

# NOVATECH INSTRUMENTS

## Precision 350 MHz Signal Generator Model 425A



The 425A is a Precision 350 MHz Frequency and Phase Agile Synthesized Signal Generator in a small shielded table top case. The 425A generates Sine, LVCMOS, and LVDS output signals simultaneously up to 350 MHz in 10  $\mu$ Hz steps under control from a serial port. Multiple 425A can be synchronized and used to generate the signals needed for radar, acoustic testing and similar applications. The 425A comes with a  $\pm 1.5$ ppm on-board TCXO clock. When using an external clock source, the 425A has the same accuracy and stability as the clock and remains phase synchronous with other units operated from the same source.

### Specifications:

#### OUTPUTS

TYPES: Sine, LVDS and LVCMOS simultaneously.  
IMPEDANCE: 50  $\Omega$ . (100  $\Omega$  differential for LVDS)  
RANGE: 250 kHz to 350 MHz with 10  $\mu$ Hz resolution (internal clock).

SINE AMPLITUDE: full scale approximately +7 dBm (0.50 Vrms) into 50  $\Omega$  load. Settable from 0.14 to 0.50 V<sub>rms</sub> by the "V0" command. (14-bit DAC).  $\pm 3$ dB referenced to amplitude at 100 MHz.

#### LVCMOS AMPLITUDE

V<sub>OL</sub> < 0.5 V, V<sub>OH</sub> > 2.0 V into a series-terminated load.  
T<sub>rf</sub> < 2.5 ns. Duty Factor: 40-60% (divider off). 50  $\Omega$ . Programmable 16-bit divider with a selectable /2 prescaler allows LVCMOS frequencies below 2 Hz. (LVCMOS optimized for frequencies  $\leq$  125 MHz)

#### LVDS AMPLITUDE

Meets EIA-644A specifications when terminated into a 100  $\Omega$  differential load (driver: SN65LVDS100, or equivalent).

#### CONTROL

Output frequency (48-bits), phase (14-bits), CMOS divider, and amplitude scaling (10-bits) are controlled by a serial port. Settings can be saved in EEPROM.

#### ACCURACY AND STABILITY

Accuracy: <  $\pm 1.5$ ppm at 10-40  $^{\circ}$ C. Stable to an additional  $\pm 2$ ppm per year, 18-28  $^{\circ}$ C.

#### EXTERNAL CLOCK/REFERENCE IN

Direct external clock frequency range of 250 to 1000 MHz or locked to a 10.0 MHz ( $\pm 0.01\%$ ) reference. The 425A specifi-

cations depend upon the quality of this signal.

#### Input Level (50 $\Omega$ ):

10 MHz Reference: 0.75-1.25 Vrms Sine or LVCMOS Square Wave.

External Clock: -3 to +6 dBm sine wave.

#### SPECTRAL PURITY (Typical, 50 $\Omega$ load, int. clock)

Phase Noise: < -133 dBc, 10 kHz offset, 10 MHz out.

Spurious: < -70 dBc below 10 MHz

< -60 dBc below 50 MHz

< -55 dBc below 150 MHz

< -45 dBc below 350 MHz

Harmonic: < -65 dBc below 1 MHz

< -60 dBc below 10 MHz

< -55 dBc below 25 MHz

< -45 dBc below 50 MHz

< -40 dBc below 150 MHz

< -25 dBc below 350 MHz

#### POWER REQUIREMENTS

+4.75 to +5.25 V @ < 750 mA. 2.5 mm center-positive connector on rear panel. AC line (country dependent) adapter provided.

#### SIZE

39 mm H, 107 mm W, 172 mm L, not including connectors.

#### CONNECTORS

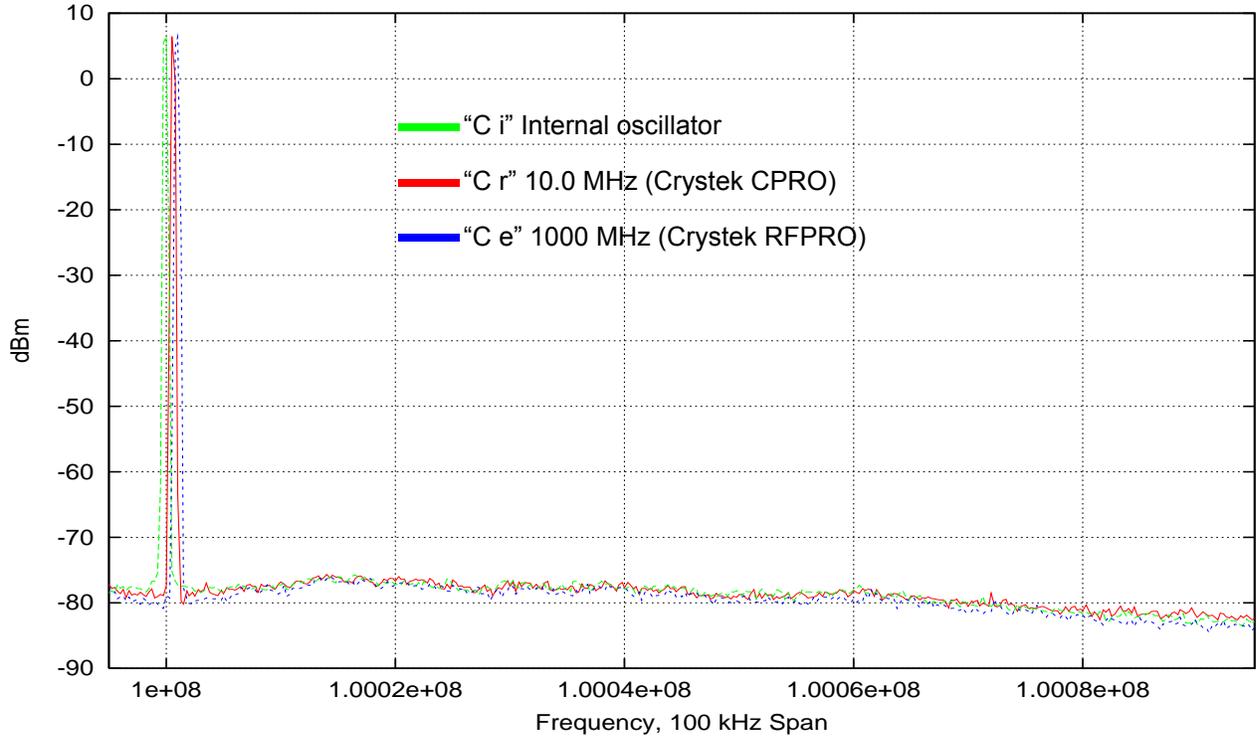
BNCs for SINE Out, LVCMOS Out, LVDS out, EXT CLK In. 2.5 mm center-positive for power. DE-9 for serial.

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**Table 2: Serial Commands**

Serial Command	Function
F0 xxx.xxxxxxxxxxxx	Set Frequency of output in MHz to nearest 10 $\mu$ Hz. Decimal point required.
P0 N	Set relative Phase of output sinewave. N is an integer from 0 to 16383. Phase is set to $N*360^{\circ}/16384$ or $N*2\pi/16384$ radians. This is useful when multiple Model 425A are running from the same clock source.
E x	Serial Echo control. x=D for Echo <b>D</b> isable, x=E for Echo <b>E</b> nable. Disable echo for maximum serial port speed.
C x	Select Clock source. x=E for <b>E</b> xternal clock input 250 MHz to 1000 MHz, x=I for <b>I</b> nternal temperature compensated reference, or x=R for external 10 MHz <b>R</b> eference. The quality of the external input affects the specifications of the 425A. The "F0" command requires scaling (see manual) when clocks other than the internal clock are used.
R	<b>Reset</b> . This command resets the 425A. EEPROM data is preserved and, if valid, is used upon restart. This is the same as cycling power.
CLR	<b>Clear</b> . This command clears the EEPROM valid flag and restores all factory default values.
A x	x=E for LVC MOS <b>E</b> nable, x=D for LVC MOS <b>D</b> isable. Default value is "D"
D0 N	Set <b>D</b> ivider value on LVC MOS output. N is an integer from 0 to 65535. The output frequency set by the "F0" command is divided by N+1 before being sent to the LVC MOS driver. Duty cycle varies with divide ratio.
PR x	x=E for Enable <b>P</b> rescaler, x=D for <b>D</b> isable Prescaler. When enabled, the frequency set by the "F0" command is divided by 2 before entering the LVC MOS divider specified by the "D0" command. This allows a maximum divide integer of 131072.
S	<b>S</b> aves current state into EEPROM and sets valid flag. State used as default upon next power up or reset. Use the "CLR" command to return to default values.
QUE	Return present frequency, phase and status. Returns a character string of all internal settings.
M N	<b>M</b> ode command. Mode 'M 0' is single tone.
V0 N	Set <b>V</b> oltage level of output. In default, the amplitude is set to the maximum of approximately $0.5 V_{rms}$ (+7 dBm) into $50 \Omega$ (default N = 1023). N can range from 0 to 1023 (no decimal point allowed). Voltage level is scaled by approximately: $0.27 + 0.19*N/264$ If N >1023, the command is ignored and the level remains at its previous setting. (range is approximately $0.15 V_{rms}$ to $0.5 V_{rms}$ )
I x	Set the <b>I</b> /O update pulse method. If x=a, then an I/O update is issued automatically at the end of each serial command (default). If x=m, then a <b>m</b> anual I/O update pulse is expected to be sent by a subsequent 'I p' command.
<b>B aabb[cc[dd[ee[ff[gg[...]]]]]]]</b>	This <b>B</b> yte command allows each register in the DDS chip to be set. Different registers require a various number of bytes to be written depending upon the instruction word "aabb". All values are in hexadecimal and no error checking, other than correct format, is performed.

Novatech Model 425A, 100 MHz



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