



V12 System Module
Made in U.S.A.

The **V12 System Module** is the in-circuit test system complex impedance measurement module. This module is one part of a typical system module set.

The **V12** features:

- **Stimulus and measurement circuitry**
- **Controlled by CheckSum test system software**
- **16-pin analog bus for switch module-to-module stimulus and measurement**
- **External sense capability for 4-wire and 6-wire measurements**
- **Up to six measurement guard circuits**
- **8-bits digital I/O**
- **Industry standard USB interface**
- **Test status and control signals for external devices**
- **Fixture control signals**
- **Test point locator connection**

CheckSum LLC
6120 195th Street NE
Arlington, WA 98223
Tel: 1.877.CHECKSUM
Tel: +1 360.435.5510
Fax: +1 360.435.5535
www.checksum.com



CheckSum is a trademark of CheckSum LLC. Other product names are trademarks of their respective owners. Final appearance of the delivered product may vary from the photographs shown herein. Specifications subject to change.

©2015 CheckSum LLC. All rights reserved. Printed in the USA. 20150327

CheckSum V12 Module

V12 Specifications

Resistance Measurement

Resistors are measured with a choice of DC-constant-voltage, DC-constant-current, or AC-complex-impedance measurements. Low impedance measurements can be externally sensed.

Measurement using DC Current Stimulus

Range	F.S.	Current	V at F.S.**	Accuracy*
19Ω ¹		10mA	200mV	1% ± 0.2 Ω
190Ω ¹		10mA	2 V	1% ± 1 Ω
		1mA	200mV	0.5% ± 0.2 Ω
1.9KΩ		1mA	2 V	0.5% ± 1 Ω
		100uA	200mV	0.5% ± 2 Ω
19KΩ		100uA	2 V	0.5% ± 10 Ω
		10uA	200mV	0.6% ± 20 Ω
190KΩ		10μA	2 V	0.6% ± 100 Ω
		1μA	200mV	1.5% ± 200 Ω
1.9MΩ		1μA	2 V	1.5% ± 1k Ω
		100nA	200mV	3% ± 2k Ω
19MΩ		100nA	2 V	3% ± 10K

1. 4-wire measurement mode. For internally sensed measurements, add 2Ω to accuracy.

*All accuracies specified as a percentage of the measured value.

**Maximum voltage may exceed full-scale value during over-range.

Measurement using AC/DC Voltage Stimulus

Range	Peak Stimulus V	Accuracy
0Ω to 10KΩ	2 V	0.5% ± 0.5Ω
	200mV	1% ± 0.5Ω
	100mV	2% ± 1 Ω
	50mV	5% ± 2Ω
10KΩ to 100KΩ	2 V	1%
	200mV	2%
	100mV	4%
	50mV	10%
100KΩ to 1MΩ	2V	2%
	200mV	4%
1MΩ to 10MΩ	2 V	5%

For internally sensed measurements, add 2Ω to accuracy. Available AC stimulus frequencies 100Hz and 1KHz. Source current is less than 10mA with MPX-3, less than 14mA with MPX-5.

Capacitance Measurement

Capacitors can be measured with either DC-constant-current or AC-complex-impedance measurements. Effective measurement range is 2pF - 20,000μF⁵.

Range (DC Current)

Accuracy

(1mA)	2V	200mV
50 uF - 500 uF	4%	---
500 uF - 5 mF	---	10%

(10mA)	2V	200mV
500 uF - 5mF	4%	---
5mF - 20 mF	---	10%

100 kHz	2V	200mV	100mV
0 - 100 pF	4% ¹	10% ²	20% ³
100pF - 1nF	4% ²	10% ³	20% ⁴
1nF - 10nF	10%	20%	---

10 kHz	2V	200mV	100mV
0-100pF	4% ¹	10% ²	20% ³
100pF - 1nF	4% ²	10% ³	20% ⁴
1nF - 100nF	4%	10%	20%
100nF - 1uF	10%	---	---

1 kHz	2V	200mV	100mV
0-100pF	4% ¹	10% ²	20% ³
100pF - 1nF	4% ²	10% ³	20% ⁴
1nF - 10nF	4%	10%	20%
10nF - 100nF	4%	10%	20%
100nF - 1uF	4%	10%	20%
1uF - 10uF	4%	10%	20%
10uF - 100uF	10%	---	---

100 Hz	2V	200mV	100mV
100pF - 1nF	10% ²	---	---
1nF - 100uF	4%	10%	20%
100uF - 1mF	10%	20%	---
1mF - 20mF	10%	---	---

Notes:

- ± 5pF
 - ± 10pF
 - ± 20pF
 - ± 40pF
 - While small isolated capacitances (pF region) can effectively be tested by the system, often times in-circuit influences such as parallel impedances in IC's degrade measurements. Values less than 100pF can be difficult to measure in many circuits.
- Specifications assume residual capacitance is offset. Technique is fully auto-ranging. AC source current is less than 10mA.

Inductance Measurement

Inductors are measured with AC-complex-impedance measurements. Effective measurement range is 1 μ H - 1000H. Add 1 μ H per Ohm of DC resistance

Range

100 kHz	2V	200mV	100mV
0 - 10 μ H	4% ¹	10%	20%
10 μ H - 100 μ H	4% ²	10%	20%
100 μ H - 1000H ⁴	---	---	---

10 kHz	2V	200mV	100mV
0 - 10 μ H	4% ¹	10%	20%
10 μ H - 100 μ H	4% ²	10%	20%
100 μ H - 10mH	4%	10%	20%
10mH - 100mH	10%	20%	---

1 kHz	2V	200mV	100mV
0 - 10 μ H	10% ²	---	---
10 μ H - 100 μ H	10% ³	20%	---
100 μ H - 100mH	4%	10%	20%
100mH - 1H	10%	10%	---

100 Hz	2V	200mV	100mV
100 μ H - 1mH	10%	---	---
1mH - 1H	4%	10%	20%
1H - 10H	10%	10%	20%
10H - 100H	10%	20%	---
100H - 1000H	20%	---	---

Notes:

1. $\pm 0.5\mu$ H
 2. $\pm 2\mu$ H
 3. $\pm 4\mu$ H
 4. Not recommended
- External sense for <100 μ H measurements

Guarding

Maximum Current per Test Point	10mA
Max. Number of Simultaneous (or guard-all less Guard points)	6
(Maximum Total Guard Current)	20mA

Typical Resistance Measurement Accuracy Degradation when using Guarding:

Guard Ratio	Multiply Accuracy
1:1	x 1
10:1	x 2
100:1	x 3

Any test point can be designated as a guard or external guard sense point without special wiring, except Power points.

Voltage Measurement

Diode and Zener Diode Measurement

Standard diodes, LEDs and zener diodes are tested by applying a constant current to the anode and cathode, then measuring the resultant voltage (forward voltage drop). Measurements of up to 50V can be performed using up to 100 mA of applied current.

Diode Test Type

Accuracy

Range	Source Current		
	10mA	1mA	0.1mA
2V	± 40 mV	± 40 mV	± 40 mV
10V*	± 200 mV	± 200 mV	± 200 mV

* Typical constant current to 7V compliance

Zener Test Type

Range	Source Current	Accuracy
20V	10mA	± 300 mV

DC Voltage Measurement

DC Voltage Measurement (VOLT test type)

Measurement Range	Accuracy
± 200 mV	4mV
± 2.0 V	40mV
± 10 V	200mV

Ranges are bipolar. Stimulus may float ± 8 V from controller chassis ground.

Opens/Shorts Measurement

The system self-learns a known-good UUT, then tests against this map. The continuity map can be edited and no-care conditions can be specified for measurements where components exist, and either condition is acceptable.

Connection/Open Thresholds	Separately programmable from 2 Ω - 50K Ω
Typical Test Time for 400 Test Points	1.2 seconds

(Test time depends on UUT circuit topology)

Low Threshold Continuity (rated speed)

Range	Threshold
1mA	2 Ω to 50 Ω

CheckSum V12 Module

High Threshold Continuity (lower speed)

Range	Threshold
100 μ A	20 Ω to 500 Ω
10 μ A	200 Ω to 5K Ω
1 μ A	2K Ω to 50K Ω

IC-Orientation/Presence Measurement

IC presence and orientation is verified by checking the semiconductor junctions of the protection diodes typically present between IC pins and the UUT power supplies. Using a proprietary algorithm, the system self-learns a mapping of these ICs and tests against this map. The map can be manually edited for specification of specific tests and no-cares.

Constant Current

Ranges	Threshold
0.1mA/1mA	0 to 2V
1mA/10mA	0 to 2V

Opto-isolator Testing

Diode Drive	Measurement Stimulus	Measurement Threshold
0mA to 10mA	1mA	0 to 2V

Transistor Testing

Three terminal devices can be measured between the power terminals (e.g., collector and emitter) while biasing the control terminal with another test point using voltage or current. This can effectively measure the operation, and in most cases the polarity of devices such as FETs, SCRs and transistors.

Third Terminal Drive	Measurement Stimulus	Measure Threshold
0mA to +1mA	1mA	0 to +2V
-10V to +10V	1mA	0 to +2V
0mA to -1mA	-1mA	0 to -2V
+10V to -10V	-1mA	0 to -2V

Voltage Sourcing

Low Power Sourcing

DCV 5

Amplitude	-10V to +10V in 80mV steps
Accuracy	3% \pm 80mV
Test Point Source Resistance	< 1K Ω

Sourced from V12

Constant Current Sourcing

Low Power Sourcing

Range	Resolution	Accuracy
-1mA to 1mA	4 μ A	3% \pm 4 μ A
-10mA to 10mA	40 μ A	3% \pm 40 μ A

Sourced from V12

Operating Environment

The test system operating temperature range is 0°C to +35°C with 0 to 80% RH (without condensation). Rated accuracy at \pm 10°C from calibration temperature. Maximum altitude for operation is 3000m (9843 ft.).

Calibration and General Notes

The system calibration cycle is 6 months. To obtain stated accuracies, low impedance measurements (less than about 100 Ω) may require external sensing to compensate for typical 5 Ω to 10 Ω lead resistance beyond internal sense points. Self-test performs automatic offset characterization for this lead resistance.

All specifications shown are typical accuracies when measuring isolated components. Accuracies may degrade depending on surrounding circuitry. Specifications are typical for a system with externally sensed measurements when impedances are less than 100 Ω . There are some limitations on the number of simultaneous sources available. Unless otherwise stated, all measurements and stimulus are from the V12 system electronics.