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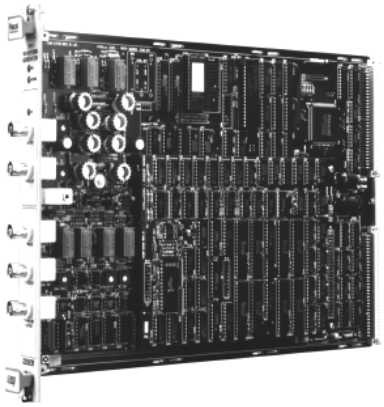
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# RACAL INSTRUMENTS™ 3151A+



## 100 MS/s Waveform Generator

- **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 Down-load Feature**

Racal Instruments™ 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 □Hz 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 3151A+ in combination with included WaveCAD™ software allows sophisticated waveform generation for many test applications.

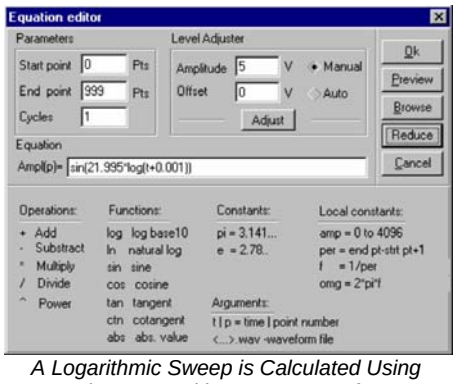
**VXIbus: A Cost Effective Format**
The 3151A+ is a sensible alternative to a GPIB-based waveform generator when developing a VXI-based test system. The 3151A+ provides a synergistic combination of a function generator, pulse generator, programmable sequencer and arbitrary waveform synthesizer in one 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.

EADS NORTH AMERICA DEFENSE

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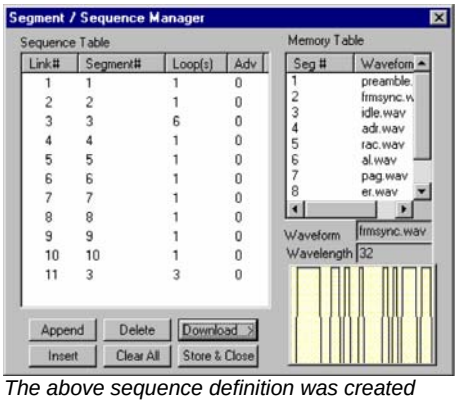

*A Logarithmic Sweep is Calculated Using Equation Entry with WaveCAD Software*

**Up to 512 k of Waveform Memory for High Speed Testing**

The 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.

**VXIplug&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 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 m | 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°

**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°

**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 □Hz 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: 120 ns +2 clock periods
Waveforms: ± 1 clock period
Arbitrary: 150 ns +2 clock periods
Waveforms: ±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°+P.O.R.)

**Phase Offset Resolution (P.O.R.)**
360° / (Number of points)

**Phase Offset Range**
0° to 360°-2880°/n
(Where n is the number of points in the selected memory segment.)

**Synchronization Source**
ECLTRG0-1

**Sample Clock Rate**
p to 66 MS/S

# 3151A+ PRODUCT INFORMATION

## 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: $Z_{out}$t = 50 Ω

Marker/Sync: $Z_{out}$ = 50 Ω, TTL

10 MHz Reference Output: $Z_{out}$t= 50 ΩTTL

## VXIBUS INTERFACE DATA

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

### Software

SCPI, IEEE 488.2

### Drivers

LabVIEW, LabWINDOWS/CVI, VXIplug&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° C Rise)

3.7l/s @0.55 mm$H_20$

### 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° C-55° C

Specification Compliance: 20° C- 30° C for specified data; 30-minute warm-up; 50 Ω load

Storage: 40° C-+70° C

### Humidity (non-condensing)

11° C-30° C, 95% ±5%

31° C-40° C, 75% ±5%

41° C-50° 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.

**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.**

## ORDERING INFORMATION

| MODEL/DESCRIPTION | PART NUMBER |
|---|---|
| Racal Instruments 3151A+ w/64k, 100MS/s Waveform Generator w/64k RAM | 407824-001 |
| Racal Instruments 3151A+ w/512k, 100MS/s Waveform Generator w/512k RAM | 407824-002 |
| Racal Instruments 3151A+ w/64k, 1ppm, 100MS/s Waveform Generator w/64k RAM, 1ppm | 407824-011 |
| Racal Instruments 3151A+ w/512k, 1ppm, 100MS/s Waveform Generator w/512k RAM 1ppm | 407824-012 |

The EADS North America Defense Test and Services policy is one of continuous development, consequently the equipment may vary in detail from the description and specification in this publication.

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