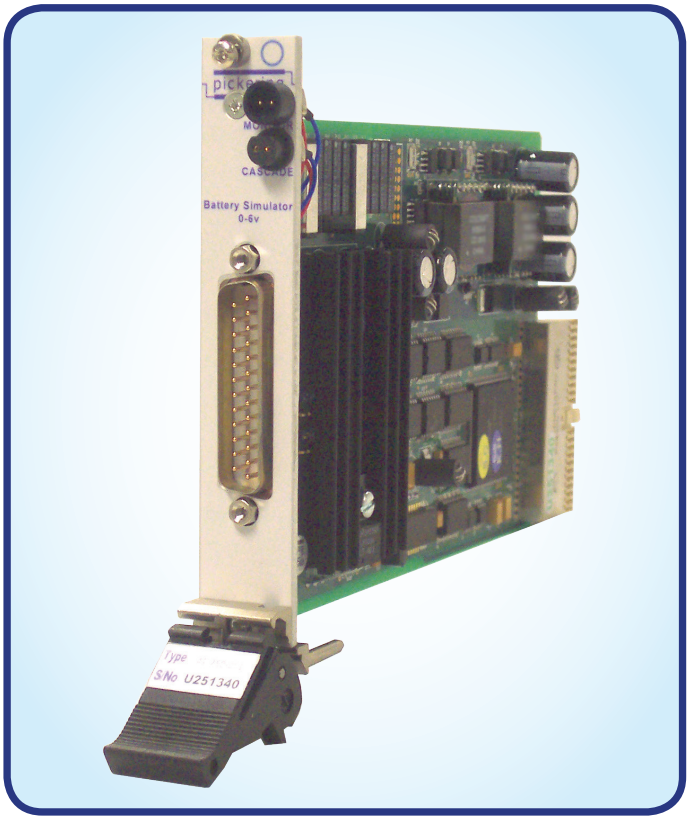
User Manual

PXI

Battery Simulator Module
(Model No. 41-750)



Issue 7.1 June 2017

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ISO 9001
Reg No. FM38792

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For Technical Support please contact Pickering Interfaces either by phone, the website or via e-mail.

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All products manufactured by Pickering Interfaces are warranted against defective materials and workmanship for a period of three years, excluding programmable power supplies, from the date of delivery to the original purchaser. Any product found to be defective within this period will, at the discretion of Pickering Interfaces be repaired or replaced.

Products serviced and repaired outside of the warranty period are warranted for ninety days.

Extended warranty and service are available. Please contact Pickering Interfaces by phone, the website or via e-mail.

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Pickering Interfaces strives to fulfil all relevant environmental laws and regulations and reduce wastes and releases to the environment. Pickering Interfaces aims to design and operate products in a way that protects the environment and the health and safety of its employees, customers and the public. Pickering Interfaces endeavours to develop and manufacture products that can be produced, distributed, used and recycled, or disposed of, in a safe and environmentally friendly manner.

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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.	
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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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 module may contain hazardous voltages. Before removing the module from the rack remove all supplies and disconnect user I/O signals. Unused slots in the PXI/LXI chassis are populated with blanking plates to prevent access to user I/O signals that may be present. Blanking panels are available to order from Pickering in a variety of slot widths. 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.	

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

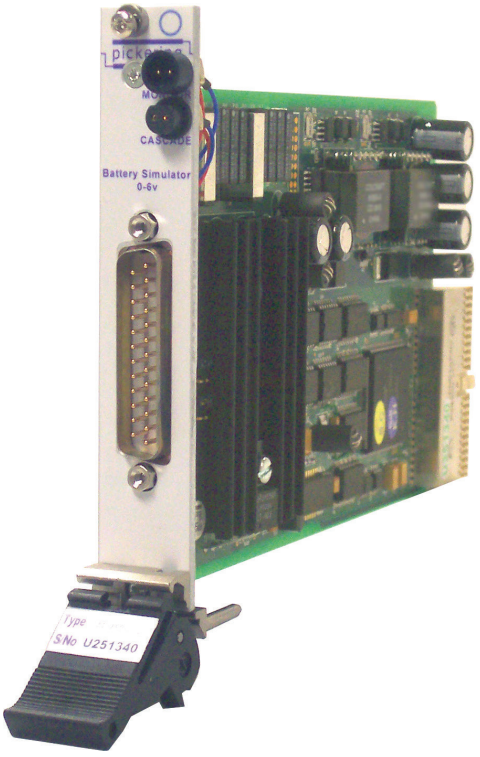
SAFETY INSTRUCTIONS
All cleaning and servicing requires the equipment to be isolated and disconnected from the power source and user I/O signals (refer to the Maintenance Section). • Appropriate manual handling procedures should be followed as dictated by the weight of the individual module or the combined 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.

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SECTION 1 - TECHNICAL SPECIFICATION

41-750
Battery Simulator Module

- Single Slot Battery Simulator
- Remote Voltage Sense
- Isolated Outputs
- Output Voltage Up To 6V
- Power Supplied From PXI Backplane
- Pickering Interfaces Monitor System For Current and Voltage
- Programmable Current Sink Capability To 0.5A For Charger Load Simulation
- VISA and Kernel Drivers
- Supported by PXI or LXI Chassis
- 2 Year Warranty



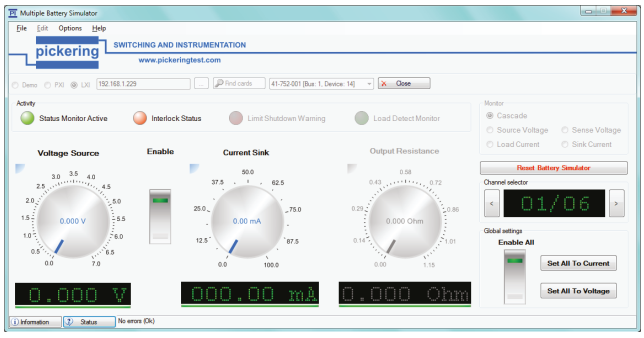
The 41-750 is a battery simulator module that can be used to simulate the power supplies of cellular phones and other portable battery devices. It features fully floating output terminals that can deliver voltages up to 6 Volts. The fast responding remote sense connections allow the module to regulate the supply voltage at the device under test. The output terminals can float ±50V relative to the front panel ground to ensure the accurate simulation of battery operation.

A module can source or sink current to provide simulation of a battery supply or a battery under charge. The use of two modules allows the simulation of both the charger voltage source and the battery. The programmable current sink can be set to divert up to 0.5A of the load current, permitting the battery simulator to act as a net current sink when connected to a charger circuit. The 41-750 is capable of delivering up to 2.8 Amps into the load.

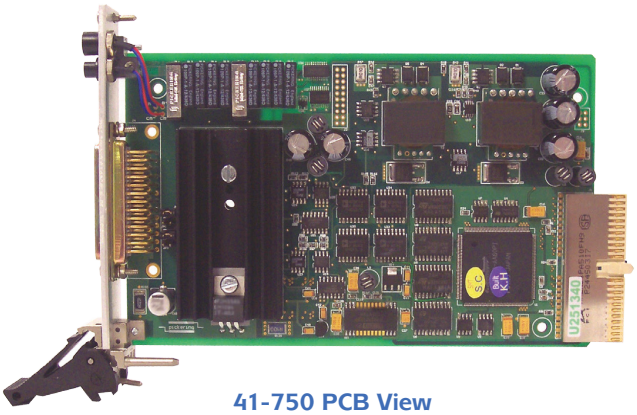
The module derives its power from the PXI backplane and requires no external power source.

The battery simulator can be configured to prevent misleading operation. If the remote sense lines are not connected to the device under test, the power supply is automatically closed down. The alternative configuration regulates the front panel voltage if the sense lines are not connected to the load.

Monitoring of the output voltage and current is provided through the simple to connect Pickering Interfaces Monitor facility. A single DMM can be used to report voltages and currents on multiple modules, through an easily implemented daisy chain connection. This facility can also be used to monitor other types of modules in the Pickering range. The wide bandwidth of the monitor facility allows the use of external data acquisition devices to capture voltage and current variations with time.



Soft Front Panel for Battery Simulator Modules



41-750 PCB View

Specification

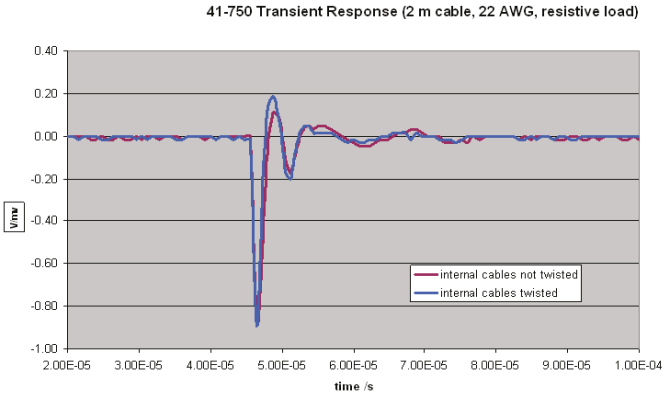
Number of Channels:	1 (isolated)
Output Voltage Range:	0 to 6 Volts (at front panel), isolated ±50V maximum common mode voltage.
Voltage Resolution:	Set with 16 bit resolution.
Voltage Sense:	Remote sensing of load voltage, mechanically configurable to either regulate front panel voltage or close down if not connected.
Output Current:	Up to 2.8 Amps (includes set sink current).
Current Sink:	Programmable current sink from 0 to 0.5 Amps available for output voltages above 0.5V. Current sink setting reduces the available maximum output current delivered to the load if an external current source is not applied.
Load Response Time:	15µs (1A to 2A, 1m connection wire, using all connection pins).
Power Source:	PXI backplane +5V.
Monitor:	Provided through monitor port to measure output voltages and currents. Can be used to measure load voltage, front panel voltage, load current and sink current. Currents are measured by voltage sensing across a resistor.
Monitor Accuracy:	Voltage DMM ±30µV Current 1% ±1mA (after zero correction).
Protection:	Short circuit protection. Thermal protection. Operation of protection is reported. Prolonged operation of protection is not recommended to avoid chassis connector damage.
Output Connector:	25-pin male D-type. Each connection is supported by two pins to permit doubling up of connections.

PXI Characteristics

Backplane connection:	33MHz, 32 bit.
Mechanical:	3U, 1 slot.

Power Requirements from PXI Power Supply

+3.3V	+5V	+12V	-12V
0.1A	6A Maximum	0.1A	0.1A



Typical load transient response of 41-750 for 6V output when load is changed abruptly from 1A to 2A in <<1µs

Product Order Codes

Battery Simulator 2.8 Amps	**41-750-001**

Mating Connectors & Cabling

For connection accessories for the 41-750 module please refer to the **90-008D** 25-pin D-type Connector Accessories data sheet where a complete list and documentation can be found for accessories.

Programming

Pickering provide kernel, IVI and VISA (NI & Keysight) drivers which are compatible with all Microsoft supported versions of Windows and popular older versions. For a list of all supporting operating systems, please see: www.pickeringtest.com/os
The VISA driver is also compatible with Real-Time Operating Systems such as LabVIEW RT. For other RTOS support contact Pickering. These drivers may be used with a variety of programming environments and applications including:

- **Pickering Interfaces Switch Path Manager**
- **MTQ Testsolutions** Tecap Test & Measurement Suite
- **National Instruments** products (LabVIEW, LabWindows/CVI, Switch Executive, MAX, TestStand, VeriStand, etc.)
- **Microsoft Visual Studio** products (Visual Basic, Visual C+)
- **Keysight** VEE • **Mathworks** Matlab • **Marvin** ATEasy

Drivers for popular Linux distributions are available, other environments are also supported, please contact Pickering with specific enquiries.

Operating/Storage Conditions

Operating Conditions

Operating Temperature:	0°C to +55°C
Humidity:	Up to 90% non-condensing
Altitude:	5000m

Storage and Transport Conditions

Storage Temperature:	-20°C to +75°C
Humidity:	Up to 90% non-condensing
Altitude:	15000m

PXI & CompactPCI Compliance

The module is compliant with the PXI Specification 2.2. Local Bus, Trigger Bus and Star Trigger are not implemented.
Uses a 33MHz 32-bit backplane interface.

Safety & CE Compliance

All modules are fully CE compliant and meet applicable EU directives: Low-voltage safety EN61010-1:2001, EMC Immunity EN61000-6-1:2001, Emissions EN55011:1998.

PXI & LXI Chassis Compatibility

Compatible with all chassis conforming to the 3U PXI and 3U cPCI specification. Compatible with Legacy and Hybrid peripheral slots in a 3U PXI Express chassis.
Compatible with Pickering Interfaces LXI Modular Chassis. For information on driving your switching solution in an LXI environment refer to the LXI Product Guide.



Latest Details

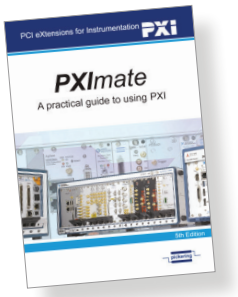
Please refer to our Web Site for Latest Product Details.
www.pickeringtest.com



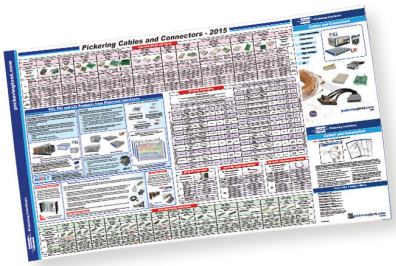
Please refer to the 200 page Pickering Interfaces "**Connection Solutions**" catalog for the full list of connector/cabling options, including drawings, photos and specifications. Available in either print or as a download.
Alternatively our web site has dynamically linked connector/cabling options, including pricing, for all Pickering PXI modules.



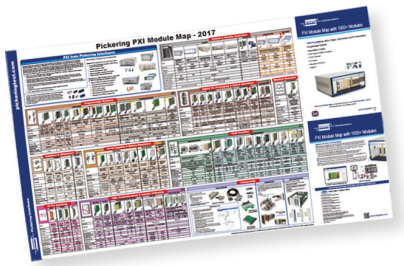
"**The Big PXI Catalog**" gives full details of Pickering's entire range of PXI switch modules, instrument modules and support products.
At over 500 pages, the Big PXI Catalog is available on request or can be downloaded from the Pickering website.



Ever wondered what PXI is all about?
Pickering Interfaces' "**PXImate**" explains the basics of PXI and provides useful data for engineers working on switch based test systems.
The PXImate is available free on request from the Pickering website.



The "**Cables & Connectors Map**" - outlines the cable and connector options available for all PXI Modules.



The "**PXI Module Map**" - a simple fold-out selection guide to all Pickering's 1000+ PXI Modules.

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SECTION 2 - TECHNICAL DESCRIPTION

FUNCTIONAL DESCRIPTION

The 41-750 is a single channel battery simulator designed to simulate the performance of a battery when testing portable equipment such as mobile phones.

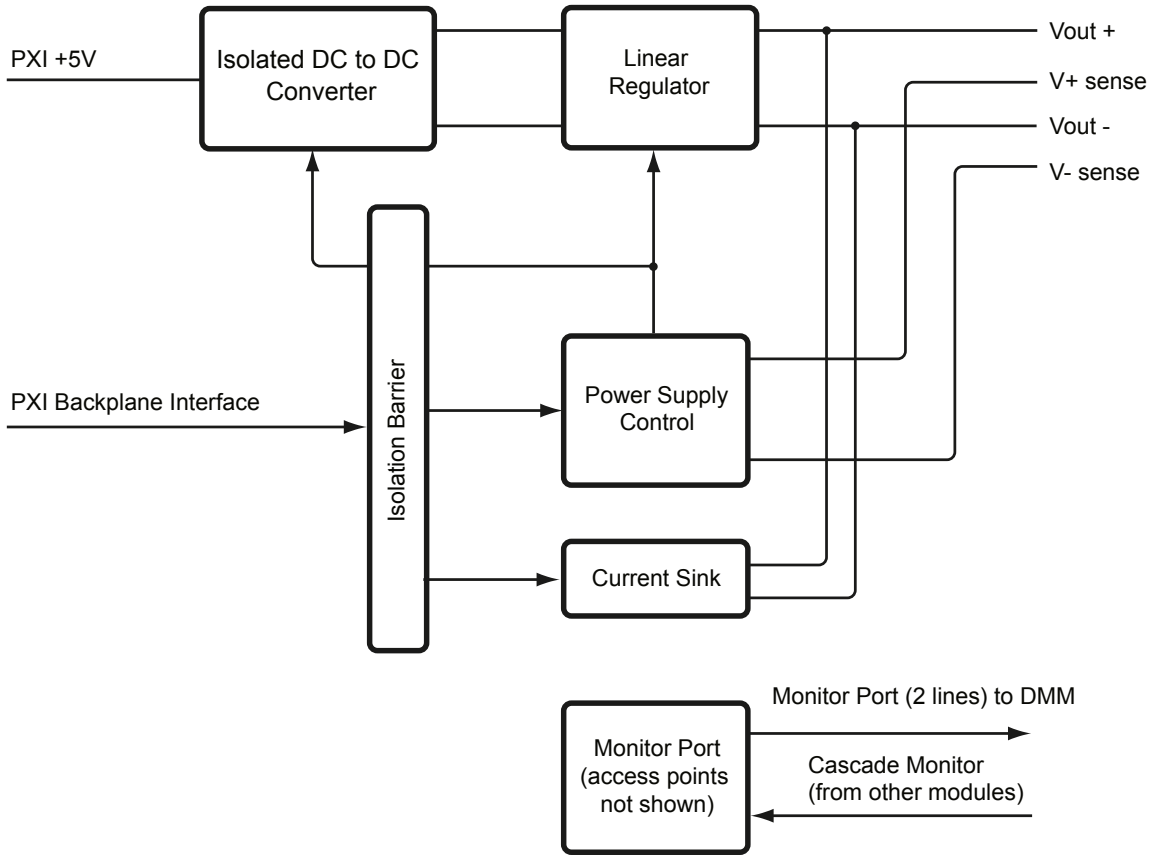


Figure 2.1 - Battery Simulator Module 40-750: Functional Block Diagram

The battery simulator uses a fast responding switched mode power supply to provide an isolated 7.5V (nominal) power source. This signal is then regulated to a voltage of between 0 and 6 Volts using a fast responding linear regulator. The accuracy of the output voltage is improved through the use of remote sense lines that detect the voltage at the load, automatically correcting voltage errors caused by losses in the connecting wires.

The sense lines and output voltage lines are provided on pairs of contacts in order to improve connection reliability and to reduce resistance in the connection to the load.

As well as sourcing current the 41-750 includes a programmable current sink. This allows the output to simulate the ability of a battery to accept current from a charger.

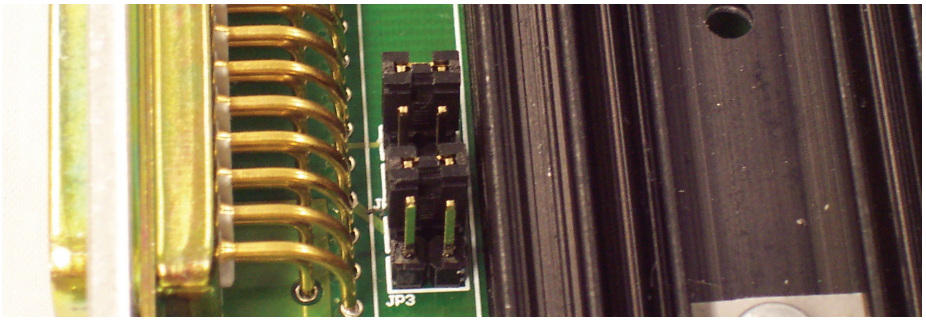
GUIDANCE ON USING THE MODULE

Sense Line Configuration

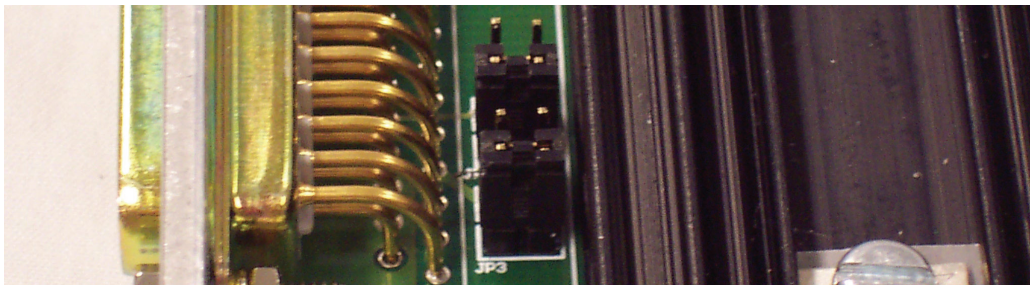
The sense lines for the 41-750 ensure that the module can regulate the voltage at a remote load.

The sense lines are manually configured in one of two ways using jumpers on the PCB:

- If one or both the sense lines are not connected to the load the battery simulator closes down the voltage feed to less than 0.7V. This will cause the load device to report gross errors in operation. This is the default setting for the module. For this mode the jumpers should be set as below:



- If the sense lines are not connected to the load the battery simulator regulates the voltage at its front panel connector. The load device may still work in this mode. The user can do a check on the sense voltage and the front panel connector output voltage. Lack of a difference between these voltages could indicate the sense wires have not been connected (unless the load is connected directly on the module's front panel connector). For this operational mode the jumpers should be set as below:



The configuration can be set with the jumpers provided, alternatively if the user wishes to fix the configuration to prevent re-configuration then soldered wire links can be used and the jumpers discarded.

Isolation

The battery simulator circuits are isolated from ground. The common mode voltage limit is ± 50V.

If no ground connection is made the 41-750 will provide an output which is approximately symmetrically balanced about ground. This is due to equal value resistors of approximately 250kΩ on each output connection.

Current Sinking

If the user wishes to use the 41-750 to sink current (i.e. behave like a battery connected to a charger) as well as source current then the internal current sink should be set. The output regulator can only act as a source, so the ability to behave like a battery under charge is achieved by adding a programmable sink that loads the output with a set current value.

If the module is asked to sink a current from a charger then the regulator makes up any difference between the charging current and the programmed sink current level.

The programmed level of sink current can limit the current that can be delivered to the load. The sink current is programmable so the user can set the level to suit the charger capacity, this normally should be set to the maximum charger current expected. Note that the monitor port can be used to measure the actual sink current programmed independently of the load current.

It should be noted that the current sink only operates correctly for output voltages above 0.5V.

Transient Load Response

The 41-750 has been designed to provide very fast recovery from transient loads. However, if the load has an excessively large capacitive component then charging this capacitance can limit the response time. The power supply includes an internal 22µF load.

Current and Voltage Monitoring

The output current and voltage of the 41-750 can be measured through the monitoring port of the module using a separate DMM.

There are two modes of operation available for the monitor:

Monitor is in loop thru

The monitor port passes the DMM connection from the input connection to the output connection. This is ideal for applications where more than one module is used in the system, a single DMM can perform accurate measurements on several modules with minimal user effort.

Monitor is in use

- Measure the load voltage (connected to the sense wires)
- Measure the front panel connector voltage
- Measure the current in the positive output by sensing the voltage across a resistor of 0.024Ω
- Measure the current being taken by the current sink by measuring the voltage across a 0.1Ω resistor

It should be noted that the difference between the load voltage reading and the front panel connector voltage gives an indication of the voltage drop in the wires connected to the load. If the sense wires are configured to regulate the front panel voltage in the event of a failed connection to the load, the readings will be the same.

The monitor port provides an analog representation of the current or voltage being measured. This provides the possibility of using a data acquisition device to capture time dependent information on voltage and current being supplied to the load.

Why use an external DMM to monitor current and voltage?

In test applications the battery simulator needs to report the output current and voltage. Reporting the voltage gives confidence that the programmed value is correct, reporting the current allows the efficiency of the device under test to be measured.

For the 41-750 a DMM or data acquisition card is connected to the monitor port. This port uses high quality relays to connect to measurement points within the module or to connected to a cascade monitor output (loop-thru). The loop-thru allows further battery simulators (or other devices with the monitor capability) to be accessed from a single DMM. The DMM is only required to measure voltage, current is measured by sensing voltage across a resistor.

The measurements supported are:

- Sensed load voltage
- Front panel voltage
- Load current
- Set sink current

Using the 41-750 module's monitor facility has many advantages:

- System calibration is simplified. The 41-750 can be measured with a real DMM that connects directly to the monitor voltages via relays. Voltage traceability is dominated by the DMM and only a functional check of the 41-750 is required. Current is measured as voltage across a single resistor, its accuracy is only limited by a resistor tolerance and the DMM. This makes system calibration simpler, and the results across multiple modules more closely related ensuring better consistency of test.
- Time dependent behaviour can be easily tested using either a DMM with a sampling capability or a data acquisition card.
- A DMM or data acquisition system can be programmed to measure what you want (peak, RMS, average) more easily than the limited functionality of an internal monitor designed with space and complexity constraints. It provides the user with greater access to the hardware measurements being performed.
- The DMM can be used to measure more than output current and voltage. It also allows the front panel voltage to be measured and the sink current to be checked. Front panel measurements will indicate cable losses (compared to load sense) and the sink sense can ensure that the device is capable of sinking the charger current.
- It has immunity to common mode issues – a performance ensured by the heavy investment made into the DMM voltage barrier technology and not easily reproduced within a power supply module.

Connecting Monitor Ports Together

The diagrams below show how the monitor ports of two Pickering devices can be connected to allow a single DMM access to all modules with a single connection.

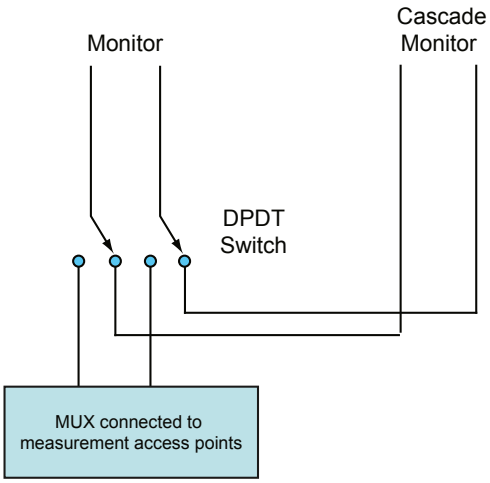


Figure 2.2 - Internal Connectivity of Monitor Port, Shown in Default Position

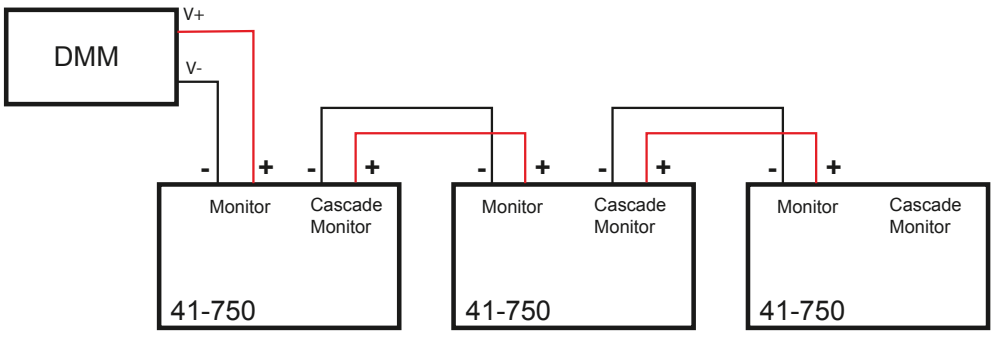


Figure 2.3 - Cascading Monitor Ports

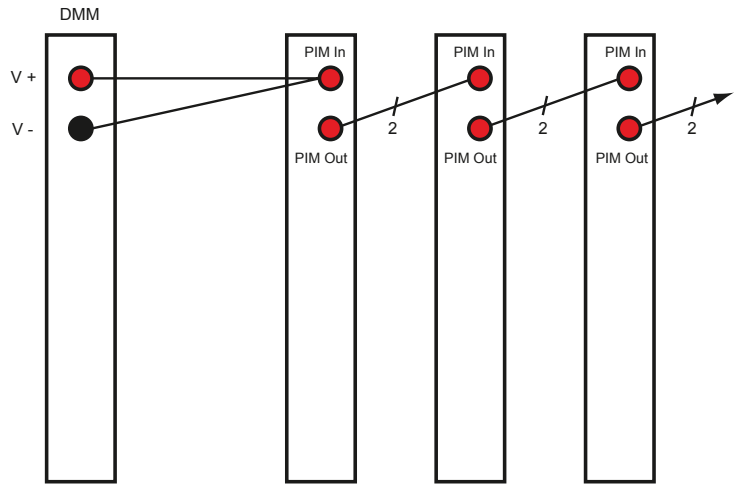


Figure 2.4 - Connecting Modules Together

Pickering can supply cables ready made to provide the connections.

This description of the monitor facility assumes that the user is using the two pin front panel connectors. This may not always be the case since the retention force of this simple connector is not high.

The 41-750 also incorporates the monitor port into the front panel 25-pin D-type connector as shown in the pin out diagram below.

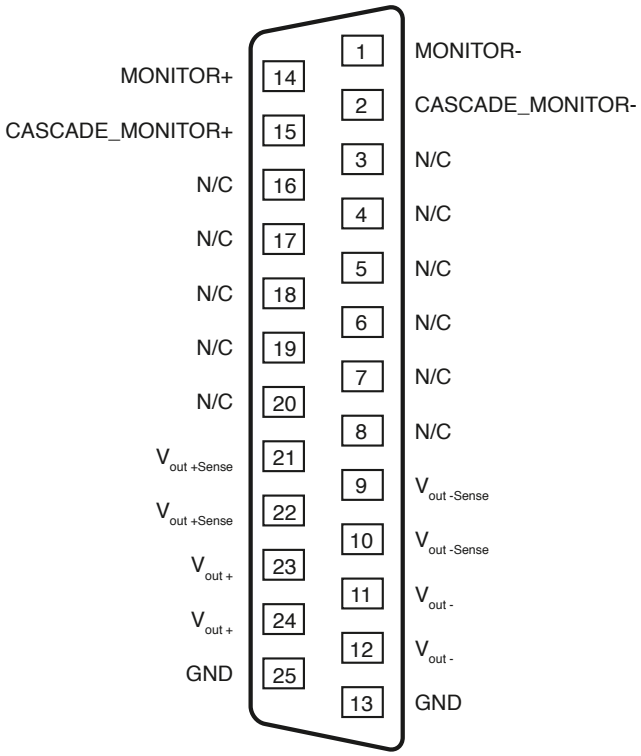


Figure 2.5 - 41-750 Battery Simulator Pinout

Accessories

Pickering Interfaces offer a range of break out boxes that support all the types of connector used on its products. These break out boxes provide a simple way of connecting to fully enclosed terminal blocks, they also incorporate cable grips to resist wire breakage. For the 25-pin D-type connector used on the 41-750, part number 40-965-025 can be used.



Figure 2.6 - View of 25-pin D-type Breakout Box With and Without Shell

Cables can be provided for extending the D-type connection to remote point.

A range of load cards and associated cable assemblies designed to simplify the calibration of the 41-750 are also available.Load cards provide a fixed or switched load and provide easy access to the monitor port. The following parts are available:

- Load Card 44-750-901 (No Load fitted)
- Load Card 44-750-902 (Fixed Load 2.14Ω)
- Load Card 44-750-903 (Switched Load between 3Ω and 1.5Ω)
- Load Card 44-750-904 (Fixed Load 6Ω)
- Load Card 44-750-905 (Switched Load between 9Ω and 4.5Ω)
- Load Card 44-750-906 (Fixed Load 100Ω)
- Cable Assembly 44-977-001-1M (1mm Bayonet Plug/Plug Red 1m)
- Cable Assembly 44-977-002-1M (1mm Bayonet Plug/Plug Black 1m)
- Cable Assembly 44-977-007-1M (4mm Bayonet Plug/Plug Red 1m)
- Cable Assembly 44-977-008-1M (4mm Bayonet Plug/Plug Black 1m)
- Cable Assembly 44-977-010-1M (4mm Bayonet Plug/1mm Plug Red 1m)
- Cable Assembly 44-977-011-1M (4mm Bayonet Plug/1mm Plug Black 1m)

The following Monitor Cables are available:

- 44-977-020 Cascade (PIMMS)
- 44-977-021 Unterminated Mon O/P Cable 1m

A Cascade cable is provided with the module and is available separately as an accessory.

Note: Test fixtures and cable assemblies are available individually or as a bundle, please contact you local Pickering sales office for availability and pricing

SECTION 3 - INSTALLATION

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

Modular products require installation in a suitable PXI/LXI chassis. The module is designed for indoor use only.

PREOPERATION CHECKS (UNPACKING)

1. Check the module for transport damage and report any damage immediately to Pickering Interfaces. Do not attempt to install the product if any damage is evident.
2. Position the chassis relative to any other equipment the module(s) will connect with. Ensure the chassis is not connected to the electrical supply.
3. Ensure that the designated area for the chassis containing the module is of flat and solid construction to withstand and support the combined weight of the module(s) and chassis.

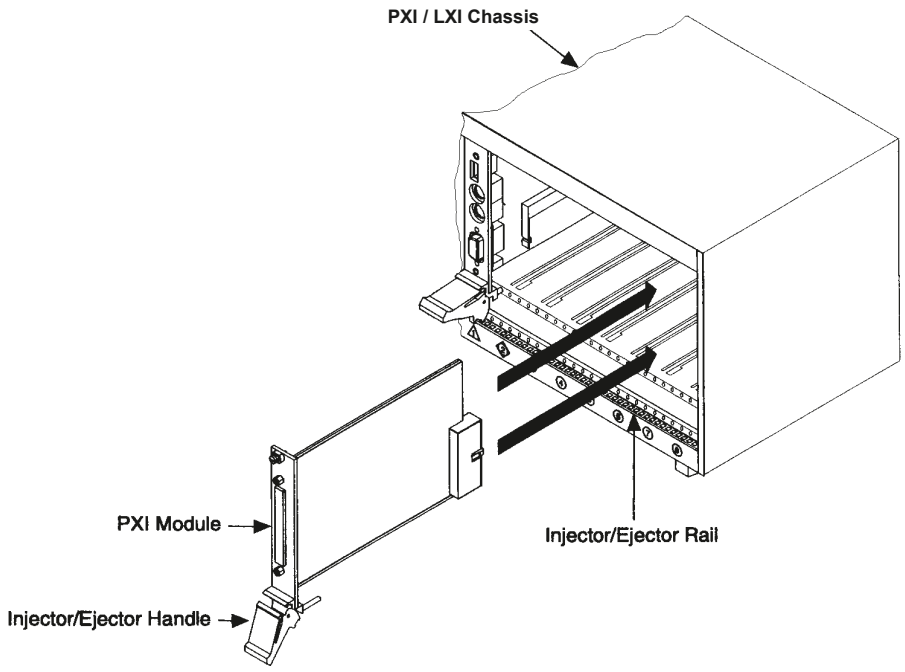


Figure 3.1 - Installing the Module into a PXI/cPCI/LXI Chassis

HARDWARE INSTALLATION
ELECTRICAL CONNECTION (CHASSIS)

1. The chassis must be electrically installed in accordance with local regional electrical codes by a qualified engineer.
2. The chassis must be grounded.

Electrostatic discharge can damage the components on the module. To avoid such damage in handling the board refer to page VII.

Ensure that there is adequate ventilation.

The module should be installed in accordance with the following procedure:

1. Ensure that the system is turned OFF but still connected to mains so that it remains grounded.
2. Choose an appropriate slot in the rack.
3. Remove the blanking plate for the chosen slot.
4. Ensure that the injector/ejector handle is in its downward position. Align the module with the card guides on the top and bottom of the slot.

   Do not raise the injector/ejector handle whilst inserting the module as the module will not insert properly.
5. Hold the handle whilst slowly sliding the module into the card guides until the handle catches on the injector/ejector rail (refer to Figure 3.1).
6. Raise the injector/ejector handle until the module firmly seats into the backplane. The front panel of the module should be flush with the front panel of the chassis.
7. Secure the front panel of the module using both screws to the chassis front panel mounting rails.
8. In a system employing a remote control interface to connect an external controller to a PXI chassis or to link multiple chassis, power-up the system as follows:
   a. For a system comprising an external controller and one chassis, power up the chassis before powering up the external controller.
   b. For a system comprising more than one chassis, turn ON the last chassis in the system followed by the penultimate, etc, and finally turn ON the external controller or chassis containing the system controller.
9. For Pickering Interfaces modular LXI installation there is no requirement to use any particular power up sequence.

SOFTWARE INSTALLATION

First install the appropriate Pickering PXI switch card drivers by running the installer program Setup.exe (provided in a compressed zip file), either from the CD-ROM supplied, or by downloading the latest version from our website **pickeringtest.com** - the recommended method. Setup is accompanied by a ReadMe file containing additional installation information. A single installation covers all cards in the System 40, System 45 and System 50 ranges.

When installation completes, the installed drivers' ReadMe file is offered for display. It can also be displayed later using a shortcut on the Programs>>Pickering menu.

If you are not a LabVIEW user you should choose the "full" version, and once that has been installed run the LabVIEW Runtime Engine installer via the shortcut on the Programs>>Pickering menu. In the absence of LabVIEW the Runtime Engine is required to support the Pickering Test Panels application.

SOFT FRONT PANEL INSTALLATION

The installation of the soft front panel utility is through a basic windows install package found on the distribution DVD.

1. Locate and run the installer package in the folder ***DVD:\Applications\Soft Front Panels***. Run the installer ***Multiple Battery Simulator vxxx.exe***
2. Follow the on screen instructions, selecting a different target directory if required. It is recommended that it be installed to the default Pickering directory created during driver installation (usually ***C:\Pickering***).
3. Once installed a new program group should be available on the ***Programs\Pickering Interfaces Ltd*** menu location.

   This will install the soft front panel utility and the corresponding windows help file.

   To un-install, either use the windows Add/Remove Programs procedure or run the ***Uninstall Multiple Battery Simulator vxxx*** menu item in ***Programs\Pickeringnterfaces Ltd\Multiple Battery Simulator vxxx***

For instructions on how to operate the module via the Soft Front Panel, please refer to the end of Section 4 “Programming Guide” of this manual.

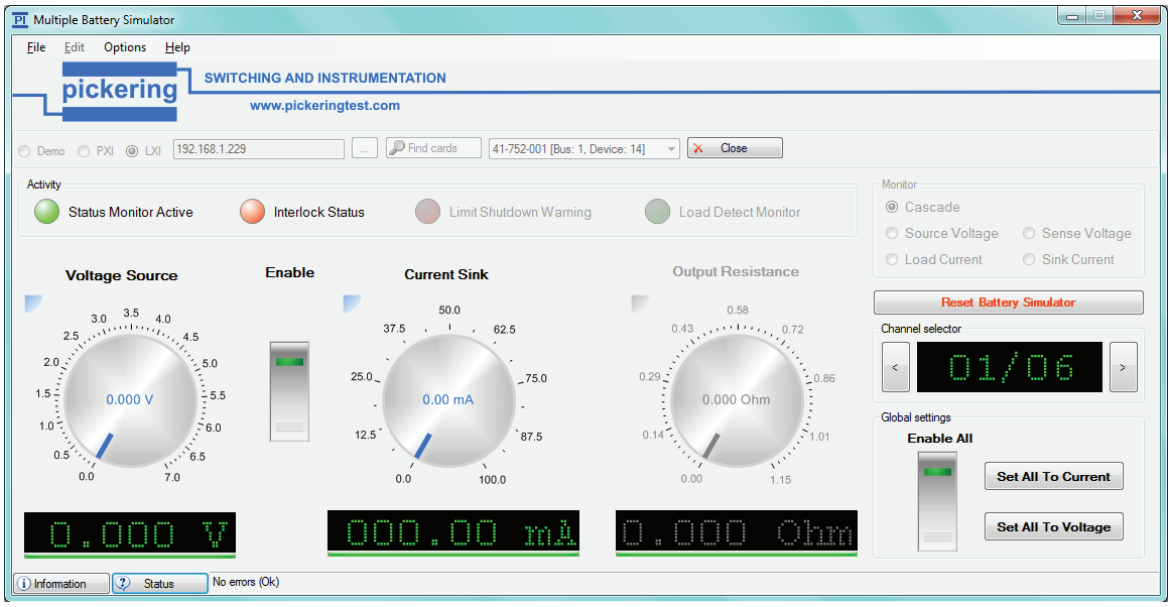


Figure 3.2 - Soft Front Panel For The Battery Simulator

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SECTION 4 - PROGRAMMING GUIDE

PROGRAMMING OPTIONS FOR PICKERING INTERFACES PXI CARDS

Software drivers are supplied for Microsoft Windows operating systems, with specific support for the following development environments:

- Microsoft Visual Studio (VB, C++, C#)
- Borland C++
- National Instruments LabWindows/CVI
- National Instruments LabVIEW and LabVIEW RT

Windows drivers are supplied in the form of Dynamic Link Libraries, which should also be usable in any other development environment that supports them.

Some recent drivers developed for the LXI platform are capable of addressing both PXI and LXI domains. Such duality may be of help to users considering future migration from PXI based systems to LXI based systems, or indeed systems containing both PXI and LXI components.

Programming for PXI

A number of different Windows drivers are available to meet particular system requirements, and should none of these be suitable there is also the option of register-level programming. Drivers are generally 'universal', handling all models in the System 40, 45 and 50 ranges; however some models that are not compliant with the Ivi Swtch class cannot be used with the pi40iv IVI driver. The pipx40 and Pilpxi drivers are also applicable to certain models in the System 41 (PXI Instruments) range - see these drivers' System 41 support list.

Please note that this documentation is available in its most up-to-date form as HTML help files, fully hyperlinked for easy access - both pipx40 and Pilpxi documents are included in the Pipx40vpp software installation.

IVI Driver for Windows - pi40iv

The pi40iv IVI (Interchangeable Virtual Instrument) driver supports all Pickering Interfaces PXI switch cards that are consistent with the Iviswtch class model - as are the great majority of cards in the System 40/45/50 ranges. It integrates well with LabWindows/CVI and LabVIEW, and is fully compatible with Switch Executive. It is also usable in general-purpose programming environments such as Visual C++ and Visual Basic.

Prior installation of the VISA and IviEngine from National Instruments are required for the correct installation and operation of this driver.

VISA Driver for Windows - pipx40

The pipx40 driver conforms to the VISA (Virtual Instrument Software Architecture) standard for programmable instrumentation. Instrument control environments such as LabVIEW and LabWindows/CVI are based on VISA, and pipx40 support libraries are provided for them.

Prior installation of VISA from National Instruments is required for the operation of this driver.

Where VISA is available, pipx40 can also be used in general-purpose programming environments such as Visual C++ and Visual Basic. When IVI is not a system requirement this driver will often yield faster operation than the pi40iv driver.

Direct I/O Driver for Windows - Pilpxi

The Pilpxi driver accesses cards directly, without using the VISA software layer, while offering similar overall functionality to pipx40. It is most commonly used in general-purpose programming environments such as Visual C++ and Visual Basic. Operating speed of the VISA and Direct I/O drivers is generally comparable.

Register-level Programming

Where the supplied drivers are not suitable, register-level programming can be employed - for example:

- If the functionality of the supplied drivers does not meet the application requirements
- If security considerations demand full source-code for the application
- In development environments that have alternate mechanisms for accessing PCI bus
- For operating systems other than Windows

Programming for LXI

When Pickering PXI cards are inserted into an LXI Modular Chassis a different set of drivers is available.

IVI Driver for Windows - pi40iv

The pi40iv IVI also supports LXI inserted cards simply by changing the resource string to address string to the appropriate address.

Direct I/O Driver for Windows - Piplx

The piplx driver is based on the PXI Direct I/O driver pilpxi, but with added functionality to deal with the added need to address the chassis using an IP address. It integrates well with LabWindows/CVI and LabVIEW, and is fully compatible with Switch Executive. It is also usable in general-purpose programming environments such as Visual C++ and Visual Basic.

Please note that this driver may also be used in the PXI domain. If the addressed card is in the local computer PCI/PXI system, commands will be passed through to the PXI Direct I/O driver. This mechanism allows the piplx driver to be used for both PXI and LXI cards.

The LXI format offers additional interface options not available in PXI :

.NET

A .NET native driver is also available. Once again this may be used for both LXI and PXI card control.

SOAP

Pickering LXI products include a SOAP interface which is usable from a wide variety of platforms and languages.

SSH

Pickering LXI products include an SSH interface which allows remote command line access to control cards, or, using a suitable package, programmatic control.

The user is advised to visit the Pickering web site for further details of all the above drivers, where documentation, example programs, and further help with driver choice are available.

LabVIEW, LabWindows/CVI and Switch Executive are trademarks of National Instruments Corporation.

General Pickering Card Architecture

With most drivers, before programming a Pickering card it is important to understand the basic architecture of Pickering cards.

The switches on a Pickering card are organized into logical sub-units, each sub-unit containing a set of objects of similar type and use. These objects may be switches, digital outputs, digital inputs, resistors, power supplies etc, depending on the nature of the specific card.

For example a simple matrix card will usually contain a single sub-unit containing the switches arranged in a 2-dimensional array. However a similar card with additional isolating relays connected to the matrix will contain additional sub-units containing those isolation relays.

Low level drivers include functions to allow the programmer to query the card to ascertain the number of sub-units, and the size and type of each sub-unit.

For full details of the driver functions available the programmer should refer to the documentation provided.

PROGRAMMING THE MODULE

The 41-750 Battery Simulator uses the same driver software as the Pickering range of switches, pilpxi or pipx40, requiring version 2.51 or later. There is no IVI driver available for this unit at present. For full detail of the range of driver functions available the user is advised to refer to documentation for the switch drivers pilpxi and/or pipx40.

MODULE ARCHITECTURE

Pickering switch modules separate functionality into logical sections referred to as sub-units. Each sub-unit represents a set of identical objects used to control or monitor aspects of card operation.

The 41-750 contains 8 output sub-units and 3 input sub-units. The purpose of each of these is described below:

Sub-Unit	Size (Bits)	Purpose
Output 1	4	Monitor MUX
Output 2	96	Current Sink
Output 3	16	Voltage Source
Output 4	8	High Voltage Calibration - Volatile
Output 5	8	Low Voltage Calibration - Volatile
Output 6	8	High Voltage Calibration - Non-volatile
Output 7	8	Low Voltage Calibration - Non-volatile
Output 8	1	Output Enable
Input 1	1	Overload indicator
Input 2	8	Maximum Voltage Calibration
Input 3	8	Zero Voltage Calibration

These sub-units are further defined in this section. Examples are given using a number of library interfaces, however the user is advised to refer to the documentation for the library for full details of its use.

Output Sub-Unit 1 - Monitor

Controls the switching associated with the monitor selection. It appears as a 4-way multiplex of which a maximum of one output may be selected. The outputs are as follows:

1 = voltage source

2 = load current

3 = sense voltage

4 = sink current

With no output selected the monitor is routed to the cascade input socket to allow multiple modules to be cascaded to a single measuring device.

For example, the following commands will set the switch the monitor to load current on channel 3.

Driver	Command
pilpxi (kernel)	PIL_OpBit(cardNum, 1, 3, TRUE);
pipx40 (VISA)	pipx40_setChannelState (vi, 1, 3, VI_TRUE);
PIPLX (LXI)	PIPLX_OpBit(session, cardNum, 1, 3, TRUE)
SOAP (LXI)	$device -> OpBit(1, 3, 1);

Output Sub-Unit 2 - Current Sink

This sub-unit appears as a 96 bit register, each bit represents one element of a bank of parallel current sinks, each element draws current from the input. With all bits set high, all current sinks are enabled and will sink the maximum 500mA, fewer bits set produce an output pro-rata.

For example, the following will set the current sink to maximum current.

Driver	Command
pilpxi (kernel)	DWORD data[3]; data[0] = data[1] = data[2] = 0xffffffff; PIL_WriteSub(cardNum, 2, data);
pipx40 (VISA)	ViUInt32 pattern[3]; pattern[0] = pattern[1] = pattern[2] = 0xffffffff; pipx40_setChannelPattern (vi, 2, pattern);
PIPLX (LXI)	DWORD data[3]; data[0] = data[1] = data[2] = 0xffffffff; PIPLX_WriteSub(session, cardNum, 2, data 3);
SOAP (LXI)	my @data = (0xffffffff, 0xffffffff, 0xffffffff) $device -> WriteSub(2, @data);

Output Sub-Unit 3 - Voltage Source

This is a 16 bit register which can be set to any binary value between 0 and 65535 (0xFFFF hexadecimal). The range of values controls the output voltage between its minimum and maximum values, nominally 0-6Volts.

For example, this code will set the voltage to maximum.

Driver	Command
pilpxi (kernel)	DWORD dac[1]; dac[0] = 0xffff; PIL_WriteSub(cardNum, 3, dac);
pipx40 (VISA)	ViUInt32 pattern[1]; pattern[0] = 0xffff; pipx40_setChannelPattern (vi, 3, pattern);
PIPLX (LXI)	DWORD dac[1]; dac[0] = 0xffff; PIPLX_WriteSub(session, cardNum, 3, dac 1);
SOAP (LXI)	my $data = (0xffff); $device -> WriteSub(3, $data);

Output Sub-Unit 4 - High Voltage Offset

Controls the calibration of the upper end of the output voltage range. It is an 8 bit register which may be set from 0 to 255 (0xFF hexadecimal). A value of 128 represents a null offset, positive and negative excursions may be set above and below that value.

Values set using this register will not be stored in non-volatile memory and so will be lost when the card is powered down.

This example sets the offset to a value of 128. This example also suffices for sub-units 5, 6, 7, 9 and 10, simply replace the second argument with the appropriate sub-unit number.

Driver	Command
pilpxi (kernel)	DWORD dac[1]; dac[0] = 0x7f; PIL_WriteSub(cardNum, 4, dac);
pipx40 (VISA)	ViUInt32 pattern[1]; pattern[0] = 0x7f; pipx40_setChannelPattern (vi, 4, pattern);
PIPLX (LXI)	DWORD dac[1]; dac[0] = 0x7f; PIPLX_WriteSub(session, cardNum, 4, dac 1);
SOAP (LXI)	my $data = (0x7f); $device -> WriteSub(4, $data);

Output Sub-Unit 5 - Low Voltage Offset

As sub-unit 4 but controls the lower end of the output voltage range.

Output Sub-Unit 6 - High Voltage Non-Volatile Store

Controls the non-volatile storage of calibration for the upper end of the output voltage range. It is an 8 bit register which may be set from 0 to 255 (0xFF hexadecimal). A value of 128 represents a null offset, positive and negative excursions may be set above and below that value. Storing the calibration value into this register will preserve the setting after power down.

Output Sub-Unit 7 - Low Voltage Non-Volatile Store

As sub-unit 6 but for the lower end of the output voltage range.

Output Sub-Unit 8 - Output Enable

A value of 1 will enable the output, 0 will disable.

This example turns the output on.

Driver	Command
pilpxi (kernel)	DWORD data[1]; data[0] = 1; PIL_WriteSub(cardNum, 8, data);
pipx40 (VISA)	ViUInt32 pattern[1]; pattern[0] = 0x01; pipx40_setChannelPattern (vi, 8, pattern);
PIPLX (LXI)	DWORD data[1]; data[0] = 0x01; PIPLX_WriteSub(session, cardNum, 8, dac 1);
SOAP (LXI)	my $data = (0x01); $device -> WriteSub(8, $data);

Input Sub-Unit 1 - Indicators

This sub-unit is 1 bit wide and contains the indicator flag that shows the state of the overload condition of the module. This may be read either with a bit-width function or a dword-width function.

Driver	Command

pilpxi (kernel)	BOOL bit;
	PIL_ReadBit(cardNum, 1, 1, &bit); // specify sub-unit and bit number
	
	or
	
	BOOL bit;
	DWORD data[1];
	PIL_ReadSub(cardNum, 1, data); // specify sub-unit
	bit = data[0] & 1;

pipx40 (VISA)	ViBoolean state;
	pipx40_readInputState(vi, 1, 1, &state); // specify sub-unit and bit
	
	or
	
	ViUInt32 data[1];
	pipx40_readInputPattern(vi, 1, data); // specify sub-unit

PIPLX (LXI)	BOOL bit; PIPLX_ReadBit(session, cardNum, 1, 1, &bit); // specify sub-unit and bit number

SOAP (LXI)	my $bit = (0);
	my @data;
	@data = $service->ReadBit(1, 1); // specify sub-unit and bit number

Input Sub-Unit 2 - High Voltage Calibration Value

The non-volatile value of the high voltage calibration may be read back from this 8 bit sub-unit.

For example, the following commands will read the non volatile high voltage calibration value. Input sub-units 3 and 4 operate in the same way, simply change the number of the second parameter.

Driver	Command
pilpxi (kernel)	DWORD data[1]; PIL_ReadSub(cardNum, 2, data);
pipx40 (VISA)	ViUInt32 data[1]; pipx40_readInputPattern (vi, 2, data);
PIPLX (LXI)	DWORD data[1]; PIPLX_ReadSub(session, cardNum, 2, data);
SOAP (LXI)	my @data; @data $device -> ReadSub(2);

Input Sub-Unit 3 - Low Voltage Calibration Value

The non-volatile value of the low voltage calibration may be read back from this 8 bit sub-unit.

USING THE SOFT FRONT PANEL

Getting Started

Run the Pickering Interfaces Multiple Battery Simulator SFP by double-clicking the icon in the application folder. The Multiple Battery Simulator SFP starts up (while loading, the initial window appears, see Figure 4.1) and you should see a display similar to Figure 4.2.

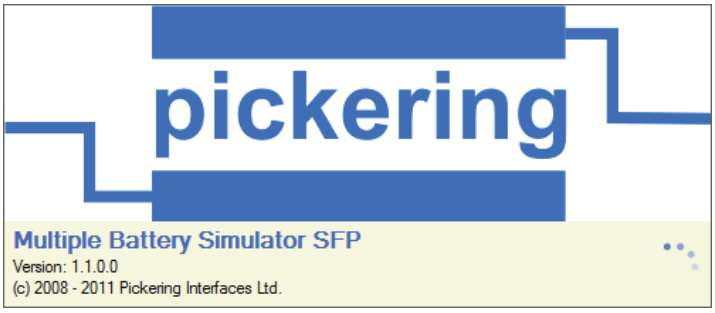


Figure 4.1 - Loading window of the Pickering Interfaces Multiple Battery Simulator SFP

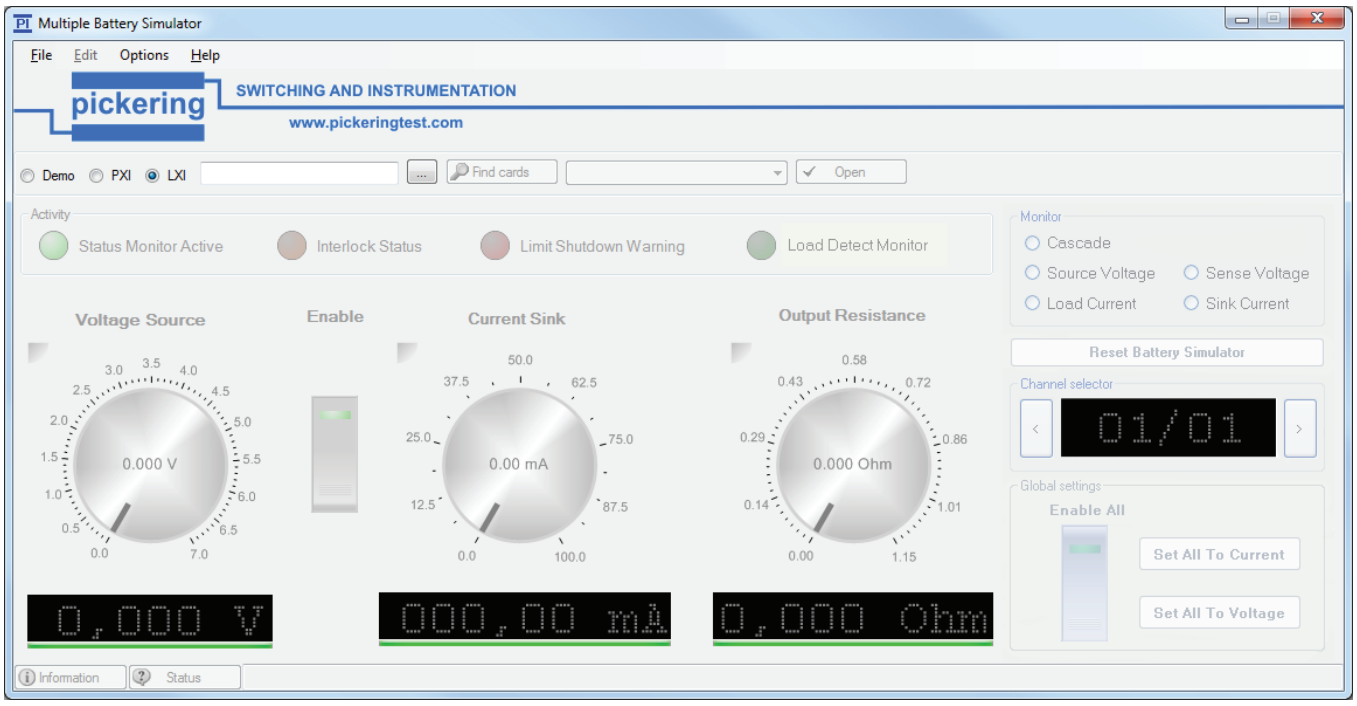


Figure 4.2 - Initial screen of the SFP after startup

After the application has started, **LXI** is the default selection (Figure 4.3). You can also choose **Demo** (see Demo section) or **PXI** (see PXI section) or leave **LXI** selected and continue to work with an LXI device. (see LXI section).

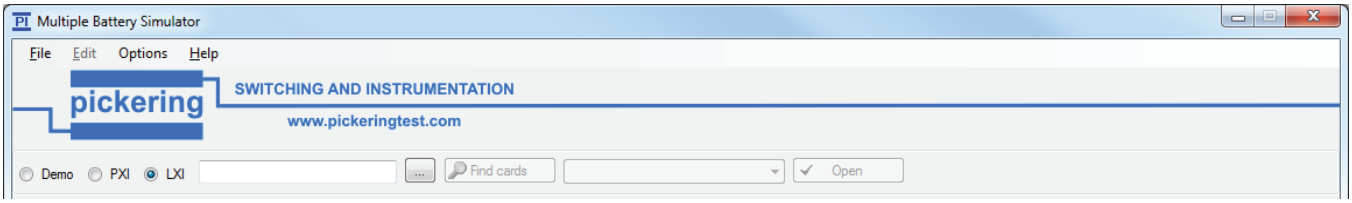


Figure 4.3 - Main controls of the SFP after startup

Demo Mode

Select the **Demo** option (Figure 4.4). The combo box with simulation cards available is now enabled as well as the **Open** button. Select a card from the list (Figure 4.5) and click on the **Open** button to start a simulation with the specified card. The application will open the card and enable the appropriate controls (similar to Figure 4.11).

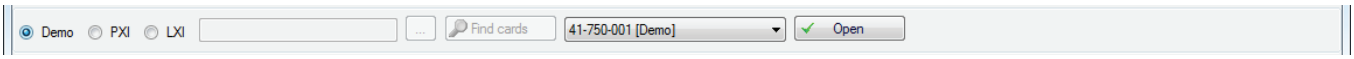


Figure 4.4 - Main controls of the SFP with Demo mode selected

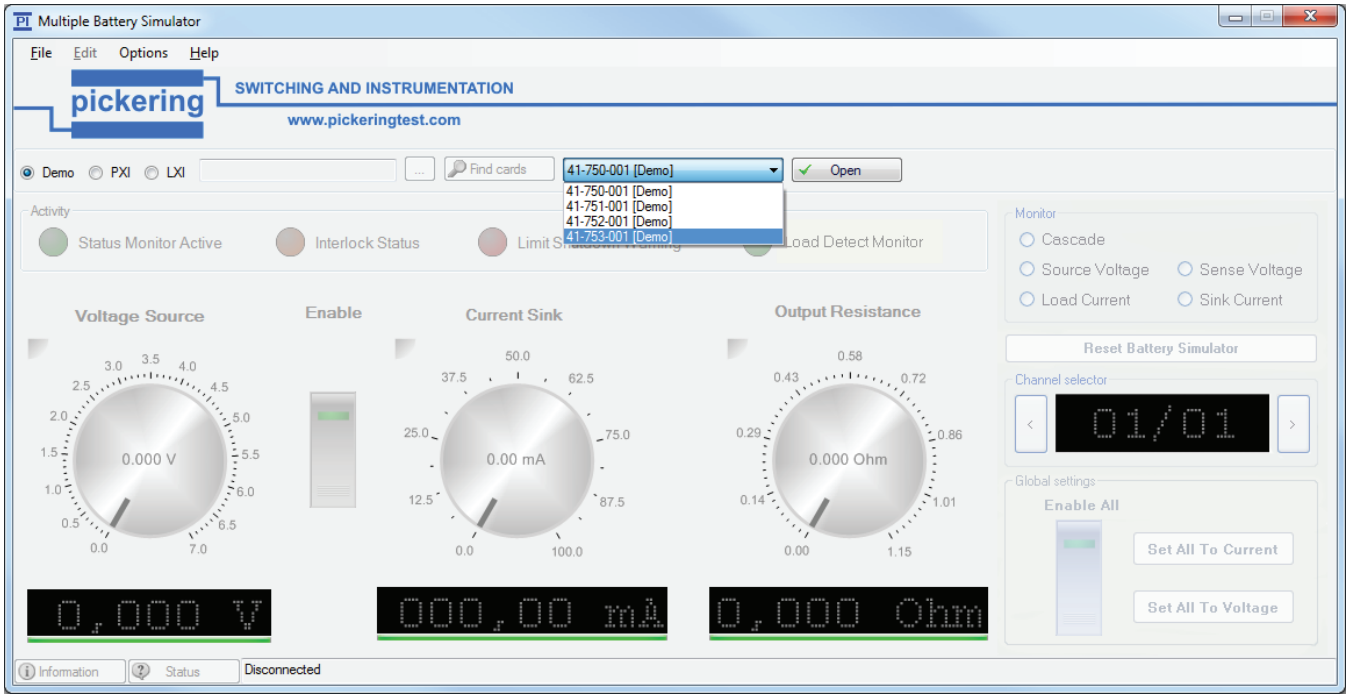


Figure 4.5 - The SFP window during the selection of a card for simulation

PXI

Select the **PXI** option (Figure 4.6). The **Find cards** button is now enabled. Click on this button to find all the available Battery Simulator cards fitted in the connected PXI device. If suitable cards are fitted, they will be listed in the combo box. Here you can select the one you want to control (in a similar way to the Demo mode) and click on the **Open** button. The application will open the card and enable the appropriate controls (Figure 4.11)



Figure 4.6 - Main controls of the SFP with PXI mode selected

LXI

Select the **LXI** option (Figure 4.7). The empty text field and the button with three dots are now enabled. You can type the IP address of the LXI device directly into the text field, or you can click on the button with three dots to use the discovery mechanism to find the LXI devices. When you click on this button it opens a new window (Figure 4.9) and automatically tries to discover all the available LXI devices. Depending on your operating system, you may see the Windows Security Alert window as shown in Figure 4.8a for Windows XP or Figure 4.8b for Windows 7. Click on the **Unblock** button to allow the Multiple Battery Simulator SFP access to the network (Windows XP), or select the networks you want Multiple Battery Simulator SFP have access to and click the **Allow access** button (Windows 7). All located devices are then listed in the table. You can select the appropriate device from the table and click the **OK** button, or simply double-click on the device you want to use. You can also refresh the table by searching for all the available devices again by clicking on the **Discover** button in the bottom of window (Figure 4.9).



Figure 4.7: Main controls of the SFP with LXI mode selected



Figure 4.8a: Windows XP security alert window

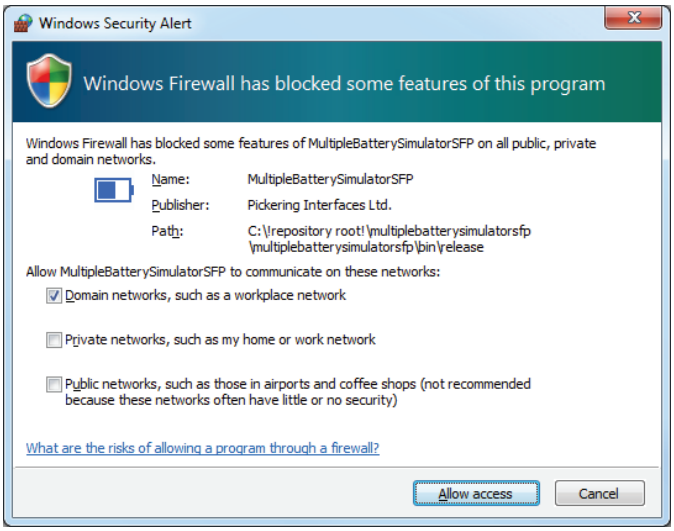


Figure 4.8b: Windows 7 security alert window

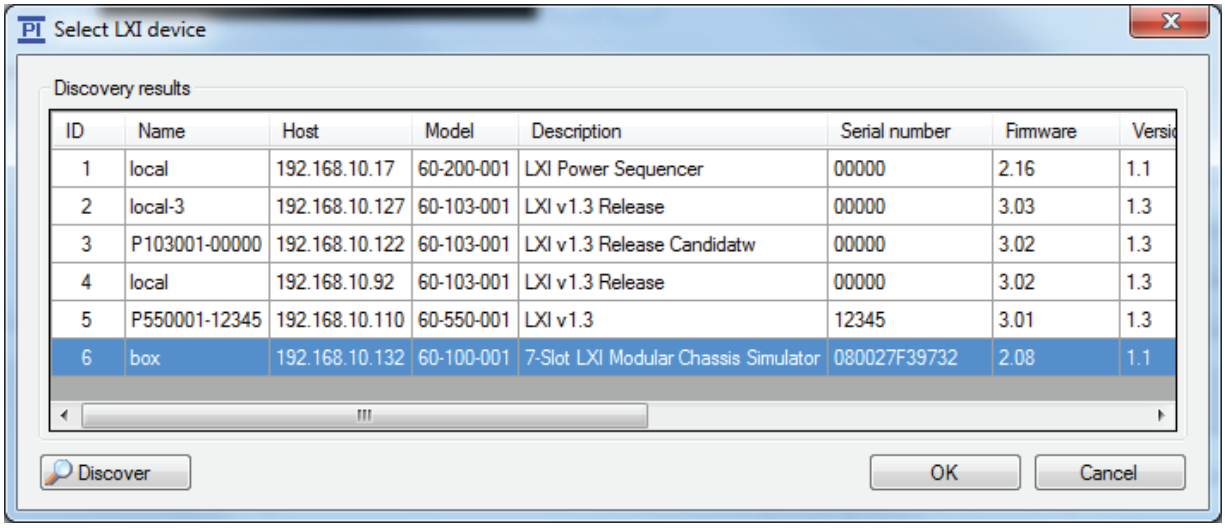


Figure 4.9 - The discovery window

After selection of the LXI device, the **Find cards** button is enabled on the SFP. Click on this button to find all available cards of the Battery Simulator type in the connected LXI device. If there are suitable cards, they will be listed in the combo box (similar to Figure 4.10). Here you can select the one you want to control (similar to Demo mode and PXI mode) and click the **Open** button. The application will open the card and enable the appropriate controls (similar to Figure 4.11).

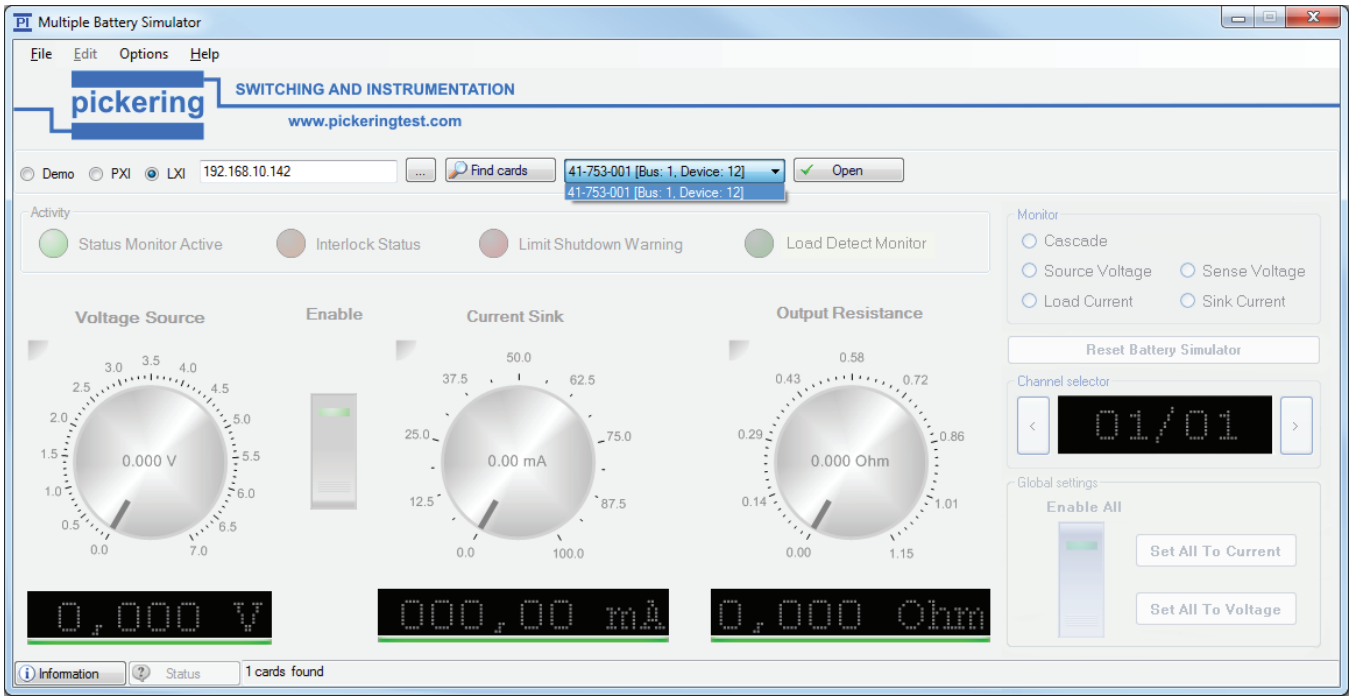


Figure 4.10 - The SFP window during selection of the Battery Simulator cards available in the specified LXI device

Controlling The Module

To control the module, you can use the rotary controls and two way switch control (Figure 4.13), the controls in the Global groupbox (Figure 4.17) or direct entry using digits (Figure 4.14). Be aware that the SFP is designed to operate several different types of Battery Simulator and certain controls may not be enabled for a particular module.

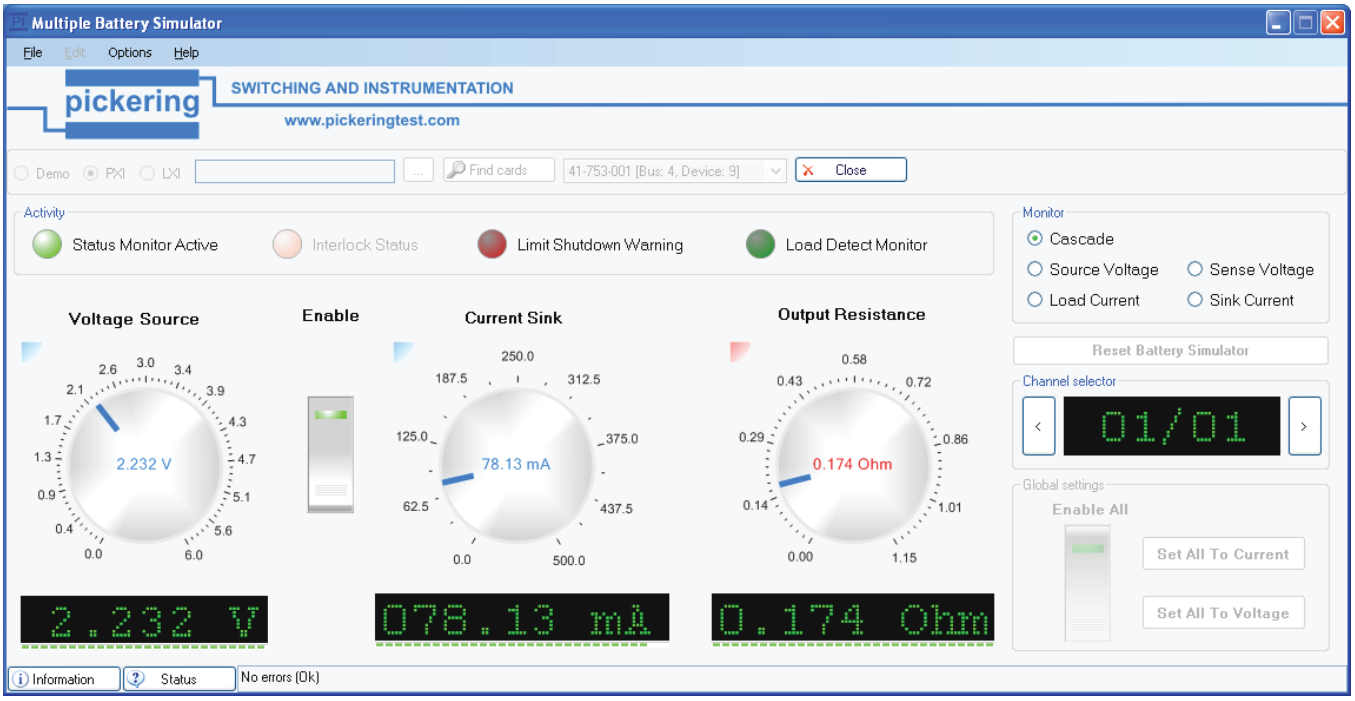


Figure 4.11 - The SFP with a Battery Simulator card opened

The activity LEDs (Figure 4.12) are enabled or disabled depending on the type of Battery Simulator module. There are four LEDs as outlined below:

- **Status Monitor Active** – flashes at 2 second intervals to indicate that the card is connected and opened.
- **Interlock** – indicates that the HW pin Interlock has been pulled low, which means no output voltage will be generated by the Battery Simulator.
- **Limit Shutdown Warning** – indicates that the Battery Simulator has reached its maximum current limit.
- **Current Draw Monitor** – indicates that the Battery Simulator is supplying more than 10mA.

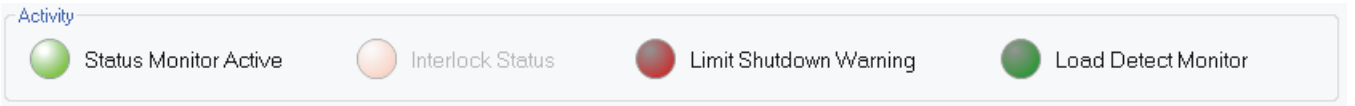


Figure 4.12 - The activity LEDs on the SFP

You can use the rotary controls (Figure 4.13) to set the Voltage Source, Current Sink and Output Resistance of the Battery Simulator. You can also use the arrow keys and Page Up / Page Down keys to control the selected knob.

- Arrow keys will increase or decrease the Voltage knob by 10x the smallest step or, in the case of the Current knob and Output Resistance knob, by the smallest step.
- Page Up / Page Down keys increase or decrease the Voltage knob by 100x the smallest step or, in the case of the Current knob and Output Resistance knob by, 10x the smallest step.

Note: The colored mark in the upper left corner of each knob control is used to indicate which knob is selected. Clicking on the mark, changes its color (red means selected, blue means not selected), this also applies to the label inside the knob, indicating that the knob control can receive commands from the keyboard (see Figure 4.13).

The **Enable** button (see Figure 4.13) enables or disables output of the Battery Simulator channel.

Note: As mentioned at the begining of this chapter, certain controls of the Battery Simulator SFP may be disabled for a particular card type.

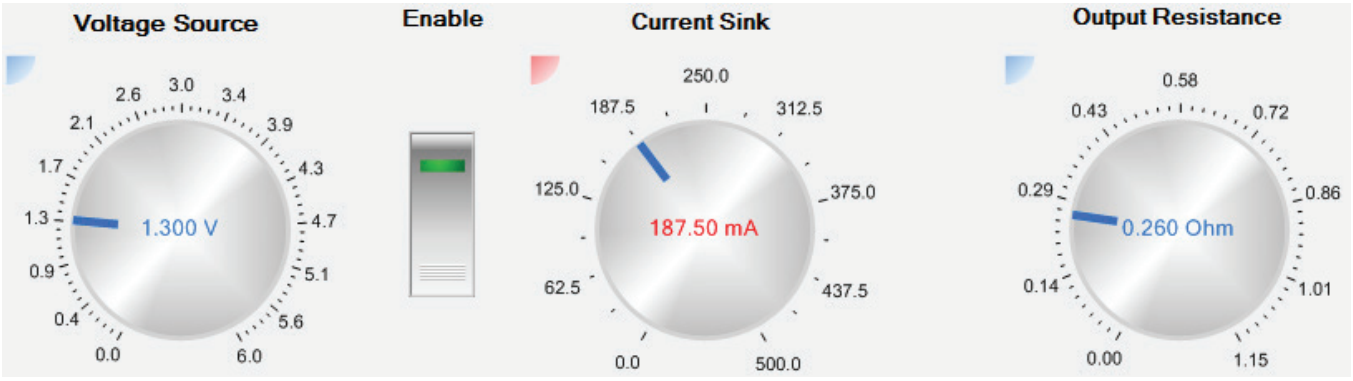


Figure 4.13 - The rotary controls and enable control

Numerical values for the rotary controls are displayed under each knob (Figure 4.14). You can use these displays to alter the settings. Double-click on the numerical display to enable text entry via the keyboard.

Note: There is a tiny progress bar under the voltage, current and resistance displays (Figure 4.14), which indicates the time delay between changing a value and writing the new setting to the Battery Simulator module. The time is set to 1000ms as a precaution against sending multiple updates to the card when a knob is adjusted. Immediately after a new value is written to the module a read command is executed to update the displayed value on the SFP.



Figure 4.14 - The numerical boxes on the SFP showing the output settings

The module includes a facility for an external meter to monitor internal voltages. (Figure 4.15). See Section 7 of this manual for more information.

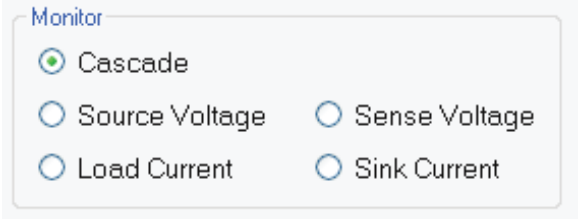


Figure 4.15 - Monitor controls display on the SFP

If the Battery Simulator module has more than one channel, the **Channel selector** box will be visible (Figure 4.16), which allows you to select the channel (subunit) to be controlled.

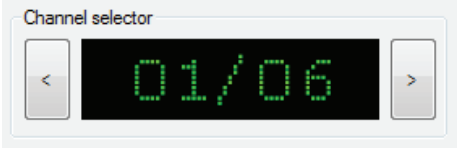


Figure 4.16 - The channel selector box of the SFP

Also, for Battery Simulators with multiple channels, the **Global settings** group box (Figure 4.17) allows you to set all channels simultaneously.

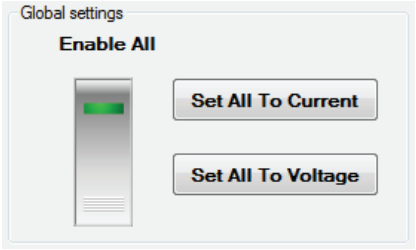


Figure 4.17 - The global settings control of the SFP

Some models of Battery Simulator module support a reset feature. In this case the **Reset Battery Simulator** button (Figure 4.18) is enabled.



Figure 4.18 - The Reset Battery Simulator button

At the bottom of the control window are two additional buttons: **Information** and **Status** (Figure 4.19). Click on the **Information** button to obtain information about the module currently being controlled by the SFP (Figure 4.20). Next to the Information button is the **Status** button and a status display. To refresh the status display for the module simply click on the **Status** button.

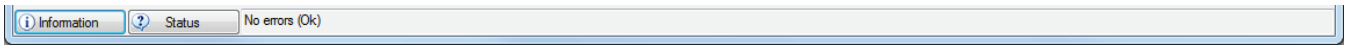


Figure 4.19 - The bottom part of the SFP

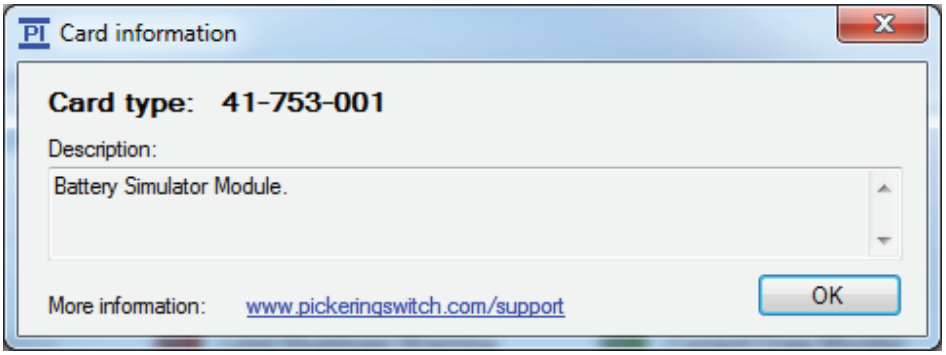


Figure 4.20 - The information window showing the module currently controlled by the SFP, in this case, a 41-753-001 Multiple Battery Simulator

Calibration

WARNING: FOR AUTHORIZED PERSONEL ONLY

All Battery Simulator modules are calibrated at the factory before delivery. But if recalibration is required, **Calibration** can be selected from the **Options** menu (see Figure 4.21). For more information how to calibrate the Battery Simulator see Section 7 of this manual.

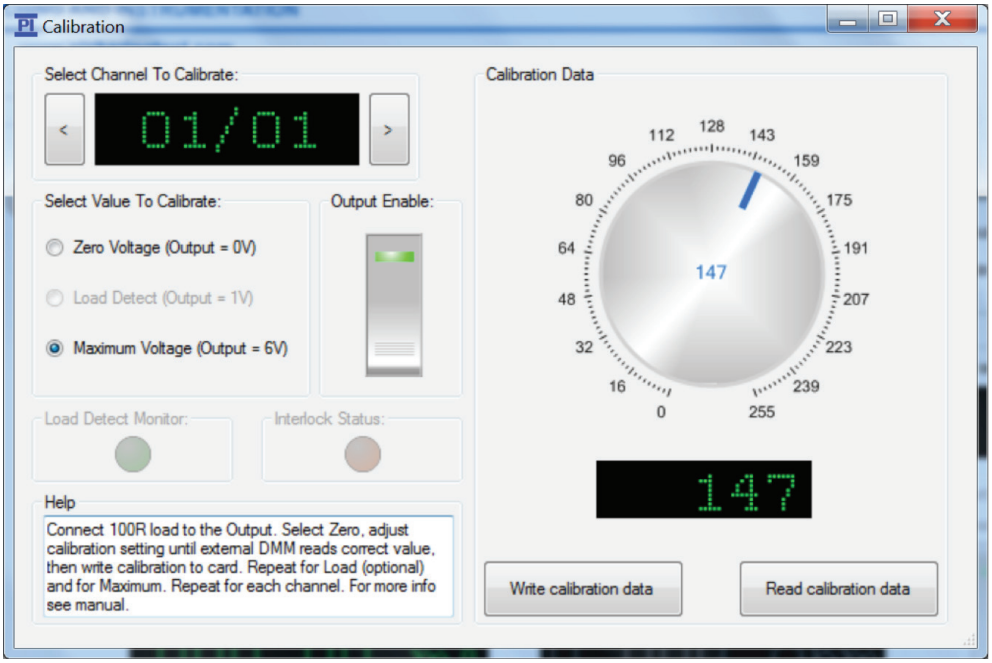


Figure 4.21 - The calibration window of the Battery Simulator SFP

Load and Save

You can save the current state of the SFP by selecting the **Save** or **Save as...** from the **File** menu (Figure 4.22). You can also load a previously saved state of the SFP by selecting **Load** from the **File** menu.

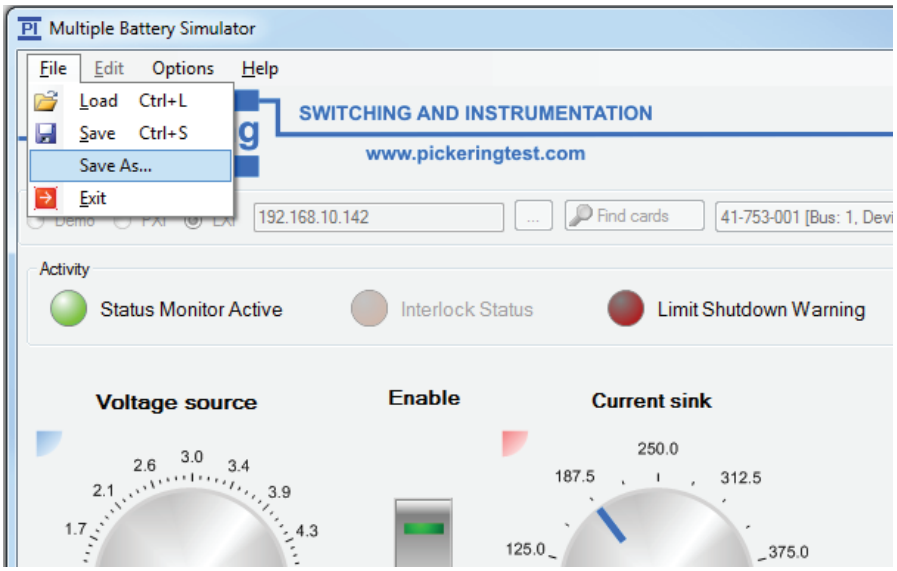


Figure 4.22 - The File menu of the SFP with “Save As…” selected

Settings

You can change settings of the SFP by clicking on **Settings** from the menu **Options** (Figure 4.23).

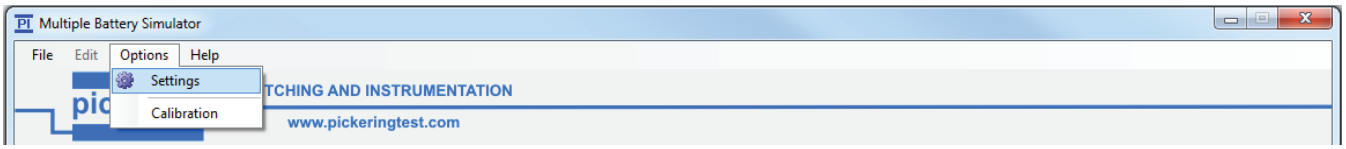


Figure 4.23 - The Options menu of the SFP with "Settings" selected

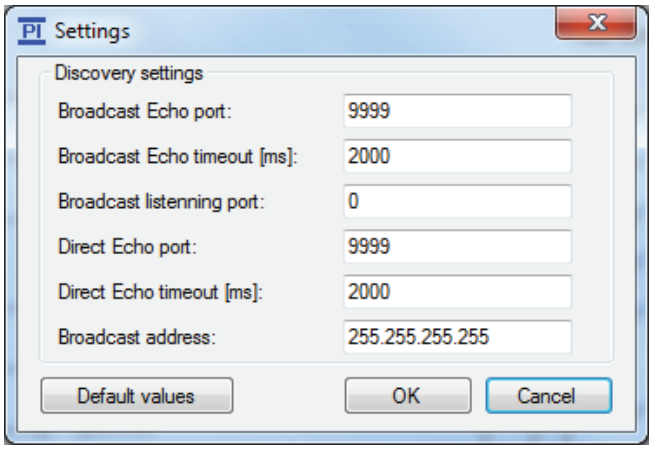


Figure 4.24 - The Settings window of the SFP

You can change the Broadcast Echo port, Broadcast Echo timeout, Direct Echo port, etc (Figure 4.24).

Note: The standard broadcast address is 255.255.255.255, but in some cases this can cause problems. For example, if you have more than one network interface (physical or virtual), you must specify the broadcast address of the specified subnet, where you want to discover LXI devices.

Example: We want to discover LXI devices connected to a class C network where there is a computer with the IP address 192.168.10.13 and the network's submask is 255.255.255.0. In this case the correct broadcast address is 192.168.10.255.

Help

From the **Help** menu you can click on **Contents** to display the help document, alternatively, press the F1 function key. Clicking on **About** (Figure 4.25) opens a new window displaying information about the application (Figure 4.26) including all modules supported by the SFP and the assemblies used. You can also get information about the system by clicking on the **System Info** button.

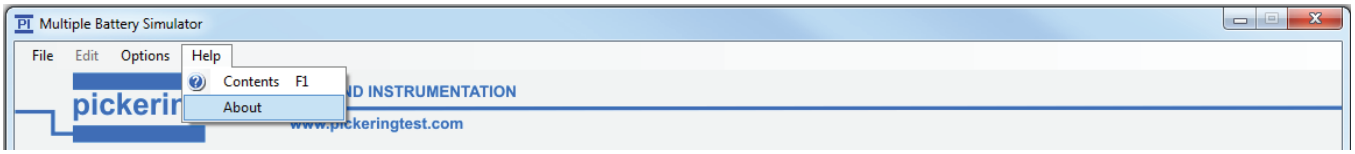


Figure 4.25 - Help menu of the SFP with "About" selected

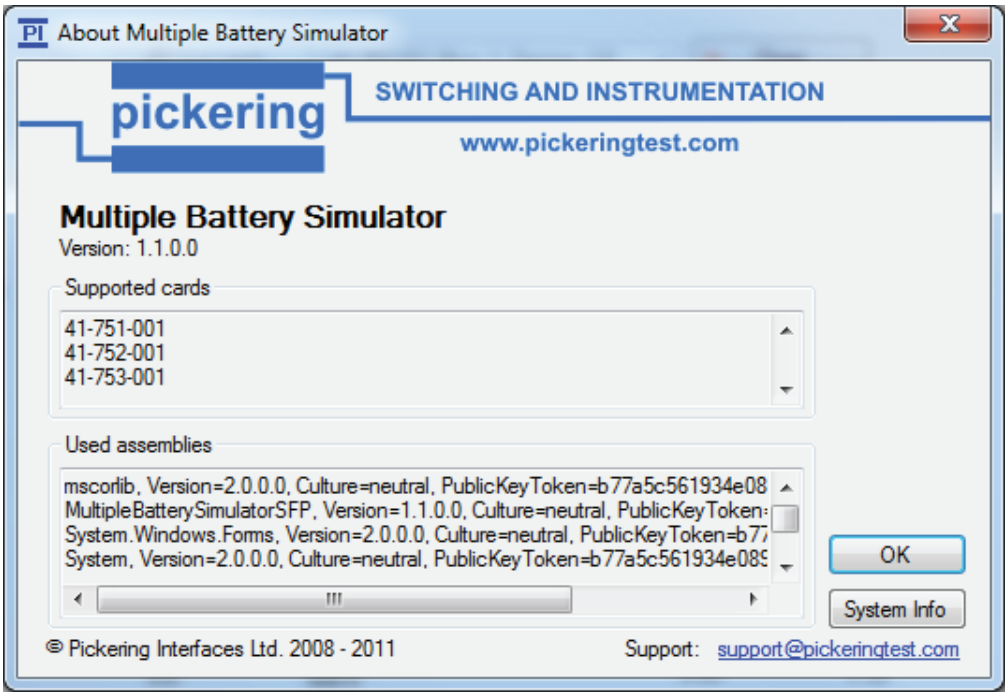
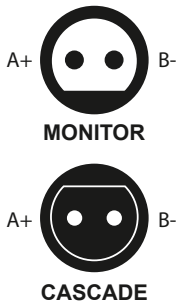


Figure 4.26 - About window of the SFP

SECTION 5 - CONNECTOR INFORMATION



Monitor A+ is electrically connected to Monitor+
Monitor B- is electrically connected to Monitor-
Cascade A+ is electrically connected to Cascade_Monitor+
Cascade B- is electrically connected to Cascade_Monitor-

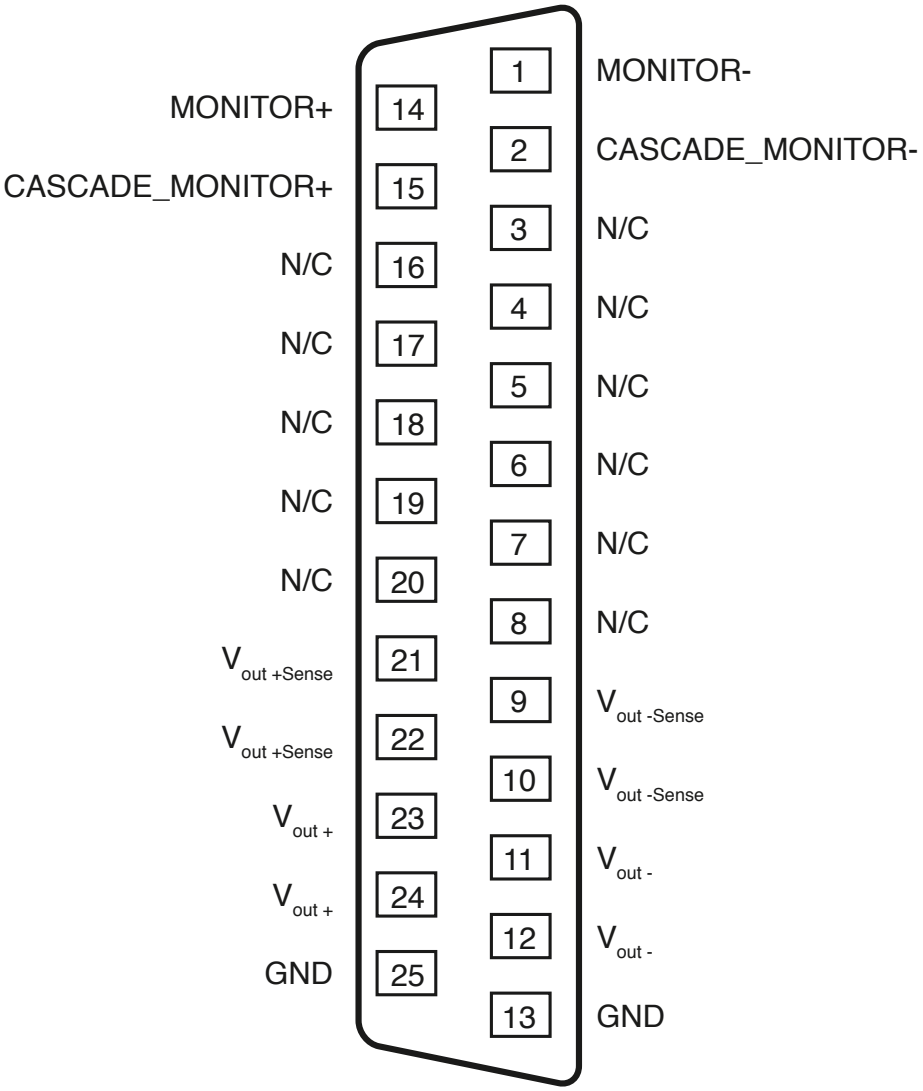


Figure 5.1 - Front Panel Connector Pinout for the Battery Simulator Module 40-750

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SECTION 6 - TROUBLE SHOOTING

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

INSTALLATION PROBLEMS

The Plug & Play functionality of Pickering switch cards generally ensures trouble-free installation.

If you do experience any installation problems you should first ensure that all cards are properly seated in their slots. Improperly mated cards may go undetected by the operating system, or may be detected as a card of an unknown type. They can also cause the computer to freeze at various stages in the boot sequence.

If your system employs a remote control interface you should check the integrity of all remote control interface links. When the system is powered up, and during Windows start-up, you should expect to see periodic activity on the remote control interface RX/TX (yellow) indicators, clearing to leave only the PWR/LNK (green) LEDs illuminated. The RX/TX indicators should show activity when you attempt to access a card.

DIAGNOSTIC UTILITY

The Pickering Diagnostic Utility (accessible through the Programs>>Pickering>>PXI Utilities menu) generates a diagnostic report of the system's PCI configuration, highlighting any potential configuration problems. Specific details of all installed Pickering switch cards are included. All the installed Pickering switch cards should be listed in the "Pilpxi information" section - if one or more cards is missing it may be possible to determine the reason by referring to the PCI configuration dump contained in the report, but interpretation of this information is far from straightforward, and the best course is to contact Pickering support: support@pickeringtest.com, if possible including a copy of the diagnostic report.

In the "VISA information" section, if VISA is not installed its absence will be reported. This does not affect operation using the Direct I/O driver, and is not a problem unless you wish to use VISA. VISA is a component of National Instruments LabWindows/CVI and LabVIEW, or is available as a standalone environment.

If VISA is present and is of a sufficiently recent version, the section "Pipx40 information" should present a listing similar to "Pilpxi information".

Please note that the Diagnostic Utility cannot access cards if they are currently opened by some other application, such as the Test Panels or Terminal Monitor.

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SECTION 7 - MAINTENANCE INFORMATION

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

PERIODIC MAINTENANCE

This product and its corresponding chassis do not require any periodic maintenance.

GENERAL CLEANING

- Isolate the electrical power from the chassis and ensure that no user I/O signals are being applied.
- Wipe the product & chassis surfaces with a clean dry anti-static cloth only.

SOFTWARE UPDATE

For PXI modules operating in a PXI chassis, no module software updates are required. For the latest version of the driver please refer to our web site **pickeringtest.com** where links to our Software Download page will provide the latest version of the driver software for the various programming environments encountered.

For PXI modules which are supported in one of Pickering Interfaces' Modular LXI Chassis (such as the 60-102B and 60-103B) no module software update is required. If the module was introduced after the LXI chassis was manufactured the module may not be recognized, in this case the chassis firmware may need upgrading. This is a simple process which is described in the manual for the Modular LXI Chassis.

CALIBRATION PROCEDURE

The following calibration procedure provides a manual method of testing the 41-750 Battery Simulator for compliance with its specification. The test is designed to ensure that the product is fully functional and is based on the use of a set of Pickering Interfaces load cards and standard cables that can be purchased through your local Pickering Interfaces sales office.

Alternatives to the load cards and cables can be used, but the user may need to adapt the test procedure described.

The procedure assumes the 41-750 is correctly installed in a suitable chassis and the soft front panel described in Section 4 of this manual has been launched.

Required test Equipment

- One or two DMMs with 100µV or better resolution on DC voltage. Most 5½ digit DMM's will meet the requirement.
- Resistive load of 2.14Ω capable of dissipating 16.8W. Recommended Pickering load card part number 44-750-902.
- 25-pin D-type to D-type cable assembly, 2m long. Recommended Pickering part number: 40-970-025-2M

Note: Test fixtures and cable assemblies are available individually or as a bundle, please contact you local Pickering sales office for availability and pricing

Pickering Load Card Description

The load cards provide an easy method of simulating various loads to test the 41-750. Each card contains a distributed resistive load. To ensure accurate measurement, a star connection is used to link the load to the sense lines, power lines and measurement connectors. The measurement connectors use 4mm sockets to allow easy connection for an external DMM.

To enable measurements made via the monitor port, 1mm sockets are provided for the connection of a DMM.

The load cards also allow the easy disconnection of the sense wires to check operation of the battery simulator without the sense connection.

Load cards can be provided with other load values or without the resistive loads fitted (44-750-901) to allow the user to perform checks corresponding more closely to the battery simulator's application.

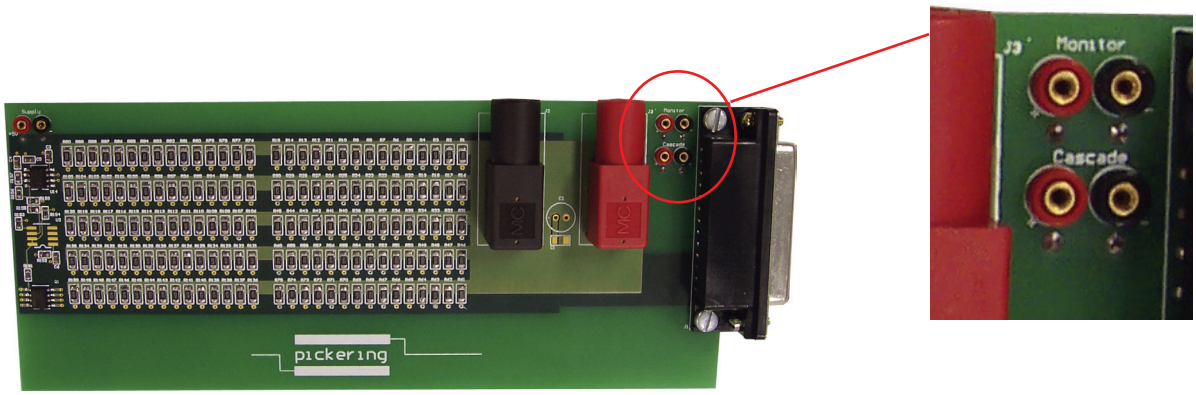


Figure 7.1 - Location of Monitor Port Connections on a Load Card

TEST PROCEDURE

Output Voltage Check

Connect a load that draws a current of 2.8 Amps at 6V (2.14Ω) and is capable of dissipating 16.8 Watts directly to the front panel connector of the battery simulator. Also, the sense lines from the front panel connector should be connected directly to the load. This is provided by load card 44-750-902.

Connect a DMM at the point where the sense lines join the load and measure the voltage with the battery simulator's output set as shown in the table below. Record the results and check against the specification.

Output Voltage Set	Output Voltage Measured	Specification limit (0.1% ± 0.015V)	
		Min	Max
0V		-0.015V	+0.015V
1V		0.984V	1.016V
2V		1.983V	2.017V
3V		2.982V	3.018V
4V		3.981V	4.019V
5V		4.98V	5.02V
6V		5.979V	6.021V

Monitor Check

Connect a 2.14Ω load, such as a 44-750-902 load card, to the battery simulator using a 2m long D-Type lead (40-970-025-2M).

Set the battery simulator's output voltage to 5V.

Connect a DMM to the 4mm sockets of the load card's measurement port. Measure the voltage across the load and record result - it should nominally be 5V.

Disconnect the DMM from the load card's measurement port and re-connect it to the 1mm sockets of the monitor port.

Via the soft front panel, set the monitor port to **Sense Voltage**. Check that the DMM reads the same as the load voltage within 5mV.

Set the monitor port to **Source Voltage**. The DMM should now read more than the load voltage, the exact value being dependent on the cable losses.

Set the monitor port to **Load Current**. Check the DMM now reads nominally 54.48mV, corresponding to a current of 2.27A as the voltage is measured across a 0.024Ω resistor.

> **Note:** The exact value depends on the load current. This test is designed to simply check the functionality of the port. If an accurate measurement is needed a second DMM should be inserted to read load current while the monitor current is measured.

Set the battery simulator's current sink to 0.2 Amps. Set the monitor port to **Sink Current** and measure with the DMM. The voltage should read nominally 20mV corresponding to 200mA across 0.1Ω.

Measurement	Result	Specification
Load Voltage		
Monitor sense voltage		Should be within 5mV of measured load voltage
Monitor output voltage		Should be greater than measured load voltage, typically by 10mV when using recommended lead
Monitor load current		54.5mV nominal Typical range 52 to 58mV dependent on load accuracy
Monitor current sink		20mV nominal Typical range 18 to 22mV

Sense Line Operation

Connect a load, such as a 44-750-902 load card, directly to the battery simulator's front panel connector.

Set the battery simulator's output voltage to 5V.

Connect a DMM to the 4mm sockets of the load card's measurement port. Measure the voltage across the load and record result.

Remove the load card and reconnect it to the battery simulator via a 2m long cable (40-970-025-2M). Measure the load voltage and check it is the same as the previous reading to within 10mV.

Disconnect the positive sense wire from the load (accomplished by removing the jumper on the load card). Check that the output voltage drops to less than 1V.

> **Note:** This assumes that the battery simulator is set to the default mode where the module shuts down the output if the sense line is disconnected from the load. In the alternate configuration it will regulate the output voltage at the module's front panel connector.

Reconnect the positive sense wire and disconnect the negative sense wire from the load (accomplished by removing the jumper on the load card). Check that the output voltage drops to less than 1V.

> **Note:** This assumes that the battery simulator is set to the default mode where the module shuts down the output if the sense line is disconnected from the load. In the alternate configuration it will regulate the output voltage at the module's front panel connector.

Test	Result	Specification
Load voltage, no cable		
Load voltage, 2m cable		Within 10mV of voltage with no cable
Disconnect positive sense wire		Output voltage < 1V or regulates at front panel according to configuration
Disconnect negative sense wire		Output voltage < 1V or regulates at front panel according to configuration

TEST RESULTS

This page can be printed and used to record the results of a calibration procedure.

Part Number:	
Serial Number:	
Date of Calibration:	
Operator's Name:	
Test Equipment Used	

Voltage Test with 2.14Ω Load

Output Voltage Set	Output Voltage Measured	Specification limit (0.1% ± 0.015V)	
		Min	Max
0V		-0.015V	+0.015V
1V		0.984V	1.016V
2V		1.983V	2.017V
3V		2.982V	3.018V
4V		3.981V	4.019V
5V		4.98V	5.02V
6V		5.979V	6.021V

Monitor Check at 5V Output

Measurement	Result	Specification
Load Voltage		
Monitor sense voltage		Should be within 5mV of measured load voltage
Monitor output voltage		Should be greater than measured load voltage, typically by 10mV when using recommended lead
Monitor load current		54.5mV nominal Typical range 52 to 58mV dependent on load accuracy
Monitor current sink		20mV nominal Typical range 18 to 22mV

Sense Line Operation

Test	Result	Specification
Load voltage, no cable		
Load voltage, 2m cable		Within 10mV of voltage with no cable
Disconnect positive sense wire		Output voltage < 1V or regulates at front panel according to configuration
Disconnect negative sense wire		Output voltage < 1V or regulates at front panel according to configuration

ALIGNMENT PROCEDURE

Install the module in the chassis and launch the Soft Front Panel. Next, launch the Calibration Soft Front Panel by selecting **Calibration** from the **Options** menu.

The Calibration Soft Front Panel will pop up as shown in Figure 7.2.

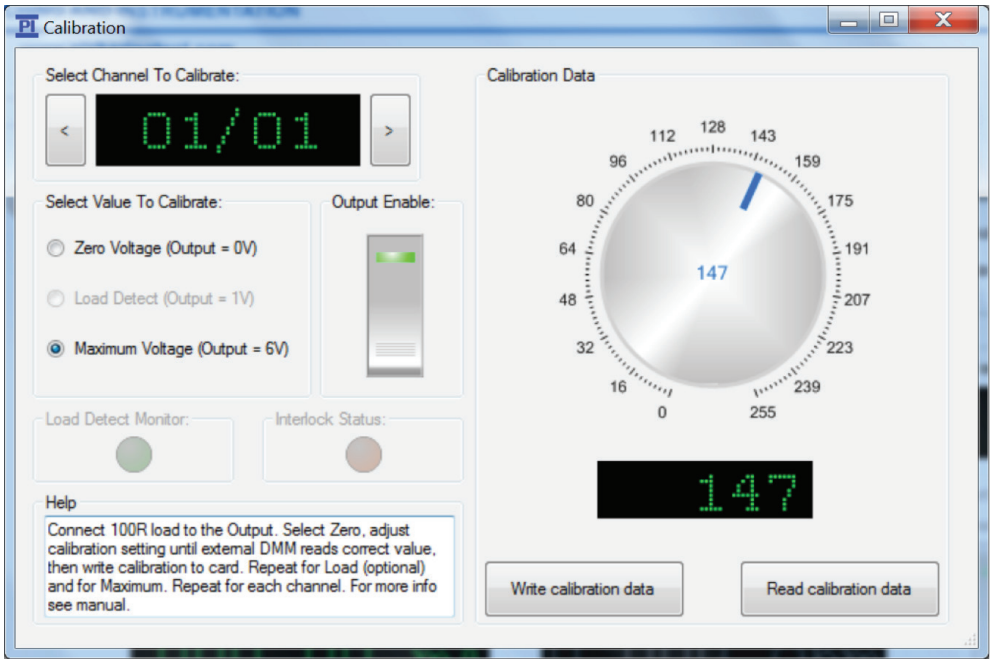


Figure 7.2 - Windows Calibration Soft Front Panel

This panel provides two additional controls for the user to select: **Zero Voltage** and **Maximum Voltage** buttons on the left of the panel. **Zero Voltage** and **Maximum Voltage** are used to set the minimum and maximum voltage output from the module.

Connect load card 44-750-902 to the module and connect a DMM to the monitor port.

From the Soft Front Panel set the monitor port to measure sense voltage.

From the Calibration Panel, select the **Zero Voltage** button, and adjust the rotary control or use the up/down arrows on the keyboard until the DMM reads as close to zero volts as possible. When complete, click the **Write calibration data** button to store the value in non-volatile memory.

From the Calibration Panel, select the **Maximum Voltage** button, and adjust the rotary control or use the up/down arrows on the keyboard until the DMM reads as close to 6 Volts as possible. When complete, click the **Write calibration data** button to store the value in non-volatile memory.

Check that the 0V setting is still correct, if further adjustment is needed repeat the procedure.

The **Load Detect** function is not implemented on the 41-750 module and is grayed out on the Calibration Panel.

Record the results of the calibration procedure in the Alignment Test Record overleaf.

ALIGNMENT TEST RECORD

Part Number:	
Serial Number:	
Date of Calibration:	
Operator's Name:	
Test Equipment Used	

	Previous setting	New setting
Zero Voltage adjustment		
Maximum Voltage adjustment		