

# S-Series

SGA Fast, Low Noise, Signal Generator

**COBHAM**

Data Sheet

The most important thing we build is trust



Compact, easy to use, high performance signal generator for R&D, manufacturing and the field

- Wide band cover:
  - SGA-3 - 100 kHz to 3 GHz
  - SGA-6 - 100 kHz to 6 GHz
- +13 dBm output (+20 dBm option)
- Low SSB phase noise:  $-135$  dBc/Hz at 1 GHz, at 20 kHz offset
- Fast frequency settling time: 100  $\mu$ s
- Wide bandwidth AM, FM,  $\emptyset$ M with comprehensive and fully flexible modulation modes (option)
- Four internal 10 MHz modulation oscillators
- Internal pulse modulator/generator (option)
- Comprehensive frequency and amplitude sweep capabilities including List Mode
- Carrier phase control
- Avionics ILS/VOR and DME options
- Half-rack width, 4U high with 8.5 inch touch-screen user-interface
- Synchronization and interaction with S-Series modules and instruments
- Aerolock™ interlocking mechanism for multiple instrument applications
- LAN and GPIB remote control
- Low cost of ownership through modular design

The SGA employs a large touch-screen user-interface to provide a signal generator with unparalleled ease of use. With such a small form-factor, the SGA is equally at home in the field as it is in the laboratory or a production line. The use of Cobham's Fast Low Noise Synthesis (FLNS) technology, added to the experience gained through decades of developing leading-edge signal source products, ensures that signal purity and integrity have not been sacrificed in the quest for speed; the SGA excels in all respects. With a comprehensive range of features and options, the SGA meets the needs for a general-purpose signal generator while offering the high performance required of demanding, critical receiver measurements or rapid manufacturing.

## Display and User-Interface

A large 8.5 inch touch-screen LCD enables all relevant set-up information to be displayed on one screen, and without the need to select configurations from lower level menu structures. It is quick to learn, easy to use, clear, with large characters and a wide viewing angle. Touch targets are sufficiently large to ensure usability even when wearing gloves. A pop-up keyboard is complemented with a touch-vernier control with adjustable sensitivity and a step control, both of which can be assigned to any variable parameter.

A mouse and keyboard may also be connected to allow ease of use when using Windows™ features.



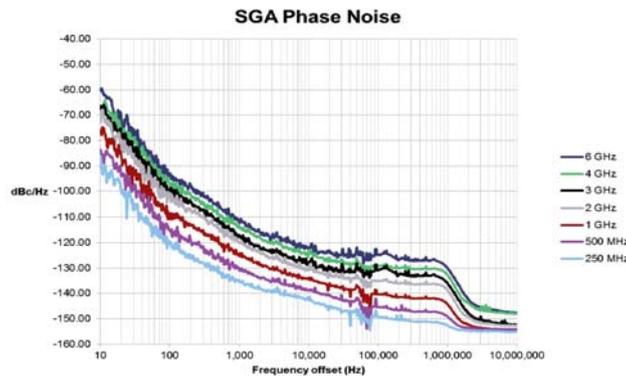
No knobs or keyboard, just a simple touch-screen user interface

### Excellent Spectral Purity

The excellent noise characteristics and the low level of spurious signals of the SGA enable the instruments to be used with confidence for a wide range of critical measurements for the most demanding measurements on modern receivers, RF systems and A-D converters.

### Low SSB Phase Noise

With a specified SSB phase noise performance of typically -135 dBc/Hz at 20 kHz offset from a carrier of 1 GHz, the SGA is easily able to measure receiver selectivity beyond 80 dB. The low residual FM noise figure of less than 1 Hz RMS at 1 GHz gives the SGA the capability of measuring receiver signal-to-noise ratios as high as 80 dB.



Graph of typical phase noise performance

### Fast Frequency and Level Settling Times

These are critical parameters to ensure maximum throughput in production applications. With frequency and level settling times of <5 ms in conventional frequency selection mode, or 100  $\mu$ s in list mode, the SGA is ideally suited for frequency hopping and semiconductor production test applications.

### Carrier Phase Control

This controls the phase of the carrier with respect to reference frequency standard and allows multiple SGA to be locked in frequency with controlled phase.

### RF Output

RF output up to +13 dBm can be set to a resolution of 0.01 dB. A high power option is available to extend the maximum calibrated RF level to +20 dBm.

In the tradition of Cobham's excellence in RF signal generation, the ultimate attention has been given to ensure the quality of the RF performance extends beyond the specification. Such attributes are:

- that no positive RF level transients generated as a result of changing between any frequency or level
- class-leading source VSWR specification helps to ensure that the specified RF level accuracy is more likely to be met when the load match is not ideal

- excellent linearity and monotonicity even over fine RF level steps
- repeatability ensures the same RF level is produced every time

The fastest level switching speed with a long life is achieved by the use of an electronic attenuator ensuring suitability for use in the most demanding production test applications.

### Flexible Modulation Capabilities (Option)

With four internal 10 MHz oscillators and two external modulation inputs, a wide selection of modulation modes is catered for. With four modulation channels it is possible to have single AM, FM or PM (phase modulation) and dual AM and FM (or PM) using any combination of internal and external sources.



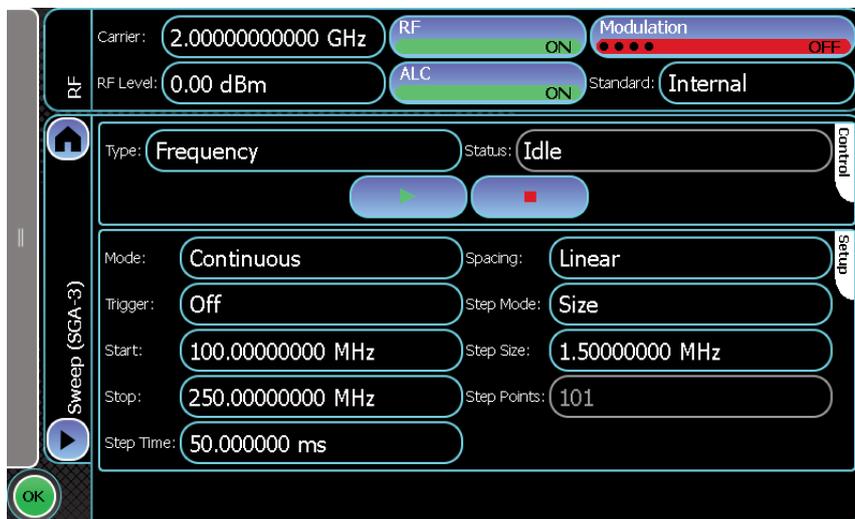
Typical multiple modulation set-up

Wide AM and FM bandwidths support the testing of broadcast systems by allowing video signals to modulate the carrier with minimal distortion. Wideband FM also supports testing of equipment using frequency shift keying for high speed digital transmission and telemetry.

### Sweep

The comprehensive sweep mode provides a digital sweep of carrier frequency and RF level in discrete steps. It is possible to set the start, stop, number of steps (or step size) and step time, up to a maximum of 65536 steps.

A sweep can be externally triggered via a rear panel BNC connector for Start, Start/Stop and Step, while up to six markers can be used to identify specific events within the sweep.



Typical frequency sweep set-up

## List Mode Sweep

With a minimum dwell time of 100 us, list mode provides the ultimate in frequency switching speed. A table of up to 1000 carrier frequency and RF level values may be created. Start address, stop address and dwell time can be controlled and can be externally triggered from a rear panel BNC connector.



Creating a list in List Mode



List Mode control screen showing a List sweep in action

## Pulse Modulation (Option)

An optional pulse modulator with internal pulse generator allows the generation of fast rise time RF signals with on/off ratios that meet the most demanding tests on radar RF and IF stages and EMC/ECCM test applications.

## Avionics Options

Following on from the industry standard 2030 Series, the SGA with option 006, retains the performance and essential features for testing ILS, VOR and aircraft communications systems, including the highest performance navigational receivers such as those used for airfield alarm monitors. Its inherent low phase noise performance enables a receiver's selectivity to be tested against the most stringent requirements in this safety critical industry. Digitally generated modulating waveforms ensure excellent accuracy and stable performance under all operating conditions.

The avionics option supports the following systems:

- Instrument Landing Systems (ILS)
- VHF Omni Range (VOR) beacons
- Marker Beacons
- Automatic Direction Finder (ADF)
- COM/ID

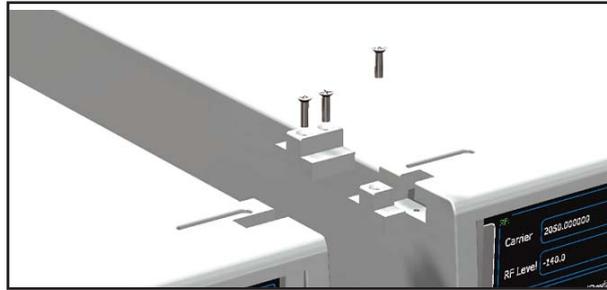
Avionics parameters are presented in the same form as described in the International Civil Aviation Organization (ICAO) standards.

DME (Distance Measuring Equipment) provides aircraft with accurate and continuous information of their slant range distance from a ground reference point. Option 010 produces the necessary Gaussian shaped double pulses required to test DME transponders, with 90% of the transmitted energy within a bandwidth of 0.5 MHz in accordance with EUROCAE ED57. Variable control of pulse width, rise and fall times, pulse pair spacing and pulse repetition rate give complete flexibility when defining the pulse profile. Rear panel connectors provide External Trigger input and Synchronization and Video outputs.

### Modular Instrument Concept Employing Aerolock™ Interlocking Mechanism

The SGA is designed to work with another SGA and a selection of S-Series modules which mount underneath.

Aerolock™ is an ingenious, simple and strong interlocking mechanism allowing SGA instruments and a full-rack width module, or two half-rack width modules, to be joined as one, creating a bespoke test solution. Weighing-in at less than 8 kg each, two SGAs joined together may be easily carried within the laboratory, the factory or the field without necessitating a 2-person lift.



*Aerolock™ interlocking mechanism*



*Two SGAs joined together as one*

When a module is connected to the SGA via a USB plug and play interface, its presence will be automatically recognized and the features and applications relevant to that module will be available on the SGA.

Many applications will be supported including tests for power amplifiers, receiver selectivity, intermodulation, adjacent channel power and mixer testing, with many more to come in the future. It will be possible to couple the settings of one SGA with another, allowing quick and simple control across any frequency or level range where two sources with a defined relationship are required.

### Remote Operation

LAN and GPIB interfaces are all supported using SCPI format commands where possible. Remote desktop and VNC are also supported allowing off-site remote control.

The 2030 Series GPIB emulation mode enables the SGA to seamlessly replace a 2030 or NAV-750C in automated test systems.

### Non-Volatile Memory

Hundreds of full instrument setting stores may be configured. Each store may be independently named allowing quick search of required memory.

### Removable Hard Disk (Option)

For use in secure areas, the optional removable hard disk allows easy removal of all sensitive instrument settings stores in the event the instrument has to leave the secure area. No settings data is stored in any other memory location within the instrument.

### Low Cost of Ownership

The SGA comes with a standard 2-year warranty and recommended 2-year calibration periodicity. Options to extend the warranty to five years are available.

The instrument's software may be installed simply from a USB port so that upgrades can be performed with the minimum down-time and maximum convenience. The latest software version will always be available on Cobham's web site.

## SPECIFICATIONS

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All specifications apply after a warm-up period of 20 minutes.

### FREQUENCY

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<i>Range</i>	100 kHz to 3 GHz (SGA-3) 100 kHz to 6 GHz (SGA-6)
<i>Resolution</i>	0.01 Hz
<i>Accuracy</i>	As frequency reference
<i>Switching Time</i> (CW Mode)	Typical switching time to within 0.1 ppm of final frequency after receipt of remote interface delimiter: 5 ms nominal
<i>Settling Time</i> (List Mode)	Switching time to within 0.1 ppm of final frequency after trigger pulse in List Mode.: <100 $\mu$ s for frequency changes exceeding 1.6 GHz within the frequency range above 3.2 GHz: >101 $\mu$ s <150 $\mu$ s, typ. 100 $\mu$ s to within 0.1 ppm of final frequency (or 30 Hz, whichever is greater)
<i>Carrier Phase</i>	0 – 359.99 degrees in 0.01 degree steps Carrier phase controls the phase of the carrier with respect to the reference frequency standard, be it internal or external.

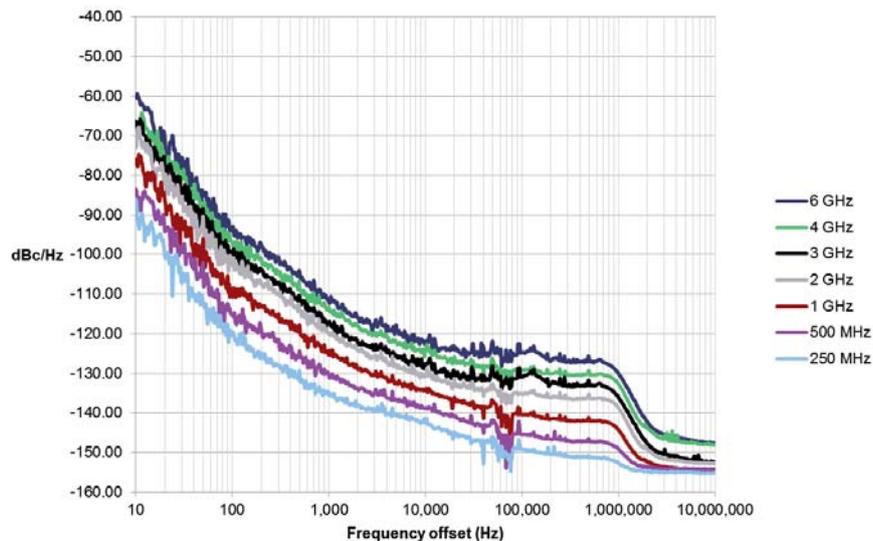
## RF LEVEL

Range	<p>-130 to +13 dBm</p> <p>-130 to +10 dBm below 3 MHz</p> <p>When AM is selected, the maximum RF output level is linearly reduced by up to 6 dB depending on the requested AM depth.</p> <p>Step attenuator: 0 to 132.5 dB in 0.25 dB steps</p> <p>Note: Performance is not guaranteed below -120 dBm</p>		
Range (option 003)	<p>-130 to +20 dBm</p> <p>-130 to +17 dBm below 50 MHz</p> <p>-130 to +15 dBm below 10 MHz</p> <p>-130 to +13 dBm below 1 MHz</p> <p>Note: Performance is not guaranteed below -120 dBm</p>		
Resolution	+0.01 dB		
Accuracy at 23°C ±5°C	<p>100 kHz to 50 MHz &lt;±0.7 dB</p> <p style="padding-left: 100px;">&lt;±1.0 dB below -110 dBm</p> <p>&gt;50 MHz to ≤3 GHz &lt;±0.5 dB</p> <p style="padding-left: 100px;">&lt;±0.6 dB from -90 to -110 dBm</p> <p style="padding-left: 100px;">&lt;±1.0 dB from -110.01 to -120 dBm</p> <p>&gt;3 GHz &lt;±0.7 dB</p> <p style="padding-left: 100px;">&lt;±0.9 dB from -100.01 to -110 dBm</p> <p style="padding-left: 100px;">&lt;±1.2 dB from -110.01 to -120 dBm</p> <p>Temperature stability 0.01 dB/°C above 1 MHz, 0.02 dB/°C below 1 MHz (CW mode)</p> <p>Add 0.2 dB for complex modulated signals or when AM is enabled</p>		
Repeatability	Better than ±0.05 dB after warm up following a return from a change of frequency or level valid for at least 2 hours and excluding temperature influence		
Monotonicity	<p>Typically better than 0.05 dB (-30 dBm to +13 dBm or to +20 dBm with option 003)</p> <p>Better than 0.2 dB typ. at an RF level between +3.0 and +4.5 dBm and between +9.0 dBm and +10.5 dBm.</p>		
Switching Time	<p>&lt;100 μs to within 0.1 dB of final value (23°C ±5°C) after trigger pulse in List Mode</p> <p>&lt;150 μs when changing carrier frequency</p>		
Output Impedance	50 Ω nominal		
Output VSWR	<+3.5 dBm	<+9.5 dBm	
	>1 MHz -3 GHz	<1.4:1	<1.5:1 typ.
		<+2.5 dBm	<+8.5 dBm
	>3 GHz	<1.6:1	<1.7:1 typ.
Reverse Power Damage Level	+25 dBm, ±16 V DC		
RF Level Offsets	<p>Up to the maximum output level range</p> <p>A given RF level offset over a given frequency band</p> <p>A profiled RF level offset between two given frequencies</p> <p>A selection of both of the above</p>		

**SPECTRAL PURITY**

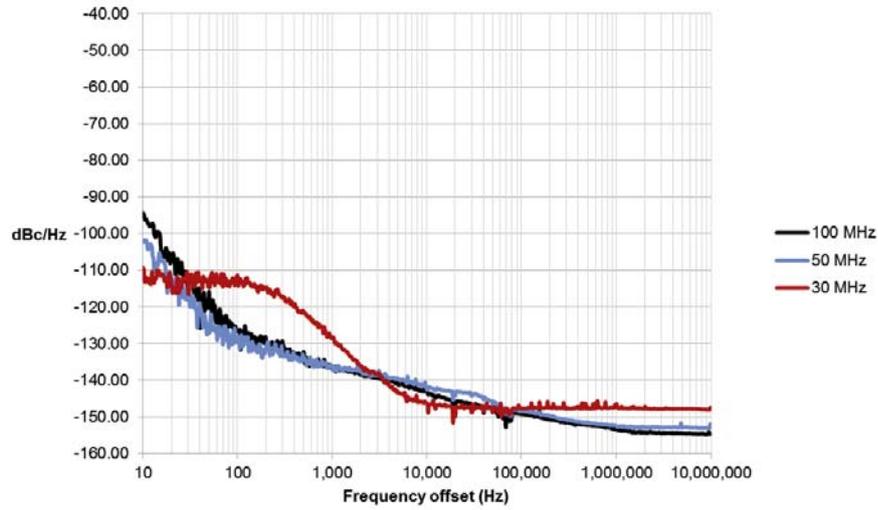
SSB Phase Noise (CW Mode)	Carrier freq.	1 kHz	20 kHz	10 MHz
	100 MHz	-132 typ.	-142 typ.	-150 typ.
	250 MHz	-131 typ.	-142 typ.	-150 typ.
	500 MHz	-125 typ.	-138 typ.	-150 typ.
	1 GHz	-117	-130 (-135 typ)	-148 (-152 typ.)
	2 GHz	-111	-124	-148 typ.
	4 GHz	-105	-118	-140
	6 GHz	-101	-115	-135
Phase noise below 100 Hz offset is dependent upon reference phase noise.				
Non-Harmonic Related Spurious (CW Mode)	At offsets >10 kHz:			
	≤1 GHz, better than -80 dBc			
	≤2 GHz better than -70 dBc			
	≤2.6 GHz better than -68 dBc			
	≤5.8 GHz better than -65 dBc >5.8 GHz better than -60 dBc			
Sub-harmonics	≤1.5 GHz, better than -80 dBc			
	≤3 GHz, better than -75 dBc			
	>3 GHz, better than -40 dBc			
Harmonics (CW Mode)	1 MHz - 6 GHz	≤-1 dBm, better than -30 dBc		
		≤+8 dBm, better than -30 dBc typ.		
Residual FM (CW mode)	Less than 1 Hz RMS deviation in a 300 Hz to 3.4 kHz unweighted bandwidth at 1 GHz			
RF Leakage	Less than 0.5 μV at the carrier frequency into a single turn 25 mm loop 25 mm or more from the case			
RMS Jitter (CW mode)	Carrier freq.	RMS Jitter Bandwidth	RMS Jitter (measured performance)	
	1 GHz	1 Hz - 10 MHz	450 fs	
	155 MHz	100 Hz - 1.5 MHz	58 fs	
	622 MHz	1 kHz - 5 MHz	31 fs	
	2.488 GHz	5 kHz - 15 MHz	25 fs	

**SGA Phase Noise**



Typical phase noise performance at 250 MHz, 500 MHz, 1 GHz, 2 GHz, 3 GHz, 4 GHz and 6 GHz

## SGA Phase Noise



Typical phase noise performance at 30 MHz, 50 MHz and 100 MHz

## MODULATION

### Modes

AM, FM, phase modulation – (Option 001)

Pulse modulation – (Option 004)

	AM1	AM2	FM1	FM2	PM1	PM2	Pulse
AM1		✓	✓	✓	✓	✓	✓
AM2	✓		✓	✓	✓	✓	✓
FM1	✓	✓		✓	✗	✗	✓
FM2	✓	✓	✓		✗	✗	✓
PM1	✓	✓	✗	✗		✓	✓
PM2	✓	✓	✗	✗	✓		✓
Pulse	✓	✓	✓	✓	✓	✓	

Allowable combinations:

Up to two simultaneous AM and or

Up to two simultaneous FM or ØM

A maximum of four modulation channels are available using any combination of four internal modulation oscillators and two external sources

All the above available with pulse modulation

## FREQUENCY MODULATION – (OPTION 001)

Range	N
100 kHz - <30 MHz	1
30.0 - <46.875 MHz	1/64
46.875 - <93.75 MHz	1/32
93.75 - <187.5 MHz	1/16
187.5 - <375 MHz	1/8
375 - <750 MHz	¼
750 MHz - <1.5 GHz	½
1.5 - <3 GHz	1
3 - 6 GHz	2

Deviation	N x 10 MHz in wide mode N x 50 kHz in narrow mode		
Resolution	1 Hz		
Accuracy	±3 % of set deviation (1 kHz mod rate)		
Total Harmonic Distortion	<0.15% (at 1 kHz mod rate and 2% max deviation) <0.5% (at 1 kHz mod rate and 20% max deviation)		
Frequency response (1 dB typ.)	10 Hz - 10 MHz DC - 10 MHz	AC coupled DC coupled	Wide mode  Narrow mode
	10 Hz - 50 kHz DC - 50 kHz	AC coupled DC coupled	

When internally modulated, the FM mode is automatically selected for optimum performance. When external modulation is selected, the user can select wide or narrow-band FM mode as required.

## PHASE MODULATION – (OPTION 001)

Deviation	N x 100 rad
Resolution	0.01 rad
Accuracy	±3% of set deviation (1 kHz mod rate)
Total Harmonic Distortion	<0.5% (at 1 kHz mod rate and 10 rad deviation) Typ.<0.1% (at 1 kHz mod rate and 1 rad deviation)
Frequency response (1 dB)	100 Hz – 10 kHz

## AMPLITUDE MODULATION – (OPTION 001)

Depth	0 - 99.9%		
Resolution	0.1%		
Accuracy	+3% of set depth +1%, for carrier frequencies up to 2 GHz. AM is usable to 6 GHz. Add 0.2 dB for AM.		
Total Harmonic Distortion 1 kHz mod rate	<1% for depths $\leq$ 30% <2% for depths $\leq$ 80%		
Frequency Response (3 dB)	10 Hz - 7 MHz DC - 7 MHz	AC coupled DC coupled	>50 MHz
	10 Hz - 50 kHz DC - 50 kHz	AC coupled DC coupled	<50 MHz

## INTERNAL MODULATION - (OPTION 001)

Four internal modulation sources.

Waveforms	Sine, 0 - 10 MHz Triangle, 0 - 1 MHz Square, 0 - 1 MHz +ve and -ve Ramp, 0 - 1 MHz		
Resolution	0.01 Hz		
Accuracy	As reference frequency oscillator		
Total Harmonic Distortion	<0.1%		
Frequency Response (1 dB)	DC to 10 MHz		

### Internal LF Output

One internal modulation source is available on the LF output rear panel BNC connector from a 50  $\Omega$  source impedance. The output level is variable from 1 mV - 1 V RMS at full scale modulation setting.

Output Level	1 mV - 1V RMS, full scale
Level Accuracy	$\pm$ 2% + 1 mV at 1 kHz
Level Flatness	<1 dB, DC - 10 MHz, relative to 1 kHz

### Function Generator Mode

One internal modulation source is available on the LF output rear panel BNC connector from a 50  $\Omega$  source impedance as an independent function generator.

## EXTERNAL MODULATION – (OPTION 001)

Two external modulation inputs of >100 k $\Omega$  or 600  $\Omega$  (selectable)

Both inputs may be configured as AC or DC coupled

The modulation is calibrated for 1 V RMS or 1 V peak (selectable)

## SWEEP FACILITY

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Provides a digital sweep of carrier frequency, RF level and modulation source in discrete steps

Control of start, stop, number of steps and step time

Sweep can be externally triggered from a rear panel BNC connector (TTL) for Start, Start/Stop and Step

Modes	Continuous; single; externally triggered
Carrier Sweep Type	Linear, logarithmic
RF Level Step Size	0.01 dB minimum
Maximum Number of Steps	65536
Marker "event" Output	A TTL pulse will appear on the sweep marker output when specified parameter values have been reached. Up to 6 markers can be set.
Step Time Settings	Up to 10 s

### List Mode Sweep Facility

Provides a table of carrier frequency and RF level values.

Start address, stop address and dwell time can be controlled.

Can be externally triggered from a rear panel BNC connector (TTL).

List can run with modulation applied, but can not be changed during playing of list.

Dwell Time Settings	161 $\mu$ s to 10 s
List Size	Up to 1000 entries

## REFERENCE FREQUENCY OSCILLATOR

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Type	OCXO
Frequency	10 MHz
Temperature Stability (0o to 40°C)	Typically better than $\pm 1 \times 10^{-8}$
Ageing Rate	1 in 10 <sup>9</sup> per day 1 in 10 <sup>7</sup> per year
Warm Up Time	<10 minutes

## MEMORY (INTERNAL HARD DISK)

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The internal hard disk contains the following:-

Operating system/device drivers

Application software

Instrument setting stores

## REMOVABLE HARD DISK – (OPTION 005)

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For use in secure areas, the removable hard disk may be extracted from the rear panel by releasing two screws.

## PULSE MODULATOR/GENERATOR (OPTION 004)

<b>Pulse Modulator</b>	
On/off ratio	>80 dB
Rise/fall time	<10 ns
Maximum PRF	10 MHz
Video Breakthrough	<100 mV

<b>Internal Pulse Generator</b>	
Modes	Free-run; triggered; single pulse; double pulse; adjustable doublet; external trigger
PRF/pulse period	0.01 Hz-10 MHz/100 ns-100s
Width	10 ns-60 s
Delay	0-60 s
Double-pulse spacing	10 ns-60 s
Resolution (delay/width/period)	10 ns

<b>Effects of Option 004 on RF Level Specification</b>	
Instruments not fitted with option 003 (high power)	Maximum specified RF level reduced to +7 dBm with pulse enabled
	Maximum specified RF level reduced to +10 dBm with pulse disabled
Instruments fitted with option 003	Maximum specified RF level reduced by 6 dB with pulse enabled
	Maximum specified RF level reduced by 3 dB with pulse disabled
RF Level Accuracy	Add 0.2 dB <25 MHz, >7 dBm (units with option 003, high power), add 0.5 dB Temperature stability: ≤3 GHz, additional 0.005 dB/°C >3 GHz, additional 0.01 dB/°C
Outout VSWR (all output levels)	Pulse disabled ≤3 GHz <1.6:1 typ. >3 GHz <1.8:1 typ. Pulse enabled Pulse enabled (off state) <5 GHz <1.7:1 typ. <2.3:1 typ. 5-6 GHz <2.1:1 typ. <2.3:1 typ.
Carrier Harmonics	Unspecified below 50 MHz

All other RF level dependent limits reduced by 3 dB with pulse disabled, and 6 dB with pulse enabled.

## AVIONICS - (OPTION 006)

<b>ILS Mode</b>	
Tone Frequencies	90 Hz, 150 Hz nominal.  Tone frequency may be changed by varying the ILS repetition rate of 30 Hz in 0.1 Hz steps. Tone frequencies maintain 3:1 and 5:1 relationships with the ILS rate.
Frequency Accuracy	As frequency standard
Tone Suppression	Either tone can be suppressed
Sum of Depth of Modulation (SDM) Range	0 to 99.9% in 0.1% steps representing the arithmetic sum of each tone depth
RF Accuracy of SDM	±2% of SDM setting for carrier frequencies up to 400 MHz  At 40% SDM accuracy is ±0.8% depth  At 80% SDM accuracy is ±1.6% depth
Difference in Depth of Modulation (DDM) Range	0 to 20% in 0.01% steps  20 to 99.9% in 0.1% steps
RF Accuracy of DDM	±0.02 of DDM setting ±0.0003 DDM (0.03% depth)  At 0 DDM (on course) accuracy is ±0.0003 DDM (0.03% depth)  At 0.155 DDM accuracy is ±0.0034 DDM (0.34% depth)
LF Output	Available from the LF Output connector
LF Accuracy of DDM	Equivalent to ±0.0003 DDM ±0.005 of setting  At 0 DDM (on course) accuracy is ±0.0003 DDM

<b>VOR Mode</b>	
Bearing Control	Relative phase of 30 Hz tone and subcarrier modulation adjustable from 0° to 359.99° in 0.01° steps by entering VOR bearing. Bearing can be entered as TO or FROM the beacon.
Bearing Accuracy	±0.05°
Additional modulation	Available on 0° bearing from an internal or external modulation source
AM Depth Accuracy	±3% of setting ±0.5% for carrier frequencies up to 400 MHz

Frequency	The VOR repetition frequency of 30 Hz may be varied in 0.1 Hz steps.  The subcarrier frequency and deviation maintain a fixed relationship with the VOR repetition rate
Frequency Accuracy	As frequency standard
9.96 kHz subcarrier - AM Range	0 to 49.9% depth in 0.1% steps
9.96 kHz subcarrier - Modulation	Frequency modulated by a 30 Hz tone with settable deviations of 240 Hz, 300 Hz, 360 Hz, 420 Hz, 450 Hz, 480 Hz, 510 Hz and 540 Hz
30 Hz Tone - AM Range	0 to 49.9% depth in 0.1% steps  Arithmetic sum of 30 Hz tone and sub carrier limited to 99.8%

### Marker Beacon

Provides default carrier of 75 MHz, 95% AM depth and a modulation frequency of 400 Hz, 1.3 kHz or 3 kHz corresponding to Outer, Middle and Inner Markers. Carrier frequencies, AM depth and modulation frequency can be adjusted from the default values.

### ADF Mode

Provides default carrier of 190 kHz with 30% AM depth at 1 kHz rate.

Carrier frequency, AM depth, modulation rate and RF level can be varied from the default values.

**COM/ID Mode**

Provides a facility for modulating the RF carrier with morse code airport identifier code.

**DME - (OPTION 010)**

Option 010 uses option 004 pulse modulator/generator to generate the double-pulses required for DME.

The following specifications apply over the frequency range 960 MHz to 1215 MHz, although the full frequency range of the SGA is available.

<b>RF Output</b>	
Range	-130 to +7 dBm -130 to +13 dBm with option 003 (high power)
Pulse Pair Level Accuracy	As per RF level accuracy
Pulse On/Off Ratio	>80 dB
Carrier Harmonics	≤+9 dBm, better than -27 dBc

<b>DME Pulses</b>	
Pulse Characteristics	Double pulses, Gaussian shaped
Pulse Width	0.70 μs to 8.00 μs, resolution 10 ns
Rise Time	0.50 μs to 6.00 μs, resolution 10 ns
Fall Time	0.50 μs to 6.00 μs, resolution 10 ns
Pulse Pair Spacing	7.00 μs to 50.00 μs, resolution 10 ns
Repetition Rate	10 pp/s to 6000 pp/s

<b>Video Output (via LF Output) - Same DME pulses as applied to the RF modulator</b>	
Level	Analog waveform: Nominal ±3 V, ±1.5 V into 50Ω

<b>Sync Output (via Trig Output)</b>	
Pulse Width	Typically 400 ns
Rise/Fall Time	Typically 5 ns
Level	LVTTTL Nominal 0 to 3.3 V, 0 to 1.65 V into 50Ω

<b>External Trigger (via Pulse/Trig Input)</b>	
Characteristics	Rising-edge, LVTTTL into high-impedance Min. pulse width 2 ns
Trigger to SYNC Delay	Typically 110 ns
Jitter	Typically 10 ns

## GENERAL DATA

<b>Remote Control</b>	
Systems	GPIB (IEEE 488) Ethernet (TCP/IP)
Command set	SCPI compatible command set
Interface functions	SH1; AH1; T6; L4; SR1; RL1; PP0; DC1; DT1; C0; E2
Emulation	2030, 2031, 2032, 2040, 2041, 2042, NAV-750C
Recommended Calibration Cycle	24 months
Weight	<8 kg (17.6 lbs)
Dimensions - H x W x D	177 mm (4U) x 222 mm x 490 mm (6.97 x 8.74 x 19.29 in.)

Instrument includes side strap handle and front tilt feet.

Instrument includes Aerolock™ interlocking mechanism with modules mounted above and below, and to another SGA on either side.

## FRONT PANEL CONNECTORS

RF Output	50 $\Omega$ N-type
External Modulation Inputs	100 k $\Omega$ / 600 $\Omega$ BNC Damage levels: $\pm 5$ V
2 x USB 2.0	Used with a memory stick for transferring memory stores, or other files in or out of the instrument Mouse or keyboard input

## REAR PANEL CONNECTORS

RF Output (Option 007)	50 $\Omega$ N-type
External Modulation Inputs (Option 007)	100 k $\Omega$ / 600 $\Omega$ Damage levels: $\pm 5$ V
Pulse Modulation Input	50 $\Omega$ BNC – TTL and CMOS compatible
4 x USB 2.0	Used with a memory stick for transferring memory stores or other files in or out of the instrument Module plug and play connection
Sweep out	BNC – Generates 0 – 10 V into $Z_{in} > 1$ k $\Omega$ when the generator is sweeping
Event Markers Output	BNC - User selectable markers for frequency or level provide an indication when the specified parameter values have been reached. LVTTTL logic output levels Damage levels: -5 V/+10 V
Trigger/Input	BNC – Applying 0 V or a switch closure starts the sweep or steps from point to point on the sweep. LVTTTL logic input thresholds Damage levels: -5 V/+10 V
Reference Frequency Input	BNC accepts 10 MHz at 200 mV to 2 V RMS into 50 $\Omega$ or 100 k $\Omega$ nominal. Damage levels: -0.5 V/+3 V
Reference Frequency Output	BNC – 10 MHz at 1.5 V pk-pk into 50 $\Omega$ Damage levels: -0.5 V/+6 V
LF Output	50 $\Omega$ BNC – The output may be configured to give an output from the internal modulation oscillator or from the internal modulation paths or as an independent function generator
GPIB Interface	As described under Remote Control
LAN Interface	As described under Remote Control

## ENVIRONMENTAL

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<b>Rated Range of Use</b>	
Temperature	0 to 50°C
Humidity	Up to 93% at 40°C
Altitude	Up to 3050 m
<b>Conditions of Storage and Transport</b>	
Temperature	-40 to +71°C
Humidity	Up to 95% at 40°C
Altitude	Up to 4600 m
EMC	EN 61326-1, Emissions Class B, Immunity Table 1 – Performance Criteria B
Safety	EN 61010-1, Safety requirements for electrical equipment for measurement, control and laboratory use-Part 1, General requirements.
Mechanical	MIL-PRF-28800F Class 3
<b>Power Requirements</b>	
AC Supply	100 – 240 V ~ (Limit 90 - 264 V) 50 - 60 Hz ~ (Limit 45 - 66 Hz) <160 VA max.

## USER INTERFACE

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Screen Size	8.5 inch, 16:9 aspect ratio, colour touch-screen
Keys/Switches	Power on/standby Home key

## ORDERING INFORMATION/PRODUCT STRUCTURE

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SGA-3	100 kHz to 3 GHz analog signal generator
SGA-6	100 kHz to 6 GHz analog signal generator
Option 001	AM, FM and phase modulation
Option 003	High power (+20 dBm)
Option 004	Fast pulse modulation
Option 005	Removable hard disk
Option 006	Avionics (requires option 001)
Option 007	Rear panel connectors
Option 010	DME (requires options 001, 004 and 006)

### Extended Warranty Options

Option 203	3 year warranty
Option 204	4 year warranty
Option 205	5 year warranty

### Supplied Accessories

AC supply lead  
Getting started manual  
CD-ROM containing operating manual  
CD-ROM containing factory test results and electronic calibration certificate

### Optional Accessories

47000/068	Operating manual (paper format)
43129/189	1.5 m GPIB lead
46662/836	Soft carry case
46662/835	Hard transit case
46885/505	Single instrument rack mounting kit (front panel brackets)
46885/506	Double instrument rack mounting kit (front panel brackets)
43139/042	RF double screened connector cable 50 $\Omega$ 1.5 m, BNC (m)
54311/095	RF double screened connector cable 50 $\Omega$ 1 m, type N connectors
54311/092	Coaxial adapter N male to BNC female
59999/163	Precision coaxial adapter N male to SMA female

### Complementary Modules (see separate datasheets)

SCO-6	10 MHz - 6 GHz Combiner module
SPA-6	10 MHz - 6 GHz Power amplifier module



