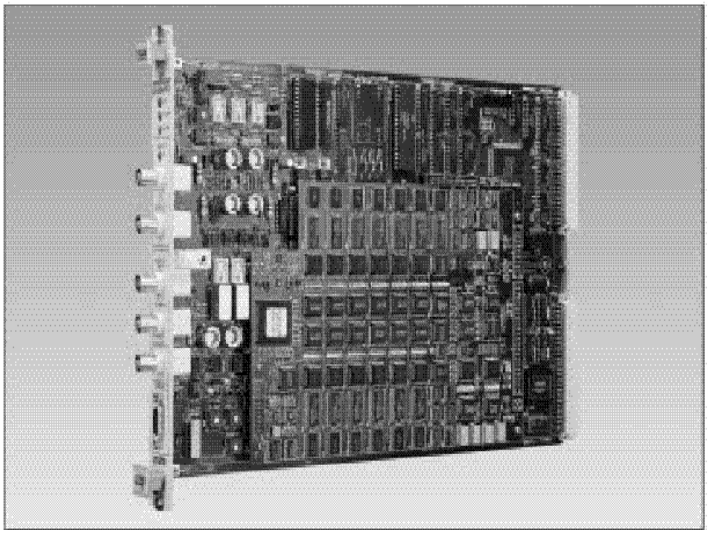
Racal Instruments
http://www.racalinstruments.com

PRODUCT INFORMATION

300MS/s Frequency Agile Waveform Synthesizer Model 3161



- **Built-in External AM, PM and FSK Modulation**
- **Phase Locks its Output to External Analog Signals**
- **Real-Time Frequency Hopping Between up to 256 Frequencies**
- **Fastest VXI Arbitrary Waveform Generator with 300M-bits/s Rate**
- **Waveform Sequences Vary Clock Rate to Save Memory**
- **256k of Standard Waveform Memory (1Meg Optional)**

The Racal Instruments Model 3161 300MS/s Frequency Agile Waveform Synthesizer combines industry-leading 300MS/s performance, frequency agility and modulation capability in a single-slot VXIbus format. Signal output in the range of 100mHz to 150MHz with 12-bit resolution supports the test stimulus needs of the information age.

300Megasample/ Second Performance
Higher performance test equipment and systems are needed as products are developed which use increasing signal bandwidths. The Model 3161's 300MS/s sample rate generates test stimuli with superior waveform quality and performance. For example, harmonics are typically below 30dB for a 150MHz sine wave.

Frequency Agility
The Racal Instruments 3161 provides real-time frequency agility with an interface allowing the user to control the 3161's output frequency instantaneously. Up to 256 frequency hops are available at clock rates that are integer division ratios of the 3161's sample clock. Division ratios range from 1 to 64k. Hops are controllable via a front panel D-sub connector. Waveform sequencing is also available with a hopped sample clock.

Modulation Capability
The 3161 also allows external modulation by providing front panel inputs for Amplitude and Phase Modulation (AM and PM), as well as Frequency Shift Keying (FSK).

Phase Lock to External Signals
The 3161 automatically locks its output to external analog signals up to 18.75MHz. Phase offset resolution is programmable in 1 point steps. The frequency of the external signal may be queried since the 3161 has a built-in 6 digit frequency counter.

Arbitrary Waveform Creation Software
WaveCAD waveform creation software allows you to create sophisticated test waveforms using equations, freehand drawing, and built-in functions or combinations of all three. Waveforms may also be imported from spread-sheets, math programs or waveform digitizers. WaveCAD is available for WIndows 3.1, 95 or NT

VXI*plug&play* Drivers
LabWindows/CVI and LabVIEW drivers simplify test system design and integration. Included on the VXI*plug&play* driver disk is a soft front panel that provides manual instrument control from Windows 3.1, 95 or NT. The VXI*plug&play* driver also gives C, C++ or Visual Basic programs access to 3161 driver functions directly.

3161 SPECIFICATIONS

AMPLITUDE CHARACTERISTICS

Amplitude
20mV-10$V_{pk\text{-}pk}$, output open circuit
10mV-5$V_{pk\text{-}pk}$, into 50Ω
Resolution
4 digits
Accuracy (at 1kHz)
1V-5$V_{pk\text{-}pk}$: ±(1%+25mV)
100mV-999.9m$V_{pk\text{-}pk}$: ±(1%+5mV)
10mV-99.99m$V_{pk\text{-}pk}$: ±(1%+2mV)
DC Offset Range
0 to ±2.495V
DC Offset Accuracy
±2% +10mV
DC Offset Resolution
5mV
Output Impedance
50Ω ±1%
Low-Pass Filters
70MHz, 7-pole, elliptic
150MHz, 7-pole, elliptic
Standby (Output Disconnected)
Output On or Off
Output Protection
Short circuit
Glitch Energy
100pV-s at 5$V_{pk\text{-}pk}$

STANDARD WAVEFORMS

(FUNC:MODE FIX) (Sine, Triangle, Square, Pulse [Standard, Exponential and Gaussian], DC)
Frequency Resolution
7 digits
Accuracy & Stability
Same as frequency standard
Sine
Frequency Range
100μHz to 150MHz
Harmonics

Frequency	Harmonic Signals
<150MHz	>25dBc
<50MHz	>30dBc
<10MHz	>40dBc
<100kHz	>50dBc

Band Flatness
<10MHz: 5% (0.42dB)
<150MHz: 10% (.83dB)
Start Phase Range
0-360°

Square
Frequency Range
100μHz to 150MHz
Duty Cycle Range
1% to 99%
Rise/Fall Time (10%-90%)
<2.5ns
Aberration
<5%+10mV

Triangle
Frequency Range
100μHz to 5MHz, usable to 18.75MHz
Start Phase Range
0-360°

Pulse and Ramp Functions
Frequency Range
100μHz to 5MHz, usable to 18.75MHz
Delay, Rise/Fall Time, High Time Ranges
0%-99.9% of period (each independently)
Gaussian Pulse Time Constant Range
10-200
Sinc Pulse "Zero Crossings" Range
4-100
Exponential Pulse Time Constant Range
-100 to 100

Noise Function
Frequency Range
100μHz to 5MHz, usable to 18.75MHz
DC Output Function Range
-100%-100% of amplitude

ARBITRARY WAVEFORMS

(FUNC:MODE USER)
(Waveform memory may be "segmented" allowing storage of multiple waveforms.)
Custom Waveform Creation Software
WaveCAD software allows instrument control and creation of custom waveforms either freehand, with equations or built-in functions or with imported waveforms.
Waveform Memory
Standard: 256k-points
Optional: 1Meg-points
Vertical Resolution
12 bits (4096 levels)
Total Harmonic Distortion (300MS/s)
4096 point Sine: 0.5% (.043dB)
Number of Memory Segments (Max.)
4096
Minimum Segment Size
16 points

SEQUENCED ARBITRARY WAVEFORMS (FUNC:MODE SEQ)

Operation
Permits division of waveform memory into smaller segments. Segments may be linked and repeated in a user-selectable fashion to generate extremely long waveforms. Sample clock is selectable for each segment. Sample clock changes coherently between steps.
Modes
Automatic Sequence Advance
No trigger required to step from one segment to the next. Sequence is repeated continuously per a pre-programmed sequence table.
Stepped Sequence Advance
Current segment is sampled continuously until an external trigger advances the sequence to the next programmed segment and sample clock rate.

3161 SPECIFICATIONS Continued

Single Sequence Advance
Current segment idles. Trigger samples the segment once. Next trigger repeats the same segment if repeat was programmed or else samples the next segment. Between triggers output idles at the value of the last output point.

Random Sequence Advance
Active segment is controlled in real-time via a front panel D-sub connector. An 8-bit binary word at this connector controls the next segment to advance to.

Sequencer Steps
1 to 4096

Segment Loops
1 to 1Meg

Segment Duration
100ns, minimum

SAMPLING CLOCK

Internal Source Range
100mHz to 300MHz

Resolution
7 digits

Accuracy and Stability
Same as reference

10MHz Reference Sources
Default: VXIbus CLK10 (100ppm)
Internal (Optional): 1ppm accuracy (19°C-29°C), 1ppm/°C (<19°C/ >29°C), 1ppm/year aging rate
External: Front panel BNC (10MHz, nominal)

SYNTHESIZER AGILITY

Frequency Hopping
Permits the selection of the sampling clock dividing ratio in real time. Sample clock hops (coherently) between up to 256 pre-defined rates.

Hop Control Source
Frequency: Front panel D-sub connector (8-bit binary word)
Trigger: Front panel BNC, TLTrg0-3 or ECLTrg0

Sampling Clock Range
100mHz to 300MHz

Ratio Between Carrier and Hop Frequencies
1 to 64k

Hop Table
256 hop frequencies

Hop Delay
Last cycle complete + 100ns

OPERATING MODES

Normal Mode
Continuous output of a waveform.

Externally Triggered Mode
An external signal triggers one output cycle.

Internally Triggered Mode
An internal timer repetitively triggers one output cycle at a fixed interval.

Gated Mode
External signal enables generator output. First gated output cycle is synchronous with the active slope of the triggering signal. Last output cycle is always completed.

Internal Burst Mode
(FUNC:MODE FIX, FUNC:MODE USER only)
An internal timer repetitively triggers a burst of up to 1Meg output cycles.

External Burst Mode
(FUNC:MODE FIX, FUNC:MODE USER only)
An external signal triggers a burst of up to 1Meg output cycles.

Delayed Trigger Mode
Trigger takes effect after a pre-defined delay ranging from 2 to 8Meg clock cycles.

Delayed Trigger Mode Accuracy
±(2 clock cycles + 100ns)

Delayed Trigger Mode Resolution
1 clock cycle

Delayed Trigger Mode Jitter
1 clock cycle

TRIGGER CHARACTERISTICS

Input Sources
Internal: 1mHz-50kHz timer (±[1%+0.5µs accuracy)
External: Front Panel BNC
VXI Backplane: TTLTrg0-3, ECLTrg0
Software: *TRG, WS Trigger Cmd.

Level Range
±10V

Level Resolution
50mV

Sensitivity
200mV$_{pk-pk}$

Input Frequency Range
100Hz to 18.75MHz

Sync Out
Front Panel: BNC
VXI Backplane: TTLTrg0-3, ECLTrg0

Sync Out Sources
BIT: Selected point in segment.
LCOM: Loop complete.
SSYN: Scope sync. Elminates ±1 clock jitter.

SYSTEM DELAY

(Trigger I/P to Waveform D/P)

Trigger Delay Mode OFF
1 Sample Clock Cycle + 100ns

Trigger Delay Mode ON
2 Sample Clock Cycles + 100ns

PLL CHARACTERISTICS

Operation
Automatically locks output to external signal.

Input Frequency Range
DC to 18.75MHz

PLL Input Characteristics
Same as TRIG IN

External Lock Frequency Range
Standard Waveforms: See curve above.
Arbitrary Waveforms: see curve below

Coarse Phase Offset Range
Cycle is 0-±360°

Resolution
360°/Number of points in waveform

Accuracy
±(Resolution + 20ns/PERIOD x 360°)

FREQUENCY COUNTER

Operation
Made available to the user in PLL mode only. Frequency reading is valid only when PLL ON LED is lit.

Range
100Hz to 18.75MHz

Resolution
6 digits

AM CHARACTERISTICS

Input Source
Front Panel BNC, 1mΩ ±5%

Bandwidth
DC to 1MHz

Modulation Range
0 to 200%

Modulation Sensitivity
0 to -2V: 100% modulation
0 to -4V: 200% modulation

Maximum Input Voltage
±12V

3161 SPECIFICATIONS Continued

PM CHARACTERISTICS

Operation
External signal offsets phase. The PM input is operational in PLL mode only.

PM Input (Front Panel BNC)
Impedance: 1MΩ, ±5%
Sensitivity: 24°/V, typical
Accuracy: ±10%
Maximum Voltage: ±12V

FSK CHARACTERISTICS

Operation
Current segment is sampled continuously. External low level (<trigger level) selects sampling clock, external high level (>trigger level) programs shifted frequency. Clock frequency changes coherently.

Carrier Sampling Clock Range
100mHz to 300MHz

FSK Input
Front Panel BNC

Bandwidth
DC to 10MHz

Delay
1 Waveform Cycle, min.

FRONT PANEL I/O

Main Output
Connector: BNC, 50Ω ±1%
Protection: Short Circuit to Case Ground

Sync Output
Connector: BNC, 50Ω ±1%
Level: >2V into 50Ω, 5V into 10kΩ
Protection: Short Circuit to Case Ground

Trigger/PLL/FSK Input
Connector: BNC, 10kΩ ±5%
Slope: Positive or Negative (selectable)
Input Voltage (max.): $30V_{rms}$
Pulse Width (min.): 20ns

External Reference Input
Connector: BNC, 10kΩ ±5%
Threshold Level: TTL
Pulse Width (min.): 20ns

Frequency Hop Control Input
Connector: 9-pin D-sub, Male
Threshold Level: TTL

VXIbus INTERFACE DATA

(Single-slot, Message-based, VXIbus 1.4 Compliant)

Software Compliance
SCPI 1993.0, IEEE488.2

Drivers
LabVIEW, LabWindows/CVI, VXI*plug&play* (WIN, WIN95, WIN NT
Frameworks)

Waveform Creation & Control Software
WaveCAD (WIN, WIN95, WIN NT)

Shared Waveform Memory
A24, D16 256K points (1M opt.)

Backplane Signal Support
TTLTrg0-3: Trigger In, Sync Out
ECLTrg0: Trigger In, Sync Out

Status Lights
Red: Power-On Self-Test Failure
Yellow: Module accessed on VXIbus
Yellow: Phase Lock is engaged
Green: Output on

Cooling (10°C Rise)
5l/s@0.6mmH_2O

Peak Current & Power Consumption

	+24	+12	+5	-2	-5.2	-12	-24
I_{Pm} (A)	.05	.5	3	.5	6	.5	.05
I_{Dm} (A)	.025	.25	1	.25	2	.25	.025

Total Power: 60Watts

ENVIRONMENTAL

Temperature
Operating: 0°C-50°C
Storage: -40°C-70°C
Spec Compliance: 20°C-30°C, 30min. warm-up

Humidity (non-condensing)
11°C-30°C: 95% ± 5%
31°C-40°C: 75% ± 5%
41°C-50°C: 45% ± 5%

Altitude
Operating: 10,000ft.
Storage: 15,000ft.

Vibration (non-operating)
2g at 55Hz

Shock (non-operating)
30g, 11ms, half sine pulse

Weight
3.8 lb (1.6 kg)

EMC (Council Directive 89/336/EEC)
EN55011, Group1, Class A, EN50082-1, IEC 801-2, 3, 4

Safety (Low Voltage Directive 73/23/EEC)
EN61010-1, IEC1010-1, UL3111-1, CSA 22.2#1010

ORDERING INFORMATION		
Model	**Description**	**Part Number**
3161	300MS/s Freq. Agile Waveform Synthesizer w/256k	407606-001
3161 w/1Meg	300MS/s Freq. Agile Waveform Synthesizer w/1Meg	407606-002
3161 w/256k (1ppm)	300MS/s Freq. Agile Waveform Synthesizer w/256k (1ppm)	407606-011
3161 w/1Meg (1ppm)	300MS/s Freq. Agile Waveform Synthesizer w/1Meg (1ppm)	407606-012

CE The CE Mark indicates that the product has completed and passed rigorous testing in the area of RF Emissions, Immunity to Electromagnetic Disturbances and complies with European electrical safety standards

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