

Specification Guide

Keysight M9514A AXIe 14-Slot Chassis and M9521A AXIe System Module



Notices

© Keysight Technologies, Inc. 2017

No part of this manual may be reproduced in any form or by any means (including electronic storage and retrieval or translation into a foreign language) without prior agreement and written consent from Keysight Technologies, Inc. as governed by United States and international copyright laws.

Manual Part Number

M9514-90015

Edition

Second Edition, December 2017
Published in USA

Keysight Technologies, Inc.
1400 Fountaingrove Parkway
Santa Rosa, CA 95403 USA

Trademarks

AXIe is a registered trademark of the AXIe Consortium.

PXI is a registered trademark of the PXI Systems Alliance.

PICMG[®], Compact PCI[®], and AdvancedTCA[®] are registered trademarks of the PCI Industrial Computer Manufacturers Group.

PCI-SIG[®], PCI Express[®], and PCIe[®] are registered trademarks of PCI-SIG.

Sales and Technical Support

To contact Keysight for sales and technical support, refer to the support links on the following Keysight websites:

www.keysight.com/find/M9514A (product-specific information and support, software and documentation updates)

www.keysight.com/find/assist (world-wide contact information for repair and service)

Declaration of Conformity

Declarations of Conformity for this product and for other Keysight products may be downloaded from the Web. Go to <http://keysight.com/go/conformity> and click on "Declarations of Conformity." You can then search by product number to find the latest Declaration of Conformity.

Technology Licenses

The hardware and/or software described in this document are furnished under a license and may be used or copied only in accordance with the terms of such license.

Warranty

THE MATERIAL CONTAINED IN THIS DOCUMENT IS PROVIDED "AS IS," AND IS SUBJECT TO BEING CHANGED, WITHOUT NOTICE, IN FUTURE EDITIONS. FURTHER, TO THE MAXIMUM EXTENT PERMITTED BY APPLICABLE LAW, KEYSIGHT DISCLAIMS ALL WARRANTIES, EITHER EXPRESS OR IMPLIED, WITH REGARD TO THIS MANUAL AND ANY INFORMATION CONTAINED HEREIN, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. KEYSIGHT SHALL NOT BE LIABLE FOR ERRORS OR FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES IN CONNECTION WITH THE FURNISHING, USE, OR PERFORMANCE OF THIS DOCUMENT OR OF ANY INFORMATION CONTAINED HEREIN. SHOULD KEYSIGHT AND THE USER HAVE A SEPARATE WRITTEN AGREEMENT WITH WARRANTY TERMS COVERING THE MATERIAL IN THIS DOCUMENT THAT CONFLICT WITH THESE TERMS, THE WARRANTY TERMS IN THE SEPARATE AGREEMENT SHALL CONTROL.

Keysight Technologies does not warrant third-party system-level (combination of chassis, controllers, modules, etc.) performance, safety, or regulatory compliance unless specifically stated.

DFARS/Restricted Rights Notices

If software is for use in the performance of a U.S. Government prime contract or subcontract, Software is delivered and licensed as "Commercial computer software" as defined in DFAR 252.227-7014 (June 1995), or as a "commercial item" as defined in FAR 2.101(a) or as "Restricted computer software" as defined in FAR 52.227-19 (June 1987) or any equivalent agency regulation or contract clause. Use, duplication or disclosure of Software is subject to Keysight Technologies' standard commercial license terms, and non-DOD Departments and Agencies of the U.S. Government will receive no greater than Restricted Rights as defined in FAR 52.227-19(c)(1-2) (June 1987). U.S. Government users will receive no greater than Limited Rights as defined in FAR 52.227-14 (June 1987) or DFAR 252.227-7015 (b)(2) (November 1995), as applicable in any technical data.

Safety Information

The following general safety precautions must be observed during all phases of operation of this instrument. Failure to comply with these precautions or with specific warnings or operating instructions in the product manuals violates safety standards of design, manufacture, and intended use of the instrument. Keysight Technologies assumes no liability for the customer's failure to comply with these requirements.

General

Do not use this product in any manner not specified by the manufacturer. The protective features of this product must not be impaired if it is used in a manner specified in the operation instructions.

Before Applying Power

Verify that all safety precautions are taken. Make all connections to the unit before applying power. Note the external markings described under "Safety Symbols".

Ground the Instrument

Keysight chassis' are provided with a grounding-type power plug. The instrument chassis and cover must be connected to an electrical ground to minimize shock hazard. The ground pin must be firmly connected to an electrical ground (safety ground) terminal at the power outlet. Any interruption of the protective (grounding) conductor or disconnection of the protective earth terminal will cause a potential shock hazard that could result in personal injury.

Do Not Operate in an Explosive Atmosphere

Do not operate the module/chassis in the presence of flammable gases or fumes.

Do Not Operate Near Flammable Liquids

Do not operate the module/chassis in the presence of flammable liquids or near containers of such liquids.

Cleaning

Clean the outside of the Keysight module/chassis with a soft, lint-free, slightly dampened cloth. Do not use detergent or chemical solvents.

Do Not Remove Instrument Cover

Only qualified, service-trained personnel who are aware of the hazards involved should remove instrument covers. Always disconnect the power cable and any external circuits before removing the instrument cover.

Keep away from live circuits

Operating personnel must not remove equipment covers or shields. Procedures involving the removal of covers and shields are for use by service-trained personnel only. Under certain conditions, dangerous voltages may exist even with the equipment switched off. To avoid dangerous electrical shock, DO NOT perform procedures involving cover or shield removal unless you are qualified to do so.

DO NOT operate damaged equipment

Whenever it is possible that the safety protection features built into this product have been impaired, either through physical damage, excessive moisture, or any other reason, REMOVE POWER and do not use the product until safe operation can be verified by service-trained personnel. If necessary, return the product to an Keysight Technologies Sales and Service Office for service and repair to ensure the safety features are maintained.

DO NOT block the primary disconnect

The primary disconnect device is the appliance connector/power cord when a chassis used by itself, but when installed into a rack or system the disconnect may be impaired and must be considered part of the installation.

Do Not Modify the Instrument

Do not install substitute parts or perform any unauthorized modification to the product. Return the product to an Keysight Sales and Service Office to ensure that safety features are maintained.

In Case of Damage

Instruments that appear damaged or defective should be made inoperative and secured against unintended operation until they can be repaired by qualified service personnel

CAUTION

Do NOT block vents and fan exhaust: To ensure adequate cooling and ventilation, leave a gap of at least 50mm (2") around vent holes on both sides of the chassis.

Do NOT operate with empty slots: To ensure proper cooling and avoid damaging equipment, fill each empty slot with an AXle filler panel module.

Do NOT stack free-standing chassis: Stacked chassis should be rack-mounted.

All modules are grounded through the chassis: During installation, tighten each module's retaining screws to secure the module to the chassis and to make the ground connection.

WARNING

Operator is responsible to maintain safe operating conditions. To ensure safe operating conditions, modules should not be operated beyond the full temperature range specified in the Environmental and physical specification. Exceeding safe operating conditions can result in shorter lifespan, improper module performance and user safety issues. When the modules are in use and operation within the specified full temperature range is not maintained, module surface temperatures may exceed safe handling conditions which can cause discomfort or burns if touched. In the event of a module exceeding the full temperature range, always allow the module to cool before touching or removing modules from the chassis.

Safety Symbols

CAUTION

A CAUTION denotes a hazard. It calls attention to an operating procedure or practice, that, if not correctly performed or adhered to could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.

WARNING

A WARNING denotes a hazard. It calls attention to an operating procedure or practice, that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

Products display the following symbols:



Warning, risk of electric shock



Refer to manual for additional safety information.



Earth Ground.



Protective Earth Ground terminal



Chassis Ground.



Alternating Current (AC).



Three-Phase Alternating Current



Direct Current (DC).



Both direct and alternating current



Terminal is at earth potential.



Terminal for Neutral conductor on properly installed equipment



Terminal for Line conductor on properly installed equipment



Standby Power. Unit is not completely disconnected from AC mains when switch is in standby.



Antistatic precautions should be taken.

CAT I
CAT II
CAT III
CAT IV

IEC Measurement Category I, II, III, or IV

For localized Safety Warnings, Refer to Agilent Safety document (p/n 5185-8500) on the product CD.



The CSA mark is a registered trademark of the Canadian Standards Association and indicates compliance to the standards laid out by them. Refer to the product Declaration of Conformity for details.



Notice for European Community: This product complies with the relevant European legal Directives: EMC Directive (2004/108/EC) and Low Voltage Directive (2006/95/EC).



The Regulatory Compliance Mark (RCM) mark is a registered trademark. This signifies compliance with the Australia EMC Framework regulations under the terms of the Radio Communication Act of 1992.

ICES/NMB-001

ICES/NMB-001 indicates that this ISM device complies with the Canadian ICES-001.



KCC-REM-AT1-
BLM0DSF01

South Korean Class A EMC Declaration. this equipment is Class A suitable for professional use and is for use in electromagnetic environments outside of the home.

A 급 기기 (업무용 방송통신기자재)
이 기기는 업무용 (A 급) 전자파적합기기로서 판 매자 또는 사용자는 이 점을 주의하시기 바라 며 , 가정외의 지역에서 사용하는 것을 목적으로 합니다.



Waste Electrical and Electronic Equipment (WEEE) Directive
2002/96/EC

This product complies with the WEEE Directive (2002/96/EC) marking requirement. The affixed product label (see below) indicates that you must not discard this electrical/electronic product in domestic household waste.

Product Category: With reference to the equipment types in the WEEE directive Annex 1, this product is classified as a "Monitoring and Control instrumentation" product.

Do not dispose in domestic household waste. To return unwanted products, contact your local Keysight office for more information.



This symbol represents the time period during which no hazardous or toxic substance elements are expected to leak or deteriorate during normal use. Forty years is the expected useful life of this product



Contents

- How to use this document 9
 - Technical Specification and Characteristics 9
 - Recommended best practices in use 9
 - Additional information 10
- M9514A 14-Slot AXIe Chassis 11
- M9521A AXIe System Module (ASM) Characteristics 13
- Environmental and Regulatory 15

How to use this document

This document contains technical specifications for all manufacturing versions of the M9514A AXIe Chassis and the M9521A AXIe System Module. Specifications published in the data sheet only apply to the current manufacturing version of the equipment.

If a specification only applies to a certain manufacturing version of the equipment, it is indicated in this document. Such changes are usually designated by a serial number break. For example, you might see a table indicating the specification for equipment with “Serial Number TW51150212 and earlier” accompanied with another column with “Serial Number TW51160201 and later.” indicating that the equipment with serial number TW51160201 and greater use the new specification.

Technical Specification and Characteristics

Specifications describe the warranted performance of calibrated instruments that have been stored for a minimum of 2 hours within the operating temperature range of 0 °C to 50 °C, unless otherwise stated and after a 45 minute warm-up period. Data represented in this document are specifications unless otherwise noted under the following conditions:

Characteristics describe product performance that is useful in application of the product, but that is not covered by the product warranty. Characteristics are often referred to as Typical or Nominal values.

- Typical describes characteristic performance, which 80% of instruments will meet when operated over a 20 °C to 30 °C temperature range. Typical performance is not warranted.
- Nominal describes representative performance that is useful in the application of the product when operated over a 20 °C to 30 °C temperature range. Nominal performance is not warranted.

Recommended best practices in use

- Use slot filler panels in empty module slots to ensure proper cooling. Keysight chassis and filler panels optimize module temperature performance and reliability of test.
- At environmental temperatures above 45 °C, chassis fans should be set to high.

Additional information

- All graphs contain measured data from multiple units at room temperature and are representative of product performance within the controlled temperature range unless otherwise noted.
- The specifications contained in this document are subject to change.

TECHNICAL SPECIFICATIONS AND CHARACTERISTICS

M9514A 14-Slot AXIe Chassis

CHASSIS CHARACTERISTICS	
Standards compliance	
AXIe 1.0 Base Architecture Specification	
Advanced TCA PICMIG 3.0 R2.0 specification	
Backplane	
Total Slots	14
Instrument module slots	13
System module Slots	1
Local Bus Lines	62 different lines between each instrument module slot
PCIe Data Fabric	x4 Gen 2 to each module slot
Mechanical	
Size	482.6 mm W x 589.7 mm H x 579.1 mm D ¹ (19 in W x 23.22 in H x 22.8
Weight (nom)	48.7 kg (107 lbs) ²
¹ From front handle to IEC 60309 AC power connector. Top cover to rubber feet.	
² Without modules	
M9514A CLOCKS AND TRIGGERS	
100 MHz system clock (CLK100)	
Maximum slot-to-slot skew	100 ps
AXIe SYNC	
Maximum slot-to-slot skew	100 ps
AXIe Star Trigger (STRIG) [™]	
Maximum slot-to-slot skew	20 ps

TECHNICAL SPECIFICATIONS AND CHARACTERISTICS

M9514A POWER SUPPLY CHARACTERISTICS		
AC input		
Operating voltage range		
Single Phase or 3-Phase Delta		200-240 VAC
3-Phase Wye		200/415 VAC
Input frequency range		50-60 Hz
Input current		24 Arms
Overcurrent protection		auto recovery
Efficiency (typical)		85-93%
DC supply		
DC Output		-52 V Nominal
Total DC module power		2800 W
Total max module current		53.8A
Load regulation		2%
Maximum ripple and noise (20 MHz BW)		500 mV pk-pk
Chassis cooling and power dissipation		
Slot airflow direction		Bottom to top
Chassis cooling intake		Bottom-front of chassis
Chassis cooling exhaust		Top-rear of chassis
Chassis cooling fans		HIGH/AUTO speed selector Six 252.85 cfm fans in three front fan trays Ten 138.0 cfm fans in rear fan tray
Power dissipation, instrument slot		200 W maximum

TECHNICAL SPECIFICATIONS AND CHARACTERISTICS

M9521A AXIe System Module (ASM) Characteristics

M9521A Module Characteristics	
Standards Compliance	AXIe 1.0 and 2.0 Specifications
Module form factor	1-slot AXIe
Size	30.5 mm W x 350.9 mm H x 292.4 mm D (1.2 in W x 13.8 in H x 11.5 in D)
Weight (nominal)	2.4 kg (5.3 lbs)
Chassis Compatibility	AXIe System Module slot ¹
Front panel connectors	
PCIe1	Upstream/Downstream x8 Gen 2
PCIe2	Downstream x8 Gen 2
10 MHz REF Clock IN/OUT	SMB (2)
MultiFrame	36-pin mini D (2)
Port1 – Port 6	SMB (6)
LAN1/2	RJ45 (2) 10/100/1000 Base-T
AXIe Backplane I/O	
PCIe Fabric	x4 Gen 2 to each slot
Ethernet	RJ45 (2) 10/100/1000 Base-T to each slot
Triggers	TRIG[0:11] and STRIG
Synchronization and Control	CLK100, SYNC, FCLK, IPMB

¹ Not compatible with M9502A or M9505A because these chassis do not have an AXIe-compliant system slot.

M9521A DC Power Requirements	
DC Current (max)	2.6A @ –52 V (nominal)
Power Dissipation (max)	135 W

TECHNICAL SPECIFICATIONS AND CHARACTERISTICS

M9521A Clocks and Triggers	
100 MHz System Clock (CLK100)	
Accuracy	± 30 ppm
Duty Cycle	45/55%
External REF Clock In (SMB)	
Input frequency	10 MHz \pm 100 ppm
Input level	5 V pk-pk, AC coupled
Minimum swing	250 mV
Input impedance	50 ohm
External REF Clock Out (SMB)	
Output frequency	10 MHz \pm 30 ppm
Output level	3.3 V pk-pk, AC coupled
Output impedance	50 ohm
Input/Output ports (SMB)	
Direction control	Input, Output, open-drain bi-directional (programmable)
Number of ports	6
Output level	3.3 V CMOS
Output impedance (push-pull mode)	50 ohm
Output impedance (open-drain mode)	316 ohms pulled up to 3.3 volts
Input level	± 5 V programmable threshold
Input impedance (input mode)	50 ohm or 3 kohm (programmable)
Minimum swing	250 mV

Environmental and Regulatory

Environmental ^{1,2,3}		
Operating and storage conditions		
	Operating	Storage
Temperature	0°C to 50°C	–25°C to 60°C
Altitude	up to 10,000 ft (3048m)	up to 15,000 ft (4572m)
Humidity	Type tested at 95%, +40°C (non-condensing)	
Vibration		
Operating random vibration: type tested at 5 to 500 Hz, 0.21 g rms		
Survival random vibration: type tested at 5 to 500 Hz, 2.09 g rms		
M9514A Acoustical emissions (LWA dB, ref 1pW)		
	Maximum	Nominal ⁴ (25°C ambient)
Sound Pressure ⁵	79 dBA	67 dBA
Sound Power ⁶	89 dBA	77 dBA

1 Characteristics apply to both M9514A and M9521A unless otherwise noted.

2 Samples of this product have been type tested in accordance with the Keysight Environmental Test Manual and verified to be robust against the environmental stresses of storage, transportation and end-use; those stresses include but are not limited to temperature, humidity, shock, vibration, altitude, and power line conditions.

3 Test methods are aligned with IEC 60068-2 and levels are similar to MIL-PRF-28800F Class 3.

4 Empty chassis at 25°C

5 At operator position (LpA dB, ref 20μPa)

6 LwA dB, ref 1pW

Regulatory¹**Safety**

Complies with European Low Voltage Directive 2006/95/EC
IEC/EN 61010-1:2010, 3rd edition
Canada: CSA C22.2 No. 61010-1-12
USA: UL std no. 61010-1, 3rd Edition

EMC

Complies with European EMC Directive 2004/108/EC
IEC/EN 61326-1
CISPR Pub 11 Group 1, Class A
AS/NZS CISPR 11
ICES/NMB-001
This ISM device complies with Canadian ICES-001.
Cet appareil ISM est conforme a la norme NMB-001 du Canada

¹ Characteristics apply to both M9514A and M9521A

