

i7090 Massively Parallel Board Test System

Redefining speed and flexibility in board testing

Introduction

The Keysight i7090 is a highly scalable, massively parallel board test system tailored for the complex demands of today's Printed Circuit Boards (PCBs). It is more than just ICT; it incorporates Functional Testing (FCT), boundary scan test (JTAG), and in-system programming. The i7090 delivers exceptional flexibility to customize your test setup, ensuring fast, efficient, and cost-effective production testing.



Table of Contents

System Summary 3

System Architecture..... 4

System Components 5

Instrument Rack 6

Functional Test Equipment (Q3001B/Q3002B)..... 7

Fixture Maintenance Trolley..... 7

Unpowered Test Measurement Specifications..... 8

Powered Test Measurement Specifications..... 11

Automated Inline Handler Specifications 12

System Dimensions 13

System Summary

The Keysight i7090 board test system offers one of the best solutions to test today's printed circuit boards (PCBs) rapidly and cost-effectively. With up to 20 parallel test cores and 160 simultaneous flashing channels, it is scalable and flexible to customize the system to meet your business needs. It also has a cost-effective testhead with up to 2560 In-Circuit Test (ICT) Analog & Digital test pins and an 18-slot PXIe instrument chassis. The 600mm test head encloses the module cards containing the tester's hardware resources, the Device Under Test (DUT) power supplies, and the system controller, contributing to the system's compact footprint.

Available models

Two variants are available for the i7090: the Q3000A and the Q3001B / Q3002 B. The release of the Q300xB variant modifies the instrument rack by adding additional space to expand with functional test equipment. This was achieved while maintaining the form factor of the ICT components, with additional FCT test pins of up to 1920. Several enhancements and features have been included, such as an automated shutter door, an independent bypass conveyor with different widths, and a choice between pneumatic (Q3001B) and motorized press (Q3002B).

Key features

Node capability	• Parallel In-circuit test resource of up to 2560 pins (20 cores x 128 pins) catered for modular user configuration. • Functional test resource up to 1920 pins of 3 Amp or up to 200 pins of 40 Amp.
Opens test capability	• NanoVTEP Vectorless Test EP. • Opens test for ICs, connectors, switches, and fuses.
ICT capability	• Up to 2560 ICT pin resources. • Analog Card – 128 analog pin resources per card. • Hybrid Card – 128 analog pin resources or 32 digital pin resources per card. • Short test programmable threshold: 2-1000 Ω. • Resistance, capacitance & inductance. • Diode, transistor, FET, fuse, jumper, switch, potentiometer measurements • NanoVTEP Vectorless test open detection. • EEPROM programming supports I2C & SPI Protocols
FCT capability	• 20 pogo slots for FCT pin resources. • Flexible configuration of pogo blocks ◦ Signal pogo block up to 96 pins with 3A and ◦ High current pogo block up to 10 pins with 40A. • Supports CAN/LIN communication protocol.
Accessories (Optional)	• Laser barcode reader • Programmable DUT power supplies • Polarity Check Technology • Flash Programmers • Pin Verification Fixture • Self-support Spare Kit

System Architecture

The Keysight i7090 is built on a modular, parallel architecture for scalability, flexibility, and high-test throughput. Its innovative design enables seamless upgrades and efficient testing in high-volume production environments. Key features include:

- **Scalable Modular Design:** Up to 20 individually controllable pin cards (supporting 2560 nodes or 20 cores) allow for high-pin-count board testing or parallel testing of up to 20 PCBs simultaneously.
- **Compact and Efficient Layout:** The 600 mm-wide test head optimizes performance by placing tester resources directly behind the fixture interface, minimizing cycle time and conserving floor space.
- **Comprehensive Fault Detection:** Incorporates unpowered and vectorless test technologies, such as NanoVTEP, to ensure rapid throughput and comprehensive fault detection.
- **Seamless Instrument Integration:** i7090 supports Keysight OpenTAP software for efficient functional test measurements and integrates PXI instruments from Keysight and third-party vendors.
- **Future-Ready for Industry 4.0:** Leverages CFX/Hermes standards and Keysight PathWave for smart manufacturing and data-driven insights.



System Components

The i7090 system features versatile components for high-performance testing, including the Vectorless Analog Measurement (VAM) Card for advanced measurement, the Analog Pin Card with 128 pins for reliable analog testing, and the Hybrid Pin Card combining analog and digital functions. The Flashing Carrier Card enables efficient programming with isolation during ICT, while the Backplane supports large-scale parallel testing, dynamic monitoring, and easy product tracking.

Components	Key features
VAM	• Two measurement channels on one VAM Module, with each channel testing concurrently and independently. • Each measurement channel can be paired with one or more Analog or Hybrid Pin Cards. • Supports up to 60 V Zener test, • Supports voltage measurement up to $\pm 65V$ • Supports NanoVTEP test, diode test, MOSFET test, open/short test, pin test, and voltage measurement. • Active discharge circuit with constant current: ◦ Discharge current 0.125 A. ◦ Max voltage to be discharged $\pm 70 V$
Analog pin card	• 128 pins, 6-wire measurement. • Power: 12V and 5V.
Hybrid pin card	• 128 analog or 32 digital pins, with 1 to 4 MUX. • Power supply: 12 V and 5 V input voltage. • Programmable: ◦ Driver/Receiver Voltage Levels ◦ Driver/Receiver Vector Cycle ◦ Over Current Protection • Per Channel pull-up/pull-down resistor and termination capability • EEPROM supports I2C & SPI Protocols
Flashing carrier card	• Docks up to 2 programming modules. • Each SMH module hosts up to 8 programming channels. • Built-in relay isolation for ICT • Maximum power supply: 12 V/5 A X 2. • On-board serial number storage for easy tracking.
Backplane	• 20 card slots for the massive parallel analog test. • On-board temperature sensor for dynamic monitoring. • Auto card type detection and fixed slot address assignment. • On-board serial number storage for easy tracking.

Instrument Rack

The instrument rack contains all the necessary instruments and cards, including the DUT's power supply and test interface. The testhead fillet, located at the top of the rack, acts as the primary interface to the test fixture. Mounted on the card cage, the fillets house pin cards, programming cards, and more.

For unpowered ICT measurements, connect the pin cards to the VAM card inside the PXIe chassis beneath the card cage.



Figure 1. Instrument rack of Q3000A variant

While the ICT test engine remains unchanged at the system front, mechanical adjustments have removed the wheeled base design, optimizing space at the system rear for functional test equipment.

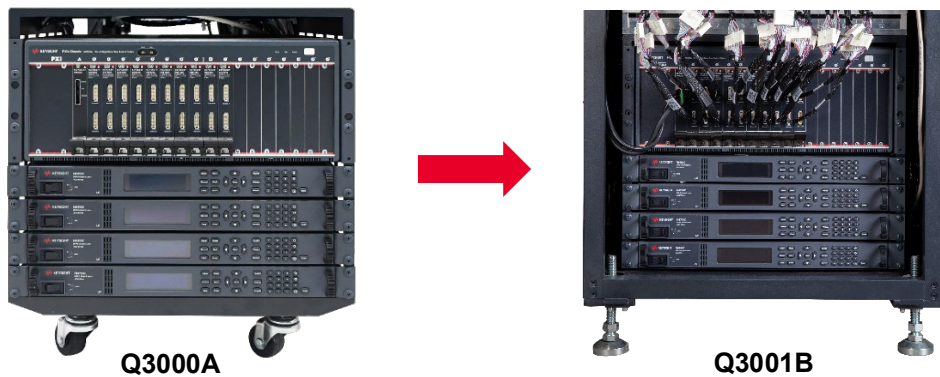


Figure 2. Image (right) of modified instrument rack for Q3001B variant

Functional Test Equipment (Q3001B/Q3002B)

The system uses a standard 19" EIA rack with 24 RU of space at the rear. The figure below illustrates an example of integration with the Keysight N6700C modular power supply and the U8989B PXI functional test system. You can integrate various test equipment for functional testing, such as the Keysight 34980A, DAQ970A, and other basic instruments.

Functional test resources connect through an independent set of fixture connections within the same fixture area.

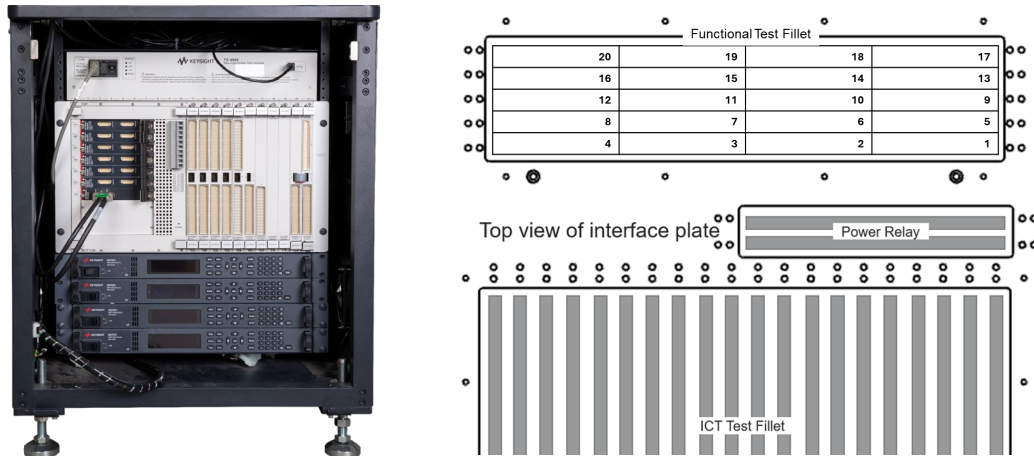


Figure 3. (left) Sample U8989B PXI / switch-load chassis for functional test (right) fixture resource area with functional test fillet at the top

Fixture Maintenance Trolley

A new fixture maintenance trolley designed for easy loading and unloading, compatible with the Q3001B.

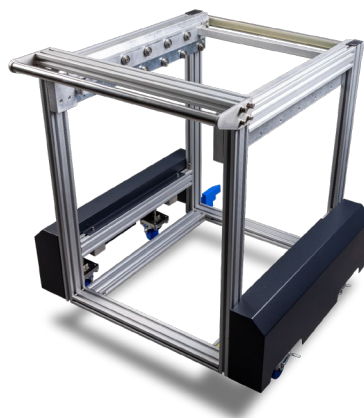


Figure 4. Image of fixture maintenance trolley in Q3001B variant

Unpowered Test Measurement Specifications

Shorts and opens

- Source impedance: 100 Ω

Parameter	Specification
Programmable threshold range	
Short	2 - 1000 Ω
Open	2 - 1000 Ω
Programming resolution	1.0 Ω
Accuracy	$\pm (0.25\% + 2.2 \Omega)$
Programmable settling time	
Minimum	0 μ s
Maximum	3.2768 s
Default	50 μ s
Programming resolution	50 μ s
Test voltage	0.1 V dc

Resistor

- Source voltage: 0.1 Vdc

Range	Measurement type	Accuracy
1 – 300 Ω	4-wire (Using: ED option)	$\pm 1.0\%$
300 Ω - 10 k Ω	4-wire (Using: ED option)	$\pm 0.25\%$
	2-wire	$\pm 1.0\%$ ¹
10 - 100 k Ω	2-wire (Using: ED option)	$\pm 0.25\%$
	2-wire	$\pm 1.0\%$
100 k Ω - 1 M Ω	2-wire (Using: ED option)	$\pm 0.5\%$
	2-wire	$\pm 2.5\%$
1.0 M Ω - 10 M Ω	2-wire (Using: ED option)	$\pm 5.0\%$

¹ Plus system residual $\leq 3.5 \Omega$.

High guard ratio tests

- Source voltage: 1.0 Vdc
- Guard ratio: 1000 to 1 on SG and 100 to 1 on IG of guard circuit

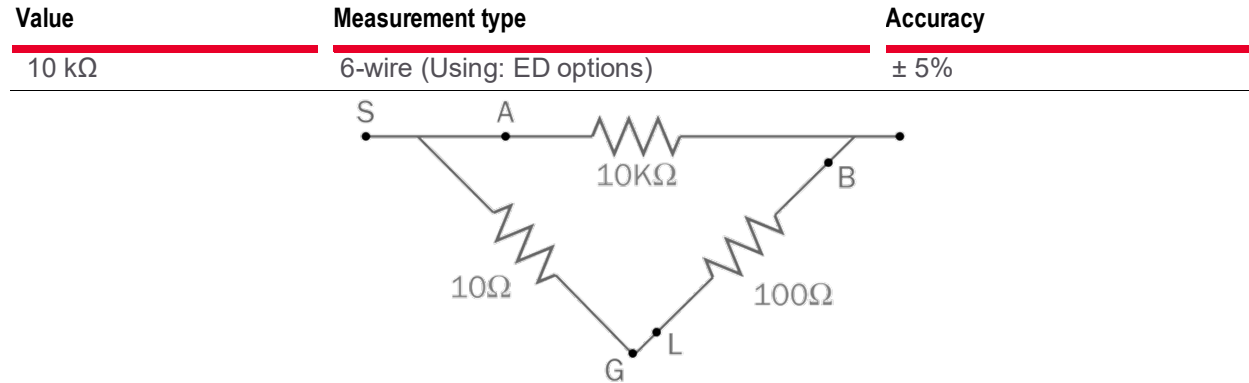


Figure 5. High guard ratio tests

Capacitor

- Source voltage: 0.1 Vac
- Dissipation factor: ≤ 1.0

Range	Measurement type	Accuracy
10 pF - 0.5 μ F	2-wire (using ED option)	$\pm 2.0\%$ ²
0.5 μ F - 150 μ F	4-wire (using ED option)	$\pm 2.0\%$

Inductor

- Source voltage: 0.1 Vac; Quality factor: ≥ 1.0

Range	Measurement type	Accuracy
150 μ H - 50 mH	4 -wire	$\pm 2.0\%$ ³
50 mH - 1.59 H	2-wire	$\pm 2.0\%$
1.59 H - 10 H	2-wire (Using ED option)	$\pm 2.0\%$
10 H- 100 H	4-wire (Using ED option)	$\pm 3.0\%$

² Plus system residual: ± 4.0 pF with capacitor compensation, 0 to +40 pF typical without capacitor compensation.

³ Plus system residual: 1 μ H.

Diode

The diode test supplies a source with serial resistors on the diode under test and measures the forward voltage drop. It is appropriate for standard, Schottky, light-emitting diodes and can detect open, short, or backward diodes.

- Source: 0 - 2.4 V
- Resistor: 50-ohm, 100-ohm, 10k-ohm, 24.3k-ohm, 249k-ohm

Bipolar transistor

- Two diode tests are between B and E, and the other is between B and C.
- Transistor ON/OFF test.

Enhancement mode FETs

- Main Source: 0 - ± 2.4 V in serial Resistor 100 ohm applied on Drain-Source.
- Auxiliary source: 0 - ± 12 V applied on Gate-Source.
- Measure the Drain-Source voltage to verify the switch function.

Nano VTEP

Parameter	Specification
Programmable low threshold	2 - 10000
Programmable high threshold	2 - 10000
Programming resolution	1
Test speed (typical)	500 pins/second

Polarity check

Parameter	Specification ⁴
Test range (total parallel capacitance)	Up to 2,000 μ F
Test range (stand-alone capacitance)	Up to 4,000 μ F
Test speed (typical)	10-15 capacitors per second

⁴ Range varies with the types of packaging used for capacitors.

Powered Test Measurement Specifications

Voltage measurement

- DC measurement: Range from ± 60 V.

Digital test measurement

Parameter	Specification
Programmable driver	
Voltage range	
Low threshold	0 V
High threshold	5 V
Programming resolution	20 mV
Static accuracy	$\pm 2\%$ of setting ± 20 mV
Continuous output current	
Maximum continuous source current	200 mA
Maximum continuous sink current	200 mA
Programmable receiver	
Voltage range	
Low threshold	0 V
High threshold	4.85 V
Input voltage range	-0.5 to +6.5 V
Programming resolution	20 mV
Static accuracy	$\pm 2\%$ of setting ± 20 mV
Programmable receive delay	
Minimum	80 ns
Maximum	Programmed vector cycle time
Resolution	50 ns
Continuous output current	
Maximum continuous source current	200 mA
Maximum continuous sink current	200 mA
Maximum peak current	500 mA
Programmable vector cycle Ttime	
Minimum	500 ns
Maximum	1.5 ms
Resolution	10% (50 ns)
Frequency range as a Clock	
Minimum	1 Hz
Maximum	6 MHz
Maximum (with divider in fixture)	50 MHz

Automated Inline Handler Specifications

Parameter	Units	Specification
Dimensions (Q300xA/B including Transparent Side Panel)	mm	1510 mm (L) x 631 mm (W) x 1954 mm (H)*
	inches	59 (L) x 25 (W) x 78 (H)
		Height does not include status lights (tower light)
System Weight	kg	• Q3000A, without crate: 1150
		• Q3001/Q3002B, without crate: 1250
		• Q3000A, with crate: 1550
		• Q3001B/Q3002B, with crate: 1650
Number of test pins		Up to 2560
PCB size	mm	430 (L) x 460 (D) (max)
		50 (L) x 50 (D) (min)
	inches	16.9 (L) x 18.1 (D) (max)
		2 (L) x 2 (D) (min)
PCB thickness (maximum)	mm	3
PCB weight (maximum)	kg	3
PCB edge support (minimum)	mm	3
PCB exchange time	sec	4.5
Fixture type		Long wire
Fixture actuation		Press down
Transport method and direction		Belt transfer, L to R, R to L, L to L, R to R (Configurable)
Transport speed	mm/sec	500
	in/sec	19.7
Transport height	mm	895 to 965 mm
Bottom fixture height	mm	90
Press force	MPa (N)	5500 x 2 (max)
Air pressure	psi	87 to 116 psi (0.6 to 0.8MPa)
		Internally air pressure regulated at 87 psi or 0.6MPa
		The system will generate an alarm if the air pressure is below 87psi (6 bar)
Power		3-phase, DELTA; supports 200-240 VAC
		3-phase, WYE; supports 208-220 VAC
		3-phase, WYE with neutral; supports 220/380
		240/415 VAC (Line-to-neutral/Line-to-line)

System Dimensions

Q300xA/B Dimensions

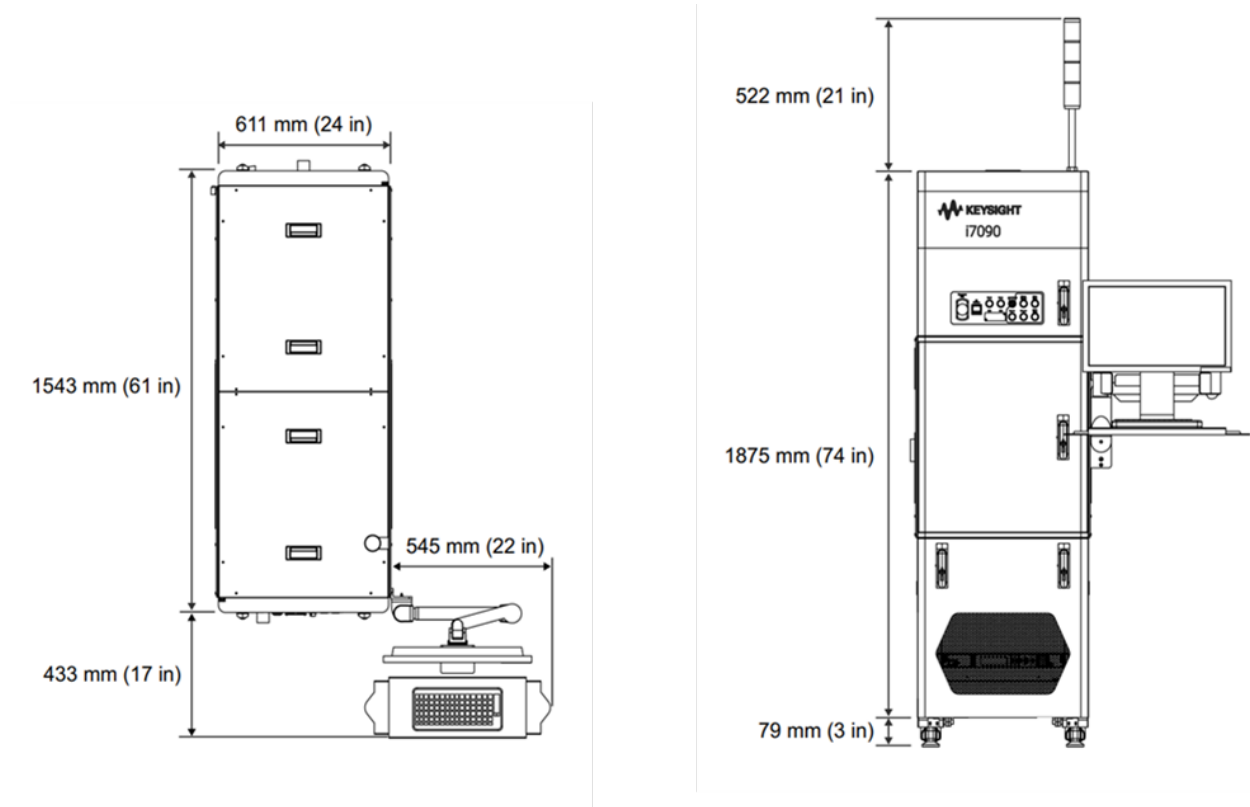


Figure 6. Product dimension (excluding Perspex transparent side panel)

Keysight enables innovators to push the boundaries of engineering by quickly solving design, emulation, and test challenges to create the best product experiences. Start your innovation journey at www.keysight.com.



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