARBITRARY WAVEFORM CREATION / EDITING

Waveform Manager Plus software for Windows is supplied.

Full details of its capabilities are on our website or within the Waveform Manager Plus brochure.

## MODULATION MODES

### Sweep

Capability provided for both standard and arbitrary waveforms. Linear or logarithmic sweep, continuous or triggered, directions of up, down, up/down or down/up.

Sweep range of 1mHz to 40 MHz in one range, phase continuous with independent setting of start/stop. Sweep time variable 1ms to 999s (3 digit resolution).

One Marker is provided, variable during the sweep.

The sweep may be free run or triggered from the following sources: Manually from keyboard. Externally from TRIG IN input or remote interface.

### Other Modulation Modes

Modes of Triggered Burst, Gated, and Tone Switching (gated, triggered, or FSK switching from a list of up to 16 frequencies).

**NOTE:** The full specification of these modulation modes is provided on our website.

### Trigger Generator

Internal source 0.005 Hz to 100kHz squarewave adjustable in 10us steps. 3 digit resolution. Available for external use from the SYNC OUT socket.

## DIGITAL INTERFACES

Full remote control and waveform download facilities are available through the RS-232 and USB interfaces. GPIB is available as an option.

RS-232: Variable Baud rate, 9600 Baud maximum. 9-pin D-connector. (Also compatible with TTI ARC system)

USB: Conforming with USB 1.1

GPIB (Optional): Conforming with IEEE488.1 and IEEE488.2

## OUTPUTS

### Main Output

Output Impedance: 50Ω

Amplitude: 5mV to 20V pk-pk open circuit (2.5mV to 10V pk-pk into 50Ω). Amplitude can be specified open circuit (Hi Z) or into an assumed load of 50Ω or 600Ω, in Vpk-pk, Vrms or dBm.

Amplitude Accuracy: Better than 2% ±1mV at 1kHz into 50Ω.

Amplitude Flatness: ±0.2dB to 1MHz; ±0.4dB to 40MHz.

DC Offset Range: ±10V. DC offset plus signal peak limited to ±10V from 50Ω.

DC Offset Accuracy: Typically within ±3% ±10mV, unattenuated.

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

### Sync Out

Multifunction output user definable or automatically selected to be any of the following: Waveform Sync, Burst Done, Sweep Sync, Sweep Marker, Phase Lock Out.

**NOTE:** The full specification of the Sync Out signal is provided on our website.

## INPUTS

### Trig In

Frequency Range: DC - 1MHz.

Signal Range: Threshold nominally TTL level; max. input ±10V.

Min. Pulse Width: 50ns for Trigger and Gate modes; 50µs for Sweep mode; 20ms for Tone mode.

Input Impedance: 10kΩ

### Modulation In

Frequency Range: DC - 500kHz.

Signal Range: VCA: - approximately 1V pk-pk for 100% level change at maximum output. SCM: - approximately ±1Vpk for max. output. Typically 1kΩ.

Input Impedance: 10kΩ

### Sum In

Frequency Range: DC - 30MHz.

Signal Range: Approximately 2Vpk-pk input for 20Vpk-pk output.

Input Impedance: Typically 1kΩ.

### Ref Clock In/Out

Set to Input: Input for an external 10MHz reference clock. TTL/CMOS threshold level.

Set to Output: Buffered version of the internal 10MHz clock. Output levels nominally 1V and 4V from 50Ω.

Set to Phase Lock: Used together with SYNC OUT on a master and the TRIG IN on a slave to synchronise (phase lock) multiple instruments.

## GENERAL

Display: 20 character x 4 row alphanumeric LCD.

Data Entry: Keyboard selection of mode, waveform etc.; value entry by numeric keys or by rotary control.

Stored Settings: Up to 9 complete instrument set-ups may be stored and recalled.

Size: 3U (130mm) height; half-rack (212mm) width; 335mm deep.

Weight: 4.1kg. (9lb.)

Power: 230V, 115V or 100V nominal 50/60Hz, adjustable internally; operating range ±14% of nominal; 60VA max. Installation Category II.

Operating Range: +5°C to 40°C, 20-80% RH.

Storage Range: -20°C to +60°C.

Environmental: Indoor use at altitudes to 2km, Pollution Degree 1.

Safety: Complies with EN61010-1.

EMC: Complies with EN61326.

## SUPPLIED ITEMS

AC Line Cable

User Manual: Printed Manual plus PDF multi-language manual on CD.

Waveform Software: Waveform Manager Plus for Windows on CD.

Driver Software: Drivers for LabWindows CVI and Labview on CD.

## OPTIONS

Rack Mount: 19 inch rack mounting kit for one or two units.

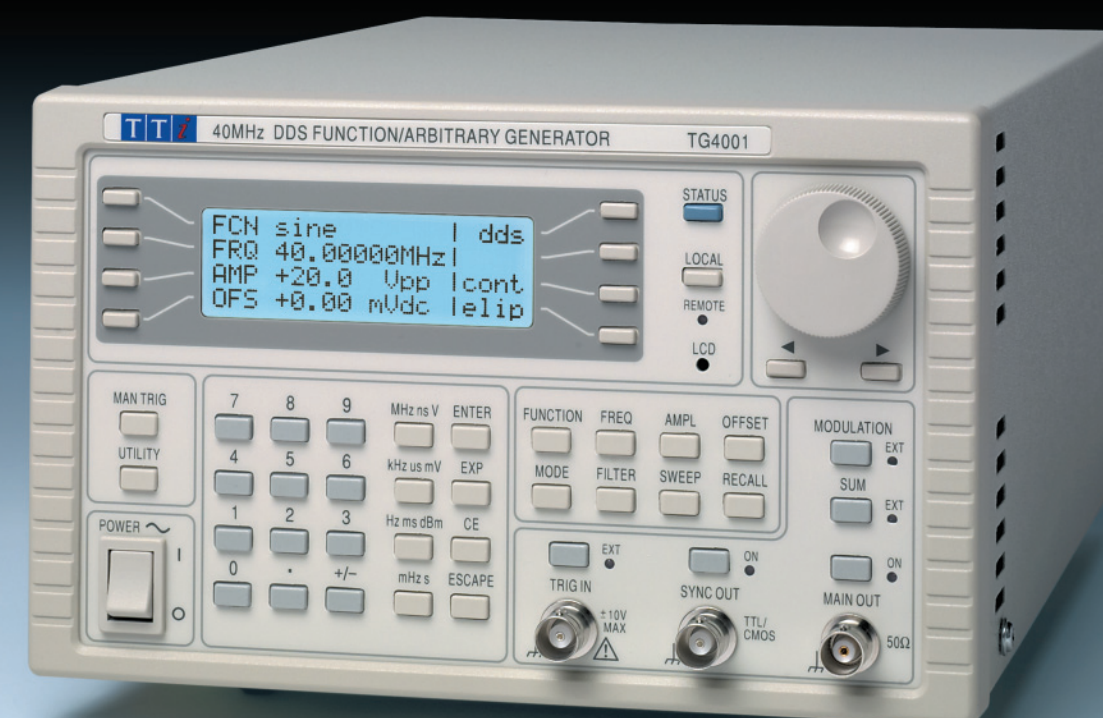
GPIB Interface: Retro-fit interface board conforming to IEEE-488.2

Thurlby Thandar Instruments Ltd. operates a policy of continuous development and reserves the right to alter specifications without prior notice.



# AIM & THURLBY THANDAR INSTRUMENTS

## TG4001



## 40MHz DDS Function / Arbitrary Generator

High resolution, high purity standard waveforms

Arbitrary waveforms up to 64K words and 100MS/s

Designed and built in Europe by:



Thurlby Thandar Instruments Ltd.

Glebe Road, Huntingdon. Cambs. PE29 7DR United Kingdom (UK)

Tel: +44 (0)1480 412451 Fax: +44 (0)1480 450409

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





AIM & THURLBY THANDAR INSTRUMENTS

Aim-TTi



## Product Summary

### Laboratory Power Supplies

Bench and system power supplies from 30 watts up to 1200 watts using linear, mixed-mode and PowerFlex regulation technologies.



### Waveform Generators

Analog and digital (DDS) function generators, true arbitrary generators, arbitrary/function generators and pulse generators.



### Precision Measurement Instruments

Benchtop DMMs, frequency counters, component measurement instruments (LCR), electronic dc loads, current probes.



### RF and EMC Test Equipment

Spectrum analyzers, signal generators, frequency counters, power meters, emc measurement instruments.



## Company name and product brands

Thurlby Thandar Instruments Ltd. (TTi) is one of Europe's leading manufacturers of test and measurement instruments.

Products have been sold under two brand names: TTi and Aim.



In the future, however, the full product range will be branded Aim-TTi.



This changeover will be gradual and many products will continue to carry the TTi or Aim brands for some time to come.

## Web Addresses (URLs)

The preferred URL for obtaining information concerning Aim-TTi products is:

[www.aimtti.com](http://www.aimtti.com) (international customers)

Customers in the UK should use the URL:  
[www.aimtti.co.uk](http://www.aimtti.co.uk)

Customers in the USA should use the URL:  
[www.aimtti.us](http://www.aimtti.us)

Note that previous URLs such as [www.tti-test.com](http://www.tti-test.com) will continue to operate for the time being.

Designed and built in Europe by:



**Thurlby Thandar Instruments Ltd.**

Glebe Road, Huntingdon, Cambridgeshire PE29 7DR England (United Kingdom)

Tel: +44 (0)1480 412451 Fax: +44 (0)1480 450409

Email: [info@aimtti.com](mailto:info@aimtti.com) Web: [www.aimtti.com](http://www.aimtti.com)

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