HS2001A RF Synthesizer

8MHz to 2GHz Single Channel Source

ULTRA LOW PHASE NOISE

PRODUCT SUMMARY

The Holzworth HS2001A RF Synthesizer is a stand alone, ultra low phase noise, single channel CW source. Capable of tuning frequencies from 8MHz to 2GHz in 0.001Hz step resolution, this versatile synthesizer can be controlled directly by the application software, LabVIEW™ or a preloaded lookup table which enables rapid frequency hopping.

Key product features include:

- **Ultra low phase noise performance of -151 dBc/Hz**
- **Fine tuning resolution (0.001Hz, 0.1dB, 0.1degree)**
- **DC coupled FM, AM, PM, Pulse Modulation**
- **Full phase coherent tuning (includes multiple linked channels)**
- **Frequency Sweep and Phase Offset functions**
- **Compact, rugged design for field and OEM applications**
- **CE and RoHS certified design**
- **Optional 2 hour Battery Backup Module**

The attractive performance-to-price ratio makes Holzworth RF Synthesizers optimal solutions for electronics design, manufacturing test applications, and OEM system integration.

PROVEN PERFORMANCE

Holzworth Instrumentation has been providing versatile ultra low phase noise products since 2004.

Holzworth RF synthesizer products are designed to meet the phase noise, spurious and harmonic performance levels that are demanded of laboratory grade references. To push the envelope even further, Holzworth design engineers have created a highly reliable electronics architecture inside a compact form factor. This provides the highest level of portability from a device that also includes many added features found in full size laboratory instruments.

Holzworth single channel RF Synthesizer designs have evolved from the robust HS1001 1GHz RF Synthesizer platform, which has proven its reliability and performance in endless applications worldwide. By incorporating similar circuit architecture and build techniques, the Holzworth engineering team has revised the original design with improved modulation capabilities while releasing alternate products with frequencies extending beyond 3GHz.

All Holzworth synthesizer products undergo full burn-in and 100% final performance testing to verify stability and phase noise performance. The end user receives product that performs as specified.

ELECTRICAL SPECIFICATIONS

The specified[2] parameters for the HS2001A 2GHz RF Synthesizer are fully verified at final performance test and 100% guaranteed for the warranted life of the product.

PARAMETER	MIN	TYP	MAX	UNITS	COMMENTS
RF Output Frequency Range	8 M		2 G	Hz	50 ohms output impedance
RF Output Frequency Resolution		0.001		Hz	
Output Power Range 8 MHz to 1 GHz 1 GHz to 2 GHz	 - 110 - 110		 + 15 + 12	 dBm dBm	 -110dBm is a typical minimum
Output Power Resolution		0.1		dB	
Output Power Accuracy 0dBm to max -20dBm to 0dBm -50dBm to -20dBm -80dBm to -50dBm -110dBm to -80dBm		 ±0.10 ±0.25 ±0.50 ±3.00 ±5.00	 ±1.00 ±2.00 ±4.00 ±6.00 ±10.0	 dB dB dB dB dB	 Verified at max freq, +10dBm. See data in Figure 2
Output Phase Offset Range	0		360	deg	
Output Phase Offset Resolution Below 1GHz 1GHz to 2GHz		 0.1 0.2		 deg deg	
Switching Speed USB Interface Wideband Lookup Narrowband Lookup (<5% BW)		 1.0 50 10		 ms µs µs	 Limited by USB HID Protocol Any frequency over full instrument BW Any frequency within 5% BW
Settling Time Wideband Narrowband (<5% BW)		 < 40us < 1us		 µs µs	
ALC Bandwidth		40		kHz	ALC fine tunes P_{OUT} leveling ±2.5dB. Major leveling managed by fixed attenuation.
Phase Noise [1] 100MHz, 10kHz offset 1GHz, 10kHz offset 2GHz, 10kHz offset		 -151 -131 -125		 dBc/Hz dBc/Hz dBc/Hz	 Refer to data in Figure 1 Refer to data in Figure 1 Refer to data in Figure 1
Output Spurious Signals		-70 -100	-60 -90	dBc dBm	Whichever is higher. See data in Fig 3 – 6 Reference Spurs Related by Nx 100MHz
Output Harmonics		-40	- 30	dBc	+8dBm, >50MHz. See data in Figures 3 - 8
Output Sub-Harmonics		-70	-60	dBc	Refer to data in Figures 3 - 6
Operating Temperature Range	0		35	C	
Initial Reference Accuracy			100	ppb	Within 1st month of operation
Reference Aging		50		ppb/mo	1ppm/yr max
Reference Temp Stability			500	ppb	0C to 35C
Reference Frequency Input/Output		100		MHz	
Reference Input Level	+3	4	+5	dBm	
Reference Output Level	+3	4	+5	dBm	
Reference Input/Output Impedance		50		ohms	
Reverse Power Protection			+15	dBm	
Power Consumption		12	15	W	6 V_{DC} at 2.5A (± 5%) maximum

[1] Final performance phase noise verification at 100MHz & 2GHz, P_{OUT}=+12dBm

[2] Specifications are subject to change per the discretion of Holzworth Instrumentation, Inc

MODULATION SPECIFICATIONS

PARAMETER	MIN	TYP	MAX	UNITS	COMMENTS
Modulation (DC Coupled)					
Rate	DC		40k	Hz	10kohm input impedance
Frequency Deviation	1		40k	Hz	±1V Input (10kohm)
Amplitude Modulation Depth	5		95	%	Linear, 0 to 1V Input (10kohm)
Phase Deviation	1		180	degrees	±1V Input (10kohm)
Pulse Modulation					
Threshold Voltage		1.65		V	3.3V/5V CMOS / TTL Compatible
On/Off Ratio		-90	-70	dBc	For POUT> -20dBm
Repetition Frequency	DC		1 M	Hz	
Pulse Width	200			ns	
T_r/T_f		100		ns	

Specifications are subject to change per the discretion of Holzworth Instrumentation, Inc

PHASE NOISE

The raw data displayed in Figure 1 is of SSB Phase Noise vs. Frequency Offset as measured for the HS2001A RF Synthesizer. All data was collected at an output power setting of +12dBm.

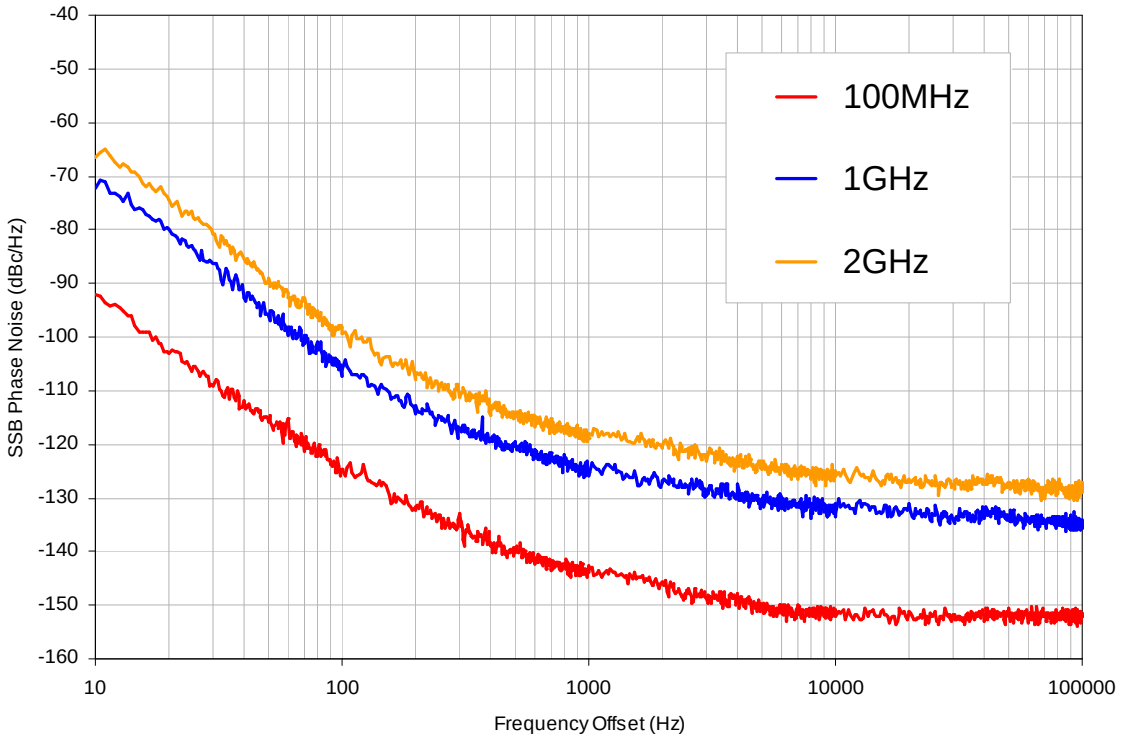


Figure 1: SSB Phase Noise at 100MHz, 1GHz & 2GHz (P_{OUT}=+12dBm)

OUTPUT POWER FLATNESS

The Output Power Flatness of the HS6001A is calibrated to the -20dBm level on all standard units, with leveling strictly by design for levels below -20dBm. Holzworth offers options for calibrated leveling below -20dBm for applications where precise output power leveling and power accuracy is necessary at lower output power levels.

The data contained in Figure 2 demonstrates the output power flatness performance from -19dBm to +15dBm (1dB increments), over a frequency range of 8MHz to 2GHz.

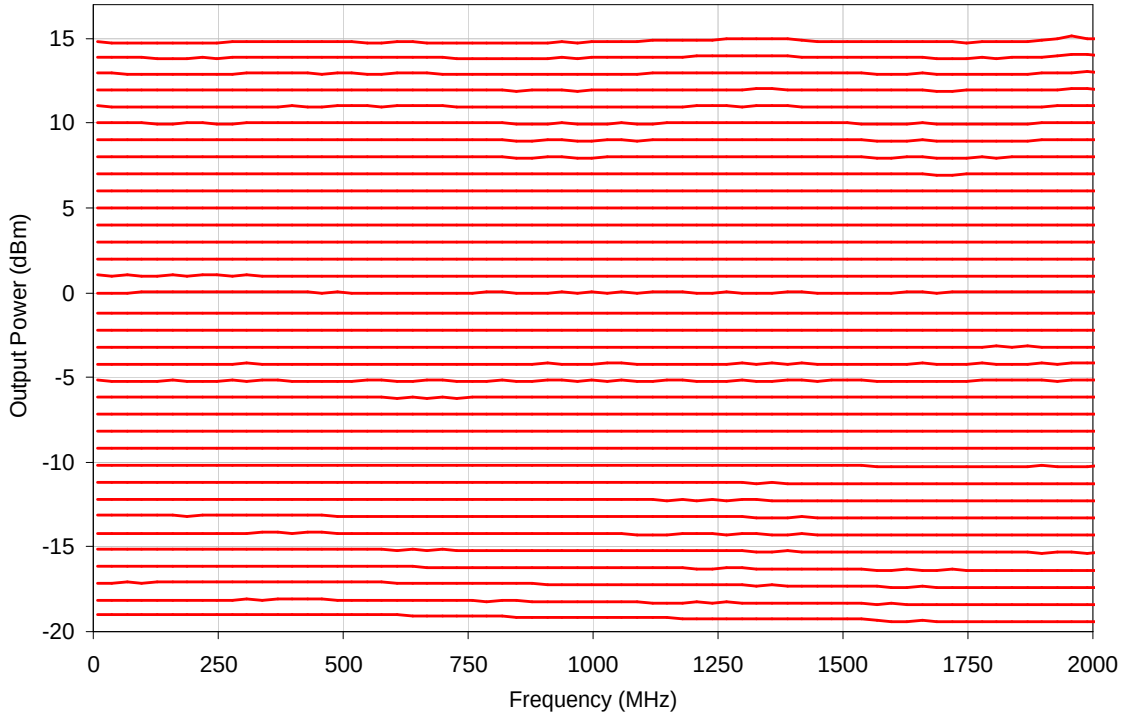


Figure 2: Output Power Flatness vs. Frequency

SPECTRAL PERFORMANCE

The data contained in Figures 3 through 6 demonstrate the spectral purity performance of the RF synthesizer at 100MHz, 300MHz, 1GHz and 2GHz carriers (P_{OUT} = +10dBm).

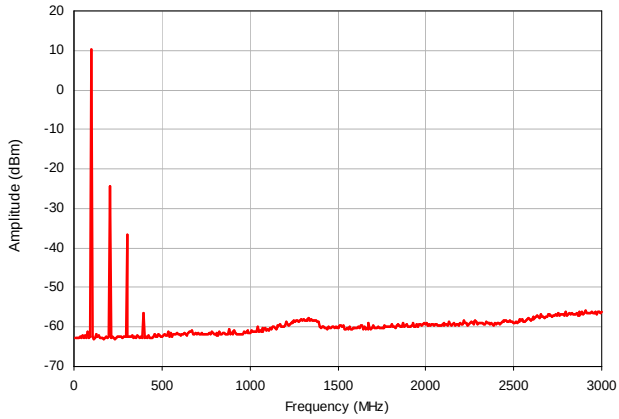


Figure 3: Spectral Data at 100MHz (P_{OUT} = +10dBm)

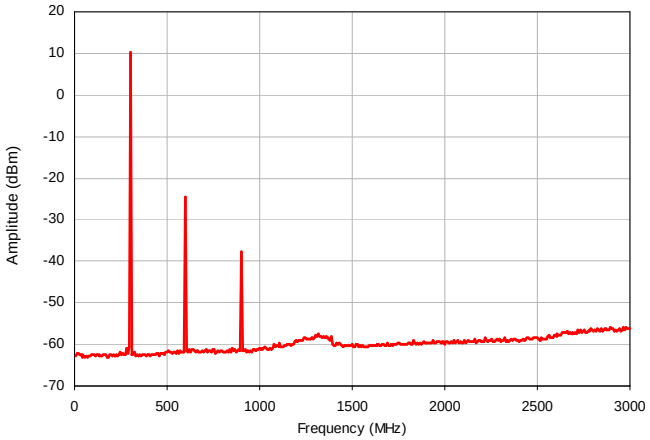


Figure 4: Spectral Data at 300MHz (P_{OUT} = +10dBm)

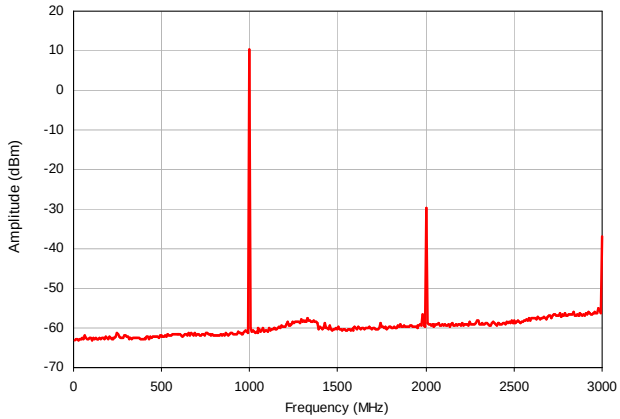


Figure 5: Spectral Data at 1GHz (P_{OUT} = +10dBm)

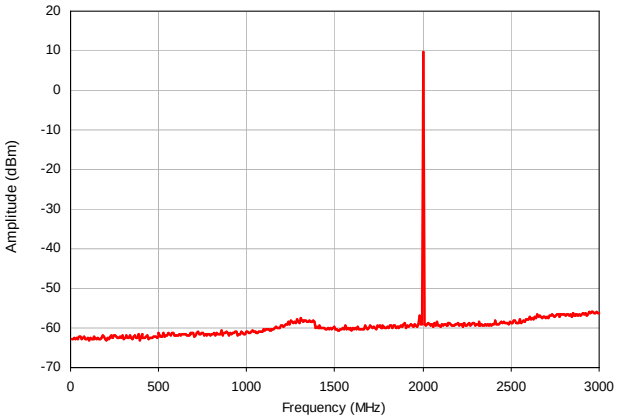


Figure 6: Spectral Data at 2GHz (P_{OUT} = +10dBm)

Figure 7 displays the absolute performance of the 2ND and 3RD harmonics as they vary with the power setting of the synthesizer. Figure 8 shows the 2ND and 3RD harmonic levels relative to the fundamental.

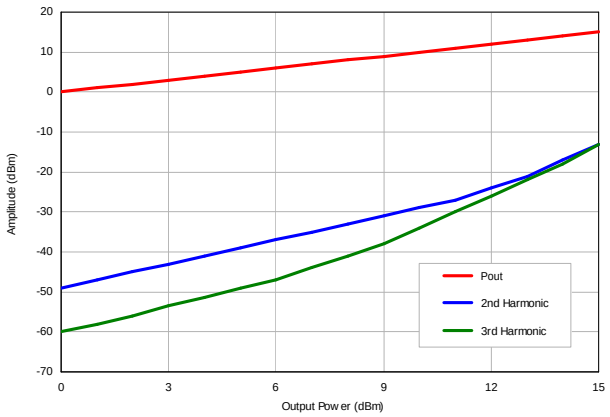


Figure 7: Absolute Harmonic Data (F_O = 1GHz)

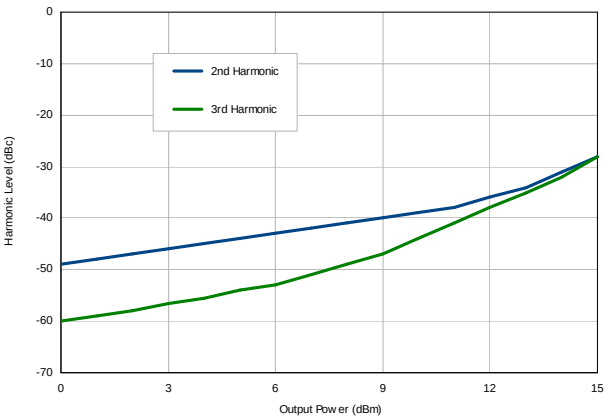
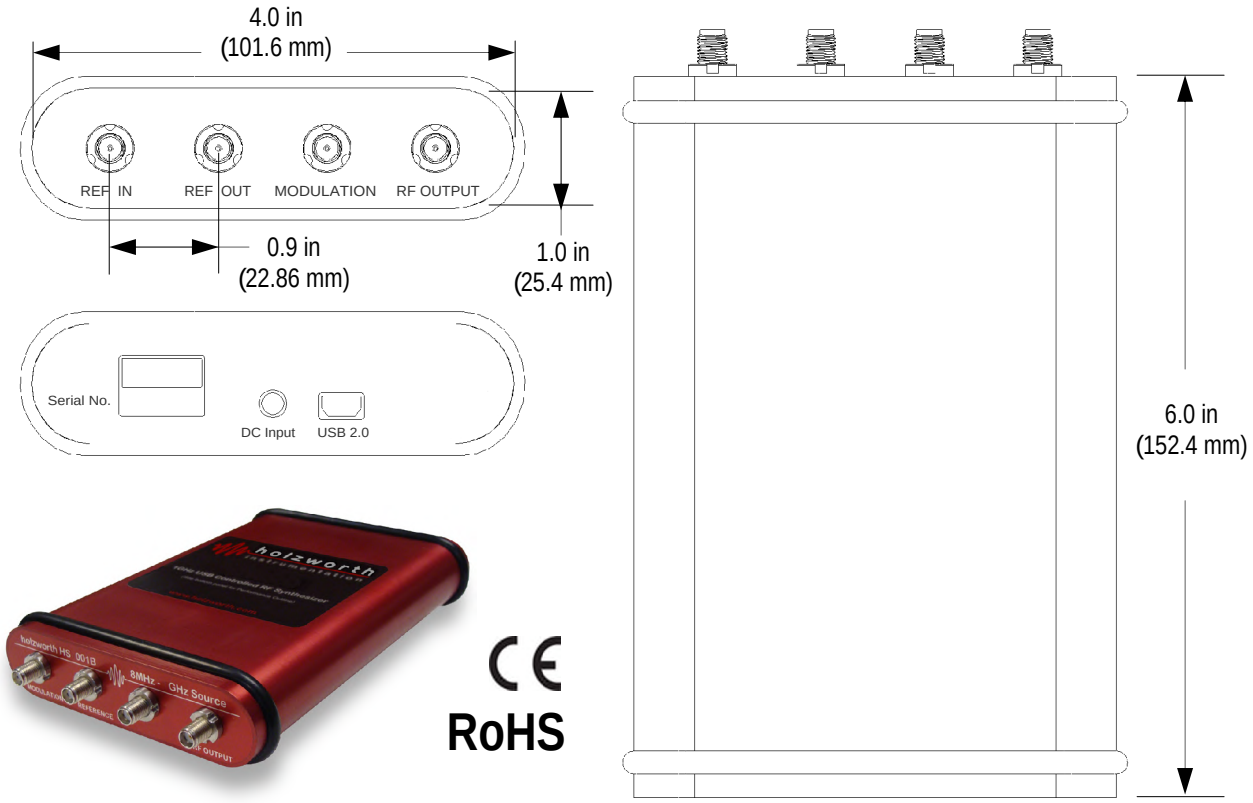


Figure 8: Relative Harmonic Data (F_O = 1GHz)

MECHANICAL CONFIGURATION

Holzworth single channel RF Synthesizer modules are encased in compact, rugged housings. An external AC/DC power supply is provided with each unit. All RF, modulation and reference connectors are contained on the front panel for ease of use. The rear panel contains the DC power input, USB input and a status display for identifying/monitoring the device.



RoHS

CONNECTORS and PHYSICAL SPECIFICATIONS

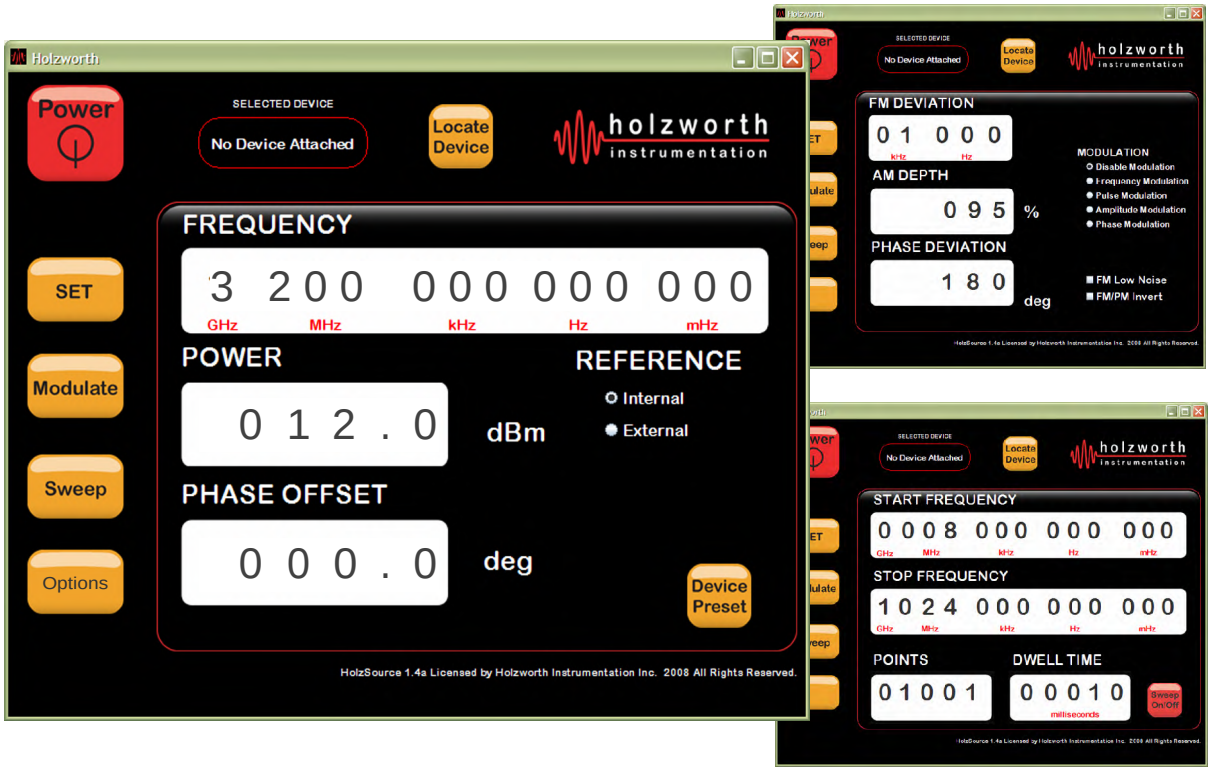
Front Panel Connectors	SMA Female (4): Reference In, Reference Out, Modulation, RF Output
Rear Panel Connectors	USB 2.0(1): Data / DC Power; DC Input (1): AC/DC Supply
Physical Dimensions (L x W x H)	6in x 4in x 1in (152.4mm x 101.6mm x 25.4mm)
Weight	1 lb (0.5 kilograms)

WARRANTY

All Holzworth synthesizers come with a 2 year 100% product warranty covering manufacturing defects. All product repairs and maintenance must be performed by Holzworth Instrumentation. Holzworth reserves the right to invalidate the warranty for any products that have been tampered with or used improperly. Refer to Holzworth Terms & Conditions of Sales for more details.

APPLICATION SOFTWARE

The Holzworth synthesizer application software is included with the purchase of our sources and works universally with all Holzworth synthesizer products. Much consideration has gone into intuitive user functionality. First time users have noted there being no need to refer to the product manual.



The application has 4 separate function windows providing a Set Mode (frequency, P_{OUT}, phase offset), a Modulation Mode (FM, AM, PM and phase), Frequency Sweep Mode, and an Options Mode (allowing for user memory presets and for loading delimited lookup tables for accelerated switching speeds).

VIRTUAL INSTRUMENT

The majority of laboratory test systems utilize PCs for data capture and compilation, so there are advantages to using a PC to control an instrument. Without sacrificing product performance, the user gains valuable real estate on the bench top or within a closed test/OEM system.

Holzworth Synthesizers utilize the USB HID (Human Interface Device) transfer protocol. The HID protocol requires no installation of hardware drivers while providing the highest level of stability.

The provided GUI application is Java™ based as it is an extremely robust platform and accepted as an industry standard. Operating on a minimal amount of memory (<1.0MB), users can run the application directly from a USB memory stick, if need be.

DLL access is also provided for “VISA”, LabVIEW™, MATLAB™, *etc*. control over the instrument.