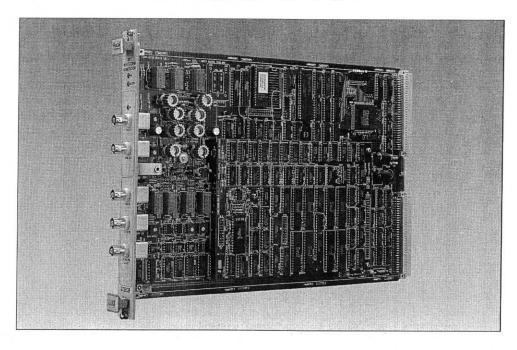# 100 MS/s Waveform Generator Model 3151

- **Wide Frequency Range:** µ100 Hz to 50MHz

- **Built-in Waveforms:** Triangle$^{(x)}$, Sine$^{(x)}$, Sinc, Square, Ramp, Pulse, DC, Exponential & Gaussian Pulse

- **Custom Arbitrary Waveforms:** Created with WaveCAD™ Software

- **Enhanced Waveform Modification:** Filtering, Smoothing and Inversion

- **Sequences and Loops:** Link Together Up To 4096 Waveforms

The Racal Instruments Model 3151 100MS/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 50MHz with 12 bit vertical resolution makes this single-slot, C-sized card a powerful solution to the most demanding test stimulus requirements.

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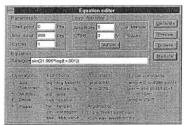
VXIbus: A Cost Effective Format
The 3151 is a sensible alternative to a GPIB based waveform generator when developing a VXI-based test system. The 3151 provides a synergistic combination of a function generator, pulse generator, programmable sequencer and arbitrary waveform synthesizer in one instrument.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

Flexible Triggering Capability
Combining VXIbus trigger lines with the 3151's sync capability transforms the 3151 into an Arbitrary Trigger Generator. In addition to continuous output, the 3151 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 3151 can trigger immediately or delay up to 1M wave points.

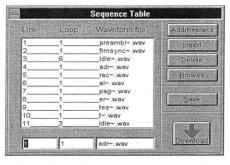### WaveCAD Software: Unlimited Source of Arbitrary Waveforms

With the 3151's WaveCAD Graphical Waveform Creation software you can create virtually an unlimited variety of production or engineering test stimuli. Freehand sketch mode allows you to draw your 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 you to create your own exotic functions. You may want to add or subtract components of a Fourier series to characterize digital or analog filters. Or you might inject random bursts into a signal to test immunity to switching noise.

A Logarithmic Sweep is Calculated Using Equation Entry with WaveCAD Software

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 1M 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 3151's output waveform is connected to the FSK input of a Racal Model 3271 Signal Generator to produce RF Paging Signals.

100 MegaSamples Per Second Sample Rate

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

VXI*plug&play* Drivers

Test system design and integration is simplified with VXI*plug&play* drivers for Windows 3.1, Windows 95 and Windows NT. Both LabWindows/CVI and LabVIEW are supported at the driver level. These drivers provide precise control of the Model 3151. A soft front panel is also included for "hands-on" access to 3151 features.

3151 Specifications

AMPLITUDE CHARACTERISTICS

Amplitude
20mV - 32V$_{pk-pk}$, output open circuit
10mV - 16V$_{pk-pk}$, into 50W

Resolution
4 digits

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

DC Offset Ranges (within specified windows)

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

DC Offset Resolution
4 digits

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

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

Standby (Output Disconnected)
Output On or Off

Output Protection
Short circuit

Glitch Energy
1nV-s at 16V$_{pk-pk}$

STANDARD WAVEFORMS

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

Frequency Resolution
4 digits

Accuracy
±.01% of setting

Stability
100ppm

Sine^x *(Sine function raised to the xth power)*

Frequency Range
100µHz to 50MHz

Distortion (2000 points)
< 0.1% below 100kHz

Harmonics

Frequency	Amplitude	Harmonic Level
<5MHz	10V$_{pk-pk}$	-50dBc
<5MHz	16V$_{pk-pk}$	-45dBc
<10MHz	10V$_{pk-pk}$	-40dBc
<10MHz	16V$_{pk-pk}$	-35dBc
<50MHz	10V$_{pk-pk}$	-28dBc
<50MHz	16V$_{pk-pk}$	-23dBc

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

Phase Range
0-360°

Exponent Range
Sine^1-Sine^9

Triangle^x *(Triangle function raised to the xth power)*

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

Phase Range
0-360°

Exponent Range
Triangle^1-Triangle^9

Square Wave
Frequency Range
100µHz to 50MHz
Duty Cycle Range
1% - 99%
Rise/Fall Time
6ns
Aberration
5%

Pulse and Ramp Functions
Frequency Range
100µHz to 1MHz
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)
6ns
Aberration
5%

Sinc Function (Sine(x) x)
Frequency Range
100µHz to 1MHz
Range of Cycles
4 to 100

Gaussian Pulse Function
Frequency Range
100µHz to 1MHz
Exponent
1 to 200

Exponential Pulse Function
(Pulses with exponential rise or decay times)
Frequency Range
100µHz to 1MHz
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
64k-points standard or 512k-points optional
Vertical Resolution
12 bits (4096 points)

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)
2048 Segments: N=4096
>2048 Segments: N=4096-number of looped segments
Segment Loops
0 to 1 Meg
Segment Duration
100ns minimum, > 1 loop

SAMPLING CLOCK

Internal Source Range
100mHz to 100MHz
External Source Range
Up to 100MHz
VXIbus Backplane Source
ECLTRG0 up to 100MHz
Internal Reference
Standard: VXIbus CLK10
Optional: 10MHz crystal
1 or 100ppm accuracy

OPERATING MODES

(Normal, Sequenced, Triggered, Triggered Sequence Advance, Delay Triggered, Gated, Burst, Amplitude Modulated)
Normal Mode
Continous 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 segment 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 to 1million 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: 10Hz to 500Hz
AM Depth: 1% to 200%

TRIGGERING CHARACTERISTICS

Sources
Internal: 1mHz-50kHz timer
External: TTL input, Z_{in}= 1 kΩ
VXI Backplane: TTLTRG0-7
Maximum Trigger Frequency
Internal Timer: 50kHz
External : 5MHz
Minimum External Trigger Pulse Width
20ns
Trigger slope
Positive or negative
Trigger Delay
0 to 2 Meg points (sample clocks)
System Delay (Trig I/P to Waveform O/P)

Standard Waveforms:	120ns +2 clock periods ± 1 clock period	
Arbitrary Waveforms	150ns +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
± (20ns *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.)
Phase Jitter
None
Synchronization Source
ECLTRG0-1

3151 Specifications Continued

FRONT PANEL I/O
(accessed with BNC connectors)

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

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

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 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 Failure
Yellow: Module accessed on VXIbus
Green: Output on/off

Cooling (10° Rise)
3.7l/s @0.55mmH$_2$0

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°-30°C for specified data, 30 min. warm-up, 50Ω 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)
2g at 55Hz

Shock (non-operating)
30g, 11mS 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

CE — The CE Mark indicates that a 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**
3151	100MS/s Waveform Generator, 100MHz w/ 64K RAM	407382-001
3151 w/512K	100MS/s Waveform Generator, 100MHz w/ 512K RAM	407382-002
3151 w/64K (1PPM)	100MS/s Waveform Generator, 100MHz w/ 64K RAM, 1PPM	407382-011
3151 w/512K, (1PPM)	100MS/s Waveform Generator, 100MHz w/ 512K RAM, 1PPM	407382-012
3151 w/64K (100PPM)	100MS/s Waveform Generator, 100MHz w/ 64K RAM, 100PPM	407382-021
3151 w/512K (100PPM)	100MS/s Waveform Generator, 100MHz w/ 512K RAM, 100PPM	407382-022

WORLDWIDE SUPPORT

LLOYD'S REGISTER QUALITY ASSURANCE · ISO9001

VXI plug&play

http://www.racalinst.com