

# Agilent L4421A 40-Channel Armature Multiplexer

Data Sheet



- LXI compliance includes built-in Ethernet connectivity
- Fully-featured graphical Web interface
- 40 2-wire latching armature relays
- Thermocouple reference junction for temperature measurements (reqs ext DMM)
- Relay counter
- Scan up to 100 ch/s
- 300 V, 1 A switch; 2 A carry current
- Software drivers for most common programming environments

## 40-channel multiplexer offers high-performance signal switching wherever your application needs it

The Agilent L4421A is a high-performance 40-channel armature multiplexer that is LXI Class C compliant. With its small size and Ethernet connectivity, this switch can be placed wherever your application needs it.

The L4421A is a versatile multiplexer for general purpose scanning. The low thermal offset characteristics and built-in thermocouple reference on the terminal block, make it ideal for temperature measurements with an external DMM. The dense, multi-function switching with 100 channel/second scan rates addresses a broad spectrum of data acquisition, design verification and

functional test applications. The Ethernet connection also simplifies distributed data acquisition so that you can collect data from multiple locations.

Four additional fused inputs (44 channels total) can route up to 1 A of current to an external DMM, allowing for AC and DC current measurements without the need for external shunt resistors.

Using this LXI instrument, you'll get all the benefits of an Ethernet connection, instrument web server, standard software drivers and more. The LXI standard is supported by multiple vendors, enabling lower cost of test with accelerated test integration and development.



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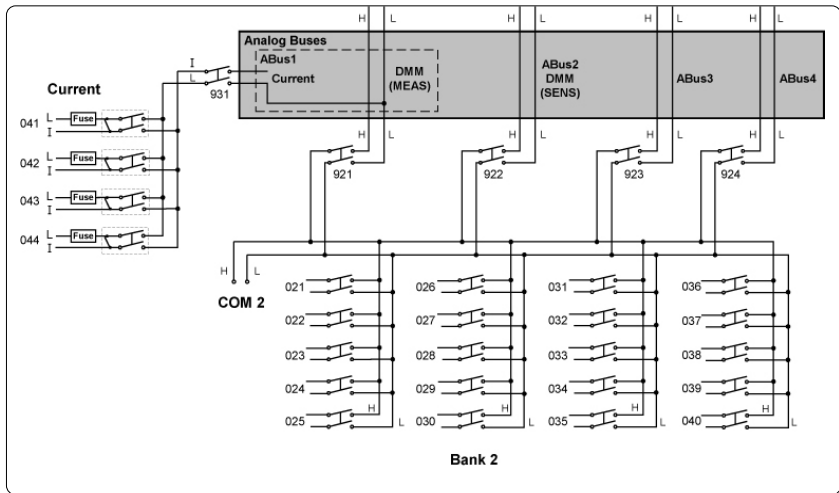
### Switch features for flexible and reliable connections

Connect one of many different points to a single point or create your own custom configuration with multiple connections. When configured as a multiplexer, the L4421A features break-before-make connections to ensure that no two signals are connected to each other during a scan.

The sequence feature defines switch sequences and controls complex signal routing to ensure the order of switch closures. Assign a sequence, give it a name and then execute it with the custom name you created.

External trigger capabilities make it easy for you to time and synchronize measurements and other events. This can help you determine when to begin or end an acquisition.

The L4421A also includes a relay counter to monitor and help predict when relays are nearing their end of life.



**Figure 1.** L4421A 40-channel armature multiplexer with low thermal offset (bank 2)

### Easily route signals to an external DMM

The L4421A switches support signals up to 300 V and 1 A so that no external signal conditioning is required. The 34921T features a built-in thermocouple reference that allows for scanning temperature measurements with an external DMM. The analog bus connector can be used to easily route your multiplexed signals to an external DMM.

Hardware handshake with an external DMM is supported through a Channel closed trigger output and a Channel advance trigger input.

### System connections you can trust

The L4421A comes with 2 heavy duty 50-pin Dsub connectors that allow for simple, reliable connection options. Each connector uses 30 micro-inches

of gold to ensure a repeatable, accurate measurement. Flexible connection options include:

- Detachable terminal blocks with strain relief
- Low-cost, standard 50-pin Dsub connector kits and cables
- Mass interconnect solutions

### Ethernet connectivity enables simple connection to the network and remote access to measurements

The Ethernet interface offers high-speed connections that allow for remote access and control. You can set up a private network to filter out unwanted LAN traffic and speed up the I/O throughput, or take advantage of the remote capabilities and distribute your tests worldwide. Monitor, troubleshoot, or debug your

application remotely. Ethernet communication also can be used with the support of LAN sockets connections.

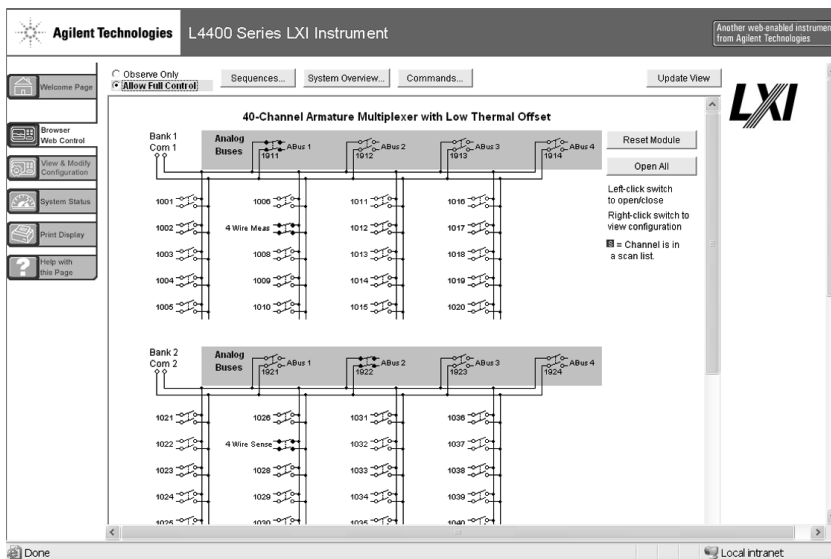
The optional GPIB interface has many years of proven reliability and can be used for easy integration into existing applications.

The L4421A ships with the Agilent E2094N I/O Libraries Suite making it easy for you to configure and integrate instruments into your system — even if your system includes instruments from multiple vendors.

**Fully-featured graphical web interface makes it easy to set-up and troubleshoot your tests from anywhere in the world**

The built-in Web browser interface provides remote access and control of the instrument via a Java-enabled browser such as Internet Explorer. Using the Web interface, you can set up, troubleshoot, and maintain your instrument from remote locations.

- View and modify instrument setup
- Open or close switches
- Send, receive and view SCPI commands



**Figure 2.** The Web interface makes it easy to set up, troubleshoot and maintain your test remotely

- Define and execute switch sequences
- View error queue
- Get status reports on relay counts, firmware revisions, and more

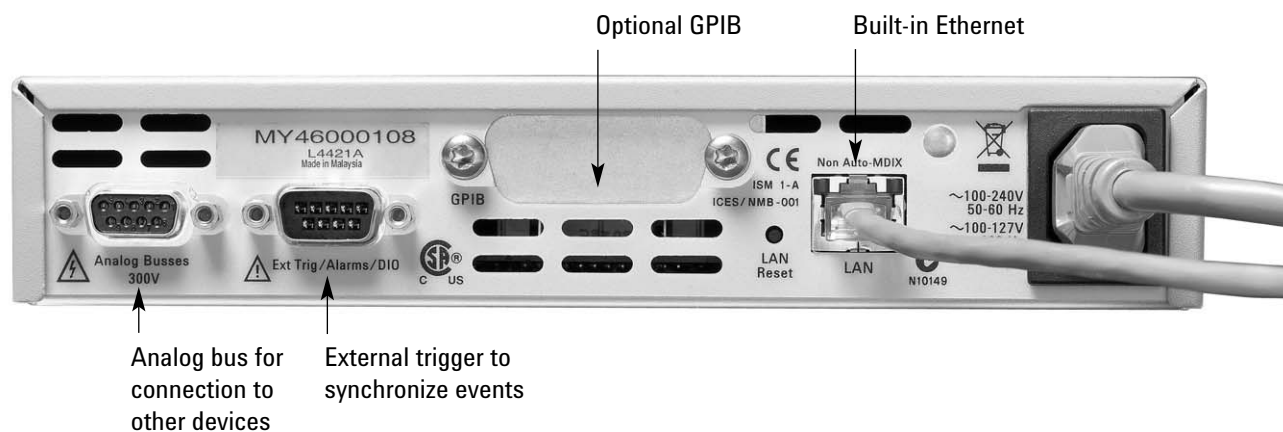
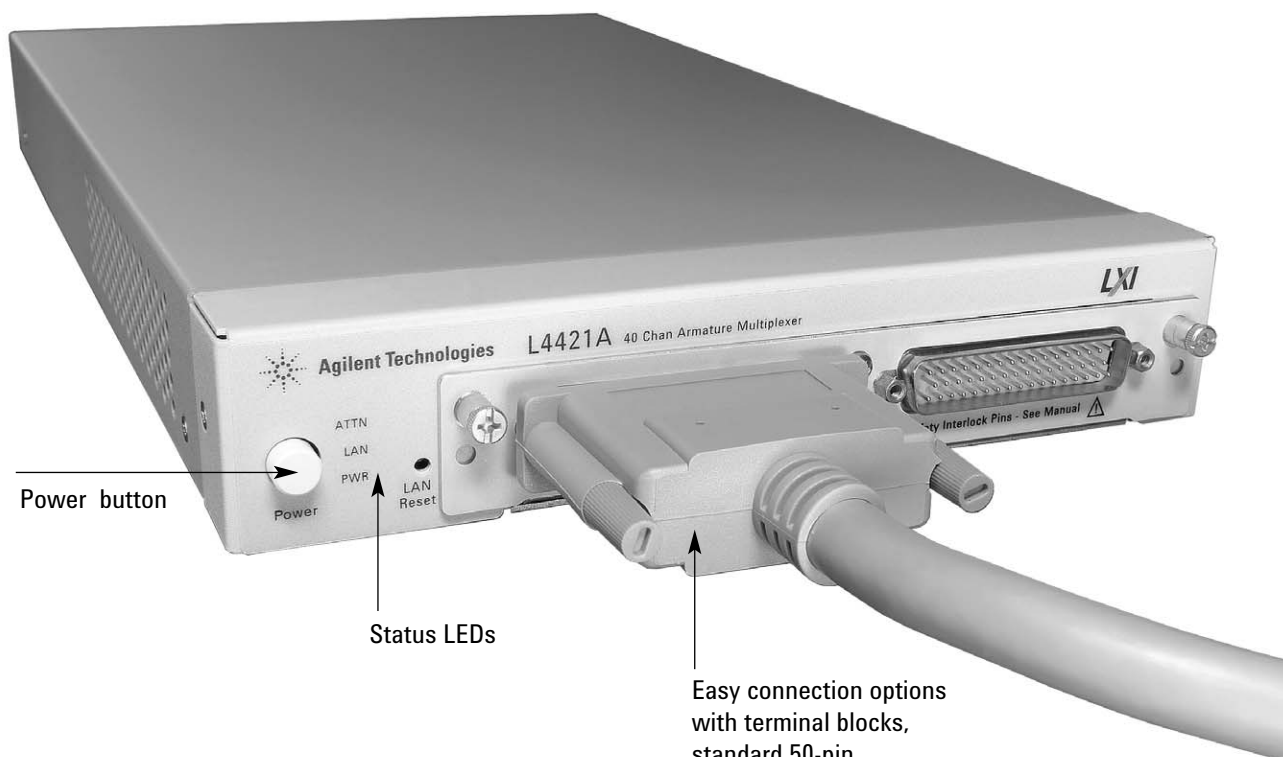
Additionally, since the Web server is built into the instrument, you can access it on any operating system that supports the Web browser without having to install any special software. Password protection and LAN lockout are also provided to limit access for additional security.

**Software for most popular programming environments**

Full support for standard programming environments ensures compatibility and efficiency. You can use direct I/O with the software you already have and know, or use standard IVI and LabVIEW™ software drivers that provide compatibility with the most popular development environments:

- Agilent T&M Toolkit for Microsoft Visual Studio®.NET and Agilent VEE Pro
- National Instruments LabVIEW, LabWindows/CVI, TestStand, and Switch Manager
- Microsoft C/C++® and Visual Basic®

**High-performance switching wherever your application needs it**



## Product Specifications

### Specifications and Characteristics

Input characteristics (per channel)	Channels/configurations		40 2-wire 20 4-wire 4-current (1.5 A fused)
	Switch type		Armature Latching
	Max volts (DC, AC RMS) <sup>1</sup>		±300 V
	Max current (DC, AC RMS)	Switch current Carry current	1 A 2 A
	Power (W, VA) <sup>4</sup>		60 W
	Volt-Hertz limit		10 <sup>8</sup>
General specifications			
	Offset voltage <sup>2</sup>		<3 uV
	Initial closed channel resistance <sup>2</sup>		< 1.5 Ω
	DC Isolation (ch-ch, ch-earth)		>10 GΩ
	T/C cold junction accuracy <sup>2,6</sup>		< 0.8 °C
AC characteristics			
	Bandwidth at terminal block <sup>3</sup>		45 MHz
	Crosstalk at terminal block (ch-ch) <sup>3</sup>	300 kHz 1 MHz 20 MHz 45 MHz	-75 dB -75 dB -50 dB -40 dB
	Capacitance at terminal block	HI-LO LO – earth	150 pF 150 pF
General characteristics			
	Relay life typical	No load 10 V, 100 mA Rated load =	100 M 10 M 100 k
	Scanning speeds <sup>5</sup>		100 ch/s
	Open /close time, typical		4 ms/4 ms
	Analog bus connection		Yes

<sup>1</sup> DC or AC RMS voltage, channel-to-channel or channel-to-earth

<sup>2</sup> At analog bus connector

<sup>3</sup> 50 Ohm source, 50 Ohm load, differential measurements verified with 4-port network analyzer (Sdd21)

<sup>4</sup> Limited to 6 W of channel resistance power loss per module

<sup>5</sup> Speeds are with an external DMM with 4-1/2 digits, delay 0, display off, autozero off, and within bank

<sup>6</sup> Includes 0.5°C error temperature reference sensor and 0.3°C terminal block isothermal gradient error.  
See User's Guide for information on supported external reference sensors.

**Measurement Accuracy** For accuracy measurement specification, combine the DMM offset with the switch offset. Bandwidth of the switch may offset the accuracy of the AC measurement.

## Product Specifications (continued)

### Command Execution Time in msec:

	<b>GPIO</b>	<b>LAN</b>
Open or Close	4.7	5.3
Init/*WAI	1.9	3
Close/Init/Open	12.4	14

### Scanning rates with external DMM (includes switch, DMM measure time and I/O time with Agilent 34401A, 34410A, 34411A)

<b>Scanning channels</b>	<b>GPIO ch/s</b>	<b>LAN (w/ VXI 11) ch/s</b>
Scanning DCV or Ohms	100	100
Scanning ACV	75	75
Scanning temperature	100	100

### Scan triggering

Source	Interval, external, software
Scan count	1 to 50,000 or continuous
Scan interval	0 to 99 hours; 1 ms step size
Channel delay	0 to 60 seconds per channel; 1 ms step size
External trig delay	<2 ms.
External trig jitter	<2 ms

### Memory

States	5 instrument states with user label in non-volatile memory
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### General specifications

Power supply	Universal 100 V to 240 V $\pm 10\%$
Power line frequency	50 Hz to 60 Hz $\pm 10\%$ automatically sensed
Power consumption	15 VA
Operating Environment	Full accuracy for 0°C to 55°C Full accuracy to 80% R.H. at 40 °C Pollution degree 1 of IEC 61010-1
Storage environment	-40°C to 70°C
Dimensions (H x W x L)	40.9 x 212.3 x 379.3 mm 1.61 x 8.36 x 14.93 in
Weight	3.8 kg, 8.4 lbs
Safety conforms to	CSA, UL/IEC/EN 61010-1
EMC conforms to	IEC/EN 61326-1, CISPR 11
Warranty	1 year

## Product Specifications (continued)

### Software

Agilent connectivity software included	Agilent I/O Libraries Suite 14 or greater (E2094N)
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### Minimum system requirements

PC hardware	Intel Pentium 100 MHz, 64 Mbyte RAM, 210 Mbyte disk space Display 800x600, 256 colors, CD-ROM drive
Operating system <sup>1</sup>	Windows® 98 SE/NT/2000/XP

### Computer interfaces

Standard LAN 10BaseT/100BaseTx
Optional IEEE 488.2 GPIB

### Software driver support for programming languages

Software drivers	IVI-C and IVI-COM for Windows NT®/2000/XP LabVIEW
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### Compatible with programming tools and environments

Agilent	VEE Pro
	T&M Toolkit (reqs Visual Studio.NET)
National Instruments	TestStand
	Measurement Studio
	LabWindows/CVI
	LabVIEW
	Switch Executive
Microsoft	Visual Studio.NET®
	C/C++
	Visual Basic 6®

<sup>1</sup> Load I/O Libraries Version M for Windows NT support or version 14.0 for Windows 98 SE support

## Ordering information

### **L4421A 40-chan armature multiplexer**

Includes User's guide on CD, power cord, and Quick Start package

#### **Option - GPIB**

Adds GPIB interface

#### **Option 0B0**

Deletes printed manual set, full documentation included on CD ROM

#### **Option ABA**

English printed manual set

### **Connection Options**

Select terminal block for discrete wiring, cables or connector kits. Cables and connector kits require 2 per instrument.

#### **34921T**

Terminal block with temp reference for 34921A and L4421A 40-Ch Multiplexer

#### **Y1135A**

1.5 m 50-pin Dsub, M/F twisted pair with outer shield cable – 300 V

#### **Y1136A**

3 m 50-pin Dsub, M/F twisted pair with outer shield cable – 300 V

#### **Y1139A**

Solder cup connector kit with female 50-pin Dsub

## Other accessories

### **Y1160A**

Rack mount kit for L4400 series instruments-racks 2 instruments side-by-side on sliding tray

### **34307A**

10-pack of J-type thermocouples

### **34308A**

5-pack of 10 k thermistors

For additional information please visit:

<http://www.agilent.com/find/L4421A>

## Related Agilent literature

### **Data Sheets**

**5988-6302EN**

Agilent VEE Pro

**5989-1441EN**

Agilent W1140A-TKT

T&M Toolkit 2.0 with Test Automation

**5989-1439EN**

Agilent E2094N

I/O Libraries Suite 14



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Your Advantage means that Agilent offers a wide range of additional expert test and measurement services, which you can purchase according to your unique technical and business needs. Solve problems efficiently and gain a competitive edge by contracting with us for calibration, extra-cost upgrades, out-of-warranty repairs, and on-site education and training, as well as design, system integration, project management, and other professional engineering services. Experienced Agilent engineers and technicians worldwide can help you maximize your productivity, optimize the return on investment of your Agilent instruments and systems, and obtain dependable measurement accuracy for the life of those products.



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(tel) 0800 047 866

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#### **Other Asia Pacific Countries:**

(tel) (65) 6375 8100

(fax) (65) 6755 0042

Email: [tm\\_ap@agilent.com](mailto:tm_ap@agilent.com)

Contacts revised: 09/26/05

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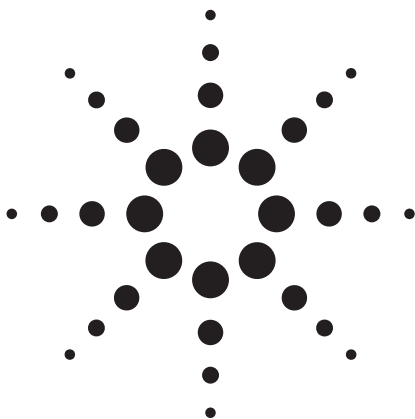
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**Agilent Technologies**



## Agilent L4433A Dual/Quad 4x8 Reed Matrix

### Data Sheet



- LXI compliance includes built-in Ethernet connectivity
- Fully-featured graphical Web interface
- Dual 4x8, 8x8, or 4x16 2-wire configurations
- 64 2-wire or 128 1-wire cross-points
- High speed reed relays
- Analog bus connection
- Relay counter
- $\pm 150$  V peak, 0.5 A switch, 1.5 A carry current
- Software drivers for most common programming environments

#### **Dual/quad 4x8 Matrix offers high-performance signal switching wherever your application needs it**

The Agilent L4433A is a high-speed reed relay matrix that is LXI Class C compliant. With its small size and Ethernet connectivity, this matrix can be placed wherever your application needs it.

The Agilent L4433A offers a flexible connection path between your device under test and your test equipment, allowing different instruments to be connected to multiple points on your device under test at the same time. This instrument

can be configured as a 2-wire or a 1-wire matrix, increasing the number of crosspoints. Multiple matrices can be combined through the analog buses connector to create a larger matrix.

Using this LXI instrument, you'll get all the benefits of an Ethernet connection, instrument Web server, standard software drivers and more. The LXI standard is supported by multiple vendors, enabling lower cost of test with accelerated test integration and development.



**Agilent Technologies**

### Switch features for flexible and reliable connections

The L4433A features a full cross-point matrix that allows you to connect any row to any column. This is a convenient way to connect multiple test instruments to multiple points on a device under test. With its high-speed reed relays you are ensured a fast response.

Each cross-point in the matrix switch has two wires—a high and a low for the measurement. Or, if you prefer, you can configure the L4433A as a single-wire matrix, increasing the number of crosspoints to 128. The L4433A also has in-rush resistors on each column for added protection. Expand your matrix using the analog bus connector to create a larger matrix, or easily connect to an external measurement device like a DMM.

The sequence feature defines switch closures and controls and can be used to easily change between different switch setups. Assign a sequence, give it a name and then execute it with the custom name you created.

External trigger capabilities make it easy for you to time and synchronize switch closures and openings.

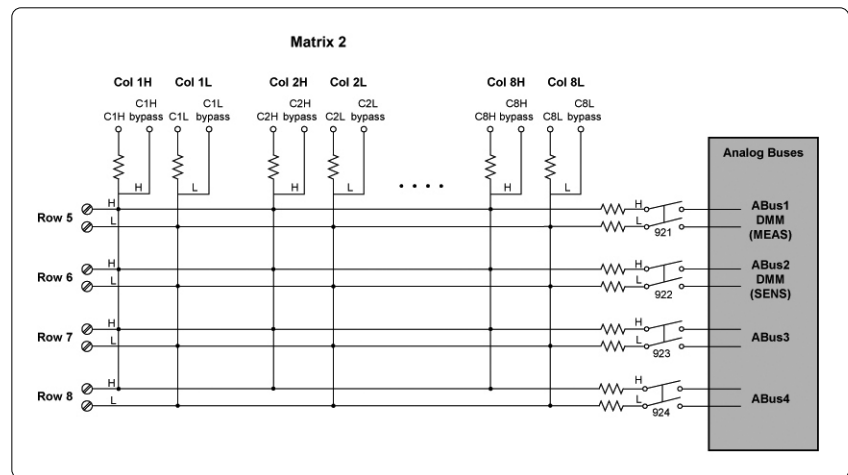


Figure 1. L4433A Dual/Quad 4 x 8 Real Matrix

The L4433A also includes a relay counter to monitor and help predict when relays are nearing their end of life.

### Easily route signals to an external DMM

The L4433A switches support signals up to  $\pm 150$  V and 0.5 A so that no external signal conditioning is required. The analog bus connector can be used to easily route your matrix switch signals to an external device.

### System connections you can trust

The L4433A comes with 2 heavy duty 50-pin Dsub connectors that allow for simple, reliable connection options. Each connector uses 30 micro-inches of

gold to ensure a repeatable, accurate measurement. Flexible connection options include:

- Detachable terminal blocks with strain relief
- Low-cost, standard 50-pin Dsub connector kits and cables
- Mass interconnect solutions

### Ethernet connectivity enables simple connection to the network and remote access to measurements

The Ethernet interface offers high-speed connections that allow for remote access and control. You can set up a private network to filter out unwanted LAN traffic and speed up the I/O throughput, or take advantage of the remote capabilities and distribute your tests worldwide. Monitor, troubleshoot, or

debug your application remotely. Ethernet communication also can be used with the support of LAN sockets connections.

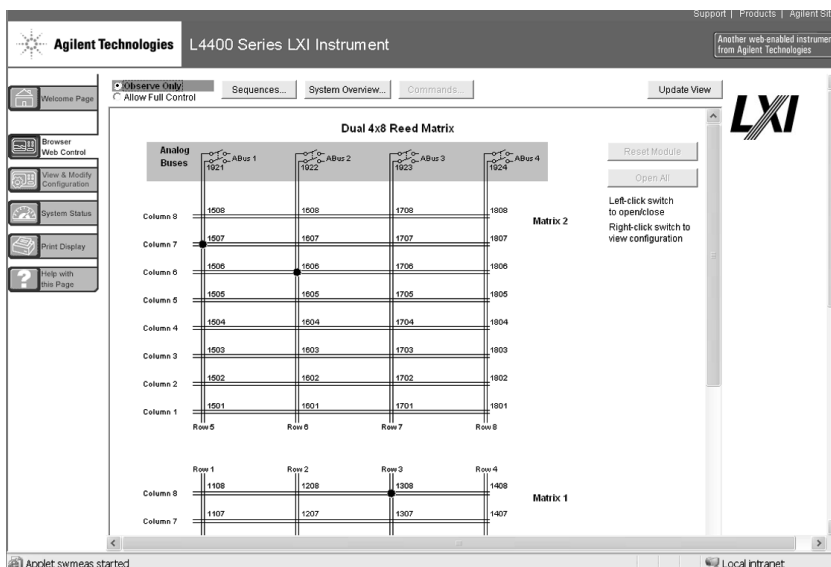
The optional GPIB interface has many years of proven reliability and can be used for easy integration into existing applications.

The L4433A ships with the Agilent E2094N I/O Libraries Suite making it easy for you to configure and integrate instruments into your system — even if your system includes instruments from multiple vendors.

**Fully-featured graphical Web interface makes it easy to set-up and troubleshoot your tests from anywhere in the world**

The built-in Web browser interface provides remote access and control of the instrument via a Java-enabled browser such as Internet Explorer. Using the Web interface, you can set up, troubleshoot, and maintain your instrument from remote locations.

- View and modify instrument setup
- Open or close switches
- Send, receive or view SCPI commands



**Figure 2.** The Web interface makes it easy to set up, troubleshoot and maintain your test remotely

- Define and execute switch sequences
- View error queue
- Get status reports on relay counts, firmware revisions, and more

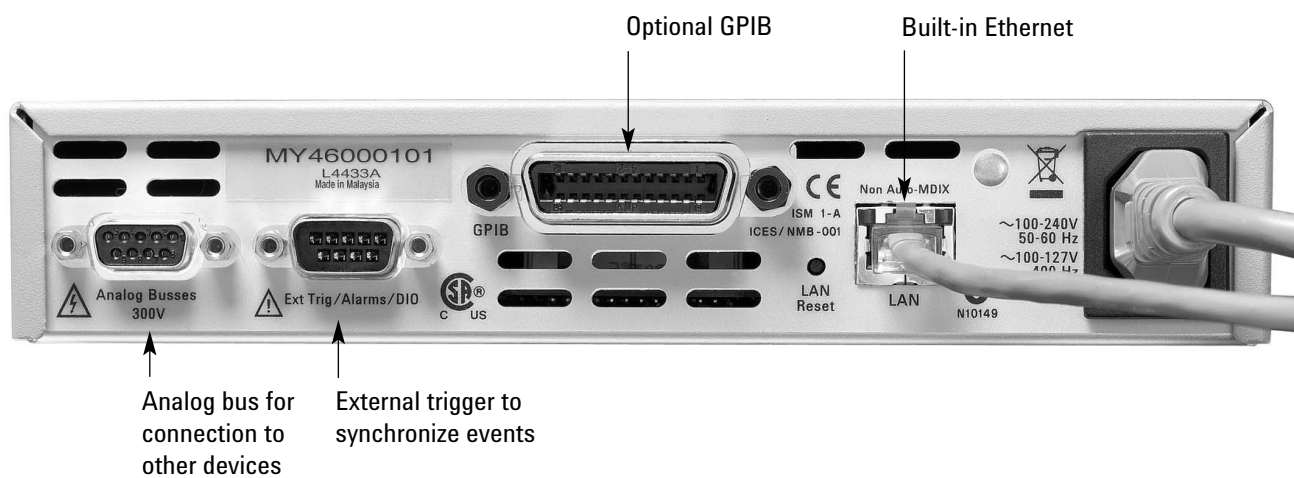
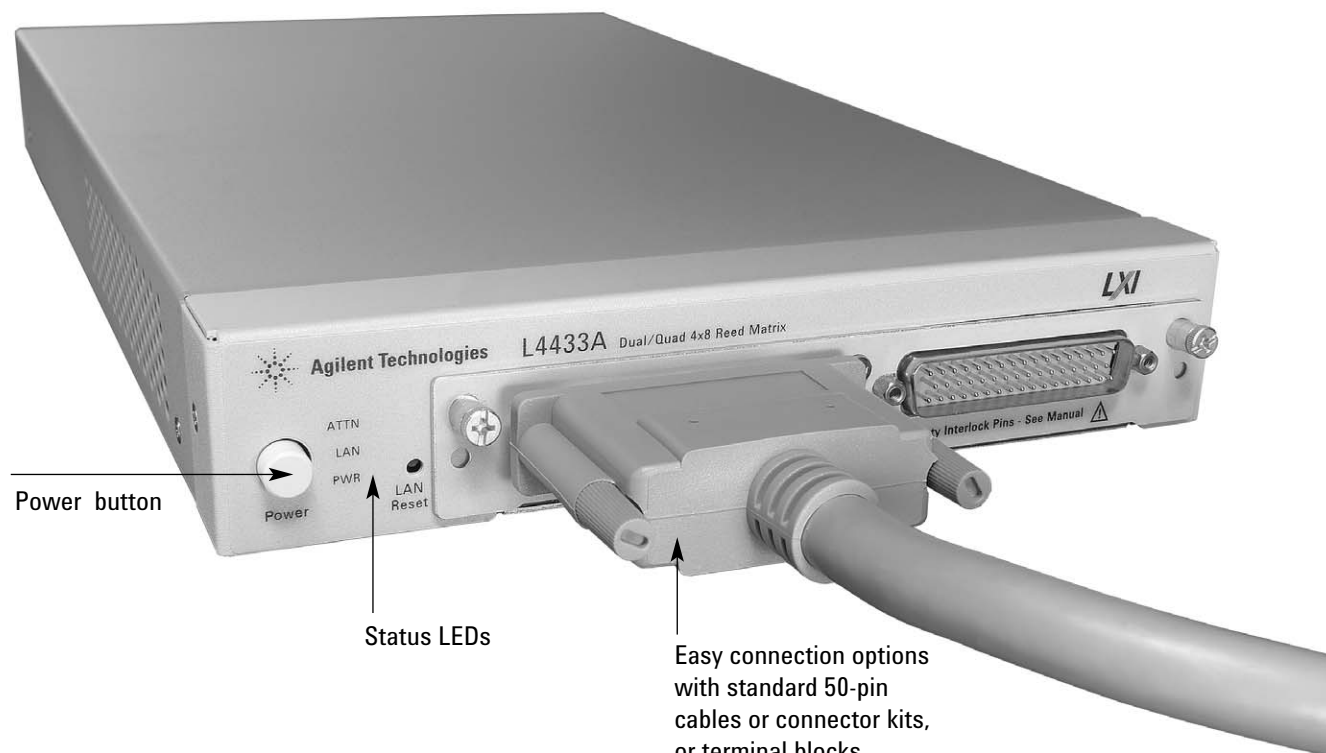
Additionally, since the Web server is built into the instrument, you can access it on any operating system that supports the Web browser without having to install any special software. Password protection and LAN lockout are also provided to limit access for additional security.

**Software for most popular programming environments**

Full support for standard programming environments ensures compatibility and efficiency. You can use direct I/O with the software you already have and know, or use standard IVI and LabVIEW™ software drivers that provide compatibility with the most popular development environments:

- Agilent T&M Toolkit for Microsoft Visual Studio®.NET and Agilent VEE Pro
- National Instruments LabVIEW, LabWindows/CVI, TestStand, and Switch Manager
- Microsoft C/C++® and Visual Basic®

**High-performance switching wherever your application needs it**



## Product Specifications

### Specifications and Characteristics

Input characteristics (per channel)	Channels/configurations		dual 4x8 8x8, 4x16 quad 4x8, 1-wire
	Switch type		Reed non-latching
	Max volts <sup>1</sup>		± 150 V peak <sup>2</sup>
	Max current (DC, AC RMS)		
		Switch current	0.5 A <sup>5</sup> /0.05 A <sup>8</sup>
		Carry current	1.5 A <sup>5</sup> /0.05 A <sup>8</sup>
Power (W, VA) <sup>2,6</sup>			10 W <sup>7</sup>
Volt-Hertz limit			10 <sup>8</sup>

### General specifications

Offset voltage <sup>3</sup>		< 50 $\mu$ V < 100 $\mu$ V 1-wire
Initial closed channel resistance <sup>3</sup>		< 1.5 $\Omega$ <sup>5</sup> /200 $\Omega$ <sup>8</sup>
DC Isolation (ch-ch, ch-earth)		>10 G $\Omega$

### AC characteristics

Bandwidth at terminal block <sup>4</sup>		30 MHz <sup>5</sup> /4 MHz <sup>8</sup> 2 MHz 1-wire
Crosstalk at terminal block (ch-ch) <sup>4</sup>		
	300 kHz	-65 dB
	1 MHz	-65 dB
	20 MHz	-40 dB
Capacitance at terminal block		
	HI-LO	80 pF
	LO – earth	75 pF

### General characteristics

Relay life typical		
	No load	1000 M
	10 V, 100 mA	10 M
	Rated load	10 k
Open /close time, typical		0.5 ms/0.5 ms
Analog bus connection		Yes

<sup>1</sup> DC or AC RMS voltage, channel-to-channel or channel-to-earth

<sup>2</sup> Peak voltage, channel-to-channel or channel-to-earth

<sup>3</sup> Into analog bus connector

<sup>4</sup> 50 Ohm source, 50 Ohm load, differential measurements verified (Sdd21)

<sup>5</sup> With input resistors bypassed. Bypassing resistors will reduce lifetime of relays.

See the rated load relay life characteristics.

<sup>6</sup> Limited to 6 W channel resistance power loss per module

<sup>7</sup> Power restrictions allow only 20 channels to be closed at one time

<sup>8</sup> With 100 Ohm input protection resistors

**Measurement Accuracy** For accuracy measurement specification, combine the DMM offset with the switch offset. Bandwidth of the switch may offset the accuracy of the AC measurement.

## Product Specifications (continued)

### General specifications

Power supply	Universal 100 V to 240 V $\pm 10\%$
Power line frequency	50 Hz to 60 Hz $\pm 10\%$ automatically sensed
Power consumption	15 VA
Operating Environment	Full accuracy for 0°C to 55°C Full accuracy to 80% R.H. at 40 °C Pollution degree 1 of IEC 61010-1
Storage environment	-40°C to 70°C
Dimensions (H x W x L)	40.9 x 212.3 x 379.3 mm 1.61 x 8.36 x 14.93 in
Weight	3.9 kg, 8.6 lbs
Safety conforms to	CSA, UL/IEC/EN 61010-1
EMC conforms to	IEC/EN 61326-1, CISPR 11
Warranty	1 year

### Memory

States	5 instrument states with user label in non-volatile memory
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## Product Specifications (continued)

### Software

Agilent connectivity software included	Agilent I/O Libraries Suite 14 or greater (E2094N)
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### Minimum system requirements

PC hardware	Intel Pentium 100 MHz, 64 Mbyte RAM, 210 Mbyte disk space Display 800x600, 256 colors, CD-ROM drive
Operating system <sup>1</sup>	Windows® 98 SE/NT/2000/XP

### Computer interfaces

Standard LAN 10BaseT/100BaseTx
Optional IEEE 488.2 GPIB

### Software driver support for programming languages

Software drivers	IVI-C and IVI-COM for Windows NT®/2000/XP LabVIEW
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### Compatible with programming tools and environments

Agilent	VEE Pro
	T&M Toolkit (reqs Visual Studio.NET)
	TestStand
	Measurement Studio
	LabWindows/CVI
National Instruments	LabVIEW
	Switch Executive
	Visual Studio.NET®
	C/C++
	Visual Basic 6®

<sup>1</sup> Load I/O Libraries Version M for Windows NT support or version 14.0 for Windows 98 SE support



## Ordering information

### **L4433A Dual/quad 4x8 Reed Matrix**

Includes User's guide on CD, power cord, and Quick Start package

#### **Option - GPIB**

Adds GPIB interface

#### **Option 0B0**

Deletes printed manual set, full documentation included on CD ROM

#### **Option ABA**

English printed manual set

## Connection Options

Select terminal block for discrete wiring, cables or connector kits. Cables and connector kits require 2 per instrument.

### **34933T**

Terminal block for 34933A and L4433A dual 4x8 Matrix

### **Y1135A**

1.5 m 50-pin Dsub, M/F twisted pair with outer shield cable – 300 V

### **Y1136A**

3 m 50-pin Dsub, M/F twisted pair with outer shield cable – 300 V

### **Y1139A**

Solder cup connector kit with female 50-pin Dsub

## Other accessories

### **Y1160A**

Rack mount kit for

**L4400 series instruments-racks 2 instruments side-by-side with sliding tray**

For additional information please visit:

<http://www.agilent.com/find/L4433A>

## Related Agilent literature

### **Data Sheets**

**5988-6302EN**

Agilent VEE Pro

**5989-1441EN**

Agilent W1140A-TKT

T&M Toolkit 2.0 with Test Automation

**5989-1439EN**

Agilent E2094N

I/O Libraries Suite 14

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#### **Our Promise**

Our Promise means your Agilent test and measurement equipment will meet its advertised performance and functionality. When you are choosing new equipment, we will help you with product information, including realistic performance specifications and practical recommendations from experienced test engineers. When you receive your new Agilent equipment, we can help verify that it works properly and help with initial product operation.

#### **Your Advantage**

Your Advantage means that Agilent offers a wide range of additional expert test and measurement services, which you can purchase according to your unique technical and business needs. Solve problems efficiently and gain a competitive edge by contracting with us for calibration, extra-cost upgrades, out-of-warranty repairs, and on-site education and training, as well as design, system integration, project management, and other professional engineering services. Experienced Agilent engineers and technicians worldwide can help you maximize your productivity, optimize the return on investment of your Agilent instruments and systems, and obtain dependable measurement accuracy for the life of those products.



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Agilent Open simplifies the process of connecting and programming test systems to help engineers design, validate and manufacture electronic products. Agilent offers open connectivity for a broad range of system-ready instruments, open industry software, PC-standard I/O and global support, which are combined to more easily integrate test system development.

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Contacts revised: 09/26/05

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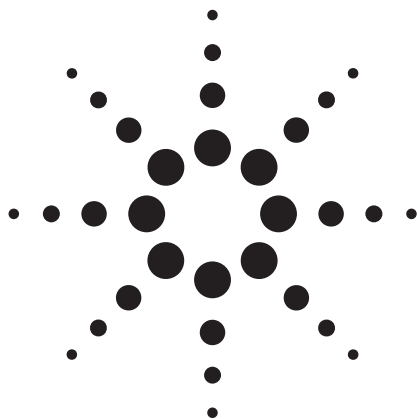
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Printed in the USA, February 28, 2006

5989-4826EN



**Agilent Technologies**



## Agilent L4437A 32-chan Form A/Form C General Purpose Switch

Data Sheet

- LXI compliance includes built-in Ethernet connectivity
- Fully-featured graphical Web interface
- 28 Form C channels up to 1 A, 60 W
- 4 Form A channels up to 5 A, 150 W
- Armature latching relays
- Relay counter
- Temperature sensor for overheating conditions
- Simultaneous channel switching
- Software drivers for most common programming environments



### **General purpose switch offers high-power signal switching wherever your application needs it**

The Agilent L4437A is a general purpose switch that is LXI Class C compliant. With its small size and Ethernet connectivity, this switch can be placed wherever your application needs it.

The L4437A has 32 general purpose switches that can be used to cycle power to products under test, control status lights, and to actuate external power relays and solenoids.

28 channels are Form C switches for basic switching needs. An addition 4 Form A channels are offered for high-power switching needs.

Using this LXI instrument, you'll get all the benefits of an Ethernet connection, instrument Web server, standard software drivers and more. The LXI standard is supported by multiple vendors, enabling lower cost of test with accelerated test integration and development.



**Agilent Technologies**

### Versatile switching for your high-power switching needs

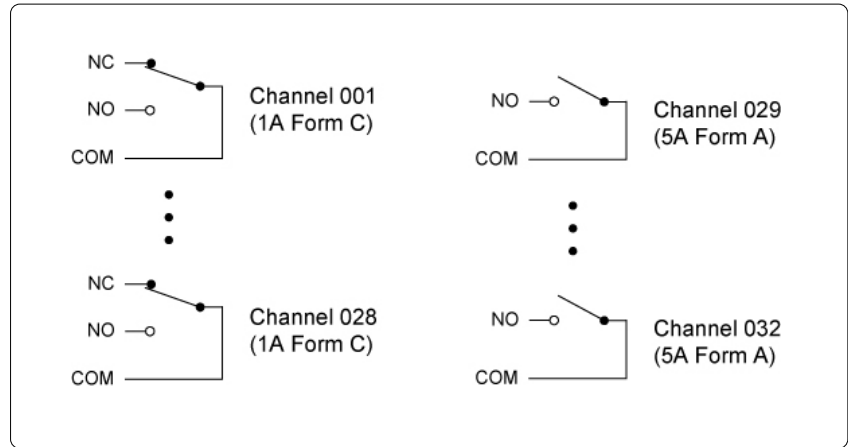
The L4437A general-purpose switch can be used to route signals or to control other system devices. This switch is ideal for device actuation and switching loads or power supplies.

The L4437A switch has 28 independent single-pole, double-throw (SPDT) 1 A relays and 4 single-pole, single-throw (Form A) 5 A relays. The 28 Form C channels have 300 V, 1 A contacts and can handle up to 60 W. The form A channels are 30 VDC/250 VAC, 5 A contacts and can handle up to 150 W, enough for many power line-switching applications.

These switches are made of latching armature relays where multiple channels can be closed at the same time. Additionally, for switching reactive loads, the optional terminal blocks have pads for snubbing circuits.

The sequence feature defines switch closures and controls and can be used to easily change between different switch setups. Assign a sequence, give it a name and then execute it with the custom name you created.

External trigger capabilities make it easy for you to time and synchronize switch closures and openings.



**Figure 1.** L4437A 32-Ch General Purpose Switch

The L4437A also includes a relay counter to monitor and help predict when relays are nearing their end of life.

### System connections you can trust

The L4437A comes with 2 heavy duty 50-pin Dsub connectors that allow for simple, reliable connection options. Each connector uses 30 micro-inches of gold to ensure a repeatable, accurate measurement. Flexible connection options include:

- Detachable terminal blocks with strain relief
- Low-cost, standard 50-pin Dsub connector kits and cables
- Mass interconnect solutions

### Ethernet connectivity enables simple connection to the network and remote access to measurements

The Ethernet interface offers high-speed connections that allow for remote access and control. You can set up a private network to filter out unwanted LAN traffic and speed up the I/O throughput, or take advantage of the remote capabilities and distribute your tests worldwide. Monitor, troubleshoot, or debug your application remotely. Ethernet communication also can be used with the support of LAN sockets connections.

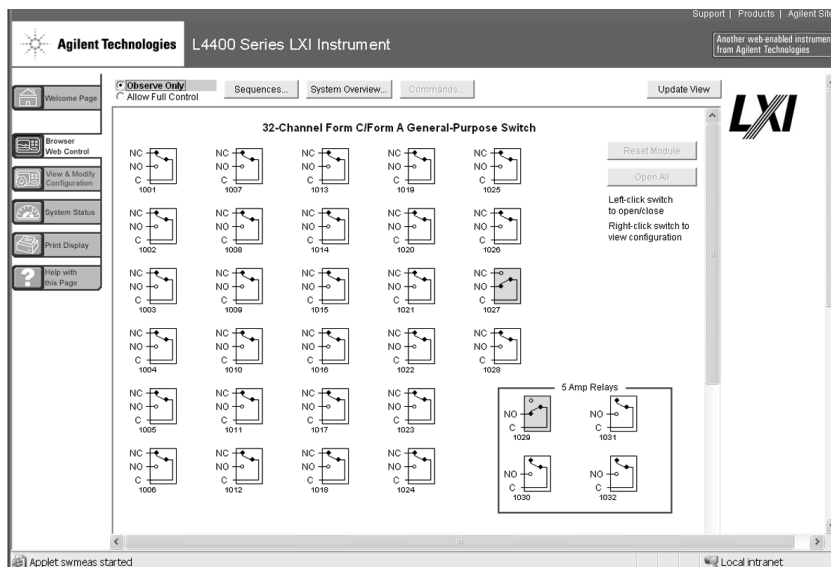
The optional GPIB interface has many years of proven reliability and can be used for easy integration into existing applications.

The L4437A ships with the Agilent E2094N I/O Libraries Suite making it easy for you to configure and integrate instruments into your system – even if your system includes instruments from multiple vendors.

**Fully-featured graphical Web interface makes it easy to set-up and troubleshoot your tests from anywhere in the world**

The built-in Web browser interface provides remote access and control of the instrument via a Java-enabled browser such as Internet Explorer. Using the Web interface, you can set up, troubleshoot, and maintain your instrument from remote locations.

- View and modify instrument setup
- Open or close switches
- Send, receive and view SCPI commands
- Define and execute switch sequences
- View error queue
- Get status reports on relay counts, firmware revisions, and more



**Figure 2.** The Web interface makes it easy to set up, troubleshoot and maintain your test remotely

Additionally, since the Web server is built into the instrument, you can access it on any operating system that supports the Web browser without having to install any special software. Password protection and LAN lockout are also provided to limit access for additional security.

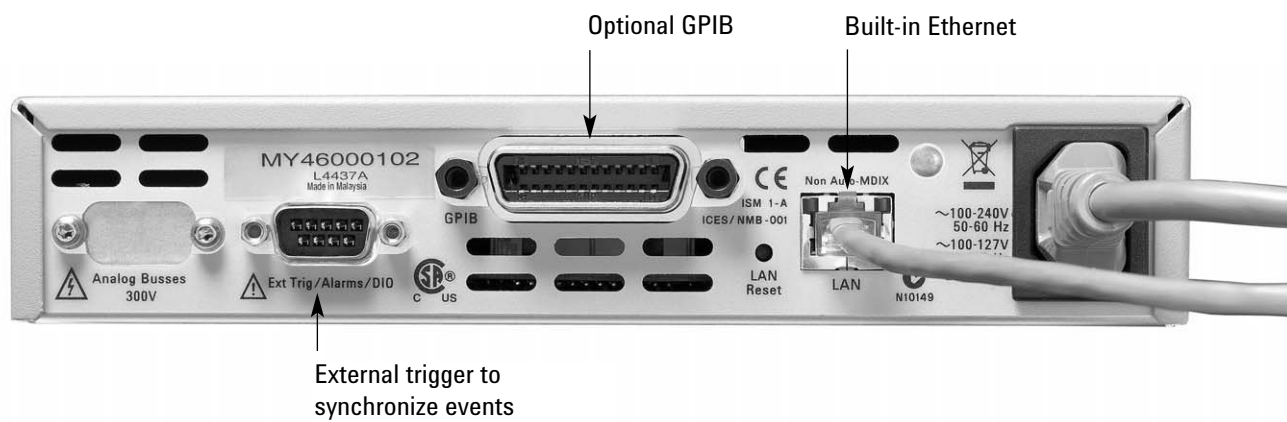
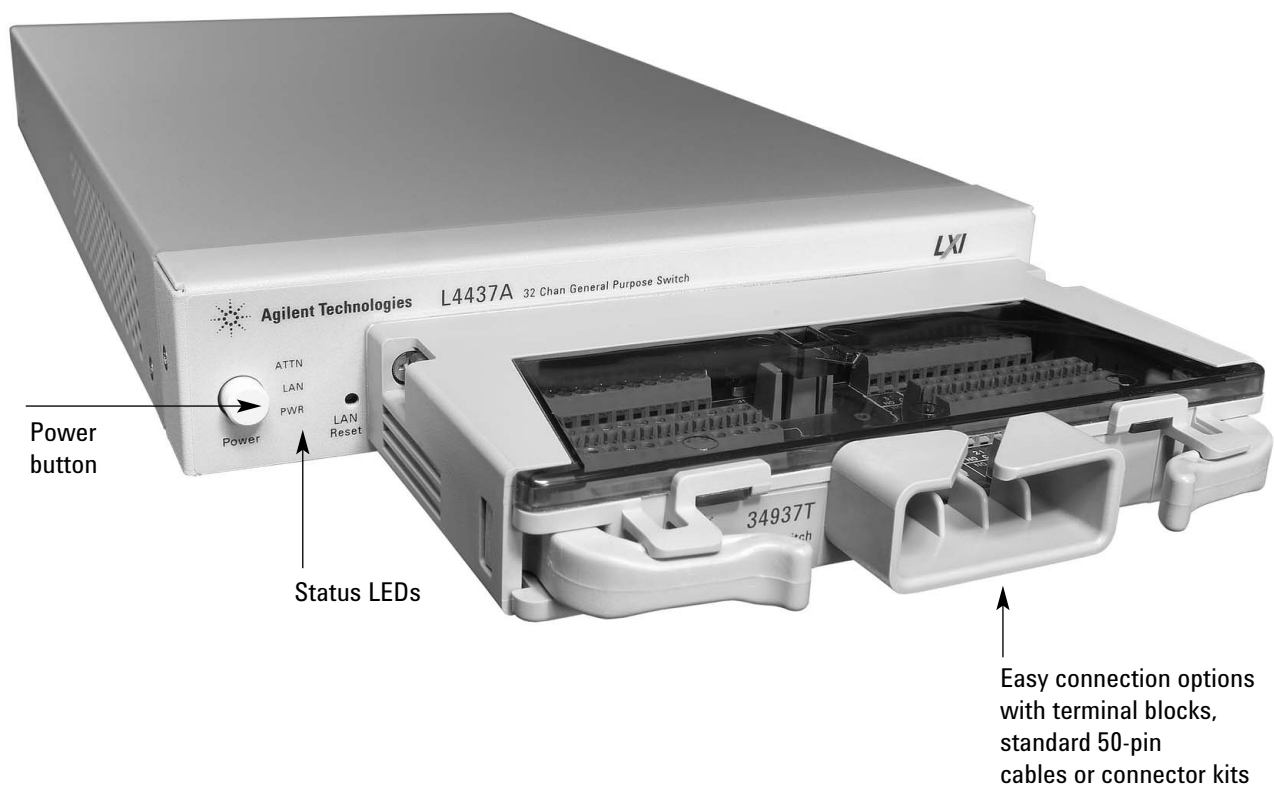
**Software for most popular programming environments**

Full support for standard programming environments ensures compatibility and efficiency. You can use direct I/O with the software you already have and know, or use

standard IVI and LabVIEW™ software drivers that provide compatibility with the most popular development environments:

- Agilent T&M Toolkit for Microsoft Visual Studio®.NET and Agilent VEE Pro
- National Instruments LabVIEW, LabWindows/CVI, TestStand, and Switch Manager
- Microsoft C/C++® and Visual Basic®

**High-performance switching wherever your application needs it**



## Product Specifications

### Specifications and Characteristics

<b>Input characteristics (per channel)</b>	Channels/configurations	28 form C 4 Form A
	Switch type	Armature latching
	Max volts (DC, AC RMS) <sup>1</sup>	Form C - 300 V Form A 30 VDC/250 VAC
	Max current (DC, AC RMS)	Form C - 1 A switch (2 A carry) Form A - 5 A switch (8 A carry)
	Power (W, VA) <sup>2</sup>	Form C - 60 W Form A - 150 W
	Volt-Hertz limit	10 <sup>8</sup>
<b>General specifications</b>		
	Offset voltage	< 3 $\mu$ V
	Initial closed channel resistance	Form C - 125 m $\Omega$ Form A - 50 m $\Omega$
	DC Isolation (ch-ch, ch-earth)	>10 G $\Omega$
<b>AC characteristics</b>		
	Bandwidth at terminal block <sup>3</sup>	10 MHz
	Channel isolation at terminal block (ch-ch) <sup>3</sup>	
	100 kHz	55 dB
	1 MHz	35 dB
	10 MHz	15 dB
	Capacitance at terminal block	
	Ch-Ch	Form C 12 pF/ Form A 10 pF
	Ch-earth	Form C 21 pF/Form A 18 pF
<b>General characteristics</b>		
	Relay life typical	Form C – 100 M/100 k Form A – 50 M/30 k
	Open /close time	Form C – 4 ms/4 ms Form A – 10 ms/10 ms
	Initial/reset relay state	Form C – maintains state Form A – user configurable
	Analog bus connection	No

<sup>1</sup> DC or AC RMS voltage, channel-to-channel or channel-to-earth

<sup>2</sup> Limited to 6 W of channel resistance power loss

<sup>3</sup> 50 Ohm source, 50 Ohm load, differential measurements verified (S21)

## Product Specifications (continued)

### General specifications

Power supply	Universal 100 V to 240 V $\pm 10\%$
Power line frequency	50 Hz to 60 Hz $\pm 10\%$ automatically sensed
Power consumption	15 VA
Operating Environment	Full accuracy for 0°C to 55°C Full accuracy to 80% R.H. at 40 °C Pollution degree 1 of IEC 61010-1
Storage environment	-40°C to 70°C
Dimensions (H x W x L)	40.9 x 212.3 x 379.3 mm 1.61 x 8.36 x 14.93 in
Weight	3.8 kg, 8.4 lbs
Safety conforms to	CSA, UL/IEC/EN 61010-1
EMC conforms to	IEC/EN 61326-1, CISPR 11
Warranty	1 year

### Memory

States	5 instrument states with user label in non-volatile memory
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## Product Specifications (continued)

### Software

Agilent connectivity software included	Agilent I/O Libraries Suite 14 or greater (E2094N)
--	--

### Minimum system requirements

PC hardware	Intel Pentium 100 MHz, 64 Mbyte RAM, 210 Mbyte disk space Display 800x600, 256 colors, CD-ROM drive
Operating system <sup>1</sup>	Windows® 98 SE/NT/2000/XP

### Computer interfaces

Standard LAN 10BaseT/100BaseTx
Optional IEEE 488.2 GPIB

### Software driver support for programming languages

Software drivers	IVI-C and IVI-COM for Windows NT®/2000/XP LabVIEW
------------------	--

### Compatible with programming tools and environments

Agilent	VEE Pro
	T&M Toolkit (reqs Visual Studio.NET)
National Instruments	TestStand
	Measurement Studio
	LabWindows/CVI
	LabVIEW
	Switch Executive
Microsoft	Visual Studio.NET®
	C/C++
	Visual Basic 6®

<sup>1</sup> Load I/O Libraries Version M for Windows NT support or version 14.0 for Windows 98 SE support

## Ordering information

### **L4437A 32 Channel Form C/Form A General Purpose Switch**

Includes User's guide on CD,  
test report, power cord, and  
Quick Start package

#### **Option - GPIB**

Adds GPIB interface

#### **Option 0B0**

Deletes printed manual set,  
full documentation included  
on CD ROM

#### **Option ABA**

English printed manual set

## **Connection Options**

Select terminal block for  
discrete wiring, cables or  
connector kits. Cables and  
connector kits require 2 per  
instrument.

### **34937T**

Terminal block for  
34937A and L4437A  
General Purpose Switch

### **Y1135A**

1.5 m 50-pin Dsub,  
M/F twisted pair with  
outer shield cable – 300 V

### **Y1136A**

3 m 50-pin Dsub, M/F  
twisted pair with outer  
shield cable – 300 V

### **Y1139A**

Solder cup connector kit  
with female 50-pin Dsub

## Other accessories

### **Y1160A**

Rack mount kit for  
**L4400 series instruments-**  
**racks 2 instruments side-by-side**  
**with sliding tray**

For additional information  
please visit:

<http://www.agilent.com/find/L4437A>

## Related Agilent literature

### **Data Sheets**

**5988-6302EN**

Agilent VEE Pro

**5989-1441EN**

Agilent W1140A-TKT

T&M Toolkit 2.0 with  
Test Automation

**5989-1439EN**

Agilent E2094N

I/O Libraries Suite 14

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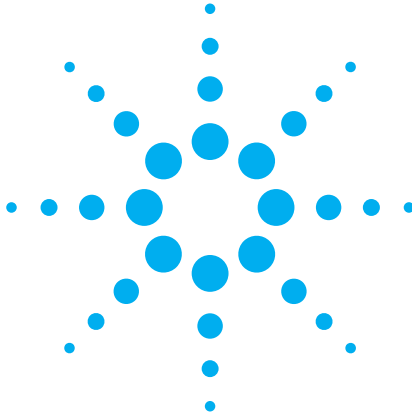
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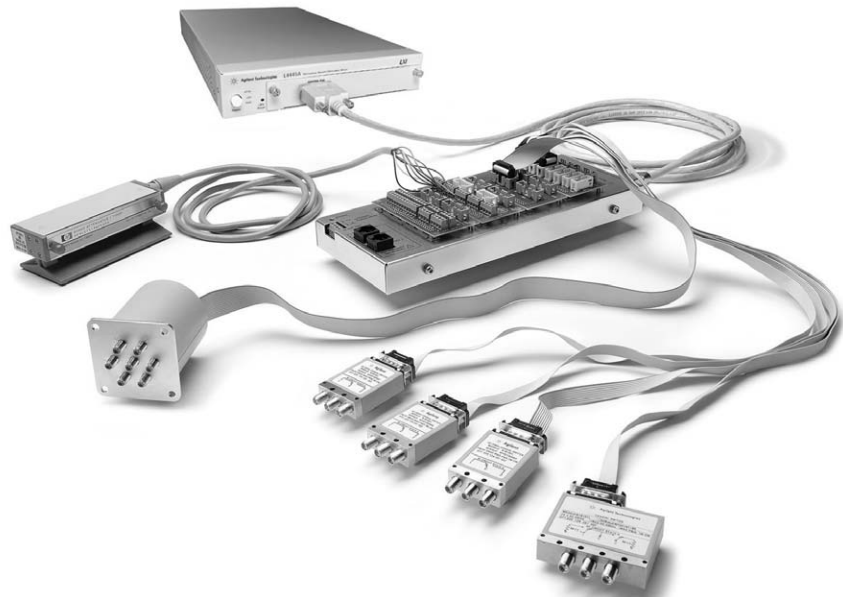


**Agilent Technologies**



# Agilent L4445A Microwave Switch/Attenuator Driver

## Data Sheet



- LXI compliance includes built-in Ethernet connectivity
- Fully-featured graphical Web interface
- Control of most popular microwave switches and attenuators
- Expandable with 34945EXT
- Distribution boards allow for easy wiring
- Switch read-back capabilities
- External power option for simultaneous switching
- Software drivers for most common programming environments

### **Microwave switch/attenuator driver offers support of most common microwave switches with distribution boards for easy configuration**

The Agilent L4445A is a LXI Class C compliant instrument that controls external switches and attenuators. With its small size and Ethernet connectivity, the switch/attenuator driver can be placed wherever your application needs it.

The Agilent L4445A provides digital outputs to control switches, attenuators, and other devices that are typically used to route signals in a high frequency system. Many of the most popular microwave switches

and attenuators are supported through the distribution boards. The distribution boards enable fast and easy connection to the microwave devices.

Using this LXI instrument, you'll get all the benefits of an Ethernet connection, instrument Web server, standard software drivers and more. The LXI standard is supported by multiple vendors, enabling lower cost of test with accelerated test integration and development.



**Agilent Technologies**

### **Microwave switch driver for easy routing of high frequency signals in your system**

The L4445A allows you to control switches, attenuators and other devices close to your device under test. The L4445A combined with the 34945EXT provides the power and control signals to drive up to 64 switch coils—that's 32 standard SPDT switches.

The L4445A can be extended by adding additional 34945EXT extenders. The first 34945EXT is powered by the L4445A. You can add up to seven additional 34945EXT extenders with user supplied power. Multiple switch operations are performed in sequential order, or for faster, simultaneous switching, you can connect an external power supply to the 34945EXT.

The digital outputs can also be used to drive LEDs for indication of the switch position. The L4445A/34945EXT also has digital inputs so that you can read back the actual position of the switch or attenuator.

The L4445A comes with a standard 9-pin connector for simple connection to the 34945EXT. The Y1150A-Y1155A distribution boards plug onto the 34945EXT and are used to route the power and control signals from the driver to the switches using user supplied cables. This enables simple connections to the external switches without a lot of complicated wiring.

The following microwave switches and attenuators are supported with the Y1150A-Y1155A distribution boards:

- N181x/U9397x series SPDT switches
- 8762/3/4 series SPDT switches (screw terminals)
- 8765x coaxial switches
- 8766x/8767x/8768x multiport switches
- 87104x/106x/L710xx/L720xx multiport switches
- 87406x series matrix switches
- 87204x/206x series multiport switches

- 87606x series matrix switches
- 87222x/L7222 transfer switches
- 849x series attenuators
- 8490x series attenuators
- Screw terminal connections

### **Ethernet connectivity enables simple connection to the network and remote access to measurements**

The Ethernet interface offers high-speed connections that allow for remote access and control. You can set up a private network to filter out unwanted LAN traffic and speed up the I/O throughput, or take advantage of the remote capabilities and distribute your tests worldwide. Monitor, troubleshoot, or debug your application remotely. Ethernet communication also can be used with the support of LAN sockets connections.

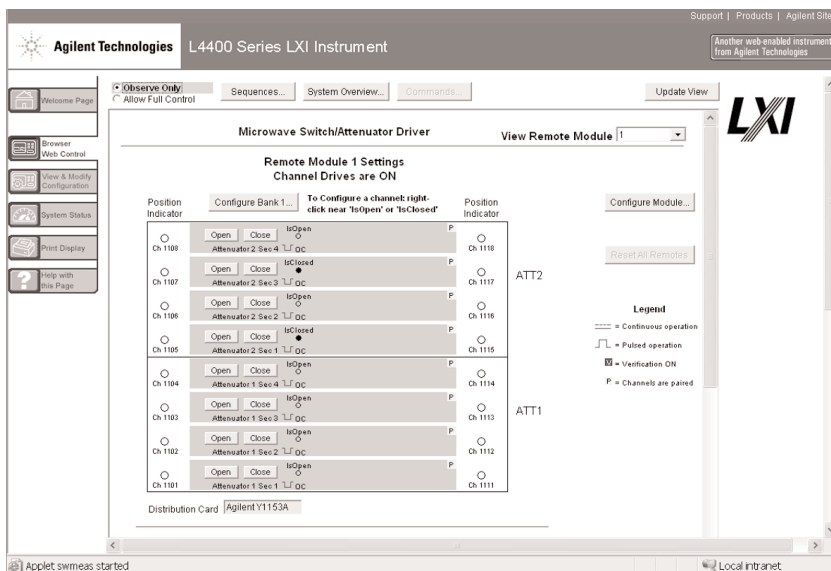
The optional GPIB interface has many years of proven reliability and can be used for easy integration into existing applications.

The L4445A ships with the Agilent E2094 I/O Libraries Suite making it easy for you to configure and integrate instruments into your system – even if your system includes instruments from multiple vendors.

**Fully-featured graphical Web interface makes it easy to set-up and troubleshoot your tests from anywhere in the world**

The built-in Web browser interface provides remote access and control of the instrument via a Java-enabled browser such as Internet Explorer. Using the Web interface, you can set up, troubleshoot, and maintain your instrument from remote locations.

- View and modify instrument setup
- Configure switch channels and switch pairs
- Open or close switches
- Send, receive and view SCPI commands
- Define and execute switch sequences
- View error queue
- Get status reports on relay cycle counts, firmware revisions, and more



**Figure 1.** The Web interface makes it easy to set up, troubleshoot and maintain your test remotely

Additionally, since the Web server is built into the instrument, you can access it on any operating system that supports the Web browser without having to install any special software. Password protection and LAN lockout are also provided to limit access for additional security.

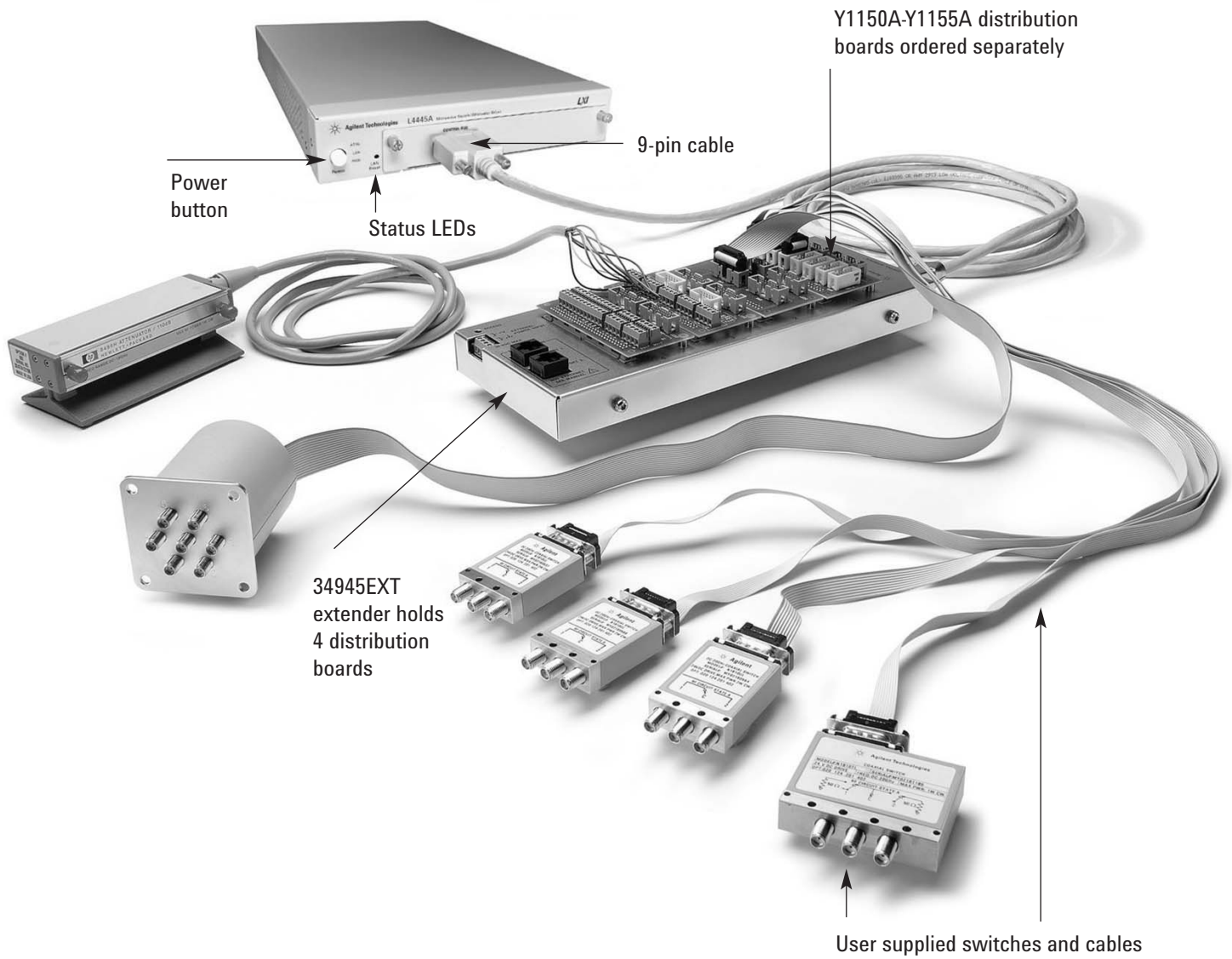
**Software for most popular programming environments**

Full support for standard programming environments ensures compatibility and efficiency. You can use direct I/O with the software you already have and know, or use standard

IVI and LabVIEW™ software drivers that provide compatibility with the most popular development environments:

- Agilent T&M Toolkit for Microsoft Visual Studio®.NET and Agilent VEE Pro
- National Instruments LabVIEW, LabWindows/CVI, TestStand, and Switch Manager
- Microsoft C/C++® and Visual Basic®

## High-performance switching wherever your application needs it



## Product Specifications

### Specifications and Characteristics

#### 34945EXT switch drive

64 channels, low side drive mode	Driver off voltage (max)	30 V
	Driver off leakage current	500 uA
64 channels, TTL drive mode	Driver on current (max)	600 mA
	Driver on voltage (max)	0.5 V @ 600 mA
64 channels, TTL drive mode	Hi output voltage	3 V @ Iout = 2 mA
	Lo output voltage	0.4 V @ Iin = 20 mA
	Lo input current	20 mA

#### 34945EXT position indicator sense inputs

Channels	64
Lo input voltage (max)	0.8 V
Hi input voltage (min)	2.5 V
Input resistance	>100 kΩ @ Vin ≤ 5 V >20 kΩ @ Vin > 5 V
Maximum input voltage	30 V

#### 34945EXT switch drive power supply (34945EXT powered by 34945A)

Voltage	24 V nominal (external power supply required for switches needing different voltages)
Current	100 mA continuous + 200 mA (15 ms pulse, 25% duty cycle)

#### 34945EXT external power connection

Voltage range	4.75 V to 30 V
Current limit	2 A

#### LED indicator (Current mode divers)

Channels	64
Supply voltage	5 V nominal
LED drive current	5 mA nominal (prog 1-20 mA)
Driver compliance voltage	0.8 V

#### Maximum 8 34945Ext's per L4445A



## Product Specifications (continued)

### Memory

States	5 instrument states with user label in non-volatile memory
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### General specifications

Power supply	Universal 100 V to 240 V $\pm 10\%$
Power line frequency	50 Hz to 60 Hz $\pm 10\%$ automatically sensed
Power consumption	15 VA
Operating Environment	Full accuracy for 0°C to 55°C Full accuracy to 80% R.H. at 40 °C
Storage environment	-40°C to 70°C
Dimensions (H x W x L)	40.9 x 212.3 x 379.3 mm 1.61 x 8.36 x 14.93 in
34945EXT dimensions	38.1 x 114.3 x 284.5 mm 1.5 x 4.5 x 11.2 in with distribution boards installed
Weight	3.6 kg, 8.0 lbs
Safety conforms to	CSA, UL/IEC/EN 61010-1
EMC conforms to	IEC/EN 61326-1, CISPR 11
Warranty	1 year

## Product Specifications (continued)

### Software

Agilent connectivity software included	Agilent I/O Libraries Suite 14 or greater (E2094N)
--	--

### Minimum system requirements

PC hardware	Intel Pentium 100 MHz, 64 Mbyte RAM, 210 Mbyte disk space Display 800x600, 256 colors, CD-ROM drive
Operating system <sup>1</sup>	Windows® 98 SE/NT/2000/XP

### Computer interfaces

Standard LAN 10BaseT/100BaseTx
Optional IEEE 488.2 GPIB

### Software driver support for programming languages

Software drivers	IVI-C and IVI-COM for Windows NT®/2000/XP LabVIEW
------------------	--

### Compatible with programming tools and environments

Agilent	VEE Pro
	T&M Toolkit (reqs Visual Studio.NET)
	TestStand
	Measurement Studio
	LabWindows/CVI
National Instruments	LabVIEW
	Switch Executive
	Visual Studio.NET®
	C/C++
	Visual Basic 6®

<sup>1</sup> Load I/O Libraries Version M for Windows NT support or version 14.0 for Windows 98 SE support

## Ordering information

### Example configuration:

A test system is being built that requires the following Microwave Switching:

- (qty 2) Agilent 87206B SP6T Switches
- (qty 8) Agilent N1810UL SPDT Switches

Select the quantity of distribution boards for the required switches using the ordering info below:

- Qty 2 Y1152A Distribution boards to control qty 2 87206B switches.
- Qty 1 Y1150A Distribution board to control qty 8 N1810UL switches.

Notice that each Y1152A can also drive two N181x switches. Therefore if you only needed to drive 4 N1810 switches, then you could have controlled those switches via the Y1152A distribution boards already selected.

### Here is the final recommended configuration:

- (qty 2) 87206B DC-20 GHz SP6T Switches
- (qty 8) N1810UL DC-20 GHz SPDT Switches
- (qty 1) L4445A Switch/Attenuator Driver (when ordering the L4445A, the 34945EXT is automatically added for controlling switches)
- (qty 2) Y1152A Distribution Boards
- (qty1) Y1150A Distribution Board
- Either build own cables using off-the-shelf parts, or order qty 1 Y1159A 16-to-16 pin connect kit (supplies for 2 cables) and qty 2 Y1157A 9-to-10 pin cable kit (supplies for 4 cables).

We recommend that the switch be ordered with options for 24 V coils, position indicators, and socket connectors. Since 24 V latching relays are specified, there is no need for an external power supply. The L4445A instrument can provide power for a single 34945EXT. Easy-to-build ribbon cables can be built to interface each of the switches to the Y1150A and Y1152A distribution boards. See the Application note: Configuring an RF/ Microwave Switch System (5989-2272EN) for additional configuration details.

## **Ordering information (Continued)**

### **L4445A Microwave Switch/ Attenuator driver**

Includes User's guide on CD,  
test report, power cord, and  
Quick Start package

### **Option - GPIB**

Adds GPIB interface

### **Option 0B0**

Deletes printed manual set,  
full documentation included  
on CD ROM

### **Option ABA**

English printed manual set

## **L4445A Accessories**

Distribution boards are required  
for control of external switches.

One 34945EXT external driver  
required for each 64 coils –  
holds 4 distribution boards  
per 34945EXT extender

### **Y1150A**

34945EXT distribution board  
for 8 N181x SPDT switches

### **Y1151A**

34945EXT distribution board  
for two 87104x/106x multiport  
or 87406B matrix switches

### **Y1152A**

34945EXT distribution board  
for one 87204x/206x or 87606B  
switch and two N181x switches

### **Y1153A**

34945EXT distribution board  
for two 84904/5/6/7/8 or  
8494/5/6 step attenuators

### **Y1154A**

34945EXT distribution board  
for two 87222 transfer switches  
and six N181x SPDT switches

### **Y1155A**

34945A distribution board  
w/ generic screw terminals  
for driving 16 switch coils

## **Cable kits for connecting switches to distribution boards:**

### **Y1157A**

9-to-10 pin cable kit for  
Y1150A, Y1152A, Y1154A -  
supplies to build 4 cables

### **Y1158A**

10-to-10/10-to-14 pin cable kit  
for Y1153A, Y1154A -  
supplies to build 2 cables

### **Y1159A**

16-to-16 pin cable kit for  
Y1150A/51A/52A/53A/54A/55A-  
supplies to build 2 cables

## **Other accessories**

### **Y1160A**

**Rack mount kit for  
L4400 series instruments-  
racks 2 instruments side-by-side  
with sliding tray**

For additional information  
please visit:

<http://www.agilent.com/find/L4445A>



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Agilent Open simplifies the process of connecting and programming test systems to help engineers design, validate and manufacture electronic products. Agilent offers open connectivity for a broad range of system-ready instruments, open industry software, PC-standard I/O and global support, which are combined to more easily integrate test system development.



### **[www.lxistandard.org](http://www.lxistandard.org)**

LXI is the LAN-based successor to GPIB, providing faster, more efficient connectivity. Agilent is a founding member of the LXI consortium.

## Related Agilent literature

### Data Sheets

**5988-6302EN**  
Agilent VEE Pro

**5989-1441EN**  
Agilent W1140A-TKT

T&M Toolkit 2.0 with  
Test Automation

**5989-1439EN**  
Agilent E2094N  
I/O Libraries Suite 14

**5989-2272EN**  
Configuring an  
RF/Microwave Switch System

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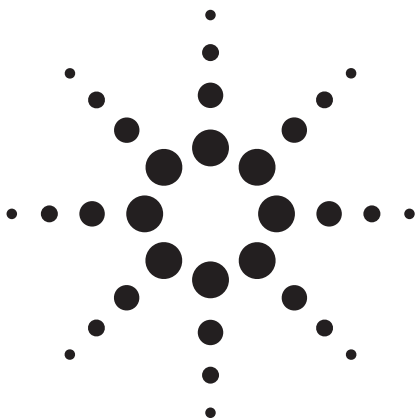
Revised: May 7, 2007

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5989-4828EN



**Agilent Technologies**



# Agilent L4450A 64-Bit Digital I/O with Memory and Counter

Data Sheet



- LXI compliance includes built-in Ethernet connectivity
- Fully-featured graphical Web interface
- 64 bi-directional digital I/O bits with programmable polarity
- Variable thresholds from 0 V to 5 V
- Handshaking protocols
- Source/sink current up to 24 mA
- 128 kbytes pattern memory
- Two 10 MHz counter channels
- 20 MHz divide-by-n clock
- Software drivers for most common programming environments

## 64-bit Digital I/O offers high-performance digital I/O wherever your application needs it

The Agilent L4450A is a high-speed 64-bit digital I/O instrument that is LXI Class C compliant. With its small size and Ethernet connectivity, the Digital I/O can be placed wherever your application needs it.

The Agilent L4450A has 64 bi-directional lines configured as eight 8-bit channels. Each 8-bit channel has programmable polarity and thresholds up to 5 V. The 128 k of memory is useful for simulating and capturing digital patterns up to 10 MHz. The configurable handshaking protocols can be used for a wide variety of applications.

In addition, the two counter channels can be used to count events, frequency, period, duty cycle, pulse width and totalize.

Using this LXI instrument, you'll get all the benefits of an Ethernet connection, instrument Web server, standard software drivers and more. The LXI standard is supported by multiple vendors, enabling lower cost of test with accelerated test integration and development.



**Agilent Technologies**

### Digital inputs and outputs for your most complicated digital applications

The L4450A can be used to simulate or detect digital patterns. It has eight 8-bit digital I/O channels with handshaking, pattern memory, two 10 MHz counters with gate functions, and a programmable clock output.

### Digital input/output

The digital I/O bits are organized into two banks of 32-bits. The I/O bits can be configured and programmed as inputs or outputs in 8-bit channels. The digital outputs can be configured as active drive or open drain outputs with a user supplied 10 k $\Omega$  pull up. User supplied pull-up resistors for up to 5 V outputs are also acceptable. The digital inputs have programmable thresholds up to 5 V for compatibility with most digital logic standards. The on-board pattern memory can be used to select and output digital stimulus or bit stream patterns, or to capture external digital data. Each bank has independent memory and directional control so that one bank can output data while another captures data. The memory can be divided up to 64 kbytes per 8-bit channel.

The memory can be allocated as follows:

	Default Configuration	Memory on Channels 1 & 2	Memory on Channel 1
Channel 1/5 (Bits 7:0) (Bits 39:32)	32 kbytes	64 kbytes	64 kbytes
Channel 2/6 (Bits 15:8) (Bits 47:40)	32 kbytes	64 kbytes	
Channel 3/7 (Bits 23:16) (Bits 55:48)	32 kbytes		
Channel 4/8 (Bits 31:24) (Bits 63:56)	32 kbytes		

The digital channels also have:

- Variable active high drive output from 1.65 V to 5 V or open drain
- Variable input thresholds from 0 V to 5 V
- Configurable handshaking protocols including synchronous and strobe
- Programmable polarity
- Source or sink up to 24 mA

- Internal alarming for maskable pattern match

- 1 hardware pattern interrupt per bank

External trigger capabilities make it easy for you to time and synchronize measurements and other events. This can help you determine when to begin or end an acquisition.

### Frequency counter and totalizer

The two channels can be used to count digital events, frequency, period, duty cycle, pulse width and totalize. The counter/totalizer also includes:

- Programmable gate functionality
- Programmable input thresholds levels 0 V to 3 V

### System connections you can trust

The L4450A comes with 2 heavy duty 78-pin Dsub connectors that allow for simple, reliable connection options. Each connector uses 30 micro-inches of gold to ensure a repeatable, accurate measurement. Flexible connection options include:

- Detachable terminal blocks with strain relief
- Low-cost, standard 78-pin Dsub connector kits and cables
- Mass interconnect solutions

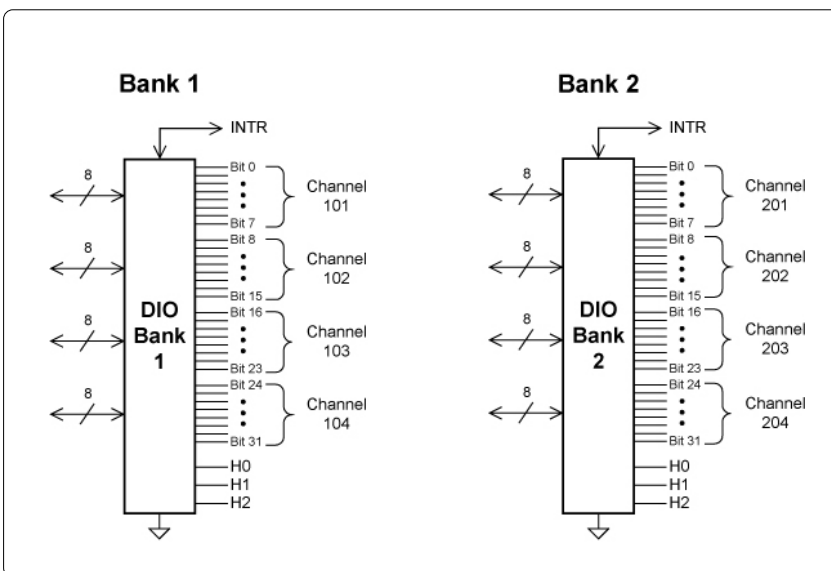


Figure 1. L4450A 64-bit digital I/O with counter

### Ethernet connectivity enables simple connection to the network and remote access to measurements

The Ethernet interface offers high-speed connections that allow for remote access and control. You can set up a private network to filter out unwanted LAN traffic and speed up the I/O throughput, or take advantage of the remote capabilities and distribute your tests worldwide. Monitor, troubleshoot, or debug your application remotely. Ethernet communication also can be used with the support of LAN sockets connections.

The optional GPIB interface has many years of proven reliability and can be used for easy integration into existing applications.

The L4450A ships with the Agilent E2094N I/O Libraries Suite making it easy for you to configure and integrate instruments into your system—even if your system includes instruments from multiple vendors.

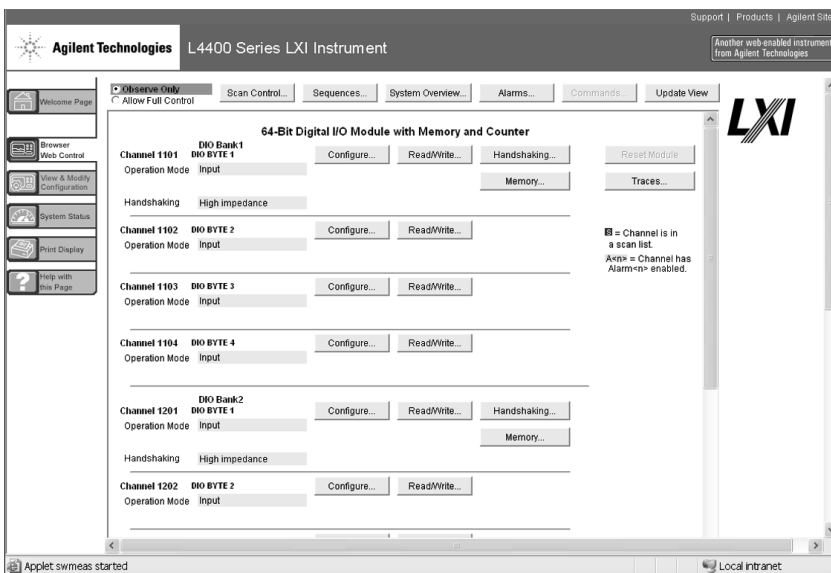


**Fully-featured graphical web interface makes it easy to set-up and troubleshoot your tests from anywhere in the world**

The built-in Web browser interface provides remote access and control of the instrument via a Java-enabled browser such as Internet Explorer. Using the Web interface, you can set up, troubleshoot, and maintain your instrument from remote locations.

- View and modify instrument setup
- Configure I/O channels, patterns and alarms
- Read and write I/O channels
- Load and step digital patterns
- Define handshaking and memory allocation
- View error queue
- Get status reports, current configuration, firmware revisions, and more

Additionally, since the Web server is built into the instrument, you can access it on any operating system that supports the Web browser without having



**Figure 2.** The Web interface makes it easy to set up, troubleshoot and maintain your test remotely

to install any special software. Password protection and LAN lockout are also provided to limit access for additional security.

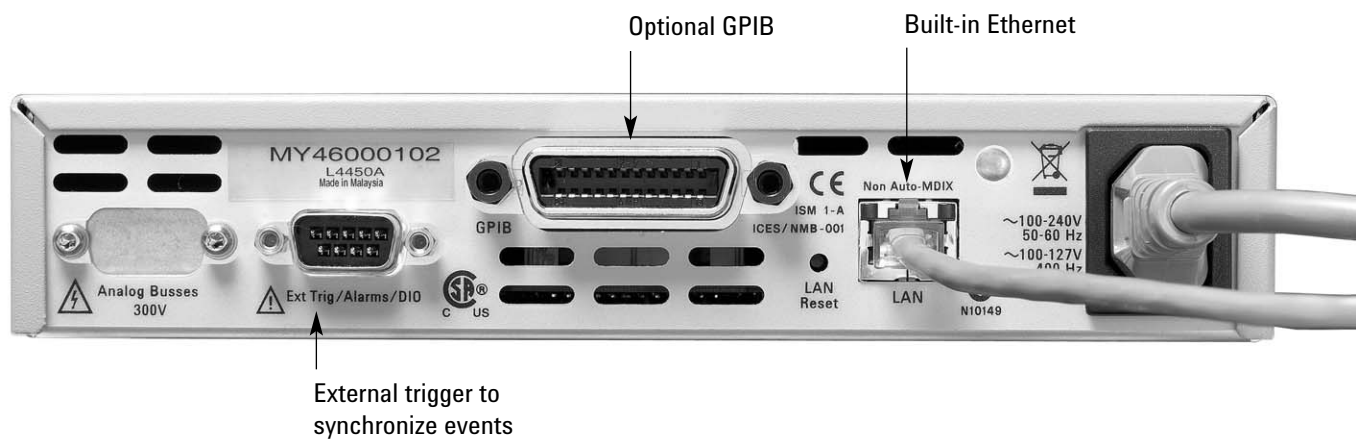
#### **Software for most popular programming environments**

Full support for standard programming environments ensures compatibility and efficiency. You can use direct I/O with the software you already have and know, or use standard IVI and LabVIEW™

software drivers that provide compatibility with the most popular development environments:

- Agilent T&M Toolkit for Microsoft Visual Studio®.NET and Agilent VEE Pro
- National Instruments LabVIEW, LabWindows/CVI, TestStand, and Switch Manager
- Microsoft C/C++® and Visual Basic®

**High-performance digital I/O wherever your application needs it**



## Product Specifications

### Specifications and Characteristics

#### Digital input/output characteristics

Eight 8-bit channels: 8 bits wide, input or output, non-isolated

Vin	0 V – 5 V <sup>1</sup>
Vout	1.65 V – 5 V <sup>1,2</sup>
Iout (max)	24 mA <sup>2</sup>
Frequency (max)	10 MHz <sup>3</sup>
ILoad (max)	400 mA
tr + tf (typ)	6 ns <sup>5</sup>

#### Handshake lines

Vin	0 – 5 V <sup>4</sup>
Vout	1.65 – 5 V <sup>2,4</sup>
I out (max)	24 mA <sup>2</sup>
Frequency (max)	10 MHz

#### Counter function characteristics

Maximum freq	10 MHz (max) 50% duty cycle
Vin	0 V – 5 V

#### Totalizer function characteristics

Maximum count	2 <sup>32</sup> – 1 (4,294,967,296)
Max input freq	10 MHz (max), rising or falling edge programmable
Vin	0 V – 5 V
Gate input	0 V – 5 V

#### System clock generator characteristics

Frequency	20 MHz – 10 Hz configurable divide-by-n 24-bits, programmable on/off
Vout	1.65 V – 5 V <sup>2</sup>
Accuracy	100 ppm

<sup>1</sup> Configurable by 8-bit channel  
<sup>2</sup> Lower current drive at lower voltages  
<sup>3</sup> From memory with handshaking  
<sup>4</sup> Configurable by bank  
<sup>5</sup> 5 V, 50 pF load

## Product Specifications (continued)

### Data out of memory to LAN or GPIB

(data transfer rate with 1000 channel blocks)	<b>GPIB rds/s</b>	<b>LAN (w/ VXI 11) rds/s</b>
Readings	2560	3542
readings with timestamp	1304	1826
readings with all format options ON	980	1361

### Scan triggering

Source	Interval, external, software, or on monitor channel alarm
Scan count	1 to 50,000 or continuous
Scan interval	0 to 99 hours; 1 ms step size
Channel delay	0 to 60 seconds per channel; 1 ms step size
External trig delay	<2 ms. With monitor on <200 ms
External trig jitter	<2 ms

### Alarms

Digital inputs	digital in maskable pattern match or state change frequency and totalize: Hi limit only
Alarm on channel	Alarm evaluated each reading
Alarm outputs	2 TTL compatible Selectable TTL logic Hi or Lo on fail
Latency	5 ms (typical)

### Memory

Type	Volatile
Size	128 kbytes for digital patterns
States	5 instrument states with user label in non-volatile memory

### General specifications

Power supply	Universal 100 V to 240 V $\pm 10\%$
Power line frequency	50 Hz to 60 Hz $\pm 10\%$ automatically sensed
Power consumption	15 VA
Operating Environment	Full accuracy for 0°C to 55°C Full accuracy to 80% R.H. at 40 °C
Storage environment	-40°C to 70°C
Dimensions (H x W x L)	40.9 x 212.3 x 379.3 mm 1.61 x 8.36 x 14.93 in
Weight	3.7 kg, 8.2 lbs
Safety conforms to	CSA, UL/IEC/EN 61010-1
EMC conforms to	IEC/EN 61326-1, CISPR 11
Warranty	1 year

## Product Specifications (continued)

### Software

Agilent connectivity software included	Agilent I/O Libraries Suite 14 or greater (E2094N)
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### Minimum system requirements

PC hardware	Intel Pentium 100 MHz, 64 Mbyte RAM, 210 Mbyte disk space Display 800x600, 256 colors, CD-ROM drive
Operating system <sup>1</sup>	Windows® 98 SE/NT/2000/XP

### Computer interfaces

Standard LAN 10BaseT/100BaseTx
Optional IEEE 488.2 GPIB

### Software driver support for programming languages

Software drivers	IVI-C and IVI-COM for Windows NT®/2000/XP LabVIEW
Compatible with programming tools and environments	
Agilent	VEE Pro T&M Toolkit (reqs Visual Studio.NET)
National Instruments	TestStand Measurement Studio LabWindows/CVI LabVIEW Switch Executive
Microsoft	Visual Studio.NET® C/C++ Visual Basic 6®

<sup>1</sup> Load I/O Libraries Version M for Windows NT support or version 14.0 for Windows 98 SE support

## Ordering information

### **L4450A 64-bit Digital I/O**

#### **with memory and counter**

Includes User's guide on CD, power cord, and Quick Start package

#### **Option - GPIB**

Adds GPIB interface

#### **Option 0B0**

Deletes printed manual set, full documentation included on CD ROM

#### **Option ABA**

English printed manual set

## **Connection Options**

Select terminal block for discrete wiring, cables or connector kits. Cables and connector kits require 2 per instrument.

### **34950T**

Terminal block for 34950A and L4450A 64-bit Digital I/O

### **Y1137A**

1.5 m 78-pin Dsub, M/F twisted pair with outer shield cable – 300 V

### **Y1138A**

3 m 78-pin Dsub, M/F twisted pair with outer shield cable – 300 V

### **Y1142A**

Solder cup connector kit with male 78-pin Dsub

## Other accessories

### **Y1160A**

#### **Rack mount kit for**

**L4400 series instruments- racks 2 instruments side-by-side on sliding tray**

For additional information please visit:

<http://www.agilent.com/find/L4450A>

## Related Agilent literature

### **Data Sheets**

**5988-6302EN**

Agilent VEE Pro

**5989-1441EN**

Agilent W1140A-TKT

T&M Toolkit 2.0 with Test Automation

**5989-1439EN**

Agilent E2094N

I/O Libraries Suite 14

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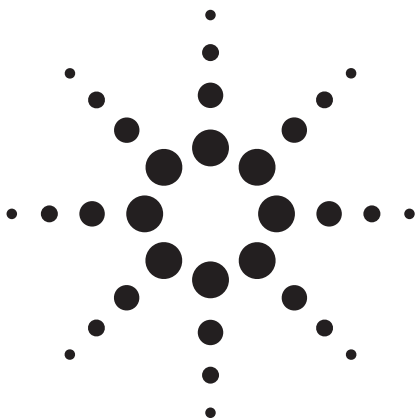
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5989-4829EN



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## Agilent L4451A 4-Channel Isolated D/A Converter with Memory

Data Sheet

- LXI compliance includes built-in Ethernet connectivity
- Fully-featured graphical Web interface
- Four isolated analog outputs
- Outputs up to  $\pm 16$  V or  $\pm 20$  mA DC
- 16-bits of resolution
- 200 kHz update rate
- Default standard waveforms
- Software drivers for most common programming environments



### **4-Channel D/A Converter offers high-voltage analog outputs wherever your application needs it**

The Agilent L4451A is a high-performance 4 channel D/A converter that is LXI Class C compliant. With its small size and Ethernet connectivity, the D/A converter can be placed wherever your application needs it.

The Agilent L4451A has four isolated analog channels that are useful to source bias voltages to your device under test, to control your analog programmable power supplies, or use the outputs as setpoints for your control systems. You

can use the standard waveforms provided or create your own with over 500,000 points. These points can be dynamically allocated among one or more channels and output as a point-to-point arb.

Using this LXI instrument, you'll get all the benefits of an Ethernet connection, instrument Web server, standard software drivers and more. The LXI standard is supported by multiple vendors, enabling lower cost of test with accelerated test integration and development.



**Agilent Technologies**



### Isolated analog outputs can be stacked for higher voltage outputs

The L4451A has four independent, isolated channels that can output DC voltage up to  $\pm 16$  V or DC current up to  $\pm 20$  mA with 16 bits of resolution. The gain and offset can be adjusted on-the-fly. And since these are isolated channels, they can be stacked to create waveforms with higher output voltages.

Each channel can be controlled manually, or use the onboard memory to download a waveform. The 500 k of memory is global and can store up to 32 waveforms. Any waveform can be dynamically allocated among one or more channels and output as a point-to-point arbitrary waveform generator at up to 200 k points/s. You can use the standard sine, square or ramp wave shapes provided or define your own wave shape using over 500,000 points and output to a device under test.

Synchronize your outputs with the CLK that can be divided down for each channel independently.

The L4451A is electronically calibrated using an external DMM and the CAL command.

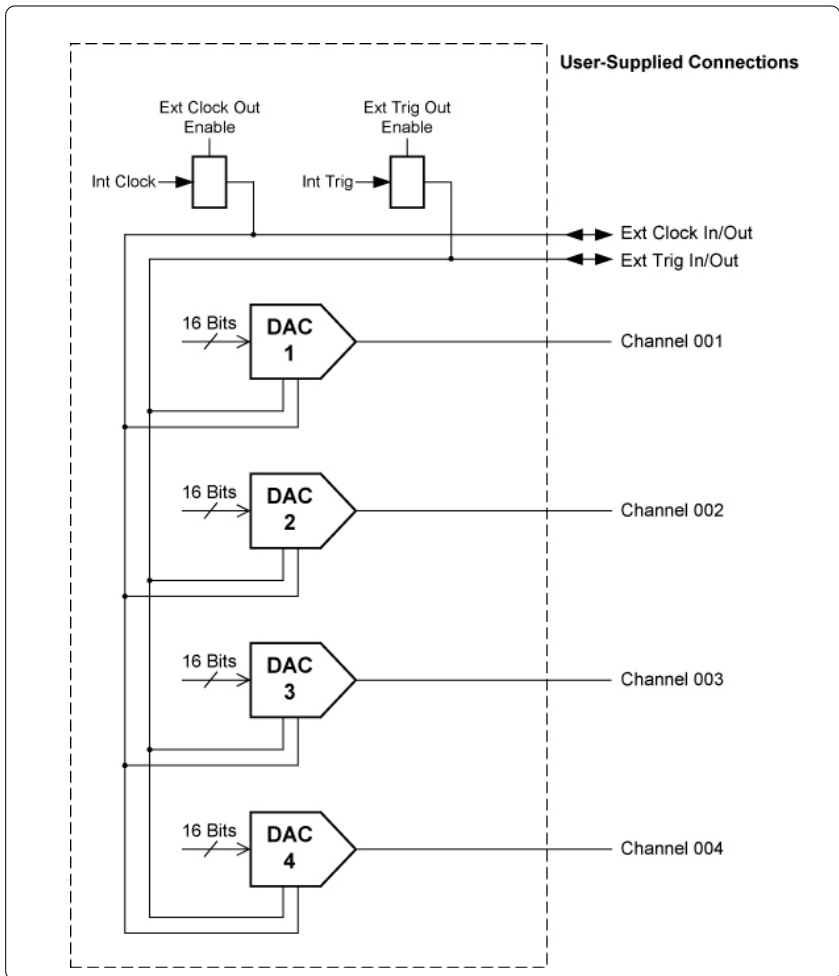


Figure 1. L4451A 4-channel isolated D/A converter

### System connections you can trust

The L4451A comes with 1 heavy duty 50-pin Dsub connector that allows for simple, reliable connection options. Each connector uses 30 micro-inches of gold to ensure a repeatable, accurate measurement. Flexible connection options include:

- Detachable terminal blocks with strain relief
- Low-cost, standard 50-pin Dsub connector kits and cables
- Mass interconnect solutions

### Ethernet connectivity enables simple connection to the network and remote access to measurements

The Ethernet interface offers high-speed connections that allow for remote access and control. You can set up a private network to filter out unwanted LAN traffic and speed up the I/O throughput, or take advantage of the remote capabilities

and distribute your tests worldwide. Monitor, troubleshoot, or debug your application remotely. Ethernet communication also can be used with the support of LAN sockets connections.

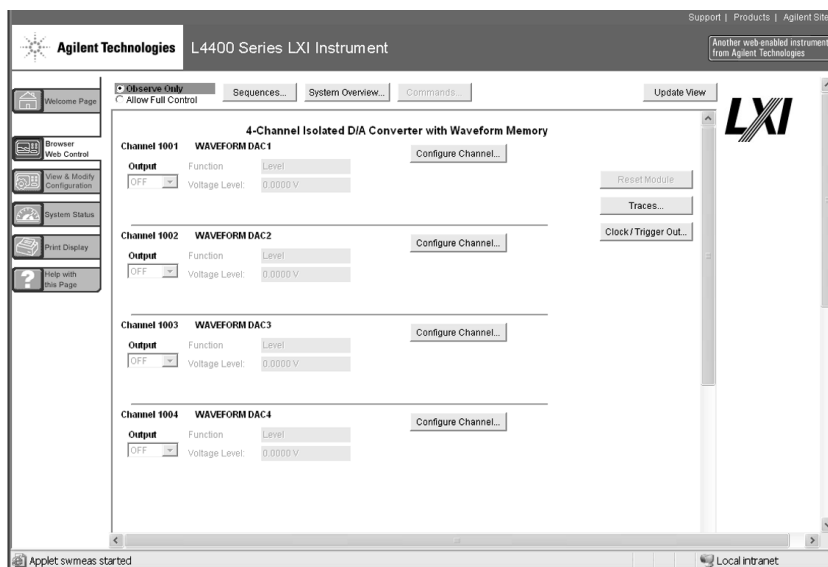
The optional GPIB interface has many years of proven reliability and can be used for easy integration into existing applications.

The L4451A ships with the Agilent E2094N I/O Libraries Suite making it easy for you to configure and integrate instruments into your system – even if your system includes instruments from multiple vendors.

**Fully-featured graphical Web interface makes it easy to set-up and troubleshoot your tests from anywhere in the world**

The built-in Web browser interface provides remote access and control of the instrument via a Java-enabled browser such as Internet Explorer. Using the Web interface, you can set up, troubleshoot, and maintain your instrument from remote locations.

- View and modify instrument setup
- Configure analog and clock outputs



**Figure 2.** The Web interface makes it easy to set up, troubleshoot and maintain your test remotely

- Define and output waveforms
- View error queue
- Get status reports, current configuration, firmware revisions, and more

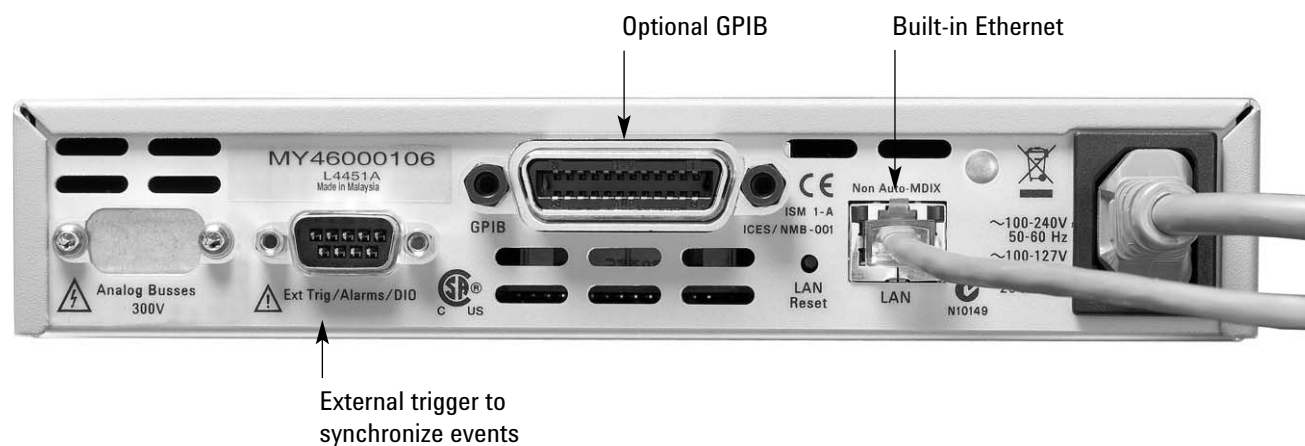
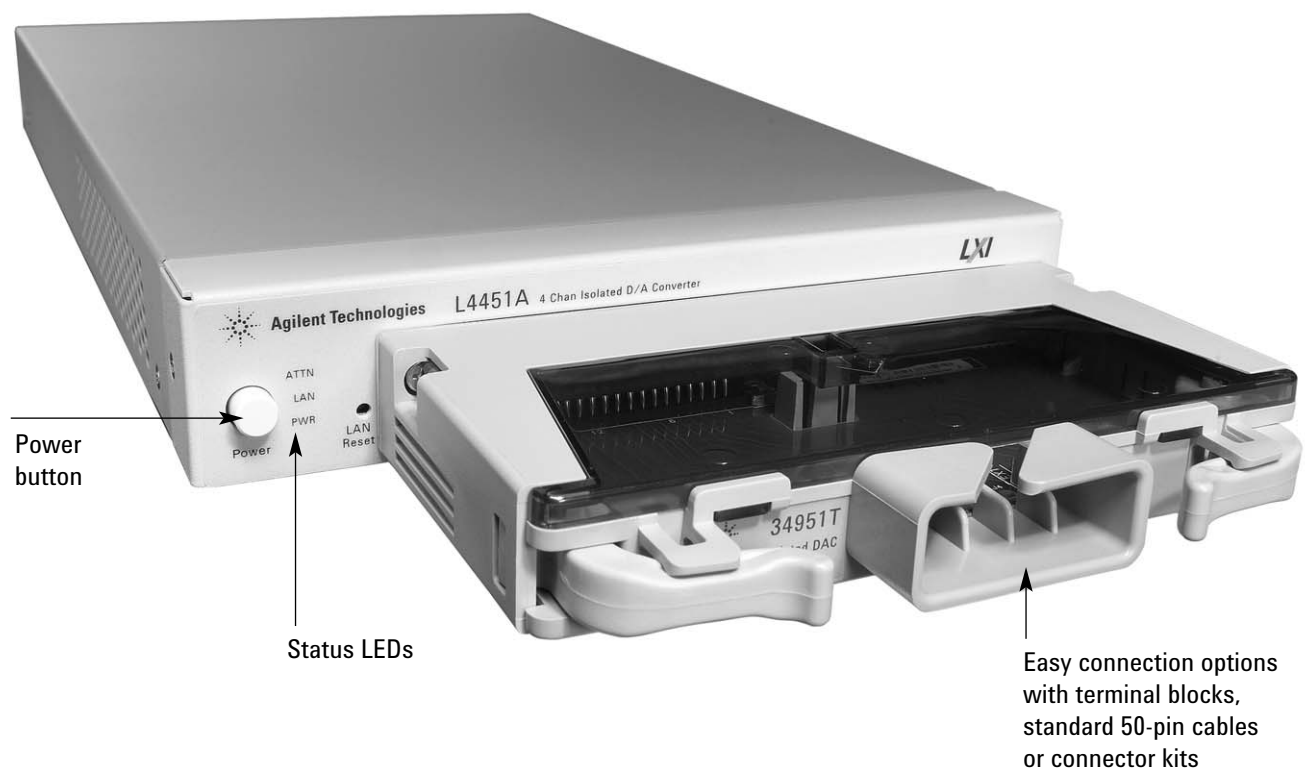
Additionally, since the Web server is built into the instrument, you can access it on any operating system that supports the Web browser without having to install any special software. Password protection and LAN lockout are also provided to limit access for additional security.

**Software for most popular programming environments**

Full support for standard programming environments ensures compatibility and efficiency. You can use direct I/O with the software you already have and know, or use standard IVI and LabVIEW™ software drivers that provide compatibility with the most popular development environments:

- Agilent T&M Toolkit for Microsoft Visual Studio®.NET and Agilent VEE Pro
- National Instruments LabVIEW, LabWindows/CVI, TestStand, and Switch Manager
- Microsoft C/C++® and Visual Basic®

**High-performance digital I/O wherever your application needs it**



## Product Specifications

### Specifications and Characteristics

<b>Output specifications</b>	Maximum update rate:	200 kHz point-to-point
	Monotonic :	to 16-bits
	Isolation:	> 80 VDC/AC peak (chan-to-chassis or chan-to-chan)
	Synchronization:	Software commands or external trigger
	Internal/external CLK accuracy:	100 ppm
	AC accuracy:	Not specified

### DC voltage

Amplitude:	$\pm 16$ V up to 10 mA
Resolution:	16-bit = 500 $\mu$ V
Amplitude Accuracy (DC):	$\pm(0.05\% + 3.0$ mV
Ripple and noise:	< 2 mVrms, 20 Hz to 250 kHz into 10 k $\Omega$ load
Settling time:	40 $\mu$ s (-full scale to +full scale step, single channel, to rated accuracy)
Output impedance:	< 1 $\Omega$ with the load sensed

### DC current

Range:	$\pm 20$ mA
Resolution:	16-bit = 630 nA
Accuracy:	$\pm(\%$ value + amps) (temperature within $\pm 5^{\circ}\text{C}$ of Tcal or *Cal?) 90-day: $\pm(0.09\% + 5.0$ $\mu$ A)
Ripple and noise:	< 2 $\mu$ Arms, 20 Hz to 250 kHz into 250 $\Omega$
Compliance voltage:	$\pm 12$ V
Max open circuit voltage:	< $\pm 22$ V

## Product Specifications (continued)

### Phase-locking I/O trigger characteristics

Trigger input	Input level:	TTL compatible (3.3 V logic, 5 V tolerant)
	Slope:	Rising or falling, selectable
	Pulse width:	> 100 ns
	Input impedance:	> 10 k $\Omega$ , DC coupled
Trigger output	Level:	TTL compatible into 1 k $\Omega$ (3.3 V logic)
	Output impedance:	50 $\Omega$ typical
Clock input	Input level:	TTL compatible (3.3 V logic, 5 V tolerant)
	Input impedance:	> 10 k $\Omega$ , DC
	Maximum rate:	10 MHz
Clock output	Level:	TTL compatible Into 1 k $\Omega$ (3.3 V logic)
	Output impedance:	50 $\Omega$ typical
	Maximum rate:	10 MHz
	Accuracy:	$\pm 100$ ppm

### Memory

Type	Volatile
Size	500 K for waveforms
States	5 instrument states with user label in non-volatile memory

### General specifications

Power supply	Universal 100 V to 240 V $\pm 10\%$
Power line frequency	50 Hz to 60 Hz $\pm 10\%$ automatically sensed
Power consumption	15 VA
Operating Environment	Full accuracy for 0°C to 55°C Full accuracy to 80% R.H. at 40 °C
Storage environment	-40°C to 70°C
Dimensions (H x W x L)	40.9 x 212.3 x 379.3 mm 1.61 x 8.36 x 14.93 in
Weight	3.7 kg, 8.2 lbs
Safety conforms to	CSA, UL/IEC/EN 61010-1
EMC conforms to	IEC/EN 61326-1, CISPR 11
Warranty	1 year

## Product Specifications (continued)

### Software

Agilent connectivity software included	Agilent I/O Libraries Suite 14 or greater (E2094N)
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### Minimum system requirements

PC hardware	Intel Pentium 100 MHz, 64 Mbyte RAM, 210 Mbyte disk space Display 800x600, 256 colors, CD-ROM drive
Operating system <sup>1</sup>	Windows® 98 SE/NT/2000/XP

### Computer interfaces

Standard LAN 10BaseT/100BaseTx
Optional IEEE 488.2 GPIB

### Software driver support for programming languages

Software drivers	IVI-C and IVI-COM for Windows NT®/2000/XP LabVIEW
------------------	--

### Compatible with programming tools and environments

Agilent	VEE Pro
	T&M Toolkit (reqs Visual Studio.NET)
	TestStand
	Measurement Studio
	LabWindows/CVI
National Instruments	LabVIEW
	Switch Executive
	Visual Studio.NET®
	C/C++
	Visual Basic 6®

<sup>1</sup> Load I/O Libraries Version M for Windows NT support or version 14.0 for Windows 98 SE support

## Ordering information

### **L4451A 4-Channel Isolated D/A Converter with Memory**

Includes User's guide on CD, power cord, and Quick Start package

#### **Option - GPIB**

Adds GPIB interface

#### **Option 0B0**

Deletes printed manual set, full documentation included on CD ROM

#### **Option ABA**

English printed manual set

## **Connection Options**

Select terminal block for discrete wiring, cables or connector kits. Cables and connector kits require one per instrument.

### **34951T**

Terminal block for 34951A and L4451A 4-Ch D/A Converter

### **Y1135A**

1.5 m 50-pin Dsub, M/F twisted pair with outer shield cable – 300 V

### **Y1136A**

3 m 50-pin Dsub, M/F twisted pair with outer shield cable – 300 V

### **Y1141A**

Solder cup connector kit with male 50-pin Dsub

## Other accessories

### **Y1160A**

Rack mount kit for L4400 series instruments-racks 2 instruments side-by-side on sliding tray

For additional information please visit:

<http://www.agilent.com/find/L4451A>

## Related Agilent literature

### **Data Sheets**

**5988-6302EN**

Agilent VEE Pro

**5989-1441EN**

Agilent W1140A-TKT

T&M Toolkit 2.0 with Test Automation

**5989-1439EN**

Agilent E2094N

I/O Libraries Suite 14

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Our Promise means your Agilent test and measurement equipment will meet its advertised performance and functionality. When you are choosing new equipment, we will help you with product information, including realistic performance specifications and practical recommendations from experienced test engineers. When you receive your new Agilent equipment, we can help verify that it works properly and help with initial product operation.

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(tel) (305) 269 7500

#### **Taiwan:**

(tel) 0800 047 866

(fax) 0800 286 331

#### **Other Asia Pacific Countries:**

(tel) (65) 6375 8100

(fax) (65) 6755 0042

Email: [tm\\_ap@agilent.com](mailto:tm_ap@agilent.com)

Contacts revised: 09/26/05

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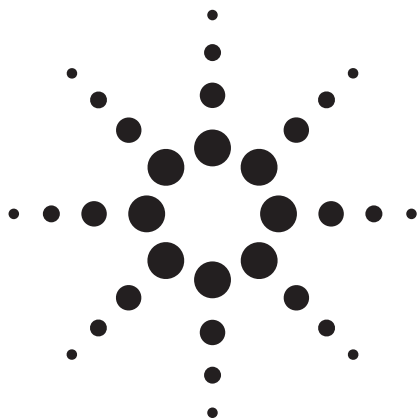
Printed in the USA, February 28, 2006

5989-4830EN



**Agilent Technologies**





## Agilent L4452A Multifunction with Digital I/O, D/A, Totalizer

Data Sheet

- LXI compliance includes built-in Ethernet connectivity
- Fully-featured graphical Web interface
- 32-bits of digital I/O up to 42 V
- 100 kHz gated totalizer
- Two  $\pm 12$  V analog outputs with 1 mV of resolution
- Software drivers for most common programming environments



### **Multifunction instrument offers your system control functionality wherever your application needs it**

The Agilent L4452A is a multifunction instrument that is LXI Class C compliant. With its small size and Ethernet connectivity, this multifunction instrument can be placed wherever your application needs it.

The Agilent L4452A allows great flexibility for a variety of sense and control applications.

It combines four 8-bit channels of digital input and output, a 100 kHz gated totalizer, and two  $\pm 12$  V analog outputs all on a single earth-referenced module.

Using this LXI instrument, you'll get all the benefits of an Ethernet connection, instrument Web server, standard software drivers and more. The LXI standard is supported by multiple vendors, enabling lower cost of test with accelerated test integration and development.



**Agilent Technologies**

### Digital I/O, D/A converter and totalizer for your most common test requirements

The L4452A combines digital I/O, analog outputs and a gated totalizer for your most common system control needs.

The digital I/O supports output levels up to 42 V. These channels can be used with an external power supply to control external devices or to sense limit switch and digital bus status with no complex handshake modes.

You can use the totalizer input to count events. The digital inputs and totalizer inputs may be included in a scan. Alarm limits for the digital and event counter inputs are evaluated continuously, capturing and logging alarm conditions even between scans.

The analog outputs can output up to  $\pm 12$  V or 10 mA DC with 1 mV of resolution. They can be used to source bias voltages to your device under test, to control your analog programmable power supplies, or use the outputs as set points for your control systems.

External trigger capabilities make it easy for you to time and synchronize measurements and other events. This can help you determine when to begin or end a scan.

### System connections you can trust

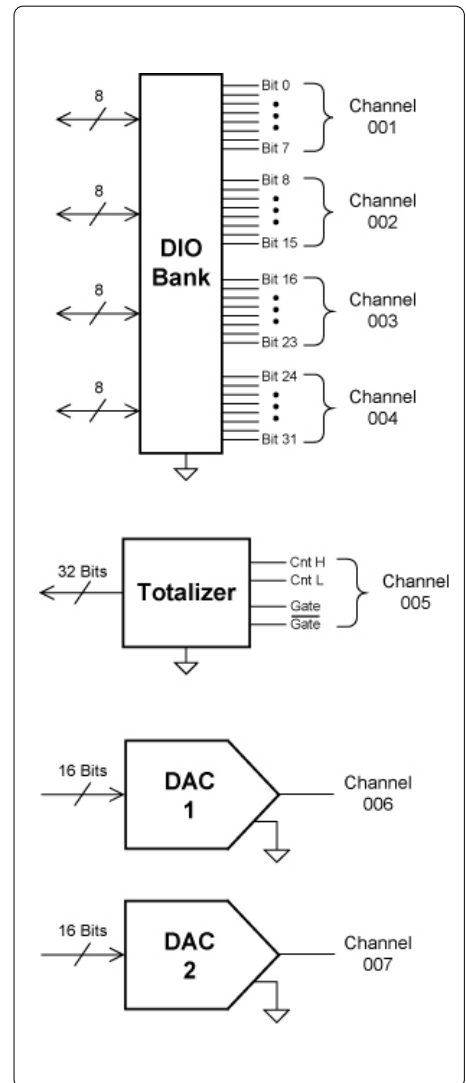
The L4452A comes with one heavy duty 50-pin Dsub connector that allows for simple, reliable connection options. Each connector uses 30 micro-inches of gold to ensure a repeatable, accurate measurement. Flexible connection options include:

- Detachable terminal blocks with strain relief
- Low-cost, standard 50-pin Dsub connector kits and cables
- Mass interconnect solutions

### Ethernet connectivity enables simple connection to the network and remote access to measurements

The Ethernet interface offers high-speed connections that allow for remote access and control. You can set up a private network to filter out unwanted LAN traffic and speed up the I/O throughput, or take advantage of the remote capabilities and distribute your tests worldwide. Monitor, troubleshoot, or debug your application remotely. Ethernet communication also can be used with the support of LAN sockets connections.

The optional GPIB interface has many years of proven reliability and can be used for easy integration into existing applications.



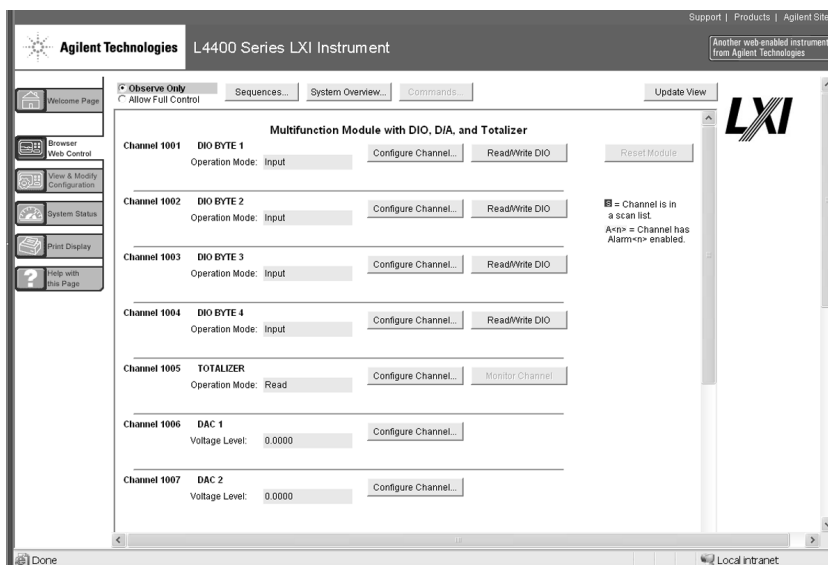
**Figure 1.** L4452A Multifunction Digital I/O, D/A, totalizer

The L4452A ships with the Agilent E2094N I/O Libraries Suite making it easy for you to configure and integrate instruments into your system – even if your system includes instruments from multiple vendors.

**Fully-featured graphical Web interface makes it easy to set-up and troubleshoot your tests from anywhere in the world**

The built-in Web browser interface provides remote access and control of the instrument via a Java-enabled browser such as Internet Explorer. Using the Web interface, you can set up, troubleshoot, and maintain your instrument from remote locations.

- View and modify instrument setup
- Configure I/O channels, analog outputs, totalizer and alarms
- Read and write I/O channels
- Output analog channels
- View error queue
- Get status reports, current configuration, firmware revisions, and more



**Figure 2.** The Web interface makes it easy to set up, troubleshoot and maintain your test remotely

Additionally, since the Web server is built into the instrument, you can access it on any operating system that supports the Web browser without having to install any special software. Password protection and LAN lockout are also provided to limit access for additional security.

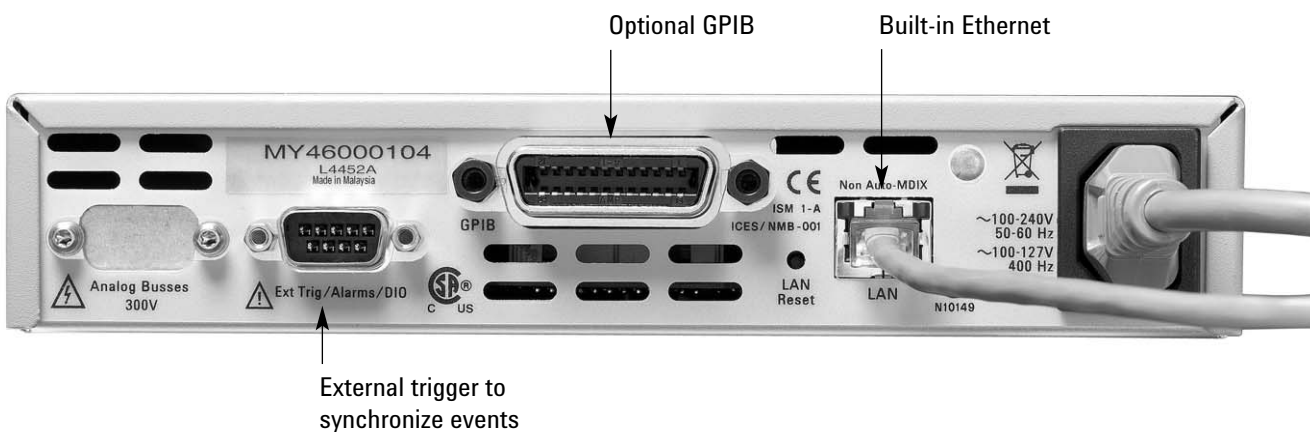
**Software for most popular programming environments**

Full support for standard programming environments ensures compatibility and efficiency. You can use direct I/O with the software you

already have and know, or use standard IVI and LabVIEW™ software drivers that provide compatibility with the most popular development environments:

- Agilent T&M Toolkit for Microsoft Visual Studio®.NET and Agilent VEE Pro
- National Instruments LabVIEW, LabWindows/CVI, TestStand, and Switch Manager
- Microsoft C/C++® and Visual Basic®

**Multifunction instrument wherever your application needs it**



## Product Specifications

### Specifications and Characteristics

#### Digital input/output characteristics

Four 8-bits channels, 8 bits wide, input or output, non-isolated

Vin(L)	< 0.8 V (TTL)
Vin(H)	> 2.0 V (TTL)
Vout(L)	< 0.8 V @ Iout = -400 mA
Vout(H)	> 2.4 V @ Iout = 1 mA
Vin(H) max	< 42 V with external open drain pull-up
Alarm	Maskable pattern match or state change
Speed	4 ms (max) alarm sampling Latency
Read/write speed	95/s

#### Totalize input characteristics

Max count	$2^{26} - 1$
Totalize input	100 kHz (max) rising or falling edge, programmable
Signal level	1 Vp-p (min) 42 Vpk (max)
Threshold	0 V or TTL
Gate input	TTL-Hi, TTL-Lo, or none
Count reset	Manual or read + reset
Read speed	85 rdgs/s

#### Analog output characteristics

DAC 1, 2	$\pm 12$ V, non-isolated
Resolution	1 mV
IOUT	10 mA max
Settling time	1 ms to 0.01% of output
Accuracy	$\pm$ (% of output + mV) 1 year (0.25% + 20 mV)
Temp. coefficient	$\pm$ (0.015% + 1 mV)/°C

## Product Specifications (continued)

### Data out of memory to LAN or GPIB

(data transfer rate with 1000 channel blocks)

	GPIB	LAN (w/ VXI 11)
	rds/s	rds/s
Readings	2560	3542
readings with timestamp	1304	1826
readings with all format options ON	980	1361

### Scan triggering

Source	Interval, external, software, or on monitor channel alarm
Scan count	1 to 50,000 or continuous
Scan interval	0 to 99 hours; 1 ms step size
Channel delay	0 to 60 seconds per channel; 1 ms step size
External trig delay	<2 ms. With monitor on <200 ms
External trig jitter	<2 ms

### Alarms

Digital inputs	Digital in maskable pattern match or state change Totalize: Hi limit only
Alarm on channel	Alarm evaluated each reading
Alarm outputs	2 TTL compatible, Selectable TTL logic Hi or Lo on fail
Latency	5 ms (typical)

### Memory

Type	Volatile
Readings	500,000 with timestamp Readable during scan
States	5 instrument states with user label in non-volatile memory

### General specifications

Power supply	Universal 100 V to 240 V $\pm 10\%$
Power line frequency	50 Hz to 60 Hz $\pm 10\%$ automatically sensed
Power consumption	15 VA
Operating Environment	Full accuracy for 0°C to 55°C Full accuracy to 80% R.H. at 40 °C Pollution degree 1 of IEC 61010-1
Storage environment	-40°C to 70°C
Dimensions (H x W x L)	40.9 x 212.3 x 379.3 mm 1.61 x 8.36 x 14.93 in
Weight	3.6 kg, 8 lbs
Safety conforms to	CSA, UL/IEC/EN 61010-1
EMC conforms to	IEC/EN 61326-1, CISPR 11
Warranty	1 year

## Product Specifications (continued)

### Software

Agilent connectivity software included	Agilent I/O Libraries Suite 14 or greater (E2094N)
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### Minimum system requirements

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Agilent E2094N

I/O Libraries Suite 14



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#### **Your Advantage**

Your Advantage means that Agilent offers a wide range of additional expert test and measurement services, which you can purchase according to your unique technical and business needs. Solve problems efficiently and gain a competitive edge by contracting with us for calibration, extra-cost upgrades, out-of-warranty repairs, and on-site education and training, as well as design, system integration, project management, and other professional engineering services. Experienced Agilent engineers and technicians worldwide can help you maximize your productivity, optimize the return on investment of your Agilent instruments and systems, and obtain dependable measurement accuracy for the life of those products.



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Email: [tm\\_ap@agilent.com](mailto:tm_ap@agilent.com)

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