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Racal Instruments™ 3172

200 MS/s Waveform Generator & Dual 50 MHz Pulse/ Timing Generator

The Racal Instruments™ 3172, a 200 MS/s Waveform Generator and Dual 50 MHz Pulse and Timing Generator, combines multi-instrument density and high-frequency performance in a single-slot, C-sized VXIbus format.

Waveform output in the range of 100 µHz to 30 MHz with 16-bit vertical resolution (12-bit vertical for 3171 emulation) and pulse output to 50 MHz make the 3172 a powerful solution to a variety of test stimulus requirements.

Key Features

- **200 MS/s, 22 V_{pk-pk} or 20 V_{pk} arbitrary waveforms**
- **Built-in waveforms: Triangle, Sine, Square, Ramp, Pulse, Arbitrary, and DC**
- **1 M waveform memory**
- **Dual 50 MHz, 22 V_{pk-pk} or 20 V_{pk} pulse generator**
- **Trigger delays up to 10 s with 10 ps resolution**
- **External 1 MHz amplitude modulation**
- **Register- or message-based VXIbus or LAN operation**

Product Information

Multi-Instrument Functionality

The 3172 is a synergistic combination of an Arbitrary Waveform Generator (AWG) and a Dual Pulse Generator. In fact, it is really up to four independent instruments in one module that may be used simultaneously for up to four separate purposes or together to create complex pulse or trigger sequences.

System modularity is maximized by allowing the 3172 to be configured as one AWG and two pulse generators or in any combination of these two items.

Legacy 3171 Replacement

The 3172-W6P2 is the recommended replacement for the legacy 3171 AWG/ Dual Pulse Generator because it emulates the software commands, waveforms, and trigger modes of the original unit when set to “Legacy” mode.

In addition, two output ranges (0 to +20 V and 0 to -20 V) have been added and are accessible from “Legacy” mode. Isolated output of the waveform generator is not emulated.

“Modern” mode adds many features including internal modulation (AM, FM, frequency and amplitude hopping, sweep, FSK, etc.), LAN control, USB I/O, higher frequency output waveforms, more waveform memory, modular configuration, a built-in counter/timer, waveform segments and sequences, peak output mode, 11-digit frequency resolution, higher speed operation, and phase locking.

Built-In Digital Word Generator

The AWG output is available as both an analog signal (up to 22 V_{pk-pk} into 50 Ω) or as a 12-bit digital word with TTL levels that can source or sink 15 mA. This powerful feature may be used as 12 synchronous TTL pulse outputs or as a 12-bit digital pattern generator.

External Amplitude Modulation (AM)

The AWG output may be controlled in amplitude by an external DC signal up to ±10 V or modulated in amplitude by an external AC signal up to 1 MHz.

This feature allows for real-time control of the AWG output for both control system applications and AM signal generation for telecom applications.

The W2 option provides high-performance AM operation while the W6 option provides AM operation that is compatible with the legacy 3171.

Dual Pulse Generator

The two pulse generator outputs are available with programmable rise and fall times ranging from 10 ns to 5 ms. Pulse and double pulse width and delay parameters are programmable on both pulse generators from 8 ns to 10 s with up to 10 ps resolution.

ASTRONICS TEST SYSTEMS

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Product Information

continued

Flexible Triggering

Output channels may be synchronized to each other or to other 3172 modules within the same VXI mainframe using triggers. Waveforms may be output continuously, one or more cycles per trigger or under the control of a gate signal. A sync and cursor output signal provides external synchronization.

True Arbitrary Waveforms and DDS Waveforms

Each 3172 waveform channel can be set to output a true arbitrary waveform played from waveform memory in either standard, user, or sequence mode. In modulated mode, a Direct Digital Synthesis (DDS) waveform is substituted. Thus, the 3172 provides the two most popular digital waveform generation techniques.

Specifications

Note: The Astronics Test Systems policy is one of continuous development and improvement. Consequently, the equipment may vary in detail from the description and specifications in this publication.

Also note that specifications may apply to AWG only or Pulse Generator 1 (PG1) and Pulse Generator 2 (PG2) only when specified.

Amplitude Characteristics

Amplitude Modes
- "Symm" mode (symmetrical about 0 V) "Pos" (0 V to +V_{pk}), and "Neg" (0 V to -V_{pk})

Amplitude (Z_{out} <2 Ω)
- "Symm" mode: 5 mV to 22 V_{pk-pk} into 50 Ω or open circuit
- "Pos" mode: +5 mV to +20 V_{pk} into 50 Ω or open circuit
- "Neg" mode: -5 mV to -20 V_{pk} into 50 Ω or open circuit

Amplitude (Z_{out} = 50 Ω)
- "Symm" mode: 2.5 mV to 11 V_{pk-pk} into 50 Ω
- "Pos" mode: 2.5 mV to 10 V_{pk} into 50 Ω
- "Neg" mode: -2.5 mV to -10 V_{pk} into 50 Ω

Resolution
- FSR/4096 (FSR per range definitions as shown in accuracy section below)

Accuracy (1 kHz, 50 Ω, "Symm" mode)
- 1 to 11 V_{pk-pk}: ±(1% +50 mV)
- 100 mV_{pk-pk} to 1 V_{pk-pk}: ±(1% +20 mV)
- 10 to 100 mV_{pk-pk}: ±(1% +5 mV)

Accuracy (1 kHz, 93 Ω, "Symm" mode)
- 1 to 11 V_{pk-pk}: ±(2% +50 mV)
- 100 mV_{pk-pk} to 1 V_{pk-pk}: ±(2% +20 mV)
- 10 to 100 mV_{pk-pk}: ±(2% ±5 mV)

Accuracy (1 kHz, >1 MΩ, "Symm" mode)
- 1 to 11 V_{pk-pk}: ±(2.5% +100 mV)
- 100 mV_{pk-pk} to 1 V_{pk-pk}: ±(2.5% +40 mV)
- 10 to 100 mV_{pk-pk}: ±(2.5% +10 mV)

DC Offset Range
- "Symm" mode: 0 to ±11 V
- "Pos" mode: 0 to 20 V
- "Neg" mode: 0 to -20 V

DC Offset Resolution
- 1 mV

DC Offset Accuracy
- 50 Ω: ±(1% ±1% from amplitude ±15 mV)
- 93 Ω: ±(2% ±1% from amplitude ±15 mV)
- >1 MΩ: ±(2.5% ±2% from amplitude ±30 mV)

Output Impedance (selectable)
- <2 Ω, 50 Ω or 93 Ω

Low-Pass Filters (AWG only)
- 2 and 25 MHz Bessel, 60 and 120 MHz Elliptic

Standby
- Output "On" or "Off"

Output Protection
- Current limit (400 mA)

Standard Waveforms

(Sine, Triangle, Square, Pulse, Ramp, Noise, DC)

Frequency Resolution (AWG only)
- 11 digits

Accuracy and Stability
- Same as frequency standard

Sine

Frequency Range
- 100 µHz to 30 MHz

Phase Adjustment
- Range: 0 to 359.95º
- Resolution: 0.05º

Harmonics and Spurious

Frequency	<5 V_{pk-pk}	<10 V_{pk-pk}
<30 MHz	29 dBc	25 dBc
<10 MHz	44 dBc	35 dBc

Flatness (<5 V_{pk-pk})
- <30 MHz: 12%
- <10 MHz: 7%
- <1 MHz: 1%

THD (STD and CW)
- <100 kHz: 0.2%

Square

Frequency Range
- 100 µHz to 30 MHz

Duty Cycle Range
- 0% to 99.99%

Rise/Fall Time (10% to 90%)
- <11 ns

Aberration
- <6.5%

Triangle

Frequency Range
- 100 µHz to 10 MHz

Phase Adjustment
- Range: 0 to 359.95º
- Resolution: 0.05º

Pulse and Ramp Functions

Frequency Range
- 100 µHz to 10 MHz

Delay, Rise/Fall Time, High Time Ranges
- 0% to 99.99% of period (each independently)

Gaussian Pulse Time Constant Range
- 1 to 200

Sinc Pulse "Zero Crossings" Range
- 4 to 100

Exponential Pulse Time Constant Range
- -200 to 200

DC Output Function

Range
- -100% to 100% of amplitude

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Specifications
continued

Modulated Waveforms
(AWG)

Carrier Frequency Range
- 10 Hz to 30 MHz

Baseline (pre-trigger state)
- DC or Carrier Frequency, selectable

Modulation Waveform
- AM, FM: Sine, Triangle, Square, or Ramp
- Arbitrary FM: Arbitrary Waveform
- Others: Sine

Run Modes
- Continuous, Triggered, Burst, and Gated

Run Mode Advance Source
- Software commands, front panel “Trig In,” backplane TTLTrg0-7

Trigger Delay Range
- 0, 100 ns to 20 s

Re-trigger Delay Range
- Range: 100 ns to 20 s
- Resolution: 20 ns

Trigger Jitter
- ±1 sample clock period

Amplitude Modulation
(AWG)

AM Carrier
- Internal AM: Sine (10 mHz to 30 MHz)
- External AM: Standard or user waveform

AM Modulation Waveform
- Sine, Triangle, Square, Ramp or External

AM Modulation Bandwidth
- Internal: 10 mHz to 100 kHz
- External: DC to 1 MHz

AM Depth
- Internal AM: 0% to 200%
- External AM: 0% to 150%
- ±5 V for 100% modulation

External AM Input Range
- -10 V to +10 V
- 10 V_{pk-pk} for 100% AM Depth

External AM Input Impedance
- 10 kΩ

Frequency Modulation
(AWG)

Modulating Frequency Range
- 10 mHz to 350 kHz

Peak Deviation
- Up to 15 MHz

Arbitrary FM Mode
- Sampling clock range: 1 S/s to 2.5 MS/s
- Frequency array size: 2 to 10k

Marker Output
- Programmable at selected frequencies

FSK, PSK, ASK
(AWG)

Baud Rate Range
- FSK, PSK: 1 bit/s to 10 Mbits/s
- ASK: 1 bit/s to 10 Mbits/s

Internal Data Bits
- 2 to 4000

Marker Output
- Programmable at selected bits

Frequency/Amplitude Hopping
(AWG)

Hopping Function
- Frequency or amplitude

Hop Table Size
- 2 to 5000, amplitude hops
- 2 to 1000, frequency hops

Advance Source
- Internal

Dwell Time Range
- 200 ns to 20 s

Dwell Time Resolution
- 20 ns

Dwell Time Mode
- Fixed or variable for each step

Hop Frequency Range
- 10 Hz to 30 MHz

Amplitude Hopping Range (Lo-Z)
- “Symm” mode: 2.5 mV to 22 V_{pk-pk}
- “Pos” mode: +2.5 mV to 20 V_{pk}
- “Neg” mode: -2.5 mV to -20 V_{pk}

Amplitude Hopping Resolution (Lo-Z)
- V_{max} ≥1 V: 5 mV
- V_{max} ≤1 V: 250 µV
- V_{max} ≤100 mV: 25 µV

Marker Position
- Programmable on a selected hop table index

Arbitrary Waveforms
(AWG)

Waveform Memory
- 1 M pts

Vertical Resolution
- 16 bits (12 bits for 3171 emulation)

Segment Size Range
- 10 pts to 1 M pts, even number

Segments/Channel
- 1 to 16k

Sequenced Waveforms
(AWG)

Operation
- Segments may be linked and repeated in a user-selectable fashion to generate extremely long waveforms. Segments are advanced using either a command or a trigger.

Advance 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 a trigger advances the sequence to the next programmed segment and sample clock rate.
- Single Sequence Advance

  Current segment is sampled the specified number of repetitions and then idles at the end of the segment. Next trigger samples the next segment the specified repeat count, and so on.
- Mixed Sequence Advance

  Each step of the sequence can be programmed to advance automatically (“Auto” mode) or with a trigger (“Stepped” mode).

Sequencer Steps
- 1 to 4096

Segment Loops
- 1 to 1 M

Segment Duration (min)
- 500 ns

Digital Pattern Generator
(AWG)

Digital Word Width
- 12 bits

Level
- TTL

Current (Source and Sink)
- ±15 mA

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Specifications
continued

Pulse Waveforms
(PG1 & PG2 only)

Frequency/Period Resolution
- 4 digits

Accuracy
- ±0.01% of set

Stability
- 100 ppm

Frequency Range
- 0.1 Hz to 50 MHz

Pulse Modes
- Single or double
- Hold duty cycle

Pulse Polarity
- Normal or inverted

Pulse Width Range
- 8 ns to 10 s

Pulse Width Resolution
- 5 digits limited by 10 ps

Pulse Width Accuracy
- ±(3% + 500 ps)

Rise & Fall Times
- 4 ns to 5 ms within 6 ranges (independent rise/fall times)

Pulse Delay Range
- 0 ns to 2 s

Pulse Delay Resolution
- 10 ps, limited by 5 digits

Pulse Delay Accuracy
- ±(3% + 500 ps)

Sampling Clock
(AWG)

Source
- Internal or external (TTL and ECL)

Internal Source Range (worst case)
- 100 mS/s to 200 MS/s

Resolution
- 11 digits

Accuracy and Stability
- Same as reference

Reference Clock
- CLK10: 100 ppm (typical)
- Internal TCXO: 1 ppm, 19° C to 29° C
- Drift: 1 ppm/yr

Operating Modes
(Normal, Triggered, Delay Triggered, Burst, Gated)

Normal Mode
- Continuous output of a waveform

Sequenced Mode (AWG only)
- Continuous or triggered output of a sequence of waveform segments (see Sequenced Waveforms)

Sweep Mode (AWG only)
- Continuous output of a swept waveform

Triggered Mode
- One waveform cycle is output

Delayed Trigger Mode
- Delays from trigger by 100 ns to 20 seconds
- Delay resolution
  - AWG: 20 ns
  - PG1 & PG2: 10 ps or 5 digits (same as pulse delay)

Burst Mode
- Waveform repeated 1 to 1 M times

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.

Amplitude Modulation (AWG only)
- Output of the AWG may be amplitude modulated by an external analog signal up to ±10 V and with a BW of up to 400 kHz

Phase Lock Mode (AWG only)
- Phase locks a standard or arbitrary waveform to an external signal to 30 V_{rms}

Modulation Mode (AWG only)
- CW or AM, FM, FSK, PSK, ASK, Sweep, Frequency/Amplitude Hopping

Phase Modulation (external; AWG only)
- PM modulation rate: 0 to 10 kHz

Counter/Timer (AWG only)
- Measures Frequency, Period, Period Averaged, Pulse Width, and Events

Triggering Characteristics

Sources
- Internal: 1 µs to 20 s, programmable
- External
  - Input impedance: 10 kΩ
  - Damage level: 30 V_{rms}
  - Level (programmable): ±10 V
  - Resolution: 10 mV
  - Sensitivity: 100 mV_{rms}
- VXI backplane: TTLTRG0-7

Maximum Trigger Frequency
- Internal timer: 50 mHz to 1 MHz
- External: DC to 5 MHz

External Trigger Pulse Width
- 10 ns (min)

Trigger Slope
- Pos or neg

System Delay (Trig I/P to Waveform O/P)
- 150 ns + 6 clock periods

Trigger Delay (Trig I/P to Waveform O/P)
- 100 ns to 20 s + system delay
- Resolution: 20 ns
- Accuracy: 150 ns + 6 clock periods + 5% of set

Re-trigger Delay (Waveform end to restart)
- Resolution: 20 ns
- Accuracy: 20 ns + 3 clock periods + 5% of set

Sync Output (AWG)
- Front panel D-Sub: TTL
- VXI backplane: TTLTRG0-7

Cursor Output (AWG)
- Any pt (digital patterns only)

AWG Sync Pulse
- Width range: 4 to n-8 clock periods
- Position range: 0 to n (Where n is the number of points in the selected memory segment)
- Resolution: 4 pts

AWG Sync Sources
- Any pt, sequence complete, ½ clock period

PLL Characteristics
(AWG only)

Operation
- Automatically locks to external signal

PLL Input Characteristics
- Same as “Trig In”

External Lock Frequency Range
- STD waveforms: 500 Hz to 10 MHz
- AWG waveforms: 500 Hz to 100 MHz divided by # of pts in segment

Coarse Phase Offset Range
- ±180°

Fine Phase Offset Control
- Range: ±36°
- Resolution: 0.01°

Phase Control Accuracy
- 2% ± sample clock period

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Specifications
continued

Counter Characteristics
(AWG only)

Operation
- "Counter/Timer" mode, when enabled, disables waveform generation

Measurement Functions
- Frequency, Period, Period Averaged, Pulse Width, and Totalize

Input Characteristics
- Input BNC: front panel TRIG IN
- Trigger level range: ±10 V
- Sensitivity: 500 mV_{pk-pk}
- Damage level: ±12 V
- Slope: pos or neg
- Min pulse width: 10 ns

Frequency, Period Averaged
- Frequency: 20 Hz to 100 MHz
- Period: 10 ns to 50 ms
- Resolution: 7 digits/s

Period, Pulse Width
- Range: 500 ns to 50 ms
- Resolution: 100 ns

Totalize
- Frequency: 20 Hz to 100 MHz
- Event counting range: 1 to 1012-1

Gate Time
- Frequency: 100 µs to 1 s

Reading Modes
- Repetitive: Continuous measurements when signal is present
- Hold: Single measurement on command
- Gated: Active in "Gated Totalize" mode

Amplifier Options

Configurations
- A3: 122 V_{pk-pk} output, gain = 12.2
- A4: 244 V_{pk-pk} output, gain = 24.4

Operational Modes
- Amplified output, "Bypass" mode, 75 Ω "Bypass" mode

Output Specifications
- Frequency range: 0 to 100 kHz
- Load impedance: < 50 Ω
- Accuracy: ±3%
- Current: 500 mA (max)

Interface

Bus Operation
- VXIbus message-based (MB-VXI) and LAN or register-based (RB-VXI)

Emulation Modes
- Legacy: 3171 emulation
- Modern: Full support of all new features

Backplane Trigger Lines
- Allow synchronization of multiple 3172s

Status Lights
- Green: AWG on
- Green: PG1/PG2 on
- Amber: Link
- Amber: PLL locked

Peak Current & Power Consumption
- Total power: <35 W

	I_{Pm}(A)	I_{Dm}(A)
+24	0 .116	0.03
+12	0.07	0.011
+5	1.74	0 .014
–2	0	0
-5.2	1.8	0.15
-12	0.06	0.01
-24	0.112	0.01

Front Panel I/O

I/O Ports
- LAN: RJ45
- USB 2.0: Type A jack

Inputs
- Trig/Gate (AWG): Programmable threshold, 0 to 5 MHz
- Sample clock(AWG): PECL
- PM in (AWG): ±10 V
- AM in (AWG): ±10 V
- Trig (PG1 & PG2): TTL
- Gate (PG1 & PG2): TTL
- Ext Width (PG1 & PG2): TTL

Outputs
- Waveform (AWG): Z_{out} = 2 Ω, 50 Ω or 93 Ω
- Cursor & sync (AWG): TTL, ±15 mA
- Digital word (AWG): TTL, ±15 mA
- Waveform (PG/PG2): Z_{out} = 2 Ω, 50 Ω, or 93 Ω
- Clock (PG1 & PG2): TTL into 50 Ω

Amplifier
- Input/Output: BNC

Software

Drivers (VXI and Ethernet Support)
- IVI-C, VXI*plug&play* (includes 3171 driver compatibility)

Software (VXI and Ethernet Support)
- ArbConnection™ (GUI)

Firmware Upgrades
- Stored in flash using VXI utility

Software Calibration
- Stored in flash

Environmental

Temperature
- Operating: 0° C to 55° C
- Storage: -40° C to 71° C

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

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

MTBF (MIL-HDBK-217F, 25° C, GB, GC)
- 43,088 hrs

Mechanical

Weight
- 3 lbs 1 oz (1.40 kg)

Cooling (10° C Rise)
- 3.7 l/s @ 0.5 mm H_2O

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

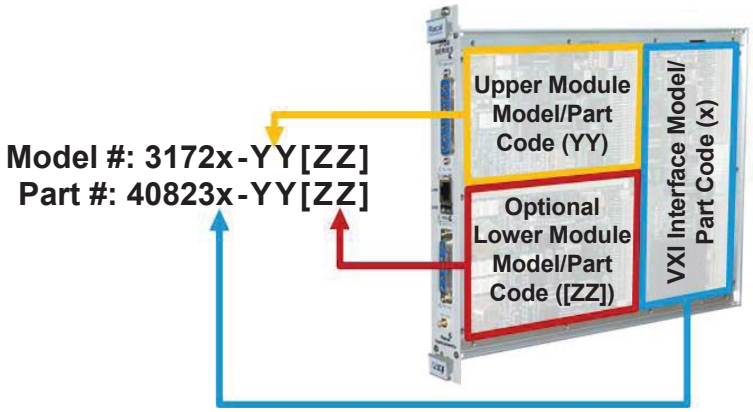
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Ordering Information

Some models are Obsolete. Contact factory for availability.

40823x-YY[ZZ] : Racal Instruments™ 3172x-YY[ZZ]

200 MS/s Waveform Generator & Dual 50 MHz Pulse/Timing Generator



Step 1: To configure the 1st section of the model/part #, substitute the "x" in the model/part # with the correct VXI Interface Model/Part # Code from the table below.

VXI Interface Model # Code (-x)	VXI Interface Part # Code (-x)	VXI Interface Type	Model # (3172x)	Part # (40823x)
None	5	Message-Based	3172	408235
R	4	Register-Based	3172R	408234

Step 2: To configure the required 2nd (upper) and optional 3rd (lower) sections of the model/part #, substitute the "-YY" and "[ZZ]" in the model/part # with the correct Internal Module Model/Part # Code from the table below.

Internal Module Model # Code (-YY), ([ZZ])	Internal Module Part # Code (-YY), ([ZZ])	Internal Module Description
W2	W2	AWG, 1 MB, Standard
W6	W6	AWG, 1 MB, 3171-compatible AM
P2	P2	Dual Pulse Generator, 50 MHz
A3	A3	122 V_{pk-pk} Amplifier
A4	A4	244 V_{pk-pk} Amplifier

Part Number Ordering Examples:

408235-W6P2	3172-W6P2: 3172 Message-Based AWG (None) with a 1 MB AWG with 3171-compatible AM (W6) in the upper module position and a 50 MHz Dual Pulse Generator (P2) in the lower module position
408234-W2A3	3172R-W2A3: 3172 Register-Based AWG (R) with a 1 MB Standard AWG (W2) in the upper module position and an 122 V amplifier (A3) in the lower module position

Special Ordering Configuration

408235-S-2852 : Racal Instruments™ 3172-S-2852

3172-W2 with J2 signal termination plug and frozen firmware

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