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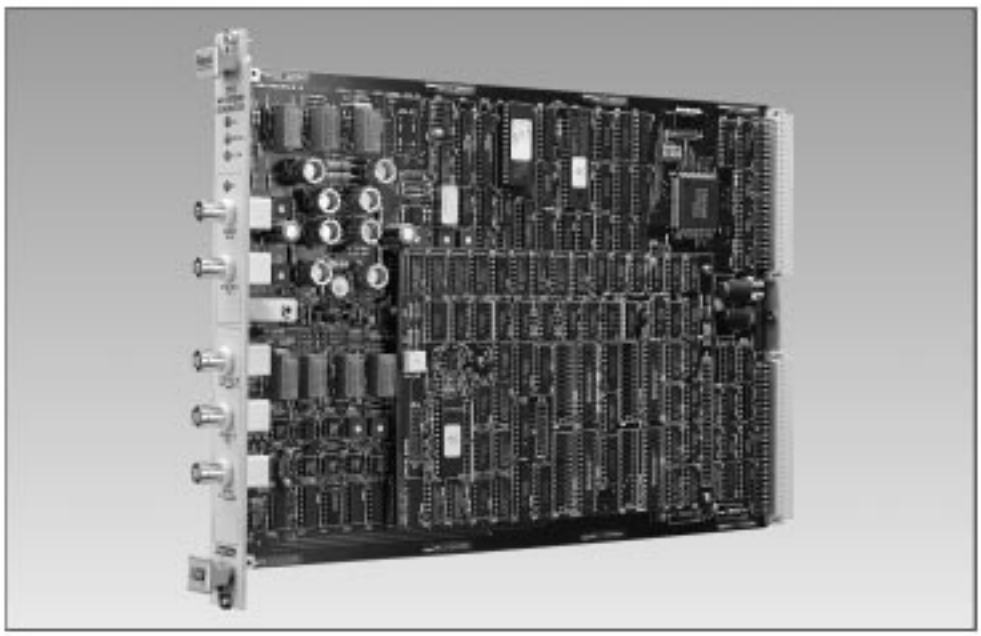
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Precision PLL Waveform Synthesizer Model 3152



- **Wide Band Performance--100µHz to 50MHz**
- **Built-in Waveforms: Triangle(x), Sine(x), Sinc, Square, Ramp, Pulse, Arbitrary**
- **Phase Locks to External Analog Signals: 500Hz to 10MHz, 100mV to 30Vrms**
- **High Performance Frequency Synthesis: 7 Digit Resolution and Accuracy to 1ppm**
- **External Phase Modulation**
- **Built-in 4 Digit Frequency Counter**

The Racal Instruments Model 3152 Waveform Synthesizer combines 100MS/s performance, versatility and compact size in a single-slot VXIbus format. Signal output in the range of 100µHz to 50MHz with 12-bit vertical resolution satisfies the most demanding test stimulus and telecommunications requirements.

Multifunctional Performance
The 3152 provides a synergistic combination of a function generator, pulse generator, programmable sequencer and arbitrary waveform synthesizer in one instrument. In addition, the 3152 integrates a phase lock loop, phase modulation and a frequency counter into a single-slot module saving valuable space.

7 Digit Frequency Resolution
The 3152's DDS (Direct Digital Synthesis) frequency synthesizer provides the high signal-noise ratio (70dB, typical) and low phase-noise and jitter needed for telecommunications test applications.

Phase Locking and Phase Modulation
The 3152 is the first VXIbus module to incorporate external analog Phase Modulation (PM) and Phase Locking to external analog waveforms into a single instrument. The PM feature is useful in real-time phase offset control and telecom applications. The phase lock feature automatically locks the 3152's output to external signals at frequencies up to 10MHz and voltages up to 30Vrms. Phase offset is programmable with 0.01° resolution and the trigger threshold is programmable with 10mV resolution.

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

Built in Frequency Counter
The 3152's PLL function adds 4-digit frequency readback for any external signal up to $30V_{rms}$ in amplitude and 10MHz in frequency. This makes the 3152 usable for general purpose frequency counter applications.

100 MegaSamples/Second Sample Rate
A high sample rate of 100MS/s makes the 3152 an ideal modulation source for troubleshooting new encoding schemes that use increasingly narrow channel widths. The 3152 also can provide high speed waveforms to simulate signal distortion, power line cycle dropouts, component failures and power supply transients.

Flexible Triggering Capability
Combining VXIbus trigger lines with the 3152's sync capability transforms the 3152 into an Arbitrary Trigger Generator. In addition to continuous output, the 3152 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 3152 can trigger immediately or delay up to 1 meg wave points. Precise trigger level control is provided to ±10V with 10mV accuracy.

VXI*plug&play* Drivers
The 3152 simplifies test system design and integration with VXI*plug&play* drivers and soft front panels. These drivers provide full control of the Model 3152.

Arbitrary Waveform Creation
The Model 3152 in combination with WaveCAD™ software allows sophisticated waveform generation for many test applications.

3152 Specifications

AMPLITUDE CHARACTERISTICS

Amplitude
20mV - $32V_{pk\text{-}pk}$, into open circuit
10mV - $16V_{pk\text{-}pk}$, into 50Ω

Resolution
4 digits

Amplitude Ranges
R1: 10.00mV-160.0mV
R2: 160.1mV-1.600V
R3: 1.601V-16.00V

Accuracy (at 1kHz)
±1% of setting

DC Offset Range
0 to ± 7.19V

DC Offset Accuracy
R1: $\pm(1\%V_{ampl.}+1\%V_{ofs.}+0.2mV)$
R2: $\pm(1\%V_{ampl.}+1\%V_{ofs.}+2mV)$
R3: $\pm(1\%V_{ampl.}+1\%V_{ofs.}+20mV)$

Waveform Dynamic Range
$V_{ampl.}+V_{ofs.}\leq$max. of selected amplitude range: 12bits
$V_{ampl.}+V_{ofs.}>$max. of selected amplitude range: <12 bits (derates as V_{ofs} is increased)

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 $16V_{pk\text{-}pk}$

STANDARD WAVEFORMS

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

Frequency Resolution
7 digits

Accuracy & Stability
Same as frequency standard

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

Frequency Range
100µHz to 50MHz

Distortion (2000 points)
< 0.1% below 100kHz

Harmonics

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

Band Flatness
< 1MHz: 1% (0.09dB)
< 10MHz: 5% (0.42dB)
< 50MHz: 15% (1.2dB)

Phase Range
0-360°

Exponent Range
Sine^1-Sine^9

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

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

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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 free-hand, using equations, simulation tools or digitized waveforms.

Waveform Memory
64k-points standard with 256k 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 million

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, AM)

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.

Triggered 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.

Phase Lock Mode
Phase locks either a standard or arbitrary waveform to an external signal up to 30V_{rms}.

Phase Modulation (external)
PM Modulation Rate: 0 to 10kHz

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

TRIGGER CHARACTERISTICS

Sources
Internal: 1mHz-50kHz timer
External: 10kΩ, 100mV to 30Vrms
Level (Programmable): ±10V
Resolution: 10mV
Sensitivity: ± (5% of level + 150mV)
VXI Backplane: TTLTRG0-7

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

Minimum External Trigger Pulse Width
20ns

Trigger Slope
Positive or negative (programmable)

Trigger Delay
0 to 2 million 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

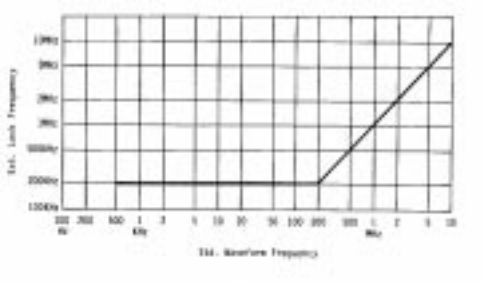
Sync Output
Front Panel: TTL
VXI Backplane: TTLTRG0-7

Sync Sources
Any point, sequence complete, ½ clock period

PLL CHARACTERISTICS

Operation
Automatically locks to external signal

PLL Input Characteristics
Same as TRIG IN



External Lock Frequency Range
Standard Waveforms: see curve above
Arbitrary Waveforms: 500Hz to 100 MHz divided by number of waveform samples

Coarse Phase Offset Range
±180°

Resolution
Std. Waveforms: 0.72°, frequency settings from 500Hz to 200kHz; 360° x frequency (in MHz) / 100, freq. settings from 200kHz to 10MHz
Arbitrary Waveforms: 360°/ number of waveform samples

Accuracy
5.4 x frequency (in MHz) + resolution/2

Fine Phase Offset Control Range
±36° around coarse phase offset setting

Resolution
0.01°

Accuracy
10%, typical

FREQUENCY COUNTER

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

Range
Same as External Lock Frequency Range above

Resolution
4 digits

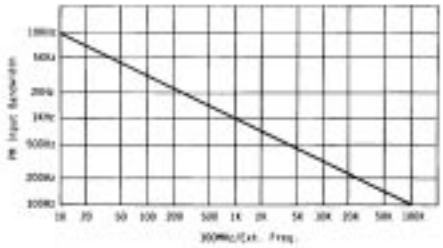
PM CHARACTERISTICS

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

PM Input
Impedance: 100kΩ, ±5%
Sensitivity: 20mV, typical
Accuracy: ±30%

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3152 Specifications Continued



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.)
720° /n (where n is the number of points in the memory segment and is 10 or greater)

Phase Offset Range
0° to 360° - 2880°/n

Phase Jitter
None (master and slave modules use the same sample clock.)

Synchronization Source
ECLTRG0-1

FRONT PANEL I/O

(Accessed with BNC connectors)

Inputs
Trigger/Gate: Z_{in} = 1kΩ, TTL level
External Sample Clock: TTL level
Phase Modulation Input: 100kΩ, 30Vrms Max.

Outputs
Waveform: Z_{out} = 50Ω
Marker/Sync: Z_{out} = 50Ω, TTL

VXIbus INTERFACE DATA

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

Software
SCPI, IEEE 488.2

Drivers
LabVIEW, LabWindows/CVI, VXI*plug&play* WIN Framework

Shared Waveform Memory
A24 VME block transfer

Backplane Signal Support
TRG0-7: Trigger In, Sync Out
ECLTRG0-1: Sample Clock Source, Module Synchronization

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

Cooling (10° Rise)
3.7l/s @0.55mmH_20

Peak Current & Power Consumption

	+24	+12	+5	-5.2	-12	-24
I_{Pm}(A)	.25	.10	3.0	2.0	.05	.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: 15,000 feet
Storage: 15,000 feet

Vibration (non-operating)
2g at 55Hz

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

Weight
3lbs 4oz. (1.5kg)

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**
3152	100MS/s Waveform Generator, 100MHz w/64K RAM	407510-001
3152 w/256K	100MS/s Waveform Generator, 100MHz w/256K RAM	407510-002
3152 w/512K	100MS/s Waveform Generator, 100MHz w/512K RAM	407510-003
3152 w/64K (1PPM)	100MS/s Waveform Generator, 100MHz w/64K RAM, 1PPM	407510-011
3152 w/256K, (1PPM)	100MS/s Waveform Generator, 100MHz w/256K RAM, 1PPM	407510-012
3152 w/512K (1PPM)	100MS/s Waveform Generator, 100MHz w/512K RAM, 1PPM	407510-013
3152 w/64K (100PPM)	100MS/s Waveform Generator, 100MHz w/64K RAM, 100PPM	407510-021
3152 w/256K (100PPM)	100MS/s Waveform Generator, 100MHz w/256K RAM, 100PPM	407510-022
3152 w/512K (100PPM)	100MS/s Waveform Generator, 100MHz w/512K RAM, 100PPM	407510-023

WORLDWIDE SUPPORT

http://www.racalinst.com

LLOYD'S REGISTER QUALITY ASSURANCE 100650SI

VXI plug&play

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