60-103 User Manual

LXI 18-Slot Modular Switching Chassis



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PRODUCT SAFETY

SAFETY SYMBOLS

The following safety symbols may be used on the product and throughout the product documentation.

MEANING / DESCRIPTION	SYMBOL
PROTECTIVE EARTH (GROUND) To identify any terminal which is intended for connection to an external conductor for protection against electric shock in case of a fault, or the terminal of a protective earth (ground) electrode.	
DANGEROUS VOLTAGE To indicate hazards arising from dangerous voltages.	
WARNING / CAUTION An appropriate safety instruction should be followed or caution to a potential hazard exists. Refer to the relevant instructions detailed within the product manual.	
THIS PAGE INTENTIONALLY BLANK **HEAVY** If this product is heavy reference should be made to the safety instructions for provisions of lifting and moving.	
STATIC SENSITIVE To indicate that static sensitive devices are present and handling precautions should be followed.	

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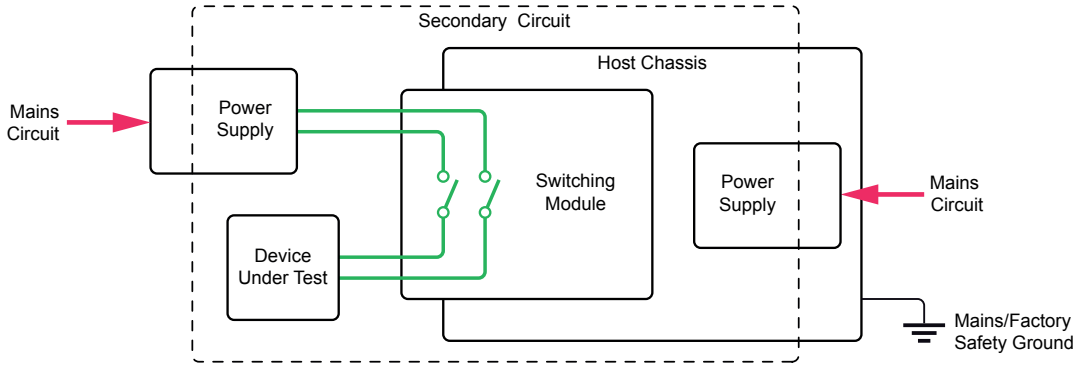
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WARNINGS AND CAUTIONS

WARNING - HAZARDOUS ENVIRONMENTS	SYMBOL
This product is not specifically designed for use in hazardous environments, for example in explosive atmospheres. If the product is to be used in hazardous environments we recommend that the user ensures suitable protective measures are taken.	

WARNING - DANGER OF ELECTRIC SHOCK	SYMBOL
This chassis may be populated with modules that contain hazardous voltages. Before removing any module from the rack remove all supplies and disconnect user I/O signals. Unused slots in this chassis are populated with blanking panels to prevent access to user I/O signals that may be present. Blanking panels are available to order from Pickering. If the product is not used in this manner for example by using an extender card then additional care must be taken to avoid contact with exposed signals. Not to be used in safety critical circuits, refer to the Pickering Interfaces' terms & conditions of sale. Installed modules must not be used for the switching of Mains Circuits. For the switching of voltages up to the module's full specification, Secondary Circuit power supplies and the Device Under Test must be fully isolated from the Mains Circuit and the safety earth. This chassis must be correctly installed and be connected to mains or factory safety ground, please refer to the Installation section of this manual.  **Diagram Showing Separation Between The Mains Circuit and Secondary Circuit / DUT** For the purposes of this document, a Mains Circuit is an installation classified as Overvoltage Category II up to 300V. Separation between the Secondary Circuit and Mains Circuit is achieved by a transformer in which the primary windings are separated from the secondary windings by reinforced insulation, double insulation, or a screen connected to the protective conductor terminal.	

CAUTION - HANDLING OF ELECTROSTATIC-SENSITIVE DEVICES	SYMBOL
Certain semiconductor devices used in this equipment are liable to damage due to static voltage. Observe the following precautions when handling these devices in their unterminated state, or sub-assemblies containing these devices: 1. Persons removing sub-assemblies from equipment using these devices must be earthed by a wrist strap and a resistor at the point provided on the equipment. 2. Soldering irons used during the repair operations must be low voltage types with earthed tips and isolated from the mains voltage by a double insulated transformer. 3. Outer clothing worn must be unable to generate static charges. 4. Printed Circuit Boards (PCBs) fitted with these devices must be stored and transported in anti-static bags.	

CAUTION - PRODUCT DOCUMENTATION	SYMBOL
Suitably qualified & trained users should ensure that the accompanying documentation is fully read and understood before attempting to install or operate the product.	

SAFETY INSTRUCTIONS

SAFETY INSTRUCTIONS
All cleaning and servicing requires the equipment to be isolated and disconnected from the power source and user I/O signals (refer to the Maintenance Section). • Appropriate manual handling procedures should be followed as dictated by the weight of the individual module or the combined weight of the modules & chassis. • Should a fault occur with the module or chassis, immediately isolate and disconnect the incoming power to the chassis and the user I/O signals. • Ensure the equipment is installed, operated and maintained by trained and authorised personnel. • For suitably equipped products in the event of an emergency press the red “emergency stop” button situated on the front of the unit.

SECTION 1 - INTRODUCTION

GENERAL

The 60-103 is fully compliant with the LXI Class C specification and supports Pickering Interfaces 3U PXI switching modules. Each module is supported as though it is an LXI compliant device, complete with a driverless soft front panel that provides complete control of the module functions. The 60-103 supports up to 18 off 3U modules and is equivalent to a 19 slot PXI chassis.

The chassis allows the majority of the large number of 3U PXI modules from Pickering Interfaces to be installed and controlled through a standardized Ethernet interface. The chassis is supplied with a built-in generic IVI driver to control the PXI modules in accordance with the LXI specification, but can also be controlled through a kernel driver.

Modules available for installation in the 60-103 chassis cover a large variety of switching functions. They include simple switches, matrices and multiplexers based on reed relay and electromechanical technology which can switch from micro Amps to 40 Amps. A range of RF, microwave and optical switching functions are supported as well as some instrument functions such as variable resistor cards. For a list of compatible PXI modules, please refer to the LXI Short Form Catalog.

The LXI compliant Ethernet interface enables the chassis to be controlled through standard LAN interfaces found on all controllers. It allows the remote operation of switching products with simple cabling over long distances, even permitting a chassis to be controlled over world wide networks. The separation of the chassis from the controller's PCI bus simplifies power-on sequencing of systems and provides a high degree of independence from the migration of the Windows and VISA environment

The form factor of the 60-103 allows efficient use of space thanks to its compact 4U height. Four 68cfm fans insure maximum module cooling and an efficient direct convection design allows the chassis to operate over an extended ambient temperature range of 0ºC to +55ºC.

The low acoustic emissions make the chassis ideal for applications such as office or laboratory environments where noise levels are critical. The sound pressure level varies between 49.7dB and 57.7dB dependant upon the fan speed which is automatically controlled according to the internal chassis temperature.

The 60-103 can be simply configured over its LXI compliant interface using any industry standard web browser. The interface can be used to open a Java based soft front panel to the user for any of the modules fitted to the chassis, permitting users to manually access modules without the need for drivers on the controller.

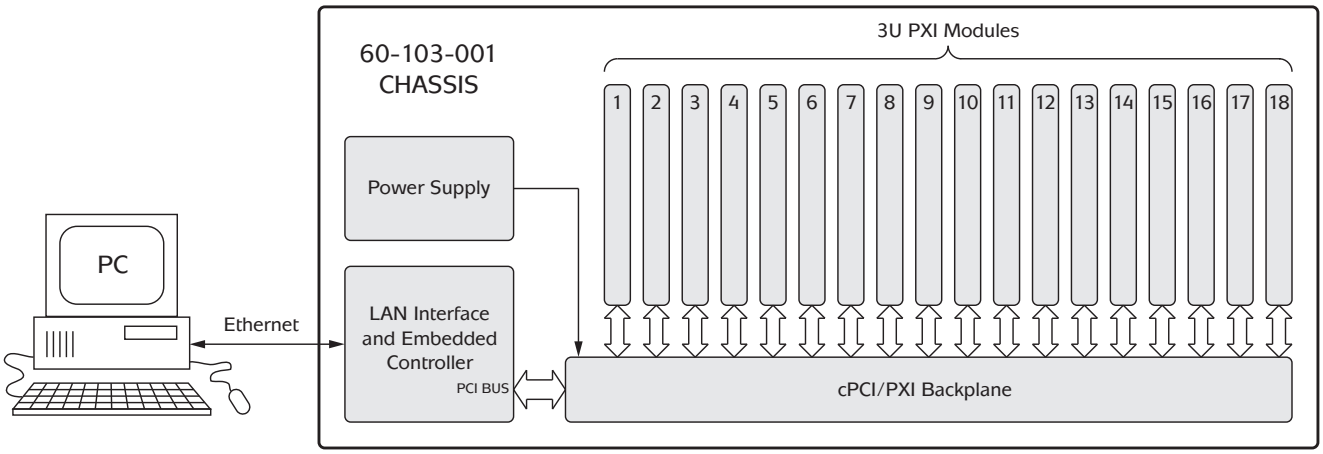


Figure 1.1 - Basic Block Diagram for the 60-103 LXI Chassis

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SECTION 2 - SPECIFICATION

Specifications

Chassis Backplane:	64 bit backplane, compliant with cPCI/PXI specification. Provides trigger, local bus support (subject to module support).
Chassis Capacity:	18 off 3U user slots available.

PXI Module compatibility

The chassis is supplied with drivers for Pickering PXI (System 40) switching modules and selected instrument modules.	
Switching Support:	All of 3U Pickering Interface's PXI switching modules. Includes (but not limited to): All BRIC modules, reed relay solutions, EMR modules, RF and optical switches.
Instrumentation support:	Programmable resistor and potentiometer modules, RF attenuators, battery simulators, programmable power supplies and digital I/O modules.
Soft Front Panel:	All supported PXI modules can be controlled through a W3C compliant web browser (Internet Explorer, Firefox, Netscape and others).
For a selection guide on the range of modules capable of being hosted by the 60-103 chassis, please see the PXI Module Selection Guide in the LXI Product Guide. This is available as a download from the On-Line Catalogs section of our website: pickeringtest.com	

Power Supply

Input Voltage Range:	90 - 264VAC
Input Voltage Frequency:	47 to 63Hz
Input Current Rating	12A 115VAC or 6A 230VAC

Integrated power supply with the following capacity for the user modules:

DC Output	+3.3V	+5V	+12V	-12V
Max Current	45A	50A	18A	4.5A

Cooling

Airflow:	Bottom intake, top exhaust
Per-slot Cooling Capacity:	25W at 55°C ambient 40W at 40°C ambient
Fans:	4 off 60cfm fans

Acoustic Noise Emissions

Sound Pressure Level(dBA):	Minimum fan speed: 49.7dB Maximum fan speed 57.7dB
Sound Power (dBA):	Minimum fan speed: 59.8dB Maximum fan speed 69.1dB

Monitoring

LXI Interface Status LEDs:	Power, Ready, Error, LAN, Active
Chassis Status LEDs:	Power, Temperature, Fan Speed
Web Page Monitoring:	Chassis air temperature, Backplane supply voltage levels, Fan speeds

LAN Interface

Designed to comply with the LXI Standard Version 1.3	
Connector:	RJ45 Connector.
Connection Speed:	100BaseT interface

Supporting Documentation

Manuals, drivers and a copy of the short form catalog are stored internally and are accessible through any browser compliant with W3C standards

Mechanical Specification

Dimensions:	Width: 444mm (17.48") Height: 178mm (7.01") Depth: 455mm (17.91") For rack mounting, recommended to be mounted in 5U to allow free bottom intake of air.
Weight:	13.4kg (29.5 lbs) without PXI modules

Operating/Storage Conditions

Operating Conditions

Operating Temperature:	0°C to +55°C
Humidity:	10% to 95% non-condensing

Storage and Transport Conditions

Storage Temperature:	-20°C to +70°C
Humidity:	10% to 90% non-condensing

Safety, CE & RoHS Compliance

All products are fully CE compliant and meet applicable EU directives: Low-voltage safety EN61010-1:2010, EMC Immunity EN61326-1:2013, Emissions EN55011:2009+A1:2010.

The 60-103 Chassis also complies with the European Restriction of Hazardous Substances directive (RoHS).

Product Order Codes

LXI Modular Switching Chassis, 18-Slot	**60-103-001**
Optional 19" rack mounting hardware*	**63-103-001**

* Please refer to the 60-103 User Manual for information on the optional chassis mounting hardware.

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SECTION 3 - GENERAL DESCRIPTION

MECHANICAL DESCRIPTION

The 60-103 LXI Chassis comprises the following:

- Full width rack mountable chassis also suitable for desk top operation.
- 18 slot PXI/cPCI compatible backplane.
- Controller module for providing the interface between the backplane and the Ethernet port.
- Power supply assembly for providing power for the Microcontroller, backplane and peripheral cards.
- Front panel mounted chassis status LEDs.
- Front panel mounted LXI interface status LEDs.
- Rear panel mounted RJ45 100baseT LAN connection for LXI control of the module over Ethernet.
- Rear panel mounted IEC plug for connection to the mains supply.





FUNCTIONAL DESCRIPTION

The 60-103 LXI Chassis is capable of supporting a wide range of PXI switching cards in a self-contained unit, the only connections required are power and an Ethernet lead. The chassis consists of a 18-slot PXI/compactPCI compatible backplane and a controller card with power being supplied from an internal mains power unit. Control and programming information for the PXI modules installed in the chassis is sent to the backplane via a PCI bridge device on the controller card. Programming information for the controller is sent to the chassis via the LAN interface from a remote computer using the chassis unique Ethernet address. Programming documentation for the chassis as well as data for Pickering's LXI compatible switching products is stored in the embedded processor on the controller card and can be downloaded over the LAN interface. LXI Status LEDs on the front of the chassis indicate condition of the LAN interface. A chassis management system monitors the status of the backplane power rails, the chassis temperature and the speed of the cooling fans. The status of the chassis is indicated on three front panel LEDs and is monitored by the controller card where it can be accessed over the LXI interface.

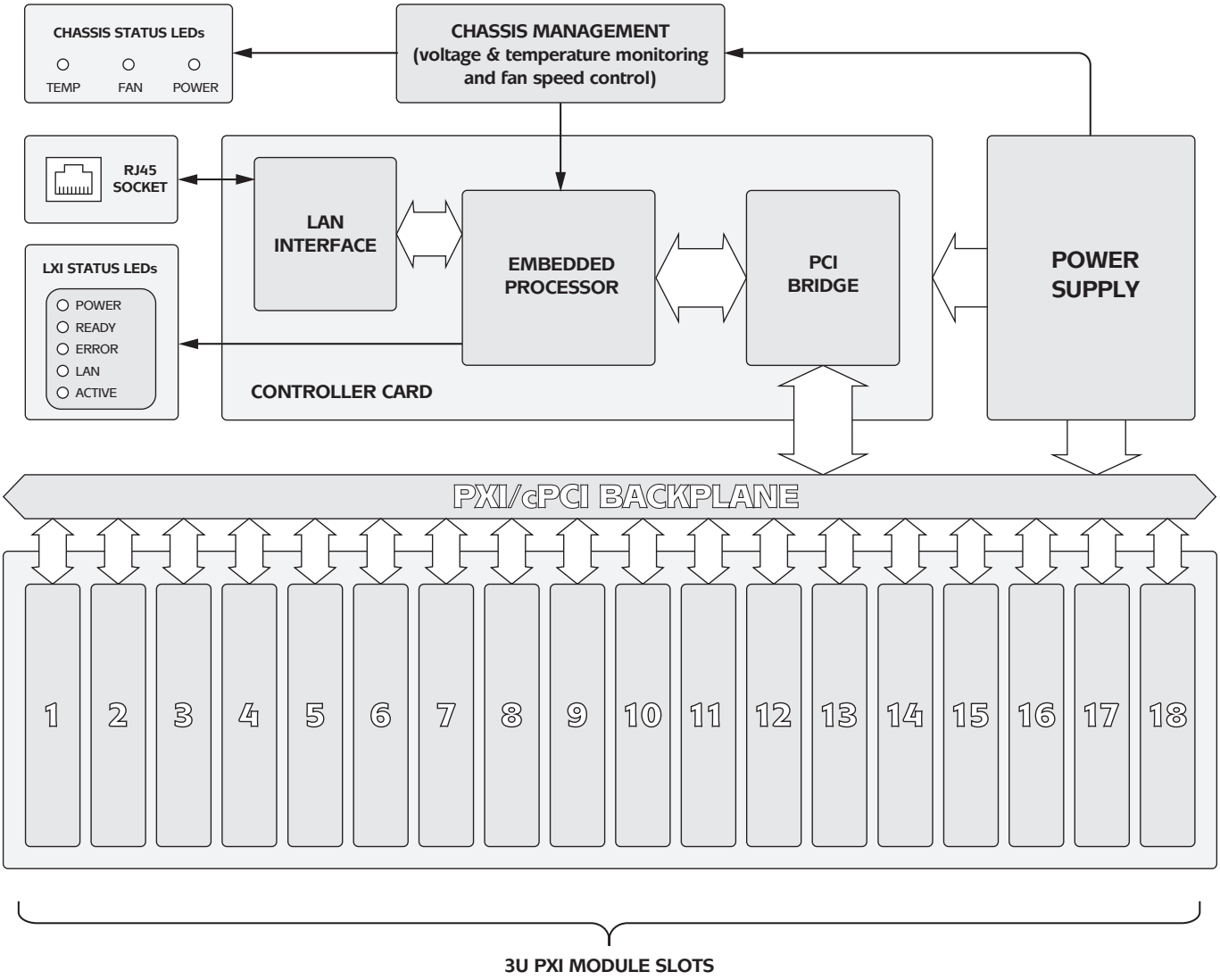


Figure 3.1 - Block Diagram for the 60-103 Eighteen Slot LXI Chassis

PXI MODULE SUPPORT

The 60-103 supports a wide variety of Pickering Interfaces 3U PXI modules, the backplane of the chassis is conformant to the PXI standard. The chassis LXI interface is conformant with the stated version of the LXI standard.

All Pickering Interfaces 3U switching modules and resistor modules are supported, support for some instrument modules is not provided where the product is sourced from a third party. PXI data sheets identify which modules are supported in the bullet points on the front page and the LXI Catalog lists the supported modules.

No third party PXI modules are supported.

The PXI modules are provided with a variety of drivers and this includes an IVI driver as required by the LXI standard, the drivers supported are described in the software section of this manual. Where PXI modules state an operating speed the specification refers to the speed when supported in a PXI chassis which is lightly loaded and not subject to operating system delays, the latency in an Ethernet connected system will increase the operate time under the same conditions (for more information consult Pickering Interfaces sales office).

Where speed is important to an application we generally recommend that the IVI driver is not used since IVI imposes additional delays and prevents more efficient operation of the switches by bulk changes (adding more than one path connection in a single operation) – the IVI software model has no feature for this.

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SECTION 4 - INSTALLATION

Refer to the Warnings and Cautions at the front of this manual
The chassis is designed for indoor use only.

Connecting Safety Ground

WARNING

THE 60-102 CHASSIS IS DESIGNED WITH A THREE-POSITION IEC CONNECTOR THAT CONNECTS THE GROUND LINE TO THE CHASSIS GROUND. TO MINIMIZE SHOCK HAZARD, MAKE SURE YOUR ELECTRICAL POWER OUTLET HAS AN APPROPRIATE EARTH SAFETY GROUND THAT IS CONNECTED WHENEVER YOU POWER UP THE CHASSIS.

IF YOUR POWER OUTLET DOES NOT HAVE AN APPROPRIATE GROUND CONNECTION, YOU MUST CONNECT THE FACTORY WIRE SAFETY GROUND TO THE CHASSIS. TO CONNECT THE SAFETY GROUND, COMPLETE THE FOLLOWING STEPS:

1. Connect a 16 AWG (1.3 mm) wire to a chassis grounding screw using a toothed grounding lug. The wire must have green insulation with a yellow stripe or must be non-insulated (bare).

2. Attach the opposite end of the wire to permanent earth ground using toothed washers or a toothed lug.

INSTALLING THE LXI CHASSIS

Site Considerations

The 60-103 is designed to operate on a bench or in an instrument rack. It is supplied fitted with feet fitted for bench top operation but if you want to use your 60-103 in a rack, mounting flanges will need to be fitted and the feet will have to be removed. Also it should be noted that there is an air intake in the underside of the chassis therefore it is important to fit the chassis in a 5U gap to provide sufficient cooling.



Figure 4.1 - Front of the 60-103 LXI Chassis configured for bench-top operation

Cooling Considerations

The chassis draws cooling air through an intake in the underside of the chassis directly below the PXI module slots (see Figure 4.2). It is important not to block the passage of air into the intake on the chassis underside. When mounting in a rack, a 1U gap should be provided between the bottom of the chassis and any other instruments to provide an unrestricted air flow into the 60-103.

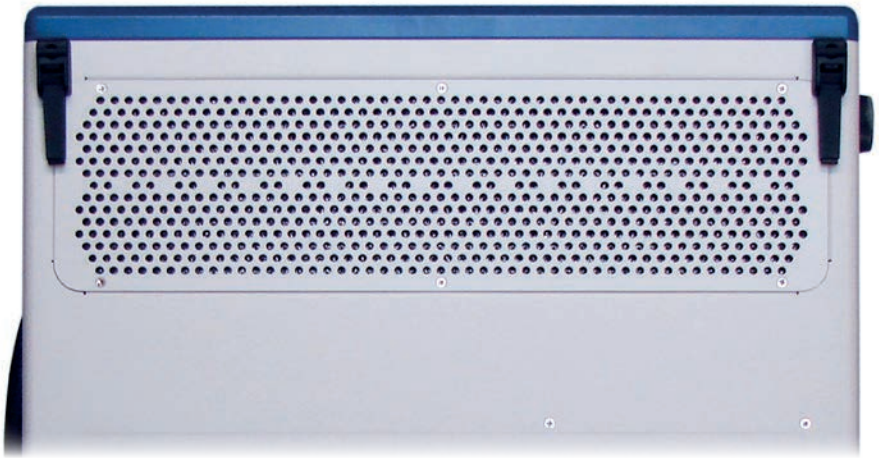


Figure 4.2 - Underside of the 60-103 LXI Chassis Showing Air Intake.

The 60-103 expels cooling air through an exhaust vent in the upper half of the rear panel (see Figure 4.4 below). During installation make sure that this outlet is not restricted in any way, and items such as loose cabling are secured out of the way.

To maintain the correct internal air flow, ensure that all unused PXI module slots in the chassis have blank front panels fitted.



Figure 4.3 - Rear of the 60-103 LXI Chassis showing air outlet in the upper half of the panel.

Selecting the 10MHz Reference Clock Source

The PXI reference clock can be used to synchronize the modules hosted by the chassis. The 60-103 can source the PXI clock from an internal high accuracy oscillator or from an external clock reference via a BNC connector on the rear panel. The source of the 10MHz clock is selected with DIP switches on the PXI backplane. To access these switches the controller module fitted in the far left chassis slot must be removed and the switches set as shown in the figure below.

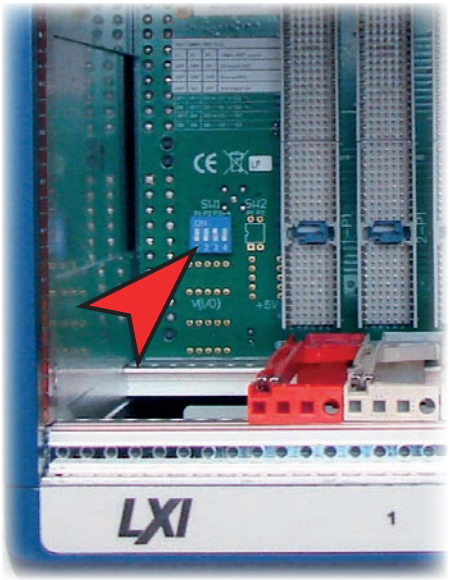


Figure 4.4 - Location of the DIP switches used for setting the source of the Reference Clock.

	P1	P2	P3
Built-in 10MHz Oscillator (default)	OFF	OFF	ON
External 10MHz Clock Input	OFF	OFF	OFF

Table 4.1 - DIP switch settings for the Reference Clock.

INSTALLATION OF INDIVIDUAL MODULES

Please refer to the module user manual for the correct installation procedure of individual PXI modules.

EXPANDING THE 60-103 CHASSIS

It is possible to expand a single 60-103 to include an external PXI chassis, such as 40-914. This allows the number of available to modules supported by 60-103 to be increased from 18.

To expand the 60-103 the user should add a 41-921 PXI interface into the 60-103 and connect it to a PXI chassis with a second 41-921 installed in Slot 1. The set up requires no installation of additional software. The modules in the PXI chassis appear as an extension to the modules fitted into the 60-103 – the fact that they are in a separate chassis is transparent to the user.

The following should be noted with this set up:

- As with the 60-103 only Pickering Interfaces modules can be supported in this way, third party modules are not supported because of the need for suitable drivers.
- National Instruments MXI-4 interface cards can be used for expansion instead of the 40-921 but the use of MXI-3 cards is strongly discouraged. There are known documented issues with MXI-3 when operated with fast PCI interfaces which have been corrected on MXI-4.
- The number of modules supported can be increased by adding further slave PXI Chassis.
- If the LXI chassis is extended in this manner, it is important to make sure that the PXI chassis powers up prior to the LXI chassis.

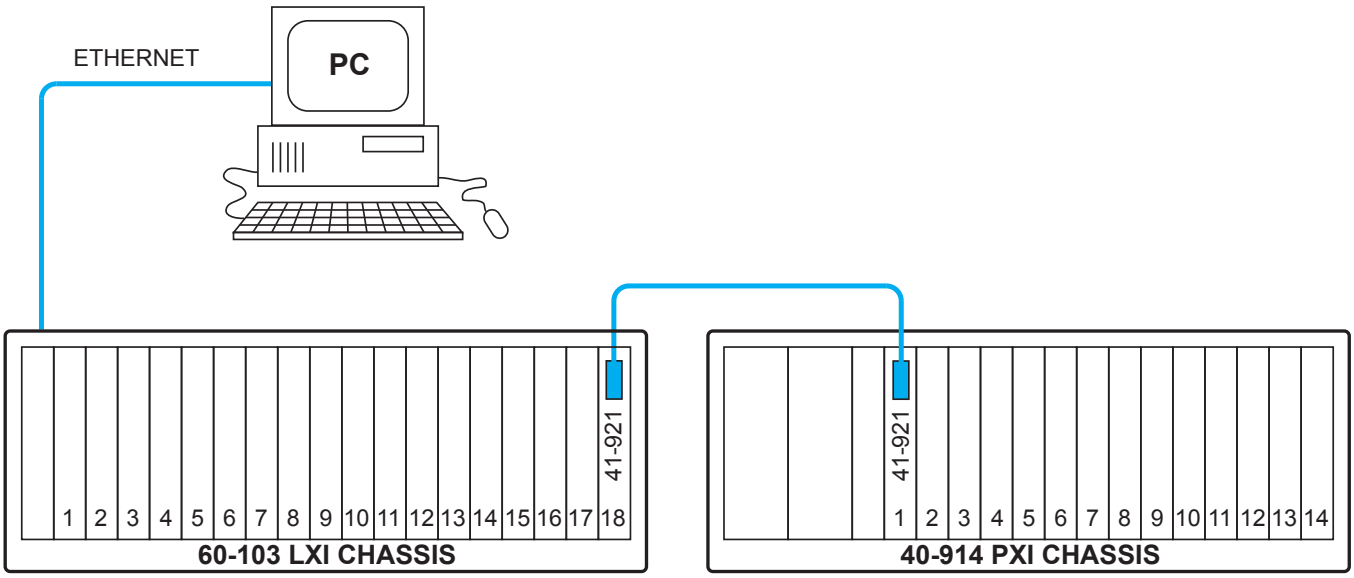


Figure 4.5 - Diagram Showing the Expansion of the 60-103 LXI Chassis

SECTION 5 - CONFIGURATION & SETUP

HARDWARE SETUP

Before you begin, take a moment to check your box contents to ensure you have the necessary components present. Contact your local sales office if you find that any part or component is missing.



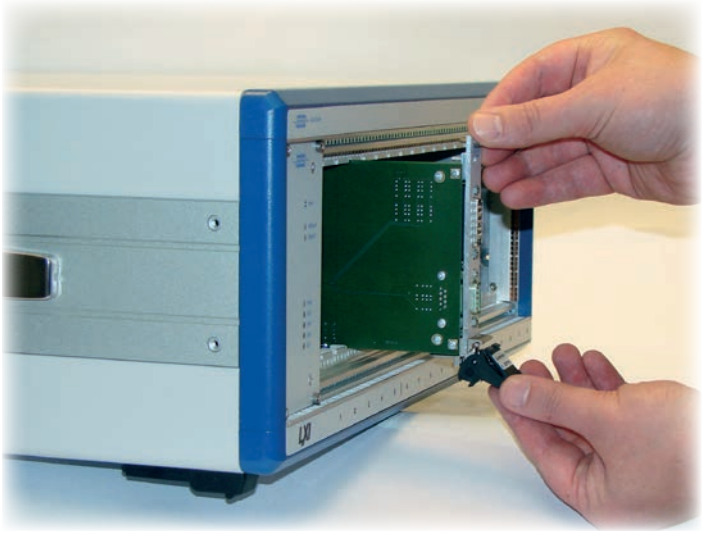
Your box will contain:

1. A 60-103 LXI Chassis
2. The document entitled ‘Getting started with your LXI device’.
3. Two 2 metre ethernet patch leads:
   One labelled ‘crossover’ (grey) and the other ‘straight-through’ (blue)
4. A power lead for your territory
5. A driver CD

You may also have a number of additional cards. Check your shipping invoice for details.

Remove your 60-103 chassis from its protective packaging.

Insert your option cards into it now. You may need to remove blanking panels to fit your cards. Retain these panels, as the chassis will not be cooled correctly with a card removed if these are not fitted.



If you are using an ethernet hub or switch, use the Ethernet cable marked ‘straight-through’. Connect one end to the socket on the back of your 60-103 chassis, and the other to a free socket on your hub or switch. If you are connecting directly from your computer to the LXI device, use the Ethernet lead marked ‘crossover’.





Insert the power lead into the socket on the back of your chassis and plug the other end into a mains electricity socket. You can now power up the chassis by first operating the switch on the rear panel below the mains inlet, then pressing the power button on the front of the chassis in the top left corner. The three status lights “Temp”, “Fan” and “Power” should be illuminated.







Your chassis will now start going through its boot up procedure which can take up to twenty seconds to complete. On the Controller module, a green “Ready” light should illuminate along with the “LAN” and “Power” lights if everything has worked correctly. If not check your Ethernet connection. If you have an error light proceed to the troubleshooting section of this manual for further assistance.

CONNECTING THE 60-103 CHASSIS

Control of the 60-103 chassis is through a web server at the devices IP address. From the web server the user can also access drivers, utility programs and documentation. So, it is important to first establish the IP address that your LXI device is using.

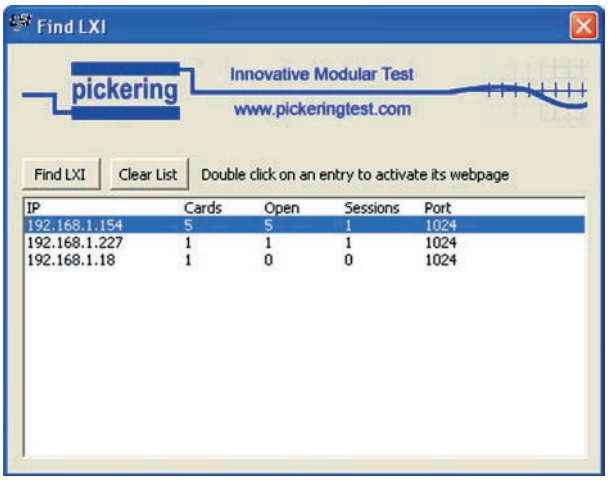
By default, Pickering LXI devices are configured using DHCP to acquire a TCP/IP address. By matching the MAC address listed on the rear of the unit, with the lease log on your DHCP server, you can determine your LXI devices address and proceed to configuring your 60-103 chassis settings.



If you do not have a DHCP server, you must ensure that your computer is set to use Auto-IP as its TCP/IP configuration method. This is the default fallback condition under Windows XP if you set your computer for DHCP and it cannot locate a server.

You can then establish your LXI chassis TCP/IP address using one of three Discovery Tools.

The Pickering Discovery tools located on the CD included in your box can tell you the TCP/IP address your chassis is using. To use the CD, insert it into you computer's drive and wait for it to auto-run. On the first screen select *LXI PRODUCTS*.



1) Find LXI – a simple Windows application which will list all Pickering LXI devices. The home page of an LXI device is displayed when the corresponding IP address is highlighted and *Open Browser* selected.

2) VXI-11 Discovery protocol.
Some tools, for example Agilent IO Library, provide a VXI-11 protocol discovery tool. This may be used to establish the address of any connected LXI compliant device.
A VXI-11 Discovery browser is supplied on the distribution CD and may be used to locate any LXI device, Pickering or otherwise. To run this, select the *VXI-11 Discovery* application.

3) Bonjour or Rendezvous discovery protocol (recommended)

By default, Pickering LXI devices have the Bonjour or Rendezvous service switched on, by using a suitable Bonjour client on your computer, you can search for and configure an LXI device without knowing its TCP/IP address beforehand. Use the MAC address on the rear of the chassis and that present on the LXI devices homepage to confirm you are configuring the correct device if you have more than one LXI device running.

A Rendezvous browser is shipped on the CD, to use it click on the Rendezvous icon.

Then click on *Web Server (HTTP)*.

A list of devices and MAC addresses should be displayed. Double click on the device with the same model number and MAC address as the 60-103 chassis you are using (the MAC address is printed on the unit next to the LAN socket).

The IP address of the device will be displayed in the browser's address field in the format:

http://169.254.59.99/path=/

delete the /path=/ section of the address and press Return to display the 60-103 Chassis Home Page.

All the discovery tools are located on the Pickering distribution CD in the LXI Products/Tools directory.

Once you have a valid IP address, you can move on to configuring your LXI chassis settings.

CONFIGURING THE 60-103 CHASSIS SETTINGS

As you now know your devices TCP/IP address, you can proceed to configure the chassis to your requirements.

This section describes the basic procedure for configuring the chassis. If any problems are encountered, please refer to the “LXI Getting Started Guide”.

Type your devices IP address into the address bar of your web browser in this format:

http://<IPNUM>

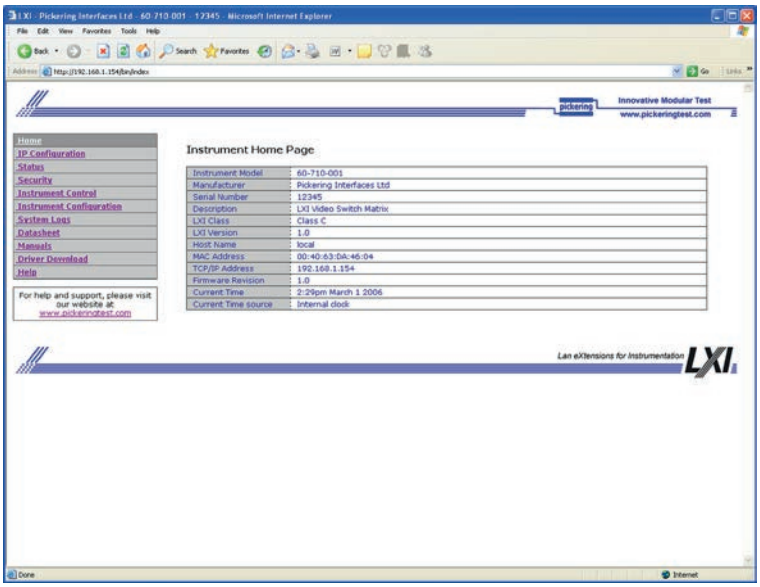
Replacing <IPNUM> with the address your LXI chassis is currently using.

I.e. if your LXI chassis has been issued an address of 192.168.1.50, then type the following into your browser address bar:

http://192.168.1.50



You will now be presented with your LXI chassis embedded homepage. This page lists the devices settings, LXI class and model number. Use the MAC address listed on this page and that on the rear of your chassis to confirm you are configuring the correct device if you have more than one.

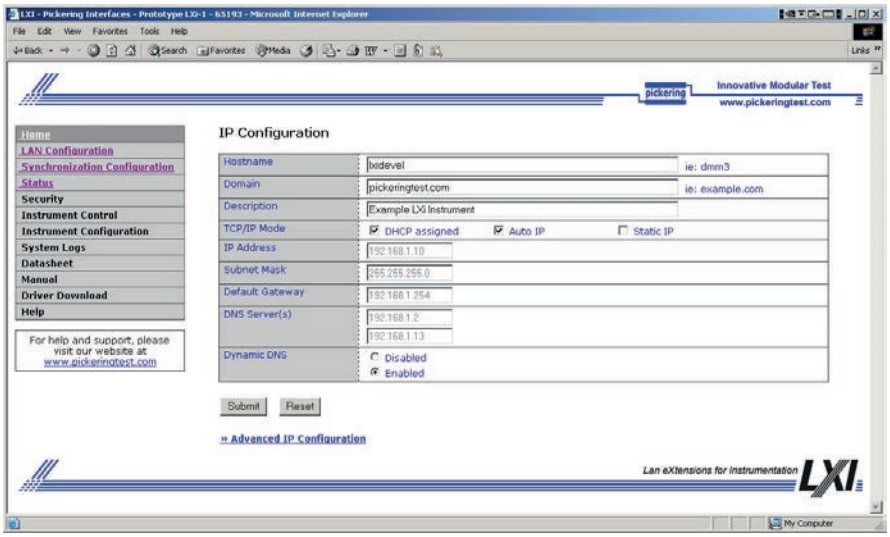


Clicking on IP Config will take you through to the main configuration screen for your chassis. It is here that you can set the method the chassis uses for acquiring a TCP/IP address.

There are three main ways of configuring your LXI chassis TCP/IP address:

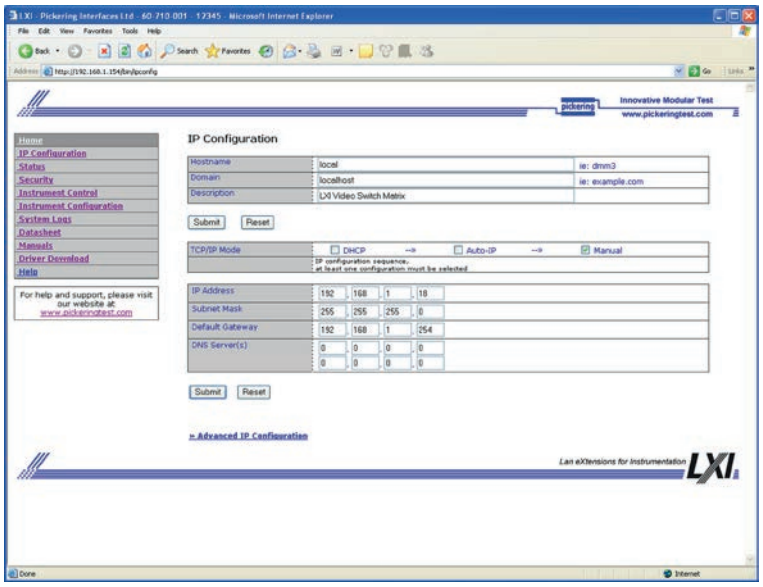
1. DHCP, a server issues IP addresses from a pool and ensures that no two devices can have the same IP address.
2. Where no DHCP server exists, Auto-IP negotiates with other devices to choose an IP address that does not conflict. This is the default condition a Windows based computer reverts to if it is configured for DHCP but there is no DHCP server present.
3. Static IP, address settings are manually entered and care must be taken to ensure that the settings chosen do not conflict with other devices present on the network.

Note: Contact your network administrator if you are unsure as what these settings should be, also refer to the information overleaf.



More than one addressing scheme may be enabled if required. By default Pickering LXI devices ship with DHCP and Auto-IP enabled. If the LXI chassis fails to acquire a TCP/IP address by using DHCP, it reverts to using Auto-IP. This fail over process is designed to ensure you can still communicate with your chassis in the event of a server failure.

Note that at least one configuration method must be enabled at all times.



SETTING THE IP ADDRESS

To use the 60-103 LXI Chassis over a LAN connection it should be set up and configured as described earlier in this section or in the “LXI Getting Started Guide”.

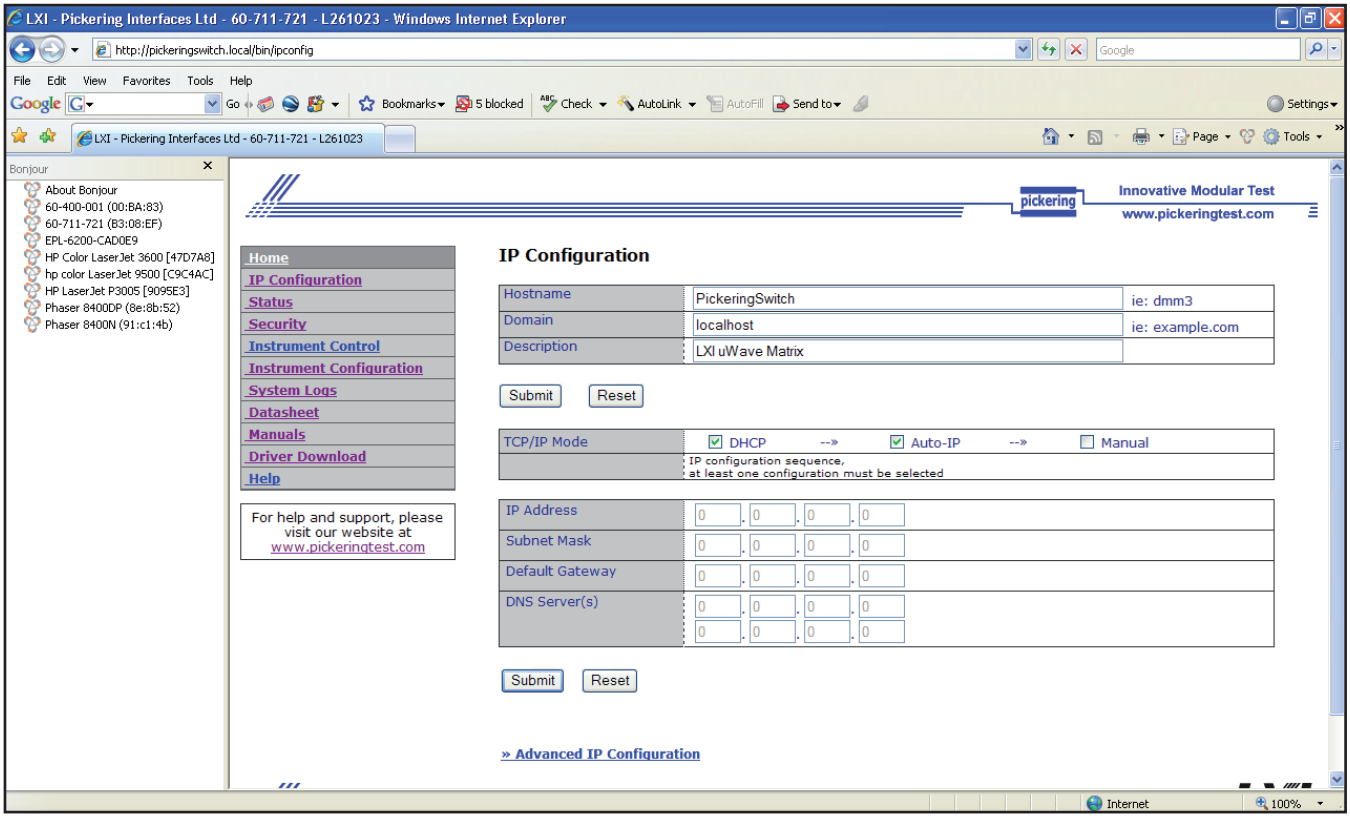
If the IP address is to be set manually and before connecting to a network, contact your IT department so they can give you the correct settings for:

- IP Address
- Subnet Mask
- Default Gateway
- DNS Server(s)

Once you have the required information, the IP configuration window is used to manually set the IP address. This is shown in the figure below.

Incorrect setting will result in a loss of communication indicated by a red LAN LED on the front panel of the Controller module.

If this does occur press and hold the reset button on the front panel of the Controller module for a full factory reset.

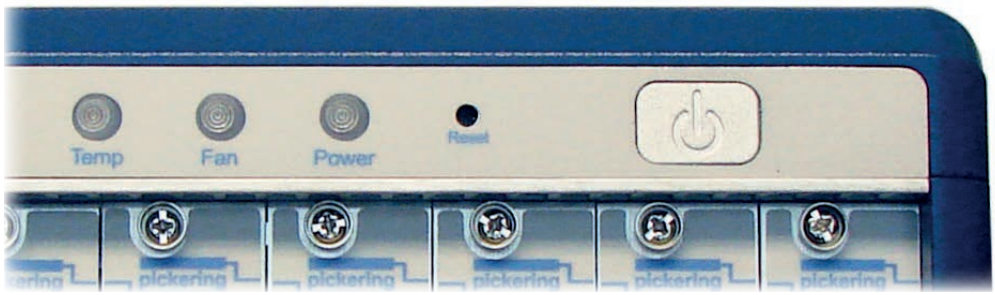


CHASSIS MANAGEMENT SYSTEM

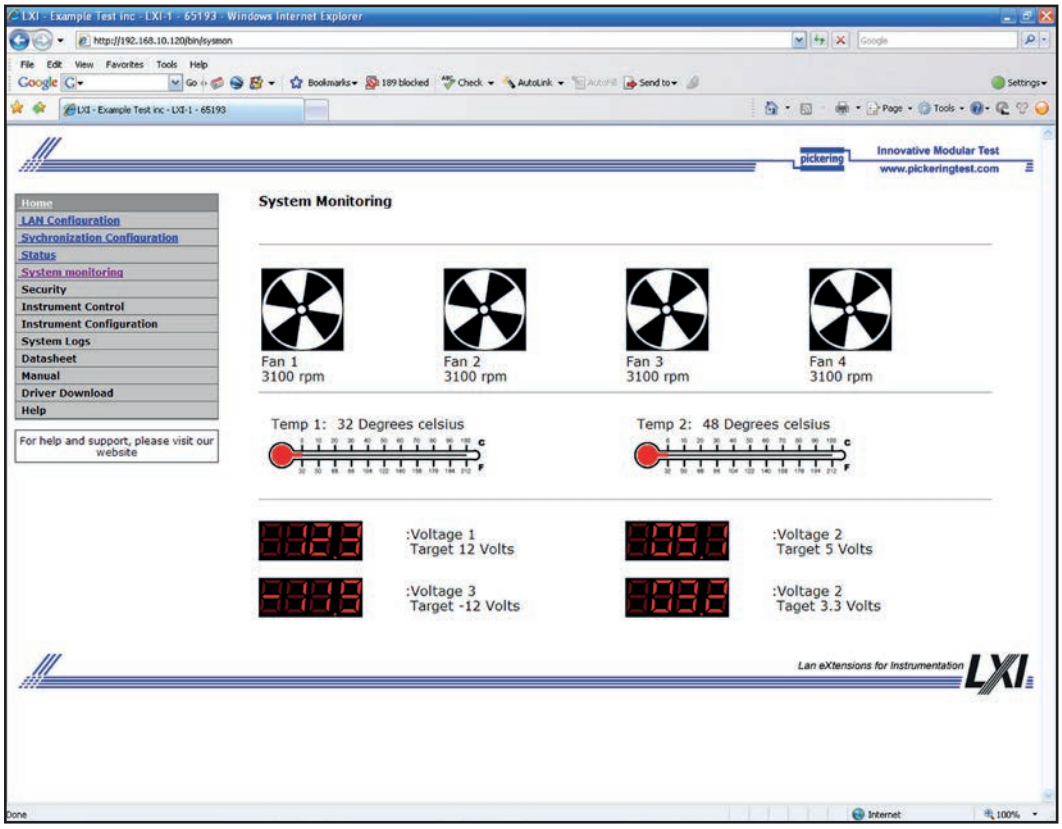
The 60-103 has a built in management system that monitors the internal chassis temperature and varies the fan speed accordingly. The system also monitors the power supply's voltage rails and speed of the fans and indicates the chassis' status on three front panel LEDs. The meaning of these LEDs is outlined in the table below.

LED		Status		
Name	**Color**	**On**	**Off**	**Blinking**
Power	Blue	DC voltage supplies are normal	No DC power is supplied	5 V or 3.3 V is outside the ±7% range, 12 V or -12 V is outside the ±12% range
Fan	Green	Fans are operating normally	The system is off	Any of the fans is operating at a speed lower than 500 RPM
Temp	Amber	The chassis temperature is normal	The system is off	Chassis temperature exceeds 50ºC

When the management system detects a fault condition, as well as indicating the chassis status by blinking the appropriate LED, an audible alarm is also triggered. This alarm can be defeated by pressing the recessed Reset button on the top right of the chassis front panel between the LEDs and the power switch. It should be noted that operating the reset only silences the alarm, and the cause of the fault should be rectified for continued correct operation of the chassis. The position of the LEDs and the Reset button is shown below.



The chassis status information can also be accessed via the LAN interface. Select “System Monitoring” on the 60-103 homepage to display a page showing the speeds of the cooling fans, the levels of the power rails and the internal chassis temperature. An example of the monitoring page is shown in the graphic below.



SECTION 6 - PROGRAMMING

Programming options for Pickering Interfaces LXI Units

For information on the installation and use of drivers and the programming of Pickering's products in various software environments, please refer to the Software User Manual.

This is available as a download from:
https://www.pickeringtest.com/support/software-drivers-and-downloads

Also, it can be accessed from the DVD supplied with the product:
<DVD_DRIVE>\downloads\Documentation\Software-Manual.pdf

Unit Architecture

Before discussing individual drivers it is important to understand the basic architecture of Pickering LXI units.

IP Address, Bus and Device

Each LXI unit has a unique IP address on your network. This address will depend on how you have configured your LXI unit and on network configuration. As delivered most LXI units are configured for dynamic address allocation, that is your network is expected to provide the IP address for the unit as part of its power-up sequence. This address may be configured as a fixed address, but there are possible problems, refer to the Getting Started guide for details on how to discover and configure your LXI unit.

Within an LXI unit, each switch card occupies a PCI slot, and so has a unique bus/device location with the embedded computer. It is vital to know that location in order to specify the address of the switch to be controlled.

Pickering provide software tools to help you discover the bus and device number of the cards in your LXI unit. Refer to the distribution disk that came with your unit in the folder LXI Products/Tools.

Sub-units

Pickering PXI cards contain one or more independently addressable functional blocks, or sub-units. Sub-unit numbers begin at 1, and separate sequences are used for input and output functions. This number is used in function calls to access the appropriate block. Generally, sub-unit numbers correspond directly to the bank numbers specified in hardware documentation.

Sub-unit examples:

Model	Configuration	INPUT sub-unit #1	OUTPUT sub-unit #1	OUTPUT sub-unit #2	OUTPUT sub-unit #3
40-110-021	16 SPDT switches	None	16 SPDT switches	None	None
40-290-121	Dual Programmable resistors + 16 SPDT switches	None	Resistor #1	Resistor #2	16 SPDT switches
40-490-001	Digital I/O	16-channel inputs	32-channel outputs	None	None
40-511-021	Dual 12 x 4 matrix	None	12 x 4 matrix #1	12 x 4 matrix #2	None

Sub-unit characteristics

The numbers of input and output sub-units in a card can be obtained using functions from the library:

For example, in the basic piplx library:

```
PIPLX_EnumerateSubs
PIPLX_SubType, PIPLX_SubInfo
```

Are used to identify the individual sub-units on a card.

Controlling a Switch

To control a Pickering switch the command must contain the full location of the sub-unit being controlled; the IP address of the LXI unit, the bus/device location of the particular card in that LXI unit, and the sub-unit which contains the switch to be controlled.

A number of tools are available to locate the IP address of an LXI unit. Refer to the “Getting Started” guide delivered with your unit, also available on the distribution disk in the “LXI Products” folder. Only Pickering tools such as “Find LXI” will identify the switch card bus/device location. Pickering Direct I/O driver includes functions to allow a Pickering LXI unit to be found programmatically

To control a card there are a number of steps required. For example using PIPLX it is necessary to first open a session on a specified LXI unit, then to obtain a handle to a particular card in the LXI unit and finally to issue commands to a particular sub-unit on that card.

For example, to access the card at bus 0, device 20, on the LXI unit at 192.168.1.100 :

```
PIPLX_Connect("192.168.1.100", &session)
PIPLX_OpenSpecifiedCard(session, 0, 20, &card_num)
PIPLX_OpBit(session, card_num, sub-unit, bit, state)
```

Using the IVI driver, the connect and open functions are combined in the pi40iv_InitWithOptions function where the VISA resource string will specify the IP address and the card bus,device location, for example:

```
pi40iv_InitWithOptions("TCPIP::192.168.1.100::0.20::INSTR",….)
```

Here the resource string identifies an IP address of 192.168.1.100 and then the bus, device location as 0.20, that is bus 0, device 20.

For full details of how to access and use Pickering drivers the user is advised to refer to the individual documentation packs provided with the installed drivers, this can be found on the distribution disk that came with your unit.

Installing the Drivers

Once you have discovered your LXI device, follow the links on its web pages to download and install the device driver. Once installed, you will have access to the basic Direct IO driver, piplx. Instructions, help and examples may be found in the installation folder.

Further drivers are available but may need further steps for installation, for example the IVI driver, pi40iv, requires the prior installation of VISA and the IVI Compliance Package from National Instruments (NB a license may be required from NI for use of these drivers).

Command Line Control of Pickering LXI Instruments

Overview

Command line control of the Pickering LXI device range was added in firmware release 2.11. The utility provided was ported to the LXI instrument from the Windows utility PILMon and provides identical functionality.

Enabling the Command Line Control Utility

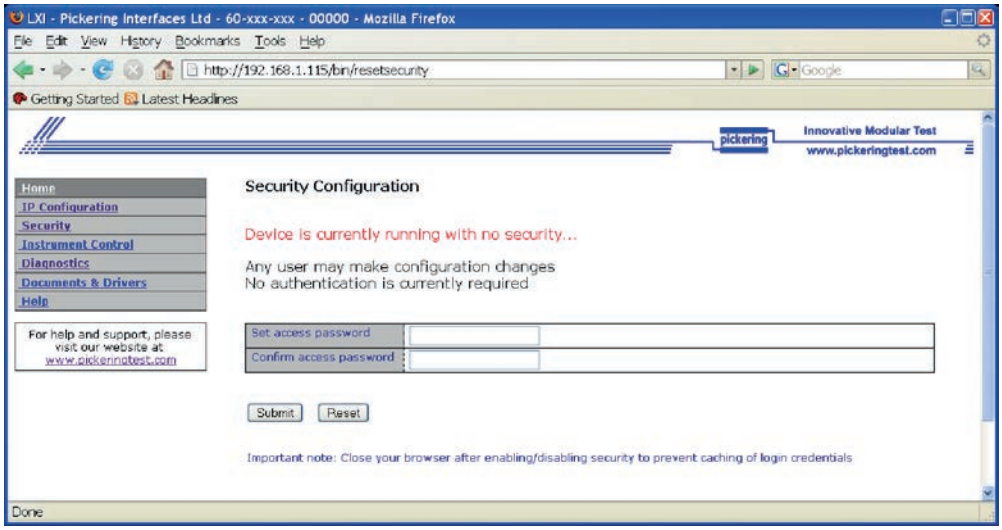
Pickering LXI devices do not provide an SSH server in the normal configuration state, the service must be explicitly enabled.

To do this the user must first enable security, this helps to prevent inadvertent access by limiting the accessibility of instrument services, principally by requiring password access to control functions. Once security is enabled, the SSH server may be started.

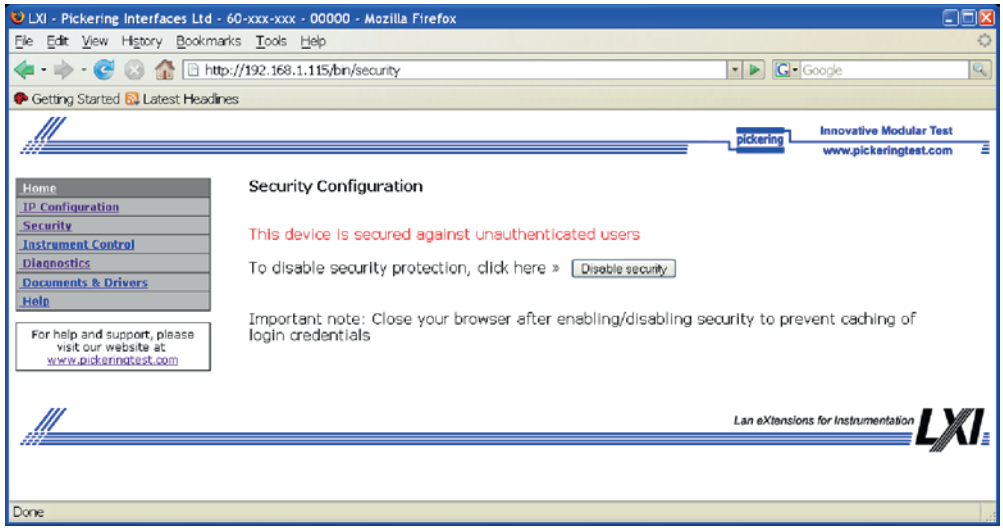
All the following assumes that the user knows the IP address of the LXI instrument. If this is not known, a number of tools are available, many on the Pickering distribution disk, to allow the IP address to be discovered.

Step 1 - Enable Security

Select the Security Page from the main menu list

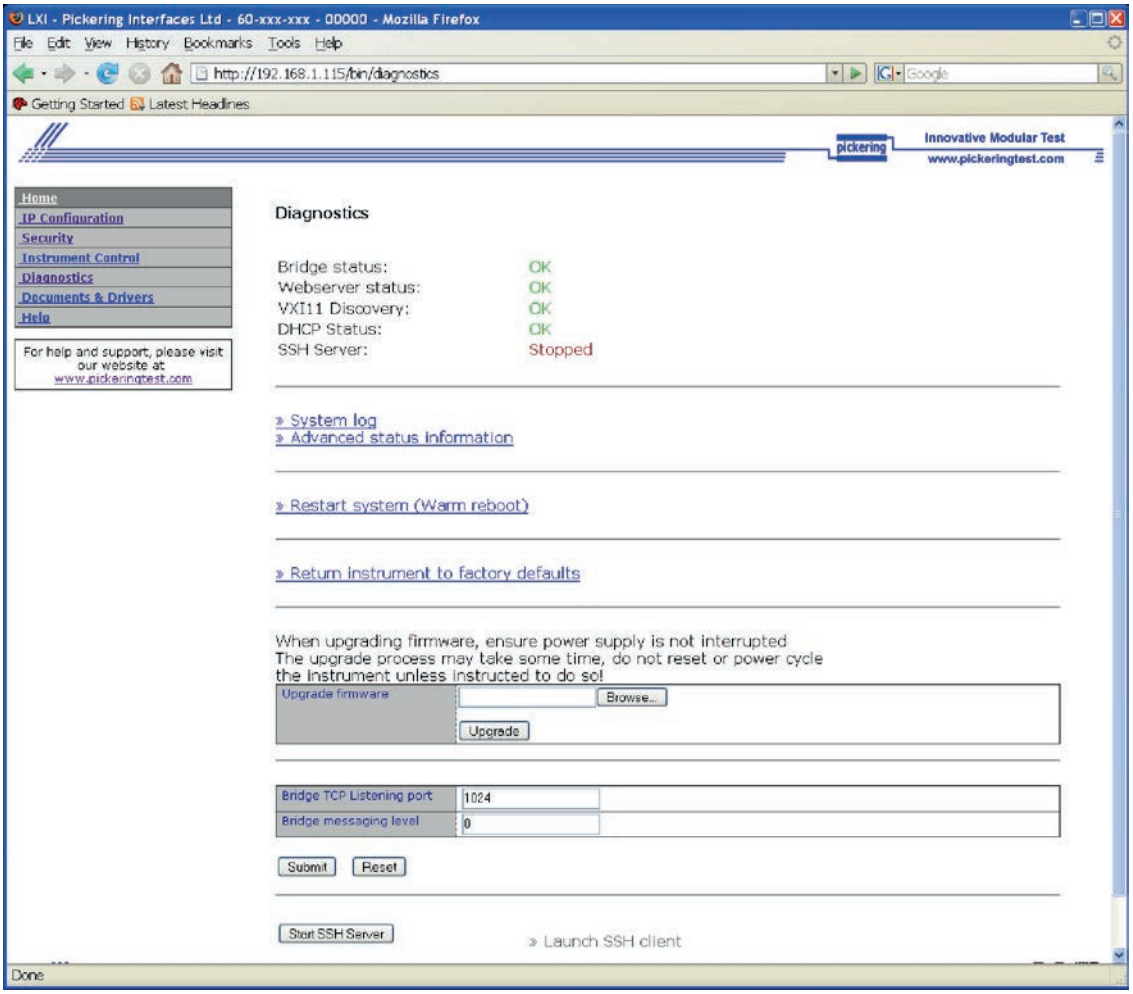


Enter a password and confirm then click on the Submit button.

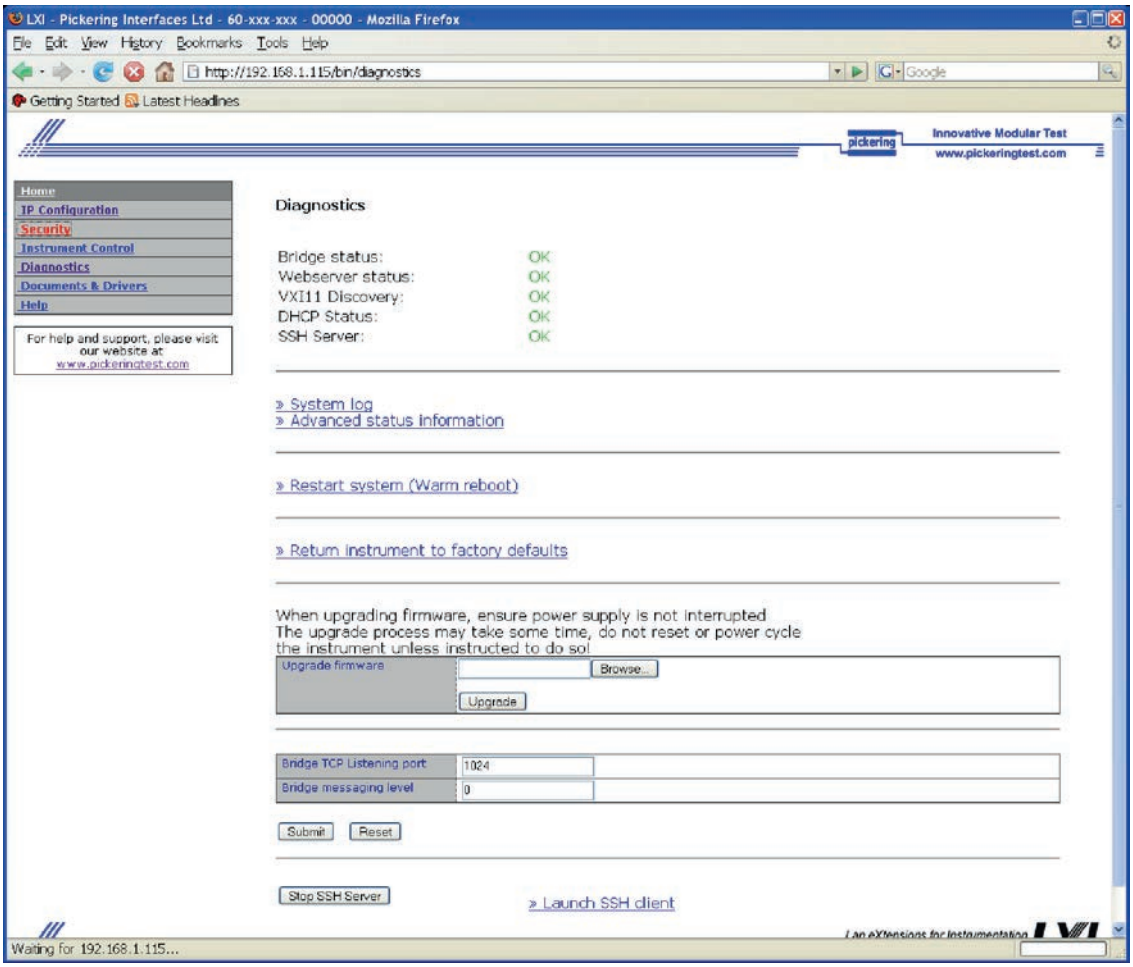


Step 2 - Enable the SSH server

Select the Diagnostics page from the main menu



Click on Start SSH server



The SSH server is now operative and instrument control access is available from an external SSH client application.

NOTES:

The password and state of the SSH server are stored in non-volatile memory within the LXI instrument and so will remain in effect even after a power cycle. It is important to remember the password applied. Should the password be forgotten, the instrument may be reset to initial conditions by operating the reset button located at the rear of the instrument in the appropriate manner, refer to the LXI product manual for details of this process.

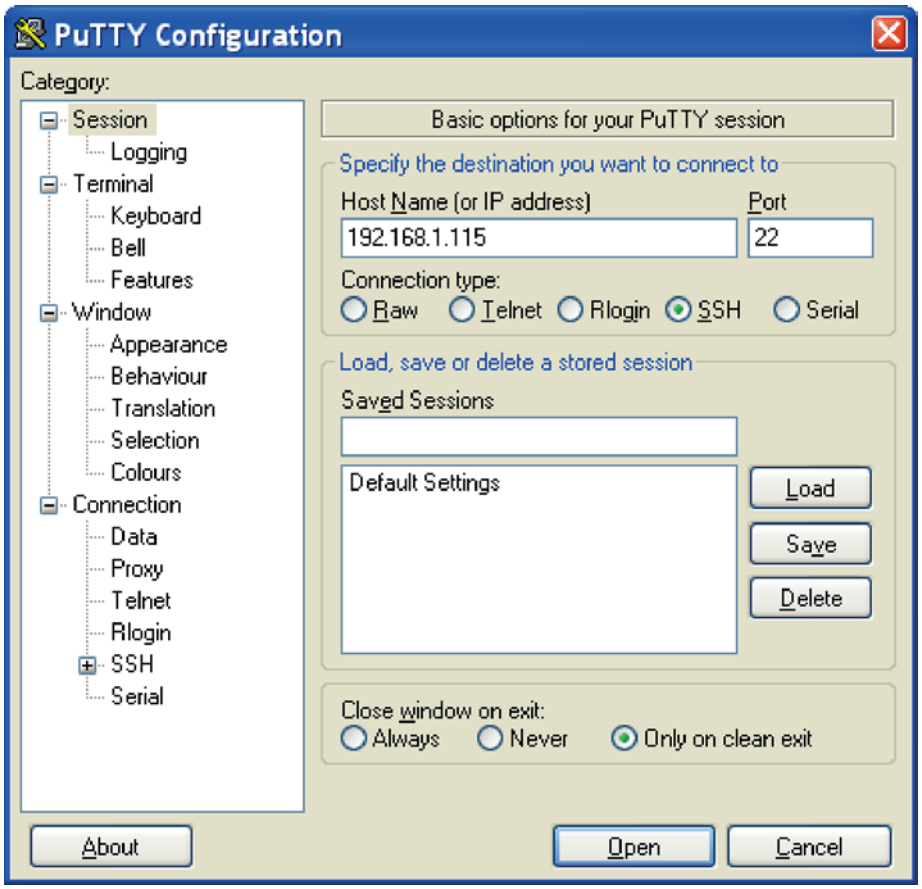
Disabling security will stop the SSH service.

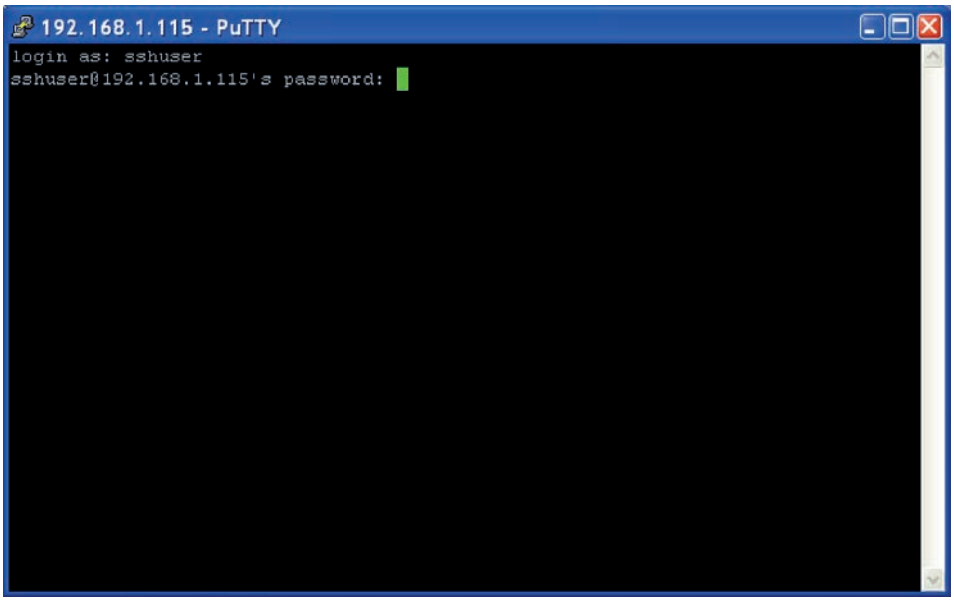
Instrument Control from an SSH Client

In the following examples the SSH client PuTTY is used, the user will have to adapt the instructions for any other client.

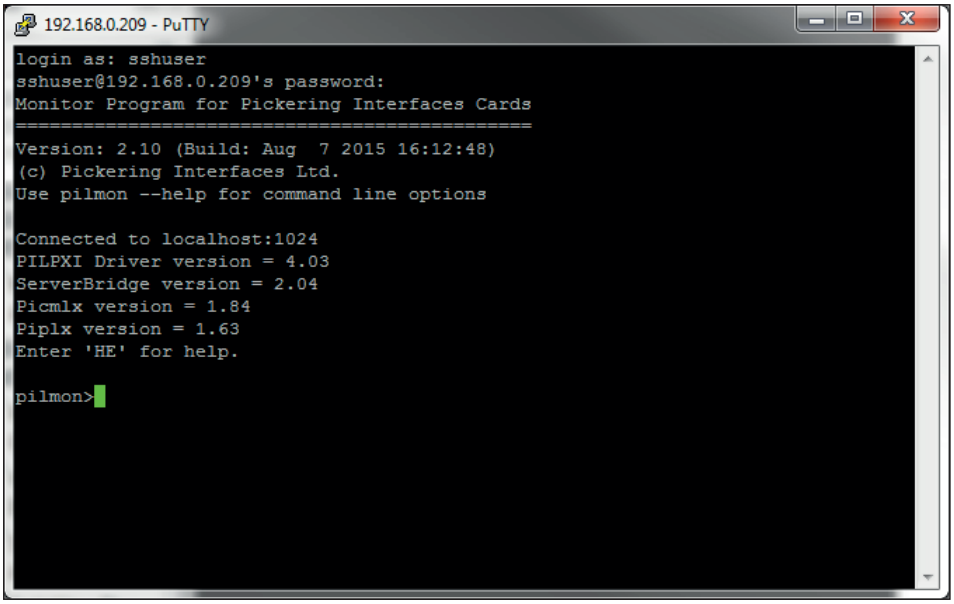
First start up the SSH client and enter the IP address of the LXI instrument. The user will be prompted for a login name and password.

The username for instrument control is ‘sshuser’, the password is that defined by the user when setting security.





Once the username and password have been supplied, the LXI instrument will enter an application providing a command line interface to the switch cards within the instrument.



When the application is expecting input, the prompt **LXI>** will be displayed. Card control is achieved using a set of mnemonics plus optional data. These mnemonics are based on the Direct IO driver pilpxi.dll.

Brief details of operation is given here, full documentation instruction set may be obtained by referring to the documentation for the pilpxi or pipx40 drivers and is available in a separate document.

By default, the application opens all available switch cards contained in the LXI instrument. This access is exclusive and prevents other users from accessing the cards thus preventing inadvertent operation switching functions from another location.

Typing **HE** in response to the prompt will list the entire command set avalailable.

These are listed in Appendix 1.

For any specific operation the appropriate command must be chosen, here a a few of the more commonly used commands:

Before attempting to control a card it is important to understand the switch architecture of that card and to know how to address the required switch. Each Pickering switch card is represented as a set of one or more sub-units, each sub-unit containing one or more switches. A sub-unit represents a collection of switches of similar type, it may represent an entire matrix, or a row of simple switches, or a power supply voltage setting.

In the case of a switch sub-unit, each switch is represented by a single bit of data and may be toggled between 0 and 1, 0 representing the off state of the switch relay and 1 representing the on state.

The precise relationship between bit positions and switch location is provided in the card manual, or by use of the LS command inside the utility program PILMon in Windows, or by the LXI SSH service application.

Commonly used mnemonic commands

LS Will list all the open cards, providing the Card Number of each which is essential for further control of a card, also provided are the details of the card model number and architecture.

AD This is used to select the card and sub-unit to which commands will be addressed.
For example to select the second sub-unit on the first card use **AD 1 2**

SC Closes a switch, needs additional bit position, eg **SC 1** energises switch 1

SO Opens a switch, also needs additional bit position

SV Obtains the current state of a switch, again bit position is required

SB Sets an entire sub-unit of switches to a binary pattern, requires additional data of a pattern of hexadecimal data, eg **SB FFFF** will energise 16 relays

CS Clears an entire sub-unit of switches

BV Used to view the current state of all the switches in a sub-unit

Many other commands are available including facilities to obtain status information, to manage masks which may be used to prevent operation of a switch or switches.

It is important to realise the difference between Read and View operations. Read is used to read back data from an input, VIEW to read back the current state of an output.

Example

AD 1 2	Selects card1, sub-unit 2
SC 3	Closes switch 3 on current sub-unit
AD 1 3	Selects card1, sub-unit 3
BV 5	Obtains state of switch 5 on current sub-unit

In the case of matrix sub-units, the XC and XO commands are useful, obviating the need for the user to calculate the bit position for a crosspoint in the matrix by allowing a point to be addressed by row and column address.

Appendix 1

```
LXI> he
PILMon commands:
  AD [<card> <sub_unit>]      = [select and] display card/sub-unit to address
  SC <number>                 = close output (set ON)
  SO <number>                 = open output (set OFF)
  SB <bit_pattern>            = set sub-unit outputs (to hex bit-pattern)
  CS                          = clear OUTPUT sub-unit
  RS                          = clear all OUTPUT sub-units on all open cards
  ST                          = display status of currently-selected card
  BV                          = view sub-unit output states (as hex bit-pattern)
  BR                          = read INPUT sub-unit (as hex bit-pattern)
  LS [<card>]                 = list info on all open cards, or specified card
  EC <0|1>                    = turn serial echo OFF|ON (default = ON)
  WC <number> <value>         = write the calibration value for an output
  RC <number>                 = read the calibration value for an output
  LC                          = list calibration values
  DM <bit_pattern>            = set driver mode flags (to hex bit-pattern)
  AC <number>                 = matrix: close all points on single row or column
  CM                          = clear OUTPUT sub-unit mask
  SM <number> <0|1>           = UNMASK|MASK an individual output
  MB <bit_pattern>            = set OUTPUT sub-unit mask (to hex bit-pattern)
  MV                          = view sub-unit output mask (as hex bit-pattern)
  OC                          = take control of all Pickering switch cards
  CC                          = release control of all Pickering switch cards
  VO <bus> <slot>             = open card at specified location
  VC <card>                   = close specified card
  HE|HL                       = show this help information
  SV <number>                 = show state of specified output
  MS <number>                 = show mask state of specified output
  IS <number>                 = show state of specified input
  AR                          = clear all OUTPUT sub-units of the current card
  XC <row> <column>           = close matrix crosspoint
  XO <row> <column>           = open matrix crosspoint
  XV <row> <column>           = show state of a matrix crosspoint
  XM <row> <column> <0|1>     = UNMASK|MASK a matrix crosspoint
  XS <row> <column>           = show matrix crosspoint mask state
  DI                          = show diagnostic information
  SE                          = show sub-unit settling time (uS)
  CL                          = show sub-unit closure limit
  SS                          = show sub-unit status
  PT                          = show PSU type description
  PI                          = show PSU information
  PS <fp value>               = set PSU output voltage
  PV                          = show PSU output voltage setting
  PE <0|1>                    = DISABLE|ENABLE the output of a PSU
  CF                          = show number of free cards
  LF                          = list bus/slot locations of free cards
  Q                           = quit the program
```

SECTION 7 - TROUBLE SHOOTING

Refer to the Warnings and Cautions at the front of this manual 

LXI STATUS INDICATORS

Status Indicator / Colour				Status Description
PWR	RDY	ERR	LAN	
Green	Off	Off	Off	**Powering Up Status:** This state occurs when the LXI unit was turned off and the user turns it on. This state will exist for ~10-15 seconds.
Green	Orange	Orange	Orange	**PI Services Init. Status:** This state triggers after powering up status and it means that PI services are initialising (pilserv is starting and initialising). This state should last <1 second.
Green	Green	Off	Green	**Normal Operation Status:** LXI unit is turned on, Ethernet connection is established (LXI unit has assigned IP address from DHCP/AutoIP or static range), ServerBridge is running and listening for incoming connections.
Green	Green	Off	Red	**Network Failure Status:** LXI unit is turned on, but the Ethernet connection is not established (LXI unit is not connected to any network and it has not assigned an IP address). Client cannot access the unit or control any of the plugged in cards.
Green	Off	Red	Green	**ServerBridge Failure Status:** LXI unit is turned on, Ethernet connection is established (LXI unit has assigned IP address from DHCP/AutoIP or static range), ServerBridge is not running. Client can access the LXI unit thru the web interface, but cannot control any of the plugged in cards.
Green	Off/Green (toggling between off & green)	Off/Red (toggling between off & red)	Green	**ServerBridge Failure Status:** LXI unit is turned on, Ethernet connection is established (LXI unit has assigned IP address from DHCP/AutoIP or static range), ServerBridge is still restarting. Client can access the LXI unit thru the web interface, but cannot control any of the plugged in cards. The cause of the fault is usually the pilpxi driver, either of the third party drivers: pi743/pxm78xx or a bug in ServerBridge.
Green	Green	Off	Orange	**Ethernet Change Notification Status:** LXI unit is turned on, Ethernet connection is changing. This is usually caused by user action: connected ethernet cable or LAN configuration change. ServerBridge is terminated in this state and waiting to establish the Ethernet connection.

Q I have a power light and a ready light on the Controller module, but the LAN light just flashes.

A If it is flashing green it is operating normally, this is used as visual identification to locate the chassis in a densely populated test rack environment.
If it is flashing red you have an IP conflict. That is another device on your network has the same TCP/IP address as your LXI chassis. Remove the conflict or change the IP address of your LXI chassis.

Q The LAN light on the Controller module does not light up at all.

A There is a cabling fault. Check your Ethernet lead is of the correct type and is plugged into a working hub or switch. Most hubs and switches have a link indicator to show when the connection is correct.

Q I have a red Error light on the Controller module, but the Ready and Power lights are on.

A Most likely cause is that peripheral cards have not been installed in the chassis. Power down the LXI chassis and install some cards.

Q I have only a red error and power light on the Controller module.

A There is a hardware fault with your chassis, contact your local sales office.

OR, the chassis has been set with an invalid IP address. Obtain the required information as outlined in "Setting the IP Address" in Section 4, and perform a full reset as described below.

Q How do I know when I can begin communicating with my chassis.

A The LXI chassis has a Ready and Active light on the Controller module that indicate its current activity. Whenever the Active light is illuminated, the system is busy and may not be able to process other commands. This will normally occur when a TCP/IP configuration change has occurred.

Q My LXI Controller module lights are all on, or flash wildly.

A The system is booting up, these sequences are used to monitor the LXI chassis boot progress as an aid to fault finding. Until the Controller module Ready light is illuminated green, you should not attempt to communicate with the chassis.

Q All of my Controller module's lights are on, and I never see a Green ready light even after a few minutes.

A Your chassis has a fault, contact your local sales office.

Please contact your local Pickering Interfaces sales office for any further support or email:

Lxisupport@pickeringtest.com

You can also visit our website for product updates, help and downloadable materials at:

http://www.pickeringtest.com

UNIT RESET

If the chassis operation is inconsistent the user should try resetting using the recessed button on the Controller module's front panel to see if this effects a cure.

Momentary operation of the button causes a reset of the unit, this is similar in effect to cycling the power.

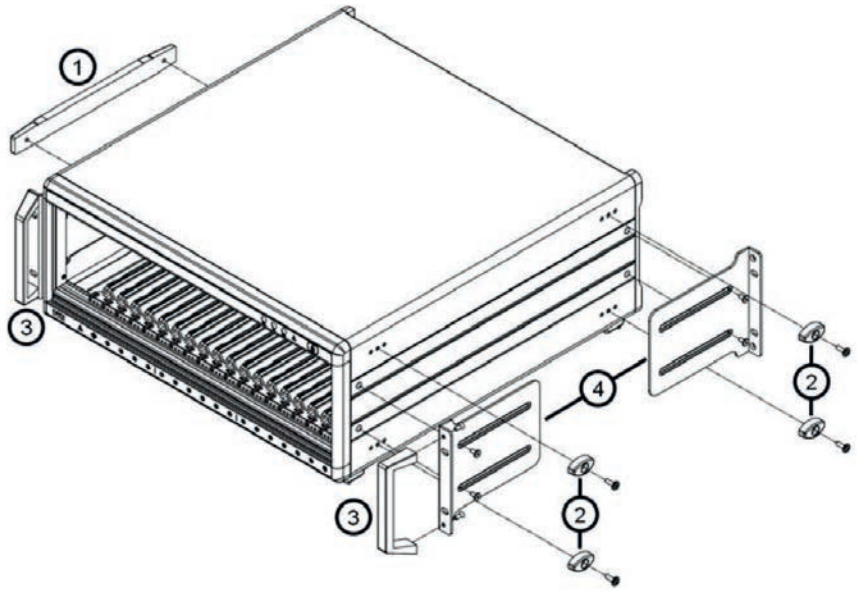
Holding the button depressed for a period of about 5 seconds causes the chassis to be set back to factory default conditions. This will destroy any user configuration data already entered, reset the IP address and put the LAN interface into DHCP and Auto mode.

Alternatively, if the chassis operation over a network is still in doubt, connect it to a laptop using a crossover cable and set it up as described in "Configuring the LXI Device Isolated from a Network" in the "LXI Getting Started Guide".

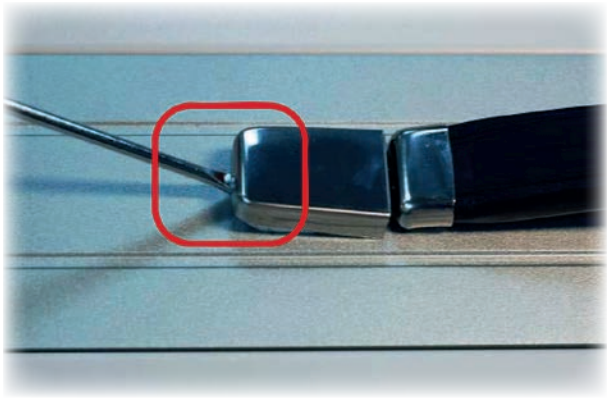
APPENDIX A - RACK MOUNTING THE CHASSIS

To allow the 60-103 chassis to operate in a 19 inch equipment rack it can be simply mounted on a standard equipment shelf, or preferably, it can be fitted with the 63-103-001 rack mounting kit. The kit consists of side brackets that allow the chassis to be secured in a rack using fixing holes at the front and rear. Additionally, the side brackets are adjustable allowing the entire chassis to be recessed into the rack enabling front clearance for connectors and mass interconnect modules.

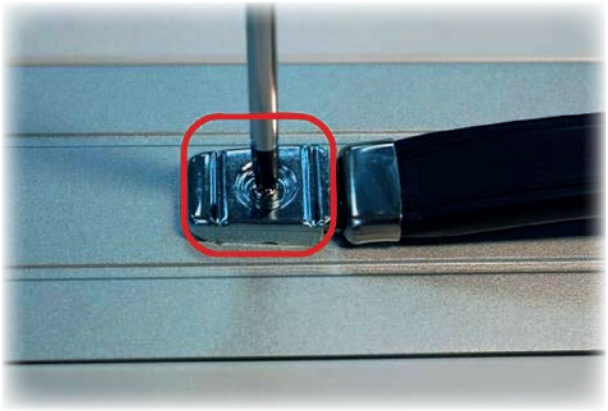
The following procedure describes the steps required for fitting the rack mounting kit.



1. On the left side of the chassis, lever off the end covers of the carrying handle (1) with a flat blade screwdriver as shown.



2. Using a cross head screwdriver, remove the two fixing screws and remove the carrying handle.



3. Remove the four feet on the right side of the chassis ② by first removing their fixing screws with a cross head screwdriver.

4. Fit the two handles ③ to two of the mounting brackets ④ with the supplied M4 screws.

5. Fit the two brackets with handles to the sides of the chassis with the supplied M4 screws so that the rack mounting flange is at the front of the chassis.

6. Fit the two brackets without handles to the sides of the chassis with the supplied M4 screws so that the rack mounting flange is at the back of the chassis.

7. The required distance between the front of the rack and the front of the chassis can be set by loosening the fixing screws and sliding each side bracket to the correct position for the host rack.

8. Once the side brackets have been set to the position required and their fixing screws tightened, the chassis can be installed into the host rack with eight screws (not supplied). Make sure that there is a 1U gap underneath the chassis to allow the correct flow of cooling air.



60-103 LXI Chassis With Rack Mounting Kit Fitted