3390

50MHz Arbitrary Waveform/ Function Generator

Keithley has paired the best-in-class performance of the Model 3390 Arbitrary Waveform/Function Generator with the best price in the industry to provide your applications with superior waveform generation functionality and flexibility at an unparalleled price.

From its fully featured Arbitrary Waveform Generator (ARB) to its high speed and ease-of-use, the Model 3390 is a complete signal generation solution for all your waveform application needs up to 50MHz.

BEST IN CLASS PERFORMANCE

- **50MHz sine wave frequency**
- **25MHz square wave frequency**
- **Arbitrary waveform generator with 256k-point, 14-bit resolution**
- **Built-in function generator capability includes: sine, square, triangle, noise, DC, etc.**
- **Precision pulses and square waves with fast (5ns) rise/fall times**
- **Built-in 10MHz external time base for multiple unit synchronization**
- **Built-in AM, FM, PM, FSK, PWM modulation**
- **Frequency sweep and burst capability**
- **Waveform creation software, KiWAVE, included**
- **LXI Class C compliance**

Versatile Waveform Creation Capabilities

The Model 3390 generates highly stable and accurate waveforms that allow you to create almost any desired shape. It uses direct digital synthesis (DDS) techniques to achieve this level of performance and functionality.

The exceptional signal quality of the Model 3390 is a result of its high resolution, fast rise and fall times, and deep memory. This combined with its low price makes it the ideal solution for applications that use the 50MHz bandwidth and below. Lower speed instruments cannot provide the signal accuracy of the Model 3390, even at bandwidths they were specifically designed for.

Arbitrary Waveform Generation (ARB)

With the Model 3390, you can precisely replicate real world signals. This 14-bit ARB provides the ability to define waveforms with up to 256,000 data points and generate them at a sampling rate of 125MSamples/second. For ease of use, up to four user-defined waveforms can be stored in the onboard non-volatile memory.

Function Generation

Standard output waveforms can be created by pressing one button on the front panel. Ten standard waveforms are provided, including the basic sine, square, ramp, and triangle shapes. The Model 3390 offers the highest repetition rates of any instrument in its class, allowing you to better emulate the signals you need to test.

Pulse Generation

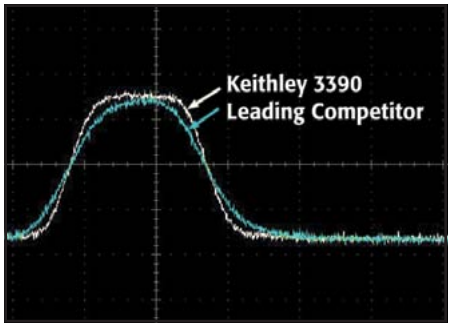
Pulse capabilities have become critically important as devices being tested have become smaller, more sensitive, and more complex. To accurately duplicate the signals these tiny devices receive, very clean pulses with crisp edges are mandatory, which is why the Model 3390 offers the fastest rise time (5ns) and cleanest pulse shapes for this class of instrument.

Modulating Waveforms

The ability of the Model 3390 to modulate at high internal frequencies allows you to accurately simulate real-world conditions. Modulate any of your signals with the built-in AM, FM, PM, PWM, or FSK source, or use your own external modulation source.

Noise Generation

Inject noise into your device under test with the press of a button. The adjustable amplitude and offset parameters control how much or how little noise is produced. The fast rise times and high speed capability provides the precise noise simulation your applications require.



The faster rise time results in cleaner pulses.

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50MHz Arbitrary Waveform/ Function Generator

Ordering Information

3390 50MHz Arbitrary Waveform/Function Generator

Accessories Supplied

Arbitrary Waveform Generator with power cord

One universal serial bus (USB) cable (USB-B-1)

One pattern generator cable (005-003-00003)

One Ethernet crossover cable (CA-180-3A)

CD-ROM containing user's manual

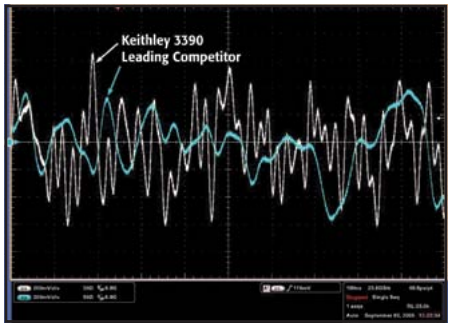
ACCESSORIES AVAILABLE

4299-3	Single Rack Mount Kit
4299-4	Dual Rack Mount Kit
7755	50Ω Feed Through Terminator
7051-2	General Purpose BNC to BNC Cable (2ft)
7007-1	Shielded GPIB Cable, 1m
USB-B-3	USB cable, Type A to Type B, 3m (10ft)
KPCI-488LPA	IEEE-488 Interface/Controller for the PCI bus
KUSB-488B	IEEE-488 USB-to-GPIB Interface Adapter

SERVICES AVAILABLE

3390-3Y-EW	1-year factory warranty extended to 3 years from date of shipment
C/3390-3Y-DATA	3 (Z540-1 compliant) calibrations within 3 years of purchase*

*Not available in all countries



The 20MHz noise bandwidth of the Model 3390 is 2× better than the competition's.

Pattern Generation

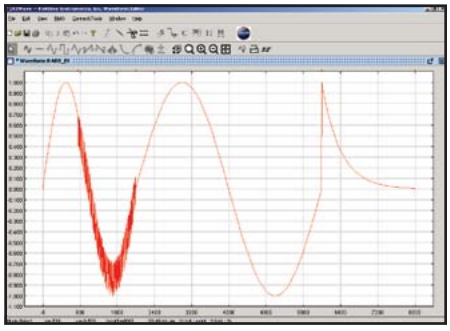
The Model 3390 is the only instrument in its class with a Digital Pattern mode. It provides the ability to transmit arbitrary 16-bit patterns via a multi-pin connector located on the rear panel of the instrument. This feature can be used for applications such as testing clock and data signals directly, sending simple protocols to devices under test, and simulating simple control functions. With Keithley's KiWAVE software package, you can easily create complex and long patterns, which the Model 3390 can generate at varying speeds and amplitudes.

10MHz External Reference Expands Flexibility

The built-in 10MHz external time base is included at no extra cost. This external time base makes it simple to control multiple instruments from the same source, connect multiple Model 3390s together, and synchronize multiple signals of any shape.

Ease of Use

This instrument is easy to use. In most cases, pressing one button on the front panel or performing one or two mouse clicks on your PC is all that is necessary to generate or modify a waveform. The KiWAVE software package helps you define and manage waveforms, apply filters to waveforms, and display waveforms on a PC. In addition, the GPIB, USB, LAN, and LXI interfaces can connect the Model 3390 to most devices under test, instruments, and test fixtures.



KiWAVE Waveform Editing Utility

LXI Class C Compliance

The Model 3390 supports the physical, programmable, LAN, and Web portions of the emerging LAN eXtensions for Instrumentation (LXI) standard. The instrument can be monitored and controlled from any location on the LAN network via its LXI Web page.

Model 3390 rear panel

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Specifications

DISPLAY: Graph mode for visual verification of signal settings.

CAPABILITY:
Standard Waveforms: Sine, Square, Ramp, Triangle, Pulse, Noise, DC.
Built-in Arbitrary Waveforms: Exponential Rise and Fall, Negative ramp, Sin(x)/x, Cardiac.

Waveform Characteristics

SINE

FREQUENCY: 1μHz to 50MHz.

AMPLITUDE FLATNESS [1, 2] (Relative to 1kHz): 0.1dB (<100kHz)
0.15dB (<5MHz)
0.3dB (<20MHz)
0.5dB (<50MHz).

HARMONIC DISTORTION [2, 3] (Unit: dBc):

DC to 20kHz:	–65(<1Vpp) –65(≥1Vpp)
20kHz to 100kHz:	–65(<1Vpp) –60(≥1Vpp)
100kHz to 1MHz:	–50(<1Vpp) –45(≥1Vpp)
1MHz to 20MHz:	–40(<1Vpp) –35(≥1Vpp)
20MHz to 50MHz:	–30(<1Vpp) –30(≥1Vpp).

TOTAL HARMONIC DISTORTION [2, 3]:
DC to 20kHz, V ≥ 0.5Vpp THD ≤ 0.06% (typical).

SPURIOUS [2, 4] (non–harmonic): DC to 1MHz: –70dBc.
1MHz to 50MHz: –70dBc + 6dB/octave.

PHASE NOISE (10K Offset): –115 dBC/Hz, typical when f ≥ 1MHz, V ≥ 0.1Vpp.

SQUARE

FREQUENCY: 1μHz to 25MHz.

RISE/FALL TIME: <10ns.

OVERSHOOT: <2%.

VARIABLE DUTY CYCLE: 20% to 80% (to 10MHz), 40% to 60% (to 25MHz).

ASYMMETRY: 1% of period + 5ns (@ 50% duty).

JITTER (RMS): 1ns + 100ppm of period.

RAMP, TRIANGLE

FREQUENCY: 1μHz to 200kHz.

LINEARITY: <0.1% of peak output.

SYMMETRY: 0.0% ~ 100.0%.

PULSE

FREQUENCY: 500μHz to 10MHz.

PULSE WIDTH: 20ns minimum, 10ns res. (period ≤10s).

VARIABLE EDGE TIME: <10ns to 100ns.

OVERSHOOT: <2%.

JITTER (RMS): 300ps + 0.1ppm of period.

NOISE

BANDWIDTH: 20MHz typical.

ARBITRARY

FREQUENCY: 1μHz to 10MHz.

LENGTH: 2 to 256K.

RESOLUTION: 14 bits (including sign).

SAMPLE RATE: 125Msamples/s.

MIN RISE/FALL TIME: 30ns typical.

LINEARITY: <0.1% of peak output.

SETTLING TIME: <250ns to 0.5% of final value.

JITTER(RMS): 6ns + 30ppm.

NON-VOLATILE MEMORY: 4 waveforms * 256K points.

COMMON CHARACTERISTIC

FREQUENCY RESOLUTION: 1μHz.

AMPLITUDE RANGE: 10mVpp to 10Vpp in 50Ω
20mVpp to 20Vpp in Hi-Z.

AMPLITUDE ACCURACY [1, 2] (at 1kHz): ±1% of setting ±1mVpp.

AMPLITUDE UNITS: Vpp, Vrms, dBm.

AMPLITUDE RESOLUTION: 4 digits.

DC OFFSET RANGE (Peak AC + DC):
±5V in 50Ω, ±10V in Hi-Z.

DC OFFSET ACCURACY [1, 2]
±2% of offset setting, ±0.5% of amplitude setting.

DC OFFSET RESOLUTION: 4 digits.

MAIN OUTPUT IMPEDANCE: 50Ω typical.

MAIN OUTPUT ISOLATION: 42Vpk maximum to earth.

MAIN OUTPUT PROTECTION: Short-circuit protected; overload automatically disables main output.

INTERNAL FREQUENCY REFERENCE ACCURACY [5]:
±10ppm in 90 days, ±20ppm in 1 year.

EXTERNAL FREQUENCY REFERENCE STANDARD/OPTION: Standard.

EXTERNAL FREQUENCY INPUT:
Lock Range: 10MHz ±500Hz.
Level: 100mVpp ~ 5Vpp.
Impedance: 1kΩ typical, AC coupled.
Lock Time: <2 seconds.

EXTERNAL LOCK RANGE: 10MHz.

FREQUENCY OUTPUT:
Level: 632mVpp (0dBm), typical.
Impedance: 50Ω typical, AC coupled.

PHASE OFFSET:
Range: –360° to +360°.
Resolution: 0.001°.
Accuracy: 8ns.

MODULATION

MODULATION TYPE: AM, FM, PM, FSK, PWM, Sweep, and Burst.

AM

CARRIER: Sine, Square, Ramp, ARB.

SOURCE: Internal/External.

INTERNAL MODULATION: Sine, Square, Ramp, Triangle, Noise, ARB.

FREQUENCY (Internal): 2mHz to 20kHz.

DEPTH: 0.0% ~ 120.0%.

FM

CARRIER: Sine, Square, Ramp, ARB.

SOURCE: Internal/External.

INTERNAL MODULATION: Sine, Square, Ramp, Triangle, Noise, ARB.

FREQUENCY (Internal): 2mHz to 20kHz.

DEVIATION: DC ~ 25MHz.

PM

CARRIER: Sine, Square, Ramp, ARB.

SOURCE: Internal/External.

INTERNAL MODULATION: Sine, Square, Ramp, Triangle, Noise, ARB.

FREQUENCY (INTERNAL): 2mHz to 20kHz.

DEVIATION: 0.0° to 360°.

PWM

CARRIER: Pulse.

SOURCE: Internal/External.

INTERNAL MODULATION: Sine, Square, Ramp, Triangle, Noise, ARB.

FREQUENCY (INTERNAL): 2mHz to 20kHz.

DEVIATION: 0% ~ 100% of pulse width.

FSK

CARRIER: Sine, Square, Ramp, ARB.

SOURCE: Internal/External.

INTERNAL MODULATION: 50% duty cycle Square.

FREQUENCY (INTERNAL): 2mHz to 100kHz.

EXTERNAL MODULATION INPUT [6]

VOLTAGE RANGE: ±5V full scale.

INPUT RESISTANCE: 8.7kΩ typical.

BANDWIDTH: DC to 20kHz.

SWEEP

WAVEFORMS: Sine, Square, Ramp, ARB.

TYPE: Linear or logarithmic.

DIRECTION: Up or down.

SWEEP TIME: 1ms ~ 500s.

TRIGGER: Internal, External, or Manual.

MARKER: Falling edge of sync signal (programmable frequency).

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BURST[7]

WAVEFORMS: Sine, Square, Ramp, Triangle, Noise, ARB.
TYPE: Internal/External.
START/STOP PHASE: –360° to +360°.
INTERNAL PERIOD: 1μs ~ 500s.
GATED SOURCE: External trigger.
TRIGGER SOURCE: Internal, External, or Manual.

TRIGGER INPUT

LEVEL: TTL compatible.
SLOPE: Rising or falling (selectable).
PULSE WIDTH: >100ns.
IMPEDANCE: >10kΩ, DC coupled.
LATENCY: <500ns.

TRIGGER OUTPUT

LEVEL: TTL compatible into ≥1kΩ.
PULSE WIDTH: >400ns.
OUTPUT IMPEDANCE: 50Ω typical.
MAXIMUM RATE: 1MHz.
FAN-OUT: ≤4 Keithley 3390s.

PATTERN MODE

CLOCK MAXIMUM RATE: 50MHz.
OUTPUT: Level: TTL compatible into ≥2kΩ.
Output Impedance: 110Ω typical.
PATTERN LENGTH: 2 to 256K.

GENERAL

POWER SUPPLY: CAT II 110–240VAC ±10%.
POWER CORD FREQUENCY: 50Hz to 60Hz.
POWER CONSUMPTION: 50VA max.
OPERATING ENVIRONMENT: 0° to 50°C.
STORAGE TEMPERATURE: –30° to 70°C.
INTERFACE: USB, LAN, LXI-C, GPIB.
LANGUAGE: SCPI-1993, IEEE-488.2.
DIMENSIONS: 107mm high × 224mm wide × 380mm deep (4.2 in. × 8.8 in. × 15 in.).
WEIGHT: 4.08kg.
SAFETY: Conforms with European Union Directive 73/23/EEC, EN 61010-1.
EMC: Conforms with European Union Directive 89/336/EEC, EN 61326-1.
WARM-UP: 1 hour.

NOTES

1. Add 10%/°C of spec for offset and amplitude for operation outside the range of 18° to 28°C.
2. Autorange enabled.
3. DC offset set to 0V.
4. Spurious output at low amplitude is –75dBm typical.
5. Add 1ppm/°C average for operation outside the range of 18° to 28°C.
6. FSK uses trigger input (1MHz maximum).
7. Sine and square waveforms above 10MHz are allowed only with an "infinite" burst count.

KEITHLEY

Model 3390

50MHz Arbitrary Waveform Generator Specifications

Keithley Instruments, Inc.
28775 Aurora Road
Cleveland, Ohio 44139
1-888-KEITHLEY
www.keithley.com

DISPLAY: Graph mode for visual verification of signal settings.

CAPABILITY:

Standard waveforms: Sine, Square, Ramp, Triangle, Pulse, Noise, DC
Built-in arbitrary waveforms: Exponential Rise and Fall, Negative ramp, Sin(x)/x, Cardiac

WAVEFORM CHARACTERISTICS

Sine	Specification
Frequency	1µHz to 50MHz
Amplitude Flatness[1],[2] (Relative to 1KHz)	0.1dB(<100KHz) 0.15dB(<5MHz) 0.3dB(<20MHz) 0.5dB(<50MHz)
Harmonic distortion[2,3] (unit: dBc)	DC to 20kHz: -60(<1Vpp) -60(≥1Vpp) 20 kHz to 100 KHz: -65(<1Vpp) -60(≥1Vpp) 100 kHz to 1 MHz: -50(<1Vpp) -45(≥1Vpp) 1 MHz to 20 MHz: -40(<1Vpp) -35(≥1Vpp) 20 MHz to 50 MHz: -30(<1Vpp) -30(≥1Vpp)
Total harmonic distortion[2,3]	DC to 20kHz, V ≥ 0.5Vpp THD ≤ 0.06% (Typical)
Spurious[2,4] (non-harmonic)	DC to 1MHz -70dBc 1MHz to 50MHz -70dBc + 6dB/octave
Phase Noise (10K Offset)	-115 dBC/Hz, typical when f ≥ 1MHz, V ≥ 0.1Vpp

Square	Specification
Frequency	1µHz to 25MHz
Rise/Fall time	< 10ns
Overshoot	< 2%
Variable Duty Cycle	20% to 80% (to 10MHz) 40% to 60% (to 25MHz)
Asymmetry	1% of period + 5ns (@ 50% duty)
Jitter (RMS)	1ns + 100ppm of period

Ramp, Triangle	Specification
Frequency	1µHz to 200kHz
Linearity	< 0.25% of peak output
Symmetry	0.0% ~ 100.0%

[1] Add 10%/°C of spec for offset and amplitude for operation outside the range of 18°C to 28°C
[2] Autorange enabled
[3] DC offset set to 0V
[4] Spurious output at low amplitude is –75dBm typical

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Pulse	Specification
Frequency	500µHz to 10MHz
Pulse width	20ns minimum 10ns res. (period ≤ 10s)
Variable Edge Time	<10ns to 100ns
Overshoot	<2%
Jitter (RMS)	300ps + 0.1ppm of period

Noise	Specification
Bandwidth	20MHz typical

Arbitrary	Specification
Frequency	1µHz to 10MHz
Length	2 to 256K
Resolution	14 bits (including sign)
Sample Rate	125Msa/s
Min Rise/Fall Time	30ns typical
Linearity	<0.1% of peak output
Settling Time	<250ns to 0.5% of final value
Jitter(RMS)	6ns + 30ppm
Non-volatile Memory	4 waveforms * 256K Points

Common Characteristic	Specification
Frequency Resolution	1µHz
Amplitude Range	10mVpp to 10Vpp in 50Ω 20mVpp to 20Vpp in Hi-Z
Amplitude Accuracy[1,2] (at 1KHz)	±1% of setting ±1mVpp
Amplitude Units	Vpp, Vrms, dBm
Amplitude Resolution	4 digits
DC Offset Range (Peak AC + DC)	±5V in 50Ω ±10V in Hi-Z
DC Offset Accuracy[1,2]	±2% of offset setting ±0.5% of amplitude setting
DC Offset Resolution	4 digits
Main Output Impedance	50Ω typical
Main Output Isolation	42Vpk maximum to earth
Main Output Protection	Short-circuit protected; overload automatically disables main output
Internal Frequency reference Accuracy[5]	±10ppm in 90 days ±20ppm in 1 year
External Frequency reference Standard/Option	Standard

[5] Add 1ppm/°C average for operation outside the range of 18°C to 28°C

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External Frequency Input:	
Lock Range	10MHz ± 500Hz
Level	100mVpp ~ 5Vpp
Impedance	1KΩ typical, AC coupled
Lock Time	<2 Sec
External Lock Range	10MHz
Frequency Output:	
Level	632mVpp (0dBm), typical
Impedance	50Ω typical, AC coupled
Phase Offset:	
Range	-360° to +360°
Resolution	0.001°
Accuracy	8ns

Modulation	**Specification**
Modulation Type	AM, FM, PM, FSK, PWM, Sweep and Burst
AM:	
Carrier	Sine, Square, Ramp, Arb
Source	Internal/External
Internal Modulation	Sine, Square, Ramp, Triangle, Noise, Arb
Frequency (Internal)	2mHz to 20KHz
Depth	0.0% ~ 120.0%
FM:	
Carrier	Sine, Square, Ramp, Arb
Source	Internal/External
Internal Modulation	Sine, Square, Ramp, Triangle, Noise, Arb
Frequency (Internal)	2mHz to 20KHz
Deviation	DC ~ 25MHz
PM:	
Carrier	Sine, Square, Ramp, Arb
Source	Internal/External
Internal Modulation	Sine, Square, Ramp, Triangle, Noise, Arb
Frequency (Internal)	2mHz to 20KHz
Deviation	0.0° to 360°
PWM:	
Carrier	Pulse
Source	Internal/External
Internal Modulation	Sine, Square, Ramp, Triangle, Noise, Arb
Frequency (Internal)	2mHz to 20KHz
Deviation	0% ~ 100% of pulse width
FSK:	
Carrier	Sine, Square, Ramp, Arb
Source	Internal/External
Internal Modulation	50% duty cycle Square
Frequency (Internal)	2mHz to 100KHz

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External Modulation Input[6]:	
Voltage Range	±5V full scale
Input Resistance	8.7KΩ typical
Bandwidth	DC to 20KHz
SWEEP:	
Waveforms	Sine, Square, Ramp, Arb
Type	Linear or logarithmic
Direction	Up or down
Sweep Time	1ms ~ 500Sec
Trigger	Internal, External or Manual
Marker	Falling edge of sync signal (programmable frequency)
BURST[7]	
Waveforms	Sine, Square, Ramp, Triangle, Noise, Arb
Type	Internal/External
Start/Stop Phase	-360° to +360°
Internal Period	1µs ~ 500Sec
Gated Source	External trigger
Trigger Source	Internal, External or Manual
Trigger Input:	
Level	TTL compatible
Slope	Rising or Falling (Selectable)
Pulse width	>100ns
Impedance	>10KΩ, DC coupled
Latency	<500ns
Trigger Output:	
Level	TTL compatible into ≥1KΩ
Pulse width	>400ns
Output Impedance	50Ω typical
Maximum rate	1MHz
Fan-out	≤4 Keithley 3390s

Pattern Mode CHARACTERISTIC	**Specification**
Clock Maximum Rate	50MHz
Output:	
Level	TTL compatible into ≥2KΩ
Output Impedance	110Ω typical
Pattern Length	2 to 256K

[6] FSK uses trigger input (1MHz maximum)
[7] Sine and square waveforms above 10MHz are allowed only with an “infinite” burst count

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General	Specification
Power Supply	110-240VAC ±10%
Power Cord Freq.	50Hz to 60Hz
Power Consumption	50VA max
Operating Environment	0°C to 50°C
Storage Temperature	-30°C to 70°C
Interface	USB, LAN, LXI-C, GPIB
Language	SCPI-1993, IEEE-488.2
Dimensions	107(H) x 224(W) x 380(D)mm
Weight	4.08Kg
Safety	Conforms with European Union Directive 2006/95/EC, EN 61010-1
EMC	Conforms with European Union Directive 2004/108/EC, EN 61326-1
Warm-up Time	1 hour
Warranty	1 Year