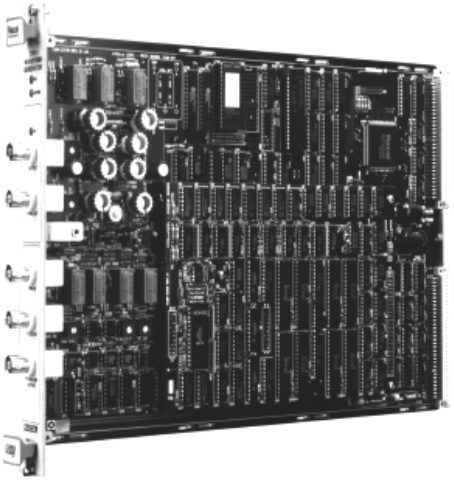
Racal Instruments
http://www.racalinstruments.com

PRODUCT INFORMATION

100 MS/s Waveform Generator Model 3151A+



- **Up to 512 k of Waveform Memory Standard**
- **Sine Waves up to 50 MHz at Amplitudes up to 16 V(pk-pk) into 50 Ω**
- **Create Custom Arbitrary Waveforms with Included WaveCAD Software**
- **Built-in Functions: Triangle(x), Sine(x), Sinc, Square, Ramp, Pulse, DC, Exponential & Gaussian Pulse**
- **Sequence up to 4096 Waveforms using the New High Speed Sequence Download Feature**

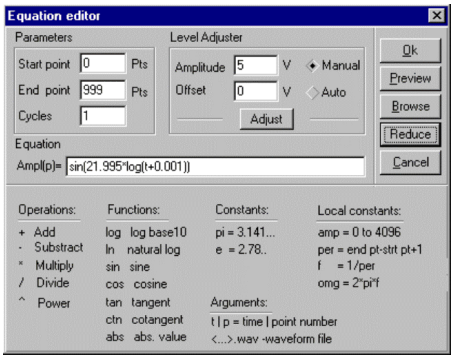
Racal Instruments Model 3151A+, 100 MS/s Waveform Generator, combines high-frequency performance, versatility and compact size in an economical VXIbus format. Signal output in the range of 100 µHz to 50 MHz with 12-bit vertical resolution and up to 512 k arbitrary waveform buffer make this single-slot, C-sized card a powerful solution to the most demanding test stimulus requirements.

The Model 3151A+ in combination with included WaveCAD™ software allows sophisticated waveform generation for many test applications.

VXIbus: A Cost Effective Format
The 3151A+ is a sensible alternative to a GPIB-based waveform generator when developing a VXI-based test system. The 3151A+ provides a synergistic combination of a function generator, pulse generator, programmable sequencer and arbitrary waveform synthesizer in one instrument. The 3151A+ delivers all this at a lower cost than comparable function generators. This versatility insures that the Model 3151A+ will adapt to future testing needs as well as current ones.

Flexible Triggering Capability
Combining VXIbus trigger lines with the 3151A+'s sync capability transforms the 3151A+ into an Arbitrary Trigger Generator. In addition to continuous output, the 3151A+ can also wait for a trigger, to initiate either a single waveform, a burst of waveforms, or a sequence of waveforms. Triggers can also be used to advance a sequence of waveforms one segment at a time. The 3151A+ can trigger immediately or delay up to 2 M wave points.

WaveCAD Software: Unlimited Source of Arbitrary Waveforms
With the 3151A+'s WaveCAD Graphical Waveform Creation software one can create virtually an unlimited variety of production or engineering test stimuli. Freehand sketch mode allows permits users to draw their own custom waveform for quick analysis of a communications channel or a signal encoding scheme. WaveCAD's library of built-in mathematical functions and equation entry ability frees the users to create their own exotic functions. Add or subtract components of a Fourier series to characterize digital or analog filters. Or, inject random bursts into a signal to test immunity to switching noise.



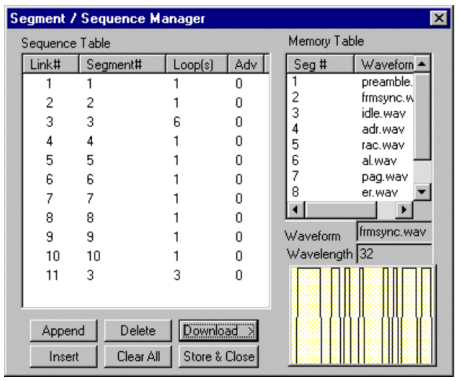
A Logarithmic Sweep is Calculated Using Equation Entry with WaveCAD Software

Up to 512 k of Waveform Memory for High Speed Testing

The Model 3151A+ provides up to 512 k of waveform memory, far more than competitive models. This waveform memory is accessible via a high-speed interface. Also, waveform memory is segmentable, allowing the storage of up to 4096 different waveforms of variable size. This allows test software to switch between many different waveforms rapidly and without having to download multiple times, enhancing test throughput in a way that cannot be duplicated by other competing products.

Sequences of up to 4096 Waveforms

Powerful sequencing capability allows the linkage of up to 4096 waveform segments and/or bursts (repeated segments) into strings. A segment can be repeated up to 1 M times in burst mode. Sequenced functions run continuously or are initiated by a trigger. These sequencing features permit the creation of complex pulse patterns using minimal amounts of memory.



The above sequence definition was created using WaveCAD software for the "Racal Pager Test" application. For this application, the 3151A+'s output waveform is connected to the FSK input of a Racal Model 3271 Signal Generator to produce RF Paging Signals.

New-Fast Sequence Download

The 3151A+ has a new feature speeding the download of large sequences to increase test throughput. In addition, a faster internal CPU enhances the execution speed of all SCPI commands.

100 MegaSample Per Second Sample Rate

New technology requirements are driving communications systems to use increasingly narrow channel widths. A high sample rate of 100 MS/s makes the 3151A+ an ideal modulation source for troubleshooting new encoding schemes. The 3151A+ also provides high-speed waveforms to simulate signal distortion, power line cycle dropouts, video signals, component failures, and power supply transients.

VXI*plug&play* Drivers

Test system design and integration is simplified with VXI*plug&play* drivers for Windows98, NT and 2000. Both LabWindows/CVI and LabVIEW are supported at the driver level. These drivers provide precise control of the Model 3151A+. A soft front panel is also included for "hands-on" access to 3151A+ features.

Compatible With 3151

The 3151A+ is fully backwards compatible with the model 3151A. The 3151A+ can optionally emulate all legacy 3151 models for Test Program Set (TPS) compatibility.

3151A+ SPECIFICATIONS

AMPLITUDE CHARACTERISTICS

Amplitude
20 mV – 32 V(pk-pk), output open circuit
10mV – 16 V(pk-pk), into 50 Ω

Resolution
4 digits

Accuracy **(at 1 kHz and specified output)**
±1% of setting

DC Offset Ranges **(within specified windows)**

Output Range	Available Offset
±80 mV	0 - ±71.9 mV
±800 mV	0 - ±719 mV
±8 V	0 - ±7.19 V

DC Offset Resolution
4 digits

DC Offset Accuracy **(within specified windows)**
±80 mV: ±(1% of amplitude+1% of offset +200 µV)
±800 mV: ±(1% of amplitude+1% of offset +2 mV)
±8 V: ±(1% of amplitude + 1% of offset + 20 µV)

Low-Pass Filters
20 MHz, 7-pole, Gaussian
25 MHz, 7-pole, elliptic
50 MHz, 7-pole, elliptic

Standby **(Output Disconnected)**
Output On or Off

Output Protection
Short circuit

Glitch Energy
1 nV-s at 16 V(pk-pk)

STANDARD WAVEFORMS

(Sine^x, Triangle^x, Square, Pulse, Ramp, Sinc, Gaussian Pulse, Exponential Decay Pulse, Exponential Rise Pulse, DC.)

Frequency Resolution
7 digits

Accuracy
±.01% of setting

Stability
1 ppm

Sine^x *(Sine function raised to the x^{th} power)*

Frequency Range
100 µHz to 50 MHz

Distortion (4000 points)
< 0.1% below 100 kHz

Harmonics

Frequency	Amplitude	Harmonic Level
<5 MHz	10 V(pk-pk)	-48 dBc
<5 MHz	16 V(pk-pk)	-40 dBc
<10 MHz	10 V(pk-pk)	-40 dBc
<10 MHz	16 V(pk-pk)	-35 dBc
<50 MHz	10 V(pk-pk)	-28 dBc
<50 MHz	16 V(pk-pk)	-20 dBc

Band Flatness
< 1 MHz: 1%
< 10 MHz: 5%
< 50 MHz: 15%

Phase Range
0-360^o

Exponent Range
Sine^1-Sine^9

Triangle^{X} *(Triangle function raised to the x^{th} power)*

Frequency Range
100 µHz to 1 MHz, usable to 10 MHz

Phase Range
0-360^{o}

Exponent Range
Triangle^{1}-Triangle^{9}

Square Wave

Frequency Range
100 µHz to 50M Hz

Duty Cycle Range
1% - 99%

Rise/Fall Time
7 ns

Aberration
5%

Pulse and Ramp Functions

Frequency Range
100 µHz to 1 MHz

Delay, Rise Time, High Time, and Fall Time Ranges
0% to 99.9% of period each (independently*)*

Pulse Rise and Fall Time
(10% to 90% of FS*)*
7 ns

Aberration
5%

Sinc Function **(Sine(x) x)**

Frequency Range
100 µHz to 1 MHz

Range of Cycles
4 to 100

Gaussian Pulse Function

Frequency Range
100 µHz to 1 MHz

Exponent
1 to 200

Exponential Pulse Function

(Pulses with exponential rise or decay times**)**

Frequency Range
100 µHz to 1 MHz

Exponent Range
-200 to 200

DC Output Function

Amplitude Range
0% to ±100% of max. amplitude

ARBITRARY WAVEFORMS

(Waveform memory may be "segmented" allowing storage of multiple waveforms.)

Custom Waveform Creation Software

WaveCAD software allows creation of custom waveforms, either freehand, using equations, simulation tools, or using waveforms recorded in the real world.

Waveform Memory
64 k or 512 k-points

Vertical Resolution
12 bits (4096 levels)

Number of Memory Segments
1 to 4096

Minimum Segment Size
10 points

SEQUENCED WAVEFORMS

(Waveform segments may be repeated or "looped." Waveform loops may be linked and sequenced.)

Sequencer Step Limits (N)
4096

Segment Loops
0 to 1 M

Segment Duration
100 ns minimum, > 1 loop

Fast Sequence Download
100 Steps < 450 ms

SAMPLING CLOCK

Internal Source Range
100 mHz to 100 MHz

External Source Range
Up to 100 MHz

VXIbus Backplane Source
ECLTRG0 up to 66 MHz

Internal Reference
Standard: VXIbus CLK10
Optional: 10 MHz TCXO
1 ppm accuracy

OPERATING MODES

(Normal, Sequenced, Triggered, Triggered Sequence Advance, Delay Triggered, Gated, Burst, Amplitude Modulated)

Normal Mode
Continuous output of a single waveform segment

Sequenced Mode
Continuous output of a sequence of waveform segments

Triggered Mode
One waveform cycle or sequence is output.

Trigger Sequence Advance Mode
A sequence is advanced to the next sequence step each time a trigger is received.

Delayed Triggered Mode
Delays any trigger by up to 2 million waveform points

Gated Mode
Generator is enabled when an external gate signal is active. The first gated output cycle is synchronous with the active slope of the gate signal. The last output cycle is always completed.

Burst Mode
A segment is repeated up to1million times. In External Burst Mode each burst begins with a trigger. In Internal Burst Mode an internal timer is used to repeat the burst at a programmed interval.

Amplitude Modulation (internal)
AM Modulation Rate: 10 Hz to 500 Hz
AM Depth: 1% to 200%

TRIGGERING CHARACTERISTICS

Sources
Internal: 1 mHz-50 kHz timer
External: TTL input, Z_{in}= 1 kΩ
VXI Backplane: TTLTRG0-7

Maximum Trigger Frequency
Internal Timer: 50 kHz
External : 5 MHz

Minimum External Trigger Pulse Width
20 ns

Trigger slope
Positive or negative

Trigger Delay
0 to 2 M points (sample clocks)

System Delay (Trig I/P to Waveform O/P)

Standard Waveforms:	120 ns +2 clock periods ± 1 clock period
Arbitrary Waveforms	150 ns +2 clock periods ±1 clock period

Sync Output
Front Panel: TTL
VXI Backplane: TTLTRG0-7

Sync Sources
Any point, sequence complete, ½ clock period

MULTIPLE-MODULE SYNCHRONIZATION

(Multiple modules may be placed in any chassis slots with no cumulative error.)

Phase Accuracy
± (20 ns *f_{out}*360^{o}+P.O.R.)

Phase Offset Resolution (P.O.R.)
360^{o} / (Number of points)

Phase Offset Range
0^{o} to 360^{o}-2880^{o}/n
(Where n is the number of points in the selected memory segment.)

Synchronization Source
ECLTRG0-1

Sample Clock Rate
Up to 66 MS/S

FRONT PANEL I/O

(accessed with BNC connectors)

Inputs
Trigger/Gate: Z_{in} = 1 kΩ, TTL voltage level
External Sample Clock: TTL voltage level

Outputs
Waveform: Z_{out} = 50 Ω
Marker/Sync: Z_{out} = 50 Ω, TTL
10 MHz Reference Output: Z_{out}= 50 Ω TTL

VXIbus INTERFACE DATA

(Single-slot, message based, VXIbus 1.4 compliant)

Software
SCPI, IEEE 488.2

Drivers
LabVIEW, LabWINDOWS/CVI, VXI*plug&play*

Shared Waveform Memory
A24/A32 VME block transfer

Backplane Signal Support
TTLTRG0-7: Trigger In, Sync Out
ECLTRG0-1: Sample Clock Source, Module Synchronization

Status Lights
Red: Power-On Self-Test
Yellow: Module accessed on VXIbus
Green: Output on/off

Cooling (10^{o} C Rise)
3.7l/s @0.55 mmH_20

Peak Current & Power Consumption

	+24	+12	+5	-5.2	-12	-24
I_{pm} (A)	.25	.10	3.0	2.0	.10	.25
I_{dm} (A)	.25	.10	.15	.15	.10	.15

Total Power: 40 Watts

ENVIRONMENTAL

Temperature
Operating: 0^{o} C-55^{o} C
Specification Compliance: 20^{o} C- 30^{o} C for specified data; 30-minute warm-up; 50 Ω load
Storage: 40^{o} C-+70^{o} C

Humidity (non-condensing)
11^{o} C-30^{o} C, 95% ±5%
31^{o} C-40^{o} C, 75% ±5%
41^{o} C-50^{o} C, 45% ±5%

Altitude
Operating: 10,000 feet
Storage: 15,000 feet

Vibration (non-operating)
2 g at 55 Hz

Shock
30 g, 11 mS half-sine pulse

Weight
3 lb 4 oz (1.5 kg)

EMC (Council Directive 89/336/EEC)
EN55011, Group 1, Class A
EN 50082-1, IEC 801-2,3,4

Safety (Low Voltage Directive 73/23/EEC)
EN 61010-1, IEC1010-1, UL3111-1, CSA 22.2 #1010

3151/3151A to 3151A+ Cross-Reference Guide

Original 3151/3151A Configuration		New 3151A+ Configuration		
Model 3151	**Part Number**	**Model 3151A+**	**Switch Change (from default)**	**Part Number**
3151 w/64k	407382-001	3151A+	3151 Emulation Switch On	407824-001
3151 w/512k	407382-002	3151A+ w/512k	3151 Emulation Switch On	407824-002
3151 w/64k, 1 ppm	407382-011	3151A+, 1 ppm	3151 Emulation Switch On	407824-011
3151 w/512k, 1 ppm	407382-012	3151A+ w/512k, 1ppm	3151 Emulation Switch On	407824-012
3151A	407719-002	3151A+ w/512k	Default (no change)	407824-002
3151	407719-012	3151A+ w/512k, 1ppm	Default (no change)	407824-012

Note: All old 3151 (407382-xxx) and 3151A (407719-xxx) models are obsolete. Use the appropriate 3151A+ configuration as a direct replacement. The user selects the emulation mode.

ORDERING INFORMATION

Model	Description	Part Number
3151A+ w/64k	100MS/s Waveform Generator w/64k RAM	407824-001
3151A+ w/512k	100MS/s Waveform Generator w/512k RAM	407824-002
3151A+ w/64k, 1ppm	100MS/s Waveform Generator w/64k RAM, 1ppm	407824-011
3151A+ w/512k, 1ppm	100MS/s Waveform Generator w/512k RAM 1ppm	407824*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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