

# ZT452VXI Specifications



Digital Storage Oscilloscope

8-bit, 1 GS/s, 500 MHz, 4 Ch  
8-bit, 2 GS/s, 500 MHz, 4 Ch  
8-bit, 2.5 GS/s, 750 MHz, 4 Ch

## Contents

Analog Input .....	2
Analog-to-Digital Converter .....	4
Waveform Memory .....	5
Acquisition Modes .....	5
Trigger .....	6
External Trigger Input .....	7
Trigger Outputs .....	7
Reference Output .....	7
Arm .....	8
External Arm Input .....	8
External Sampling Clock Input .....	8
10 MHz Time Base Reference .....	8
Data Processing .....	8
Measurements .....	9
Reference Waveforms .....	9
Calculations .....	9
Instrument Setup Storage .....	10
Data Interface .....	10
VXIbus P2 Trigger & Clock Pin Usage .....	10
LED Indicators .....	11
DC Power .....	11
Physical .....	12
Temperature Range .....	13
Relative Humidity .....	13
Altitude .....	13

# Analog Input

Channels

Quantity 4

Bandwidth (50  $\Omega$ )

Product Option	50 $\Omega$ Typical Bandwidth	50 $\Omega$ Minimum Bandwidth
<b>ZT452-0X</b>	500 MHz	400 MHz
<b>ZT452-2X</b>	500 MHz	400 MHz
<b>ZT452-5X</b>	750 MHz	650 MHz

Bandwidth (1 M $\Omega$ )

Product Option	1 M $\Omega$ Typical Bandwidth	1 M $\Omega$ Minimum Bandwidth
<b>ZT452-0X</b>	300 MHz	250 MHz
<b>ZT452-2X</b>	300 MHz	250 MHz
<b>ZT452-50/51</b>	350 MHz	300 MHz
<b>ZT452-55/56</b>	400 MHz	300 MHz
<b>ZT452-55/56 using ZT6103 probe</b>	450 MHz	400 MHz

Maximum Input (50  $\Omega$ )

$\pm 5$  VDC, input load protection @  $\pm 6$  VDC

Maximum Input (1 M $\Omega$ )

$\pm 210$  VDC, de-rated 20 dB/decade above 1 MHz

Product Option	1 M $\Omega$ Maximum Working Voltage	1 M $\Omega$ Maximum Range + Offset
<b>ZT452-0X</b>	$\pm 210$ VDC	$\pm 150$ VDC
<b>ZT452-2X</b>	$\pm 210$ VDC	$\pm 150$ VDC
<b>ZT452-5X</b>	$\pm 210$ VDC	$\pm 100$ VDC

Input VSWR (50  $\Omega$ )

$\leq 1.4:1$ , DC to 50 $\Omega$  Bandwidth

Input Bias (50  $\Omega$ )

$\leq \pm 40$   $\mu$ A

Input Bias (1 M $\Omega$ )

$\leq \pm 1$  nA

Full Scale Input Range  
& Offset Adjust

Impedance	ZT452-0X or ZT452-2X		ZT452-5X	
	Range	Offset	Range	Offset
1 M $\Omega$	100 Vpp	$\pm 100V$	100 Vpp	$\pm 50V$
	50 Vpp	$\pm 100V$	50 Vpp	$\pm 25V$
	20 Vpp	$\pm 100V$	20 Vpp	$\pm 10V$
	10 Vpp	$\pm 100V$	10 Vpp	$\pm 5V$
	5 Vpp	$\pm 5V$	5 Vpp	$\pm 2.5V$
	2.5 Vpp	$\pm 5V$	2.5 Vpp	$\pm 1.25V$
	1 Vpp	$\pm 5V$	1 Vpp	$\pm 0.5V$
	0.5 Vpp	$\pm 5V$	0.5 Vpp	$\pm 0.25V$
			0.2 Vpp	$\pm 0.1V$
		0.1 Vpp	$\pm 0.05V$	
50 $\Omega$	10 Vpp	$\pm 10V$	10 Vpp	$\pm 5V$
	5 Vpp	$\pm 10V$	5 Vpp	$\pm 2.5V$
	2 Vpp	$\pm 10V$	2 Vpp	$\pm 1V$
	1 Vpp	$\pm 10V$	1 Vpp	$\pm 0.5V$
	0.5 Vpp	$\pm 0.5V$	0.5 Vpp	$\pm 0.25V$
	0.25 Vpp	$\pm 0.5V$	0.25 Vpp	$\pm 0.125V$
	0.1 Vpp	$\pm 0.5V$	0.1 Vpp	$\pm 0.05V$
	0.05 Vpp	$\pm 0.5V$	0.05 Vpp	$\pm 0.025V$

DC Gain Accuracy

Product Option	DC Gain Accuracy
<b>ZT452-0X</b>	$\leq \pm 1.5\%$ of full scale
<b>ZT452-2X</b>	$\leq \pm 1.5\%$ of full scale
<b>ZT452-5X</b>	$\leq \pm 1.0\%$ of full scale

DC Offset Accuracy

Product Option	DC Offset Accuracy
<b>ZT452-0X</b>	$\leq \pm (1\% \text{ offset} + 2\% \text{ full scale})$
<b>ZT452-2X</b>	$\leq \pm (1\% \text{ offset} + 2\% \text{ full scale})$
<b>ZT452-5X</b>	$\leq \pm (1\% \text{ offset} + 1\% \text{ full scale})$

DC Offset Drift

Product Option	DC Offset Drift
<b>ZT452-0X</b>	$\leq \pm (0.3\% \text{ full scale}) \text{ per } ^\circ\text{C}$
<b>ZT452-2X</b>	$\leq \pm (0.3\% \text{ full scale}) \text{ per } ^\circ\text{C}$
<b>ZT452-5X</b>	$\leq \pm (0.1\% \text{ full scale}) \text{ per } ^\circ\text{C}$

Impedance 1 M $\Omega$  || 12 pF or 50  $\Omega$

Impedance Accuracy  $\pm 1\%$

Coupling DC or AC

AC Coupling 200 kHz high pass (50Ω)  
10 Hz high pass (1 MΩ)

Probe Attenuation 0.9 to 1000:1

Analog Filter 20 MHz or Bypass  
Filter Stopband Rejection: approximately 3dB @ 20 MHz

RMS Noise (50Ω)

Product Option	RMS Noise (50 Ω)
<b>ZT452-0X</b>	≤ (350 μV + 0.5% range), 0.05 Vpp to 0.5 Vpp ≤ (3.5 mV + 0.5% range), 1 Vpp to 10 Vpp
<b>ZT452-2X</b>	≤ (350 μV + 0.5% range), 0.05 Vpp to 0.5 Vpp ≤ (3.5 mV + 0.5% range), 1 Vpp to 10 Vpp
<b>ZT452-5X</b>	≤ (100 μV + 0.5% range)

RMS Noise (1MΩ)

Product Option	RMS Noise (1 MΩ)
<b>ZT452-0X</b>	≤ (3.5 mV + 0.5% range), 0.5 Vpp to 5 Vpp ≤ (35 mV + 0.5% range), 10 Vpp to 100 Vpp
<b>ZT452-2X</b>	≤ (3.5 mV + 0.5% range), 0.5 Vpp to 5 Vpp ≤ (35 mV + 0.5% range), 10 Vpp to 100 Vpp
<b>ZT452-5X</b>	≤ (1 mV + 0.5% range)

RMS Noise (20 MHz Filter) ≤ (0.25% range)

Connectors BNC

## Analog-to-Digital Converter

Resolution 8 bit

Sample Rate

Product Option	1 Channel <b>Maximum Sample Rate</b>	2 Channel <b>Maximum Sample Rate</b>
<b>ZT452-0X</b>	2 GS/s	1 GS/s
<b>ZT452-2X</b>	1 GS/s	500 MS/s
<b>ZT452-5X</b>	2.5 GS/s	1.25 GS/s

2.5 kS/s to 2-Channel Maximum Sample Rate in 1, 2.5, or 5 steps  
1 GS/s, 1 channel interleaved (ZT452-2X)  
2 GS/s, 1 channel interleaved (ZT452-0X or ZT452-5X)  
2.5 GS/s, 1 channel interleaved (ZT452-5X)



# Trigger

Trigger Source	Channels 1 to 2, External Trigger, ECLTRG0-1, TTLTRG0-7*, External Arm, Pattern, Software
Trigger Slope/Polarity	Positive or Negative
Trigger Position	0% to 100% of waveform time + trigger delay ±1 sample interval position accuracy
Post-Trigger Delay	0 to 655 seconds
Pre-Trigger Delay	0 to waveform time
Trigger Holdoff	Programmable delay after trigger before recognizing next trigger event
Holdoff Range	0 to 655 seconds
Trigger B	Second edge trigger event qualifier
Pattern Trigger	Pattern match true or false
Pattern Sources	Channels 1 to 4, External Trigger, External Arm, ECLTRG0-1
Event Trigger	Event Counter: 1 to 65535 trigger events
Trigger Modes	Edge, Pulse Width, Video
Edge Trigger Mode	Rising or Falling Edge
Pulse Width Trigger Mode	Triggers on pulse width greater than, less than, or between limits
Pulse Width Type	< limit1, > limit1, < limit1 & > limit2
Pulse Width Range	20 ns to 655 seconds
Pulse Width Resolution	10 ns
Video Trigger Mode	PAL (50 Hz), NTSC (60 Hz), SECAM (50 Hz) Standard, Field, Line selectable
Ch 1-4 Trigger Level	(offset – full scale/2) to (offset + full scale/2)
Ch 1-4 Trigger Sensitivity	5% of full scale (DC to 100 MHz) 10% of full scale (100 MHz to 500 MHz) 25% of full scale (> 500 MHz)

Ch 1–4 Trigger Bandwidth	300 MHz minimum, 400 MHz typical
Ch 1–4 Trigger Hysteresis	5% (overdrive required)
Ch 1–4 Level Resolution	0.025% of full scale
Ch 1–4 Level Accuracy	$\pm(2\% \text{ setting} + 2\% \text{ full scale} + \text{offset accuracy})$
Trigger Timestamp	100 ns resolution, 1 second rollover

## External Trigger Input

Maximum Input	$\pm 5\text{V}$ , no damage
Threshold Input	$\pm 1\text{V}$
Threshold Accuracy	$\pm 20 \text{ mV}$
Threshold Resolution	0.5 mV
Input Impedance	$50 \Omega \pm 2\%$
Connector	BNC

## Trigger Outputs

Functionality	Event Output Signals
Outputs	TTLTRG0–7*, ECLTRG0–1
Source	Trigger Event, Arm Event, OPC, Constant

## Reference Output

Functionality	reference voltage, ground, trigger event, arm event, 10 MHz clock, 500 Hz probe compensation, 10 ns pulse @ 1 ms rate
Reference Voltage Output	$+8 \text{ V} \pm 1\%$ into 10 k $\Omega$ load
Logic Output (all other types)	TTL Compatible
Connector	BNC

---

# Arm

Functionality	Arm to qualify trigger event
Source	External Trigger, External Arm, ECLTRG0-1, TTLTRG0-7*, Software
Polarity	Positive or Negative

## External Arm Input

Maximum Input	0V to 5V, no damage
Nominal Level	TTL Compatible
Input Impedance	1 k $\Omega$ $\pm$ 2%, pull-up to +5V
Connector	BNC

## External Sampling Clock Input

Function	External Sampling Clock bypasses Phase Locked Loop, All ADC channels synchronized to external clock
Clock Rates	200 MHz to 1 GHz
Maximum Input	$\pm$ 5V, no damage
Input Signal Level	500 mVpp to 1 Vpp, sine or square wave
Input Impedance	AC coupled, 50 $\Omega$ $\pm$ 2%
Connector	BNC

## 10 MHz Time Base Reference

Clock Source	Internal TCXO, VXI Backplane CLK10
Internal TCXO	$\pm$ 2.5 ppm accuracy

## Data Processing

Auto Scale	Automatic adjust to input signals: Input Range, Offset, Sample Rate, Trigger Source, and Trigger Level
------------	--

## Measurements

Measurements	Min, Max, Low, High, Mid, Average, Amplitude, Peak-to-Peak, DC RMS, AC RMS, +Width, -Width, Period, Frequency, +Duty, -Duty, Phase, Rise Time, Rise Overshoot, Rise Preshoot, Rise Crossing Time, Fall Time, Fall Overshoot, Fall Preshoot, Fall Crossing Time, Time of Maximum, Time of Minimum, Cycle Average, Cycle RMS, Cycle Frequency, Cycle Period, AC High-Precision, DC High-Precision								
Measurement Methods	Entire Waveform, Gated by Time, Gated by Points								
Measurement Levels	Low, Mid, High reference levels for edge measurements set in absolute voltages or relative percentages								
Measurement Accuracy	<table> <tr> <td>Delta DC Voltage</td> <td><math>\pm</math> (DC gain accuracy)</td> </tr> <tr> <td>Absolute DC Voltage</td> <td><math>\pm</math> [(DC gain accuracy)+(offset accuracy)]</td> </tr> <tr> <td>Time</td> <td><math>\pm</math> (time resolution)</td> </tr> <tr> <td>Frequency</td> <td><math>\pm</math> [1/(time resolution)]</td> </tr> </table> <p>Note: time resolution = one sample interval or one ETS sample interval (for ETS acquisition)</p>	Delta DC Voltage	$\pm$ (DC gain accuracy)	Absolute DC Voltage	$\pm$ [(DC gain accuracy)+(offset accuracy)]	Time	$\pm$ (time resolution)	Frequency	$\pm$ [1/(time resolution)]
Delta DC Voltage	$\pm$ (DC gain accuracy)								
Absolute DC Voltage	$\pm$ [(DC gain accuracy)+(offset accuracy)]								
Time	$\pm$ (time resolution)								
Frequency	$\pm$ [1/(time resolution)]								

## Reference Waveforms

Reference Channels	Quantity 4
Reference Storage	Non-volatile memory storage
Reference Size	32k maximum waveform size

## Calculations

Calculate Channels	Quantity 2
Calculate Size	32k maximum waveform size
Calculate Functions	Add, Subtract, Multiply, Copy, Invert, Integral, Derivative, Absolute Value, Limit Test, Mask Test, Frequency Transform, Time Transform
Limit Test	Measurement Limit Range Testing or Waveform Mask Testing
Limit Test Reports	Measurement maximum, minimum, average, current value, pass/fail counts
Frequency Transform	FFT Magnitude

FFT Windowing	Rectangular, Hamming, Hanning, Blackman
Time Transform	Infinite Impulse Response (IIR) filtering
IIR Filter Count	2 to 40 data points

## Instrument Setup Storage

Reset	Non-volatile storage of default instrument setup configuration
Save & Recall	Non-volatile storage of 31 instrument setup configurations

## Data Interface

VXIbus Connection	Standard P1 and P2 interface
Command Interface	A16 SCPI message-based
Interrupt Operation	Programmable interrupter, Level 1–7
Data Interface	64MB A32 register-based
Manufacturer ID	3712 (E80 <sub>16</sub> )
Model Code	452 (1C4 <sub>16</sub> )

## VXIbus P2 Trigger & Clock Pin Usage

Pin A1	ECLTRG0	(ECL level bidirectional)
Pin A3	ECLTRG1	(ECL level bidirectional)
Pin A23	TTLTRG0*	(TTL level bidirectional)
Pin A24	TTLTRG2*	(TTL level bidirectional)
Pin A26	TTLTRG4*	(TTL level bidirectional)
Pin A27	TTLTRG6*	(TTL level bidirectional)
Pin C1	CLK10+	(ECL level input)

Pin C2	CLK10-	(ECL level input)
Pin C23	TTLTRG1*	(TTL level bidirectional)
Pin C24	TTLTRG3*	(TTL level bidirectional)
Pin C26	TTLTRG5*	(TTL level bidirectional)
Pin C27	TTLTRG7*	(TTL level bidirectional)

## LED Indicators

READY	Unit has passed power-up self-diagnostics. Toggles when unit has an error pending in error queue.
VXI	VXI access occurring or VXIbus MODID asserted
TRG	Flashes when trigger event occurs
BUSY	Unit is busy with one of the following operations: auto-scale, self-calibration, self-test, data capture, download or storage

## DC Power

### Total Cooling & Power Consumption

Product Option	Typical Cooling & Power	Maximum Cooling & Power
<b>ZT452-00</b>	36.6 W	48.0 W
<b>ZT452-01</b>	46.6 W	58.0 W
<b>ZT452-20</b>	34.6 W	45.0 W
<b>ZT452-21</b>	44.6 W	55.0 W
<b>ZT452-50/55</b>	46.6 W	64.0 W
<b>ZT452-51/56</b>	56.6 W	74.0 W

Product Option	Voltage	Typical Current	Maximum Current
<b>ZT452-00</b>	+5V	6.6A	8.5A
	+12V	0.05A	0.1A
	+24V	0.0A	0.0A
	-2V	0.05A	0.08A
	-5.2V	0.06A	0.08A
	-12V	0.0A	0.0A
	-24V	0.0A	0.0A
<b>ZT452-01</b>	+5V	8.6A	10.5A
	+12V	0.05A	0.1A
	+24V	0.0A	0.0A
	-2V	0.05A	0.08A
	-5.2V	0.06A	0.08A
	-12V	0.0A	0.0A
	-24V	0.0A	0.0A
<b>ZT452-20</b>	+5V	6.2A	7.9A
	+12V	0.05A	0.1A
	+24V	0.0A	0.0A
	-2V	0.05A	0.08A
	-5.2V	0.06A	0.08A
	-12V	0.0A	0.0A
	-24V	0.0A	0.0A
<b>ZT452-21</b>	+5V	8.2A	9.9A
	+12V	0.05A	0.1A
	+24V	0.0A	0.0A
	-2V	0.05A	0.08A
	-5.2V	0.06A	0.08A
	-12V	0.0A	0.0A
	-24V	0.0A	0.0A
<b>ZT452-50/55</b>	+5V	8.6A	11.7A
	+12V	0.05A	0.1A
	+24V	0.0A	0.0A
	-2V	0.05A	0.08A
	-5.2V	0.06A	0.08A
	-12V	0.0A	0.0A
	-24V	0.0A	0.0A
<b>ZT452-51/56</b>	+5V	10.6A	13.7A
	+12V	0.05A	0.1A
	+24V	0.0A	0.0A
	-2V	0.05A	0.08A
	-5.2V	0.06A	0.08A
	-12V	0.0A	0.0A
	-24V	0.0A	0.0A

## Physical

Physical size

Single-Wide C-size VXIbus

---

Weight 3 lbs. or 1.36 kg

## Temperature Range

Operating 0 °C to +40 °C Ambient

Storage -40 °C to +75 °C

Calibration Range +20 °C to +30 °C Ambient, after a 20 minute warm-up period, to meet all calibration specification accuracies.

## Relative Humidity

Operating or Storage 10 to 90%, non-condensing, up to +40 °C

## Altitude

Operating Up to 2,000 m

Storage Up to 15,000 m