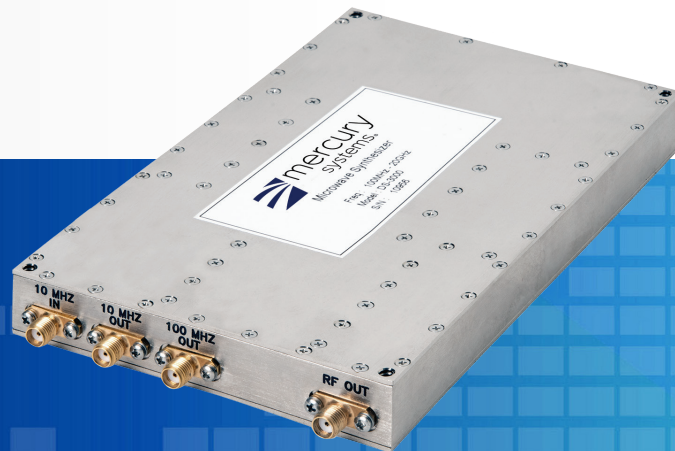**mercury systems®**

# *SpectrumSeries*™ DS-3000 Synthesizers

Ultra-Low Phase Noise Synthesizer, 0.1 - 20 GHz

- **100 MHz to 20 GHz, in 1 Hz steps**
- **State-of-the-art phase noise**
- **10W power consumption**
- **Auto-sensing reference clock**
- **-30°C to +70°C temp range**
- **SPI & USB control - command-set and GUI control**

Mercury's DS-3000 series is a state-of-the-art, DDS-based synthesizer family tuning continuously from 100 MHz to 20 GHz, in 1 Hz steps. Phase noise and spurious performance is consistent with most demanding test equipment, receiver or carrier transmitter requirements.

Tuning is accomplished via 4-wire SPI tuning or USB. The synthesizer includes an internal reference which will auto-lock to an external 10 MHz reference when present.
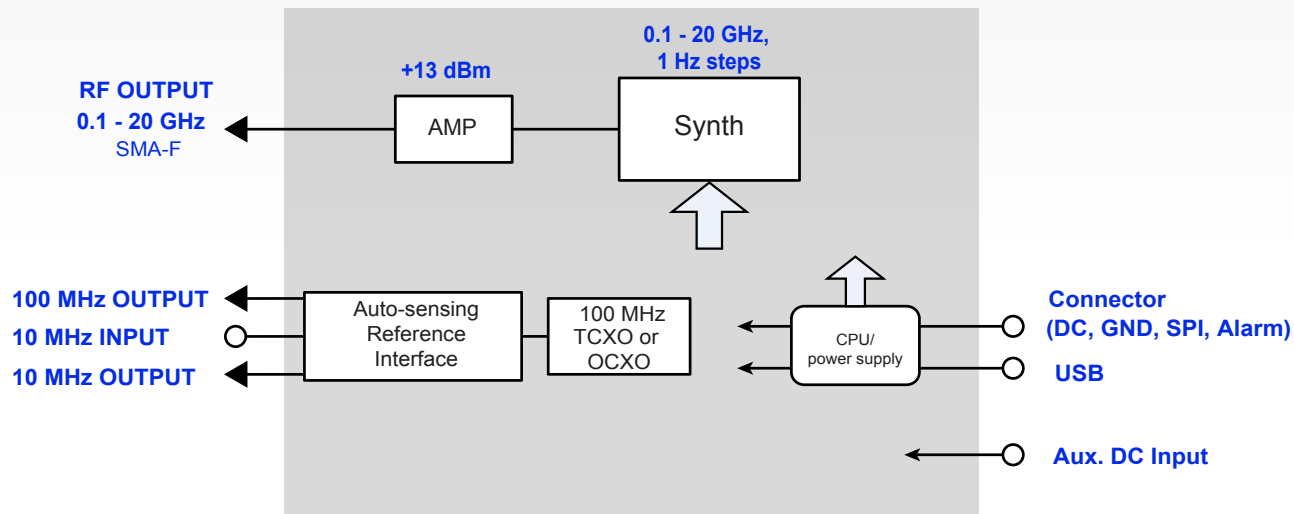
Mercury Systems is a leading commercial provider of secure sensor and safety-critical processing subsystems. Optimized for customer and mission success, Mercury's solutions power a wide variety of critical defense and intelligence programs.

ACQUIRE   DIGITIZE   PROCESS   STORAGE   EXPLOIT   DISSEMINATE

Specifications

RF Output

Parameter	Value
Frequency Tuning Range	100 MHz to 20 GHz
Frequency Tuning Resolution	1 Hz
Switching Speed	200 microsec, max, list mode. 1 msec normal mode.
RF Power Output	+13 dBm typ
RF Power Flatness, over freq range	+/- 2 dB max
Harmonics	-12 dBc max
Non-Harmonic spurious	-60 dBc max
VSWR (in band)	2.5:1 max (50 ohm)
Connector	SMA-female

Reference

	DS-3001	DS-3002
Internal Oscillator Type	TCXO	OCXO
Internal Reference Frequency	100 MHz	100 MHz
Internal Reference Aging, per year	<2 ppm	<1 ppm
Internal reference Stability over temp*	+/-0.5 ppm	+/-0.1 ppm
* stability temperature range	0 to +70°C	-20 to +70°C
Reference Output, 10 MHz	10 MHz @ 6 dBm, +/- 2 dB, locked to the reference in use	
Reference Output, 100 MHz	100 MHz @ 6 dBm, +/- 2 dB, locked to the reference in use	
External Reference Input (customer supplied)	10 MHz @ 0 dBm +/- 6 dBm	
External Reference Input Max (no damage)	+17 dBm	
Locking Range of External Reference	+/- 3 ppm	+/- 0.5 ppm
Reference Select	Auto-Sense; locked to external if present, otherwise internal	
Input/Output Connectors	SMA-female	

The DS-3000 has an internal 100 MHz reference. Two versions are available, with differing stabilities and phase noise. A sample of the 100 MHz is provided. An external 10 MHz can be used to phase lock the internal 100 MHz and a sample of the external 10 MHz reference is provided for daisy-chaining purposes.
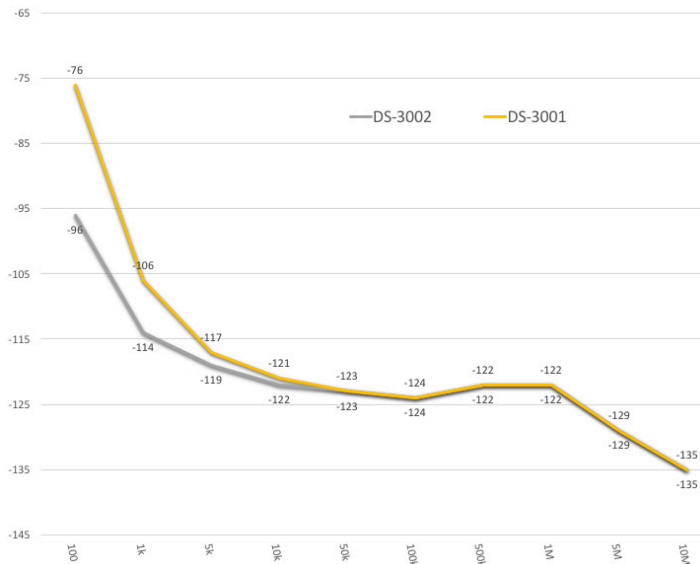
General

DC Power	+9 to +15 VDC	
Power Consumption	10W typ, 12W max	12W typ, after warm-up
Stand-by Power & Wake-Up	<2 Watt in stand-by (std reference). Wake-up time approx. 100 mS	
DC Power & Control Connector	14 Pin Male. Harwin M80-5401442 Datamate High Reliability series. Mates with M80-4611442 (female).	
Aux DC Power	2.0 mm center pin. CUI MODEL: PJ-063AH. Mates with Jack Insertion Diameter/Depth: 5.5	
USB Connection	Mini-USB	
Operating Temperature	-30 to 70 deg C, baseplate	
Warm Up time	1 minute, max	2 minutes, max
Humidity	95% non-condensing	
Alarm Type	TTL, Hi = ok	
Size, inches	6.5 x 4 x 0.7	
Weight	14.5 oz	

A closer look at phase noise

Model DS3000 was created to give state-of-the-art phase noise performance. Mercury currently offers two versions of the synthesizer: DS-3001 which is TCXO-based and DS-3002 which is OCXO-based.

DS-3002 "Ultimate" phase noise

Phase Noise: typ, in dBc/Hz	2.5 GHz	5 GHz	10 GHz	20 GHz
100 Hz	-108	-102	-96	-90
1 kHz	-126	-120	-114	-110
10 kHz	-134	-128	-122	-117
100 kHz	-138	-132	-124	-118
1 MHz	-134	-128	-122	-116
10 MHz	-147	-141	-135	-130
Deg RMS	0.02	0.05	0.10	0.20

DS-3001 "Standard" phase noise

Phase Noise: typ, in dBc/Hz	2.5 GHz	5 GHz	10 GHz	20 GHz
100 Hz	-88	-82	-76	-70
1 kHz	-118	-112	-106	-100
10 kHz	-133	-127	-121	-116
100 kHz	-136	-130	-124	-118
1 MHz	-134	-128	-122	-116
10 MHz	-147	-141	-135	-130
Deg RMS	0.04	0.07	0.14	0.27

Comparison of DS-3001 vs DS-3002 at 10 GHz output
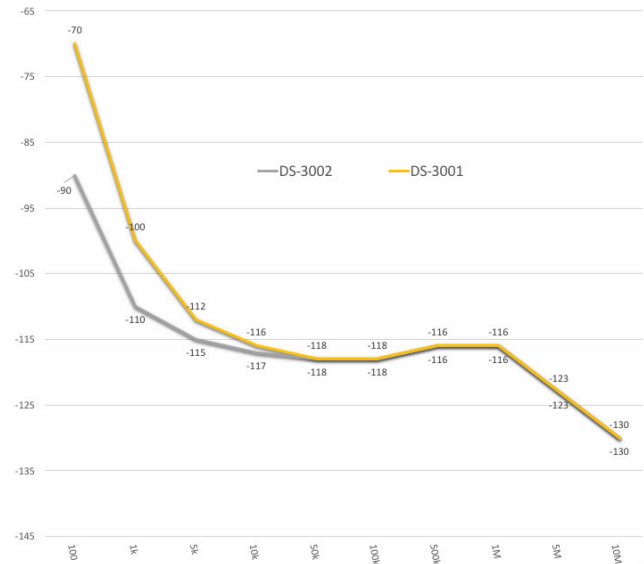
Comparison of DS-3001 vs DS-3002 at 20 GHz output

100 MHz reference oscillator output phase noise

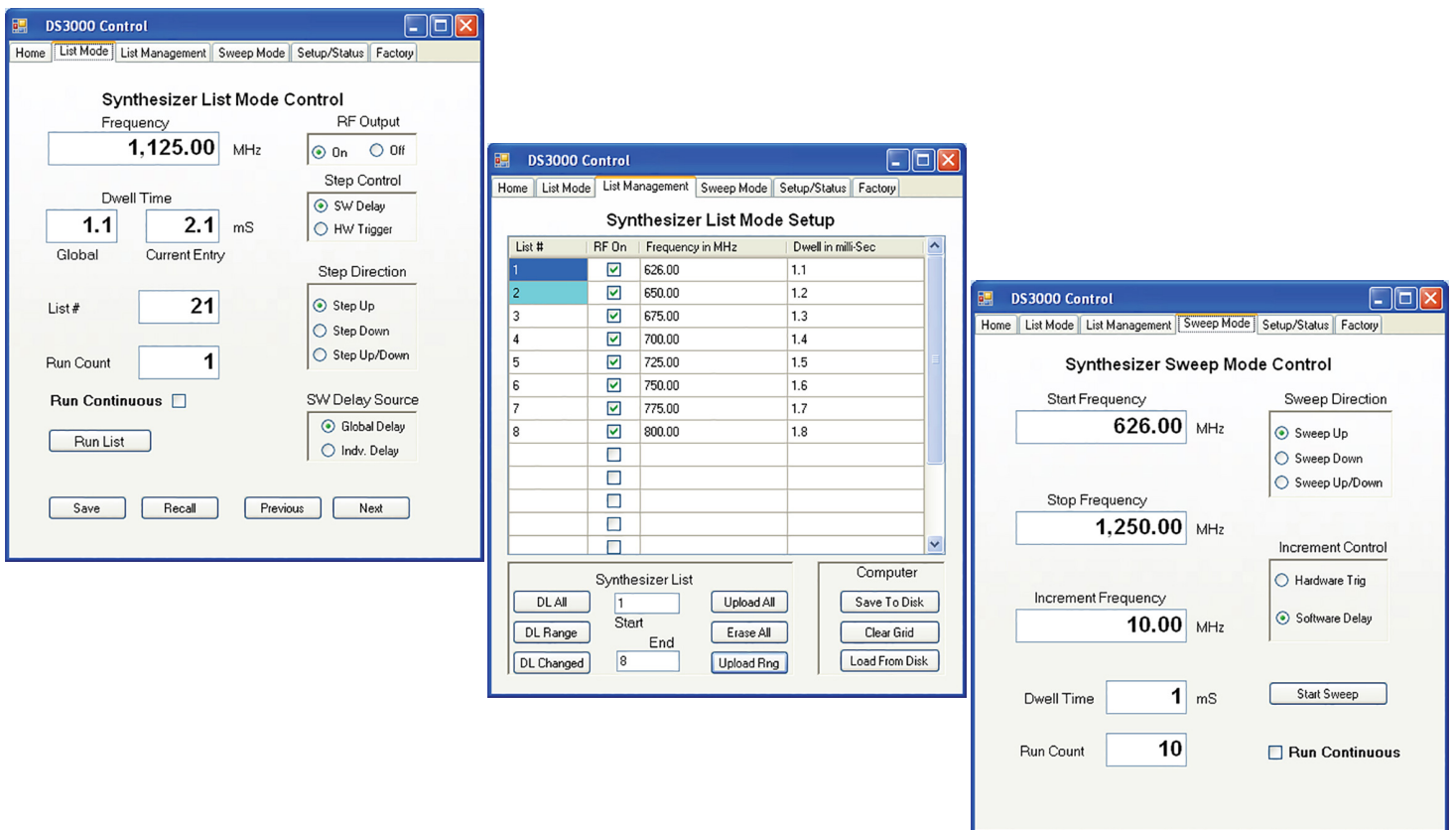| Phase Noise: typ, in dBc/Hz	DS-3001 (TCXO)	DS-3002 (OCXO)
10 Hz	-85	-100
100 Hz	-115	-135
1 kHz	-145	-160
10 kHz	-160	-160
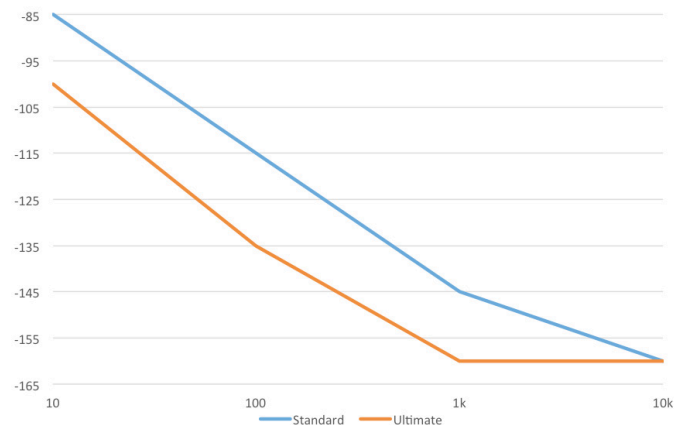
Phase Noise 100 MHz reference output

GUI-driven interface and control
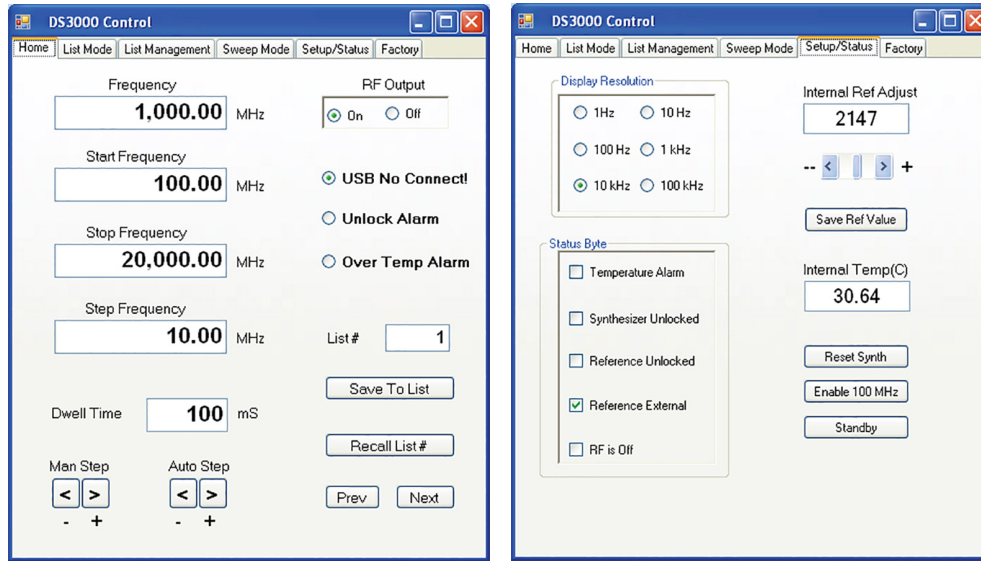
List and Sweep modes available

Complete control also available using SPI

Monitor and Control

Monitor & Control of the DS-3000 is accomplished by a single connector which provides DC, Ground, 4-Wire SPI, Alarms, and Muting. The interface connector locks to the female mating connector, providing a rugged and stable coupling for lab or field use. A secondary connection port is provided utilizing mini-USB. A user GUI is provided via the USB and packet level control is accomplished via SPI.
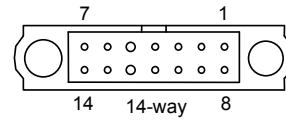
Programming	
DC Power & Control Connector	Multi-pin Interface, male (all connections on one connector)
Programming Interface	Clock/MOSI/MISO/SS (4-wire SPI)
Alternate Programming Port	USB; mini-USB form factor, with GUI on Windows 7 or later

14 Pin Connector	Designation
Pin 1	RS-232 TX
Pin 2	SPARE
Pin 3	LD OUT
Pin 4	FREQ MODE
Pin 5	SPI: MOSI
Pin 6	SPI: SS
Pin 7	+VIN
Pin 8	RS-232 RX
Pin 9	RF ON/OFF
Pin 10	TRIGGER
Pin 11	SPI: MISO
Pin 12	SPI: SCLK
Pin 13	GND
Pin 14	+VIN

Consult the factory or your user documentation for command-set instructions.
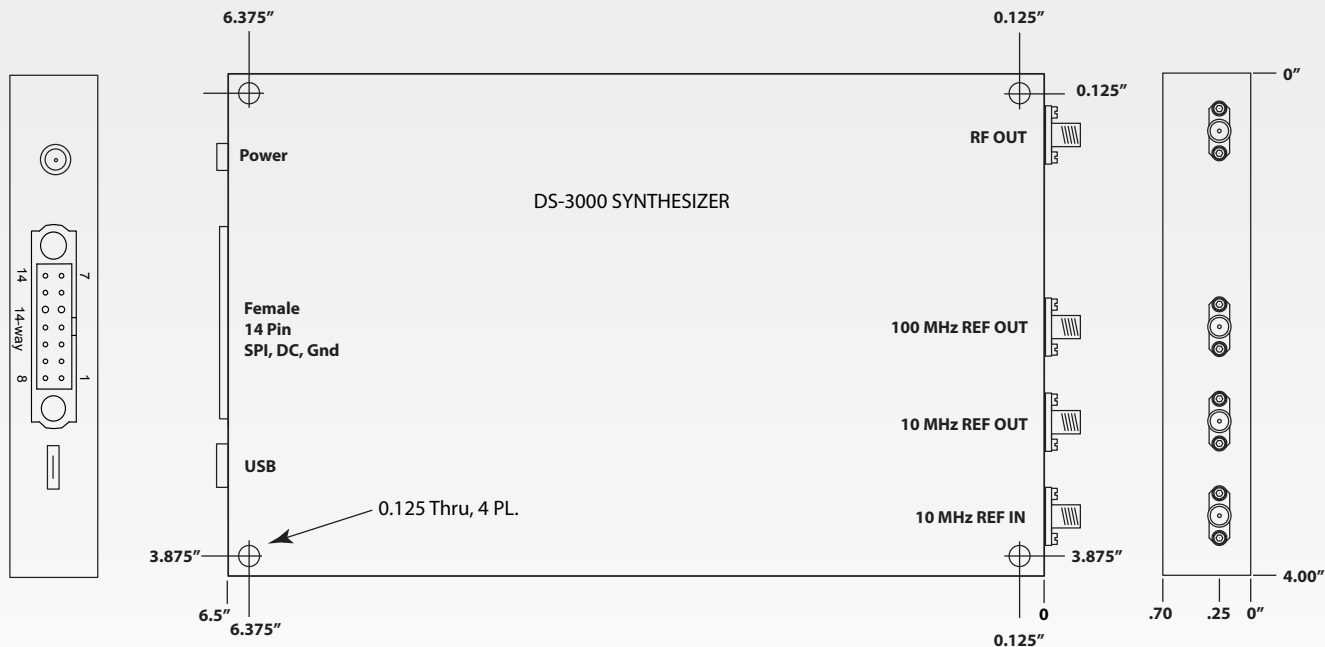
DS-3000 outline drawing

Ordering Information

The DS-3000 is available in various versions, with differing stabilities and phase noise profiles.

Model	Description
DS-3001	Standard Phase Noise profile and stability
DS-3002	DS-3000 with "Ultimate" Phase Noise profile and stability
Option - SK	Optional Shock Mount Kit
Option - HS	Heatsink and Mount Kit
Option - CAB	Custom Cable Kit

Need More Help?   Need a Variant of This Product?

Contact Mercury's RF & Microwave engineering team at **rf.microwave@mrcy.com** or visit **www.mrcy.com/rf** for a detailed listing of RF and Microwave products.

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