THURLBY THANDAR INSTRUMENTS

TG2000



20MHz DDS function generator

Sweep, AM, FSK & Tone switching modes

RS-232 and USB interfaces fitted as standard

Direct Digital Synthesis

A value-for-money 20MHz function generator

with the precision of Direct Digital Synthesis

A new price point

The TG2000 breaks new ground by offering a high quality 20MHz DDS function generator at a significantly lower price.

DDS (direct digital synthesis) is a technique for generating waveforms digitally using a phase accumulator, a look-up table and a DAC. The accuracy and stability of the resulting waveforms is related to that of the crystal master clock.

When correctly engineered, the DDS generator offers not only exceptional accuracy and stability but also high spectral purity, low phase noise and excellent frequency agility.

Total digital control

Unlike some other generators which only provide digital control of frequency, every function of the TG2000 is digitally controlled via the front panel or the digital interfaces.

Wide frequency and amplitude range

The TG2000 can generate waveforms between 0.001Hz and 20MHz with a resolution of six digits and a one year accuracy better than 10ppm.

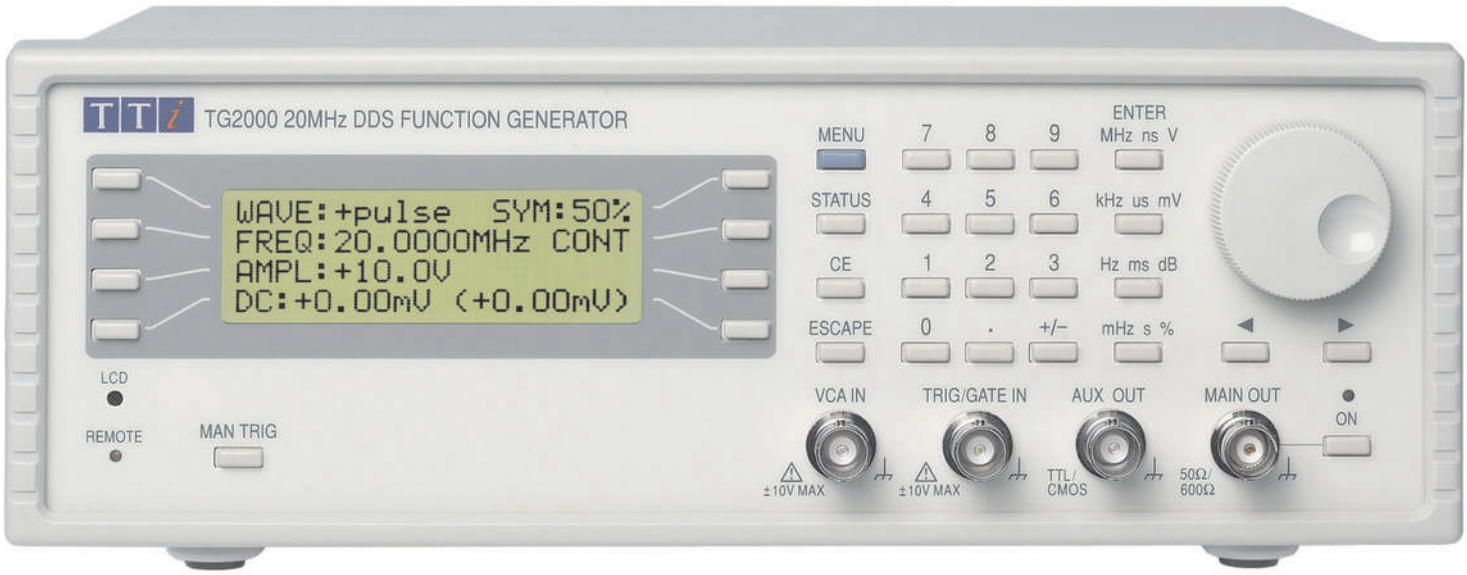
Amplitude is variable between 5mV and 20V pk-pk from a source impedance of 50Ω or 600Ω.

Unlike many generators, the waveform quality remains excellent over the full amplitude range.

RS-232 and USB interfaces

The TG2000 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 remotely storing instrument set-ups.



- *0.001Hz to 20MHz frequency range, 6 digits or 1mHz setting resolution.*
- *1ppm stability and better than 10 ppm absolute accuracy for one year.*
- *Sine, square, triangle, positive pulse and negative pulse waveforms.*
- *Low distortion, high spectral purity sine waves.*
- *Internal sweep, linear or logarithmic, full range phase continuous, adjustable marker.*
- *Modulations modes of gated, AM, FSK and tone switching; built-in trigger generator.*
- *5mV to 20V pk-pk output from 50 Ω or 600 Ω; plus multi function auxiliary output.*
- *Storage for up to nine complete instrument set-ups in non-volatile memory.*
- *Fully programmable via RS-232 or USB interfaces.*

Ease of use

The TG2000 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 is floating point using whatever units the operator prefers.

Flexible amplitude entry

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

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

Quick recall of settings

The TG2000 provides nine memories for storing settings.

Because all parameters are controlled electronically, the memories store the full set-up of the instrument and automated test sequences are easy to set up.

In addition to the nine user memories, the current state of the instrument is saved at switch off. The user can choose to have this state restored at switch on, or choose a pre-defined default set-up.

Synchronisation

The auxiliary output socket can provide any one of three different Sync. signals.

Waveform Sync is a 50% duty cycle square wave at the frequency of the main output.

Sweep Sync. outputs a pulse at the start of each sweep and can also output a pulse at a user defined marker frequency.

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

Modulation modes

Sweep

All waveforms can be swept over their full frequency range (0.2Hz minimum) at a rate variable between 50 milliseconds and more than 15 minutes. The sweep is fully phase continuous.

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.

Gated

The Gated mode sets the output signal on or off depending on the gating signal state.

The gating source can be the front panel key, internal trigger generator, trigger input socket, or bus interface signal.

AM

External Amplitude Modulation of up to 100% is available for all waveforms via the VCA input.

FSK

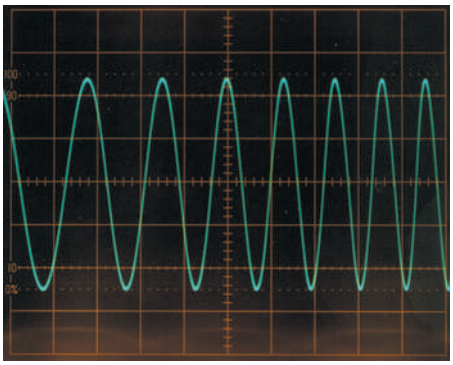
Frequency Shift Keying provides phase coherent switching between two selected frequencies at a rate defined by the source.

The switching source can be the front panel key, internal trigger generator, trigger input socket, or bus interface signal.

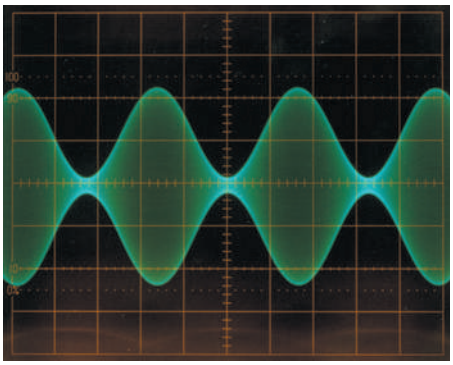
Tone Switching

The generator can be set to switch between a number of different frequencies in response to a trigger signal.

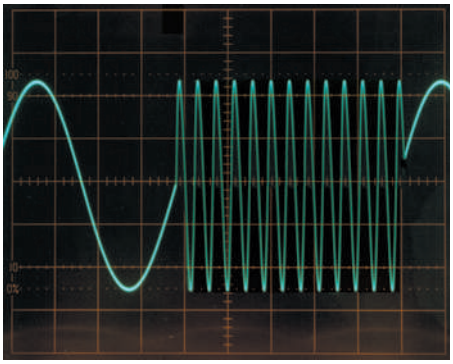
Up to 16 frequencies can be defined.



Phase continuous frequency sweep.



Amplitude modulation using an external sine wave modulation source.



Frequency switching in FSK mode.

See the difference !

Ultimately what matters in a function generator is the quality of the output signal.

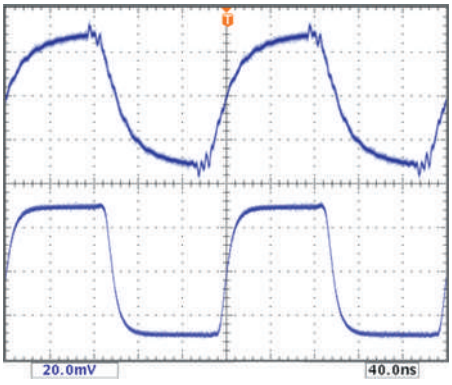
The TG2000 maintains the TTi reputation for high signal quality at all frequencies and all levels.

The waveform capture opposite shows just how much difference that can make !

The 'scope display opposite was captured from two 5MHz square wave signals each at 60mV pk-pk level into 50 Ω.

The upper waveform is from a widely available competitive DDS generator.

The lower waveform is from a TG2000.



Technical Specifications

Specifications apply at 18°- 28°C after 1 hour warm-up, at maximum output into 50Ω.

FREQUENCY

All waveforms are derived from a crystal clock using Direct Digital Synthesis.

Frequency Range:	1mHz to 20MHz (except triangle)
Resolution:	6 digits or 1mHz
Accuracy:	±10ppm for 1 year, 18°C to 28°C
Tempco.:	Typically <1ppm/°C outside of 18°C to 28°C

WAVEFORMS

Sinewave

Range:	1mHz to 20MHz
Resolution:	6 digits or 1mHz
Distortion:	<0.3% THD to 20kHz (typically 0.1%), <-45dBc to 300kHz, <-35dBc to 20MHz (typically <-40dBc)
Spurii:	Non harmonically related spurii <-55dBc to 1MHz, <(-55dBc + 6dB/octave) 1MHz to 20MHz
Output Level:	5mV to 20V pk-pk from 50Ω or 600Ω

Squarewave

Range:	1mHz to 20MHz
Resolution:	6 digits or 1mHz
Symmetry:	variable 20% to 80% in 1% steps
Aberrations:	<5% + 2mV
Rise & Fall Times:	<22ns
Output Level:	5mV to 20V pk-pk from 50Ω or 600Ω

Triangle

Range:	1mHz to 1MHz
Resolution:	6 digits or 1mHz
Linearity error:	<0.5% to 100kHz
Output Level:	5mV to 20V pk-pk from 50Ω or 600Ω

Positive and Negative Pulse

Range:	1mHz to 20MHz
Resolution:	6 digits or 1mHz
Symmetry:	variable 20% to 80% in 1% steps
Aberrations:	<5% + 2mV
Rise & Fall Times:	<22ns
Output Level:	2.5mV to 10V pk-pk from 50/600Ω positive or negative only pulses with respect to the DC Offset baseline

MODULATION MODES

Continuous

Continuous cycles of the selected waveform are output at the selected frequency.

Gated

Non phase-coherent signal keying - output is On while Gate signal is high and Off while low.

Carrier frequency:	From 0.1Hz to 20MHz
Carrier waveforms:	All
Trigger rep. rate:	dc to 100kHz external, dc to 5kHz internal
Gate source:	Front panel MAN TRIG key, Internal Gate Generator, TRIG/GATE input, or Remote Interface

Sweep

Carrier waveforms:	All
Sweep Mode:	Linear or logarithmic, single or continuous
Sweep Width:	0.2Hz to 20MHz in one range. Phase continuous. Independent setting of the start and stop frequency
Sweep Time:	50ms to 999s (3 digit resolution)
Markers:	Available from AUX output. Variable during sweep
Sweep Trigger source:	The sweep may be free run or triggered from: front panel MAN TRIG key, TRIG/GATE input, or Remote Interface

Amplitude Modulation

Carrier frequency:	1mHz to 20MHz
Carrier waveforms:	All
Modulation source:	VCA IN socket

Frequency Shift Keying (FSK)

Phase coherent switching between two selected frequencies at a rate defined by the switching signal source.

Carrier frequency:	1Hz to 20MHz
Carrier waveforms:	All
Switch repetition rate:	dc to 5kHz (internal), dc to 1MHz (external)
Switching signal source:	Front panel MAN TRIG key, Internal Trigger Generator, TRIG/GATE input, or Remote Interface

Tone

The tone is output while the trigger signal is high, and stopped when the trigger signal is low. The next tone is output when the trigger signal goes high again.

Carrier waveforms:	All
Frequency list:	Up to 16 frequencies between 1Hz and 20MHz
Min. switching time:	1ms per tone
Switching source:	Front panel MAN TRIG key, Internal Trigger Generator, TRIG/GATE input, or Remote Interface

Internal Trigger/Gate Generator

Period:	0.2ms to 999s (resolution 0.2 ms)
Waveform:	Square wave (1:1 duty cycle)

MAIN OUTPUT

Output Impedance:	50Ω or 600Ω switchable
Amplitude:	5mV to 20V pk-pk open circuit (2.5mV to10V into 50/600Ω)

Output can be specified as V-HiZ (open circuit value) or V (potential difference) in pk-pk, RMS or dBm. Note that in positive or negative Pulse modes the amplitude range is 2.5mV to 10V pk-pk O/C.

Accuracy:	±3% ±1mV at 1kHz into 50Ω/600Ω
Flatness:	±0.2dB to 500kHz; ±2dB to 20MHz
DC Offset:	±10V from 50Ω/600Ω. DC offset plus signal peak limited to ±10V. Accuracy ±3% ±10mV
Resolution:	3 digits for both amplitude and offset

AUXILIARY OUTPUT

Multi-function output user definable to be any of the following:

Waveform Sync:	Outputs a 50% duty cycle squarewave at the main waveform frequency
Trigger Out:	Outputs a replica of the current trigger signal
Sweep Sync:	Outputs a trigger signal at the start of sweep (for synchronising an oscilloscope or chart recorder). Can additionally output a sweep marker.
Signal Levels:	Output Impedance 50Ω nominal. Logic levels of <0.8V and >3V. Sweep Sync is a 3 level waveform, low at start of sweep, high at end of sweep, with a narrow 1V pulse at the marker point

INPUTS

Ext Trig/Gate

Frequency Range:	DC to 1MHz for FSK; DC to 100kHz for Gate; DC to 2.5kHz for Tone and Sweep
Signal Range:	Nominal TTL level threshold; maximum input ±10V
Min. Pulse Width:	100ns for Gate/FSK; 0.2ms for Sweep and Tone
Input Impedance:	Typically 10kΩ

VCA In

Frequency Range:	DC - 100kHz
Signal Range:	2.5V for 100% level change at maximum output
Input Impedance:	Typically 6kΩ

INTERFACES

Full remote control facilities are available through the RS232 or USB interfaces.

RS232:	Variable Baud rate (19200 max), 9-pin D-connector. As well as operating in a conventional RS-232 mode the interface can be operated in addressable mode whereby up to 32 instruments can be addressed from one RS-232 port
USB:	Standard USB hardware connection. Conforming USB 1.1

GENERAL

Display:	20 character x 4 row alphanumeric LCD
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 in battery-backed memory.
Size & Weight:	260(W) x 88(H) x 235(D) mm; 2kg (4.5lb)
Power:	100V, 110-120V or 220-240V ±10% 50/60Hz, adjustable internally. 40VA 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 up to 2000m, Pollution Degree 2
Safety & EMC:	Complies with EN6010-1 and EN61326

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

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: sales@tti-test.com **Web: www.tti-test.com**