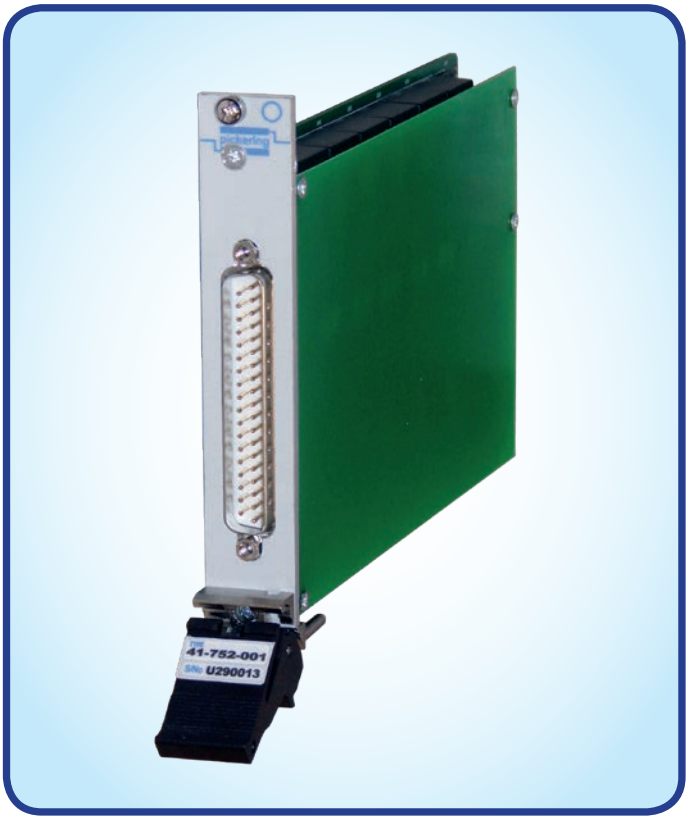
User Manual

PXI

6-Channel Battery Simulator Module
(Model No. 41-752)



Issue 4.2 September 2019

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ISO 9001
Reg No. FM38792

TECHNICAL SUPPORT

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

WARRANTY

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.

ENVIRONMENTAL POLICY

Pickering Interfaces operates under an environmental management system similar to ISO 14001.

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

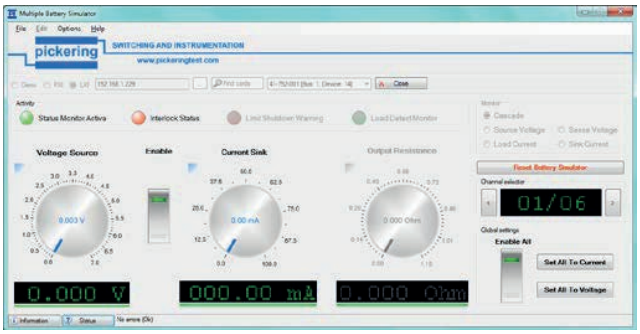
- 6 Power Supplies In A Single PXI Slot
- Independent Sense Connections
- Ideal For Battery Stack Emulation
- 750V Independent Isolation Barriers
- Up To 300mA Output Per Simulator
- Battery Charging Emulation To 100mA
- Uses Backplane Power Sources
- Hardware Shutdown Control
- VISA and Kernel Drivers Supplied For Windows Plus Soft Front Panel
- Use In Pickering 19-Slot PXI Chassis Or 18-Slot LXI Chassis



The 41-752 is a 6 channel battery simulator, capable of supplying up to 7V and 300mA per channel. Each channel is fully isolated from ground and from each other allowing series connection to simulate batteries in a stacked architecture. The 750V isolation barrier allows the module to be used as a lower power version of a battery stack representative of those used for vehicle propulsion.

Each channel provides independent power and sense connections, allowing the battery simulator to sense a remote load and correct for wiring losses. The battery simulator is designed to respond to dynamic loads, minimizing the need for local decoupling capacitors at the load.

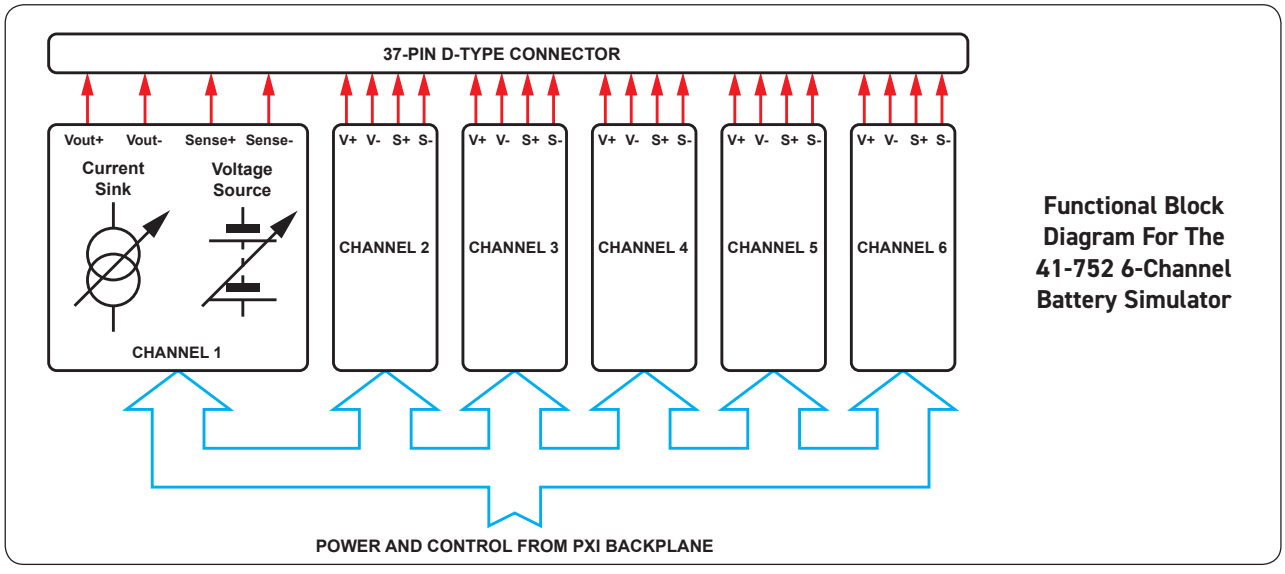
A control line on the user connector allows the user to shutdown all battery simulator channels with one signal. Multiple control lines may be linked together to provide an easy way of inhibiting the output when using many series connected modules. This also provides a means of automatic shutdown when connectors are removed.



Soft Front Panel for Battery Simulator Modules

The 41-752 can be used as a 6 channel fully isolated power supply with independent sense lines on each channel.

The user connector is a 37-pin high voltage D-type which is fully supported by the wide range of Pickering Interfaces connector accessories.



Functional Block Diagram For The 41-752 6-Channel Battery Simulator

Specification

Number of Channels:	6 independent isolated channels.
Output Voltage Range:	0 to 7V, settable with 14-bit resolution (approximately 0.43mV).
Output Voltage Accuracy:	±0.2% ±20mV from 1V to 7V output over ambient temperature range +11°C to +31°C.
Isolation Voltage:	±750V
Output Current:	Up to 300mA per channel for voltages from 2.5V to 7V Linearly de-rate to 200mA into a short circuit below 2.5V without thermal shutdown.
Current Sink:	Variable current sink permits the output to be loaded so the battery simulator can sink current from a charger. Current sink can be set from 0 to 100mA in 16 steps. Current sink setting reduces the current available at the user connector.
Output Connections:	Vout+, Vout- and two sense inputs for each simulator channel. Sense inputs detect output voltage at front panel connector if no remote sense lines are connected.
Load Response Time:	250µs
Power Source:	PXI backplane +12V, +5V, +3.3V and -12V.

Power Requirements

+3.3V	+5V	+12V	-12V
0.8A	2.0A	0.6A	0.3A

At maximum load for all channels,

Recommended chassis are 60-103 and 60-103A or 40-923 and 40-923A for applications requiring many modules (up to 18 off) in a single chassis to avoid chassis limitations.

Mechanical Characteristics

Single slot 3U PXI (CompactPCI card).
3D models for all versions in a variety of popular file formats are available on request.

Connectors

PXI bus via 32-bit P1/J1 backplane connector.
Signals via front panel 37-pin male high voltage D-type connector, for pin outs please refer to the operating manual.

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 EN61010-1:2010, EMC Immunity EN61326-1:2013, Emissions EN55011:2009+A1:2010.*

Product Order Codes

Battery Simulator, 6-Channel	**41-752-001**

Product Customization

Pickering PXI modules are designed and manufactured on our own flexible manufacturing lines, giving complete product control and enabling simple customization to meet very specific requirements.

All customized products are given a unique part number, fully documented and may be ordered at any time in the future. Please contact your local sales office to discuss.

Mating Connectors & Cabling

For connection accessories for the 41-752 module please refer to the 90-007HVD 37-pin High Voltage D-type Connector Accessories data sheet where a complete list and documentation can be found for accessories, or refer to the Connection Solutions catalog.

Chassis Compatibility

This PXI module must be used in a suitable chassis. It is compatible with the following chassis types:

- All chassis conforming to the 3U PXI and 3U Compact PCI (cPCI) specification
- Legacy and Hybrid Peripheral slots in a 3U PXI Express (PXIe) chassis
- Pickering Interfaces LXI or LXI/USB Modular Chassis



Chassis Selection Guide

Standard PXI or hybrid PXIe Chassis from any Vendor:

- Mix our 1000+ PXI switching & simulation modules with any vendor's PXI instrumentation
- Embedded or remote Windows PC control
- Real-time Operating System Support
- High data bandwidths, especially with PXI Express
- Integrated module timing and synchronization

Pickering LXI or LXI/USB Modular Chassis—only accept our 1000+ PXI Switching & Simulation Modules:

- Ethernet or USB control enables remote operation
- Low-cost control from practically any controller
- LXI provides manual control via Web browsers
- Driverless software support
- Power sequencing immunity
- Ethernet provides chassis/controller voltage isolation
- Independence from Windows operating system



Connectivity Solutions

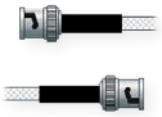
We provide a full range of supporting cable and connector solutions for all our switching products—20 connector families with 1200+ products. We offer everything from simple mating connectors to complex cables assemblies and terminal blocks. All assemblies are manufactured by Pickering and are guaranteed to mechanically and electrically mate to our modules.



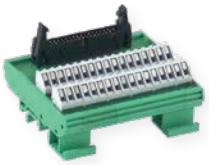
Connectors & Backshells



Multiway Cable Assemblies



RF Cable Assemblies



Connector Blocks

We also offer customized cabling and have a free online Cable Design Tool that can be used to create custom cable solutions for many applications.
Visit: pickeringtest.com/cdt to start your design.



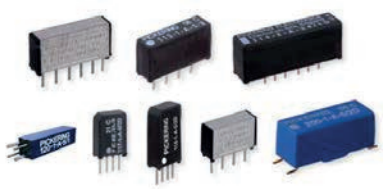
Mass Interconnect

We recommend the use of a mass interconnect solution when an Interchangeable Test Adapter (ITA) is required for a PXI or LXI based test system. Our modules are fully supported by both Virginia Panel and MacPanel.

Pickering Reed Relays

We are the only switch provider with in-house reed relay manufacturing capability via our sister company, Pickering Electronics. These instrument grade reed relays feature ***SoftCenter***® technology, ensuring long service life and repeatable contact performance

To learn more, please go to: pickeringrelay.com



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: 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**
- **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
- **MTQ Testsolutions** Tecap Test & Measurement Suite

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

We provide Soft Front Panels (SFPs) for our products for familiarity and manual control, as well as comprehensive documentation and example programs to help you develop test routines with ease.

To learn more about software drivers and development environments, please go to: pickeringtest.com/software

Signal Routing Software



Our signal routing software, Switch Path Manager, automatically selects and energizes switch paths through Pickering switching systems. Signal routing is performed by simply defining test system endpoints to be connected together, greatly accelerating Test System software development.

To learn more, please go to: pickeringtest.com/spm

Diagnostic Relay Test Tools



eBIRST Switching System Test Tools are designed specifically for our PXI, PCI or LXI products, these tools simplify switching system fault-finding by quickly testing the system and graphically identifying the faulty relay.

To learn more, please go to: pickeringtest.com/ebirst

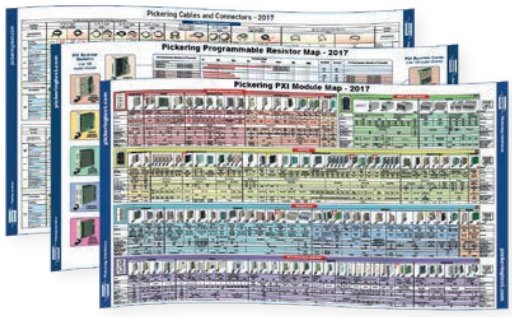
Three Year Warranty & Guaranteed Long-Term Support

All standard products manufactured by Pickering Interfaces are warranted against defective materials and workmanship for a period of three years from the date of delivery to the original purchaser. Extended warranty and service agreements are available for all our modules and systems with various levels to suit your requirements. Although we offer a 3-year warranty as standard, we also include guaranteed long-term support—with a history of supporting our products for typically 15-20 years. To learn more, please go to: pickeringtest.com/support

Available Product Resources

We have a large library of product resources including success stories, product and support videos, articles, as well as complete product catalogs and product reference maps to assist when looking for the switching, simulation and cable and connector solutions you need. We have also published handy reference books for the PXI and LXI standards.







To view, download or request any of our product resources, please visit: pickeringtest.com/resources

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SECTION 2 - TECHNICAL DESCRIPTION

FUNCTIONAL DESCRIPTION

The 41-752 is a six channel battery simulator designed to simulate the performance of six separate batteries and is suitable for testing equipment that employ a battery stack.

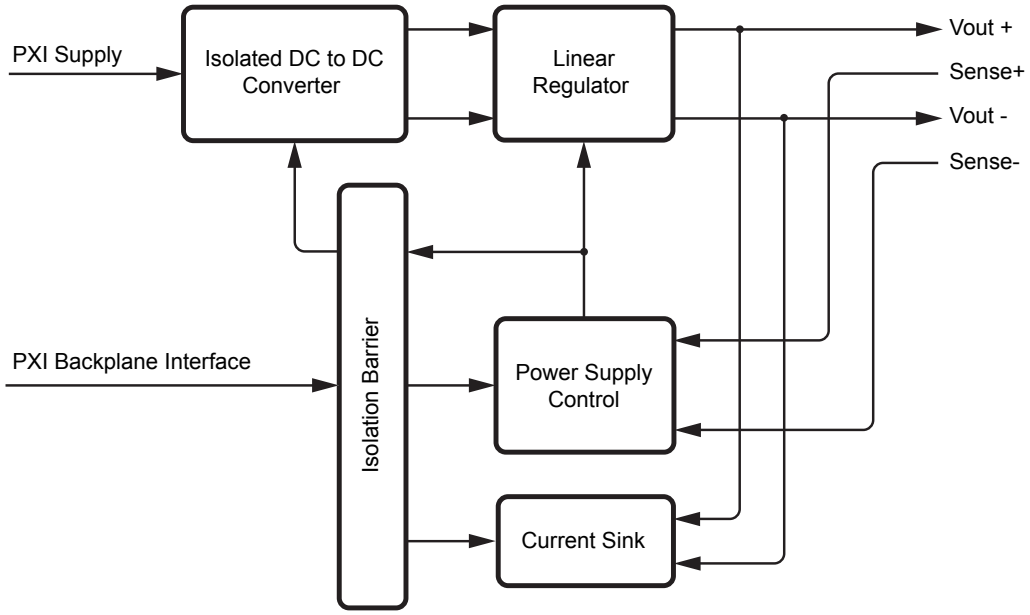


Figure 2.2 - Functional Block Diagram - Single Channel Shown

The battery simulator uses an isolated DC to DC converter system that provides a fixed voltage to a linear regulator. The control system for the linear regulator is powered from separate DC to DC converters (not shown). The linear regulator provides an output voltage of between 0 and 7V to the output terminals. The use of remote sense connections allows the batter simulator to sense the supplied voltage at the load, permitting the regulator to correct for voltage drops in the connecting wires.

The 41-752 also includes a programmable current sink that allows the outputs to sink as well source current, simulating the ability of a battery to accept a charging current from a battery charger.

USING THE 41-752 BATTERY SIMULATOR

Sense Line Connections

The two sense lines for each channel of the battery simulator should be connected to the remote load so the battery simulator corrects for any voltage drop in the connecting wires. If the sense wires are not connected to the remote load the battery simulator will sense the voltage at the module front panel and regulate the voltage to the requested value.

Isolation

Each battery simulator channel is fully isolated and can withstand a common voltage of up to 750V relative to PXI ground.

It is recommended that one point of the battery simulator chain output is referred to a reference voltage (for example ground on the most negative series cell) in order to avoid the unintended creation of high common mode voltages. The connection to a reference voltage can be a low resistance connection (for example a wire) or a high value resistance (e.g. 100kΩ) that can be easily driven by the user to the required output voltage.

Current Sinking

If the user wishes to allow the 41-752 to sink current (i.e. behave like a battery when connected to a charger) as well as source current then the internal current sink should be set. The output regulator can only source current, so the ability to sink current like a battery is achieved by adding a programmable current sink that loads the output with a known amount of current even when there is no load current.

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

The sink current programmed can limit the current that can be delivered to the load. The sink current is made to be programmable so the user can set the current to suit the charger capacity. Normally the sink current should be set to the maximum charger current expected.

It should be noted that the current sinks only operate correctly for output voltages above 0.5 Volts.

In applications where a charging simulator may be present and the output current required is 200mA or less it is recommended that user sets the current sink to 100mA.

If the battery simulator channel is connected to a charger whose output current exceeds the sum of the current sink set and the load current, the output voltage of the channel will rise above the set value of the channel voltage. Typically it initially rises by 100mV above the set value for low excess currents and then then increases with increasing excess charger current. The output voltage accuracy and regulation characteristics will be degraded. No damage will occur to the channel for all reasonable charger implementations.

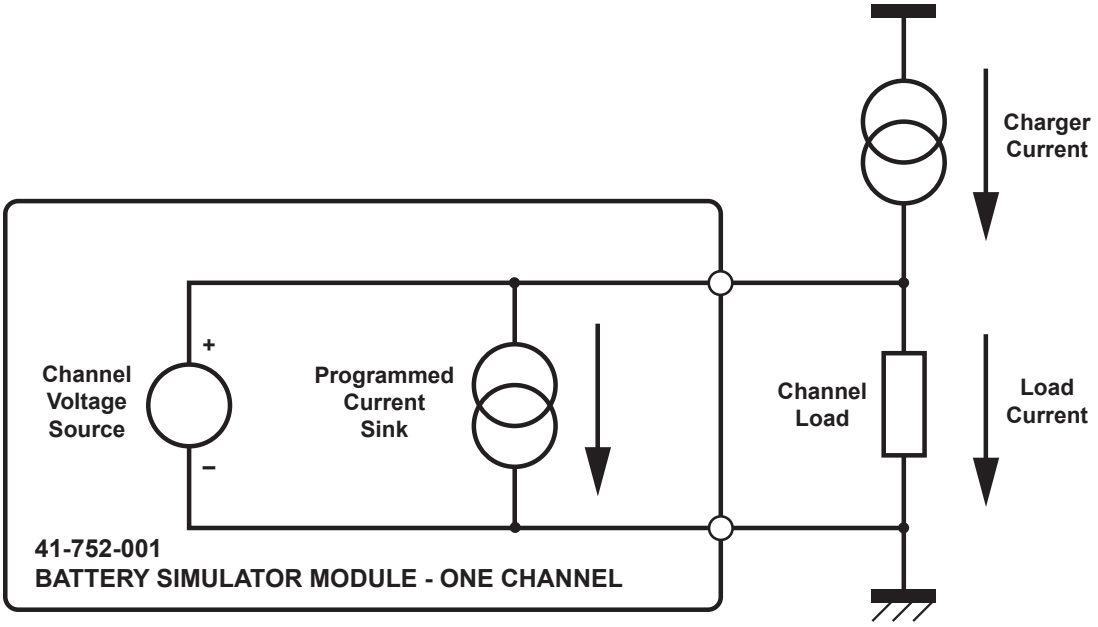


Figure 2.3 - Connection of the Battery Simulator to a Charging Circuit

Transient Load Response

The 41-752 has been designed to provide a very fast recovery from transient loads. However, if the load has an excessively large capacitive component then the need to charge this capacitance can limit the response time. The power supply includes an internal 22µF load.

Cooling and Chassis Considerations

The 41-752 can dissipate high internal powers and use high backplane currents. When using many 41-752 in a chassis users should:

Ensure the chassis has an adequate PSU source under all anticipated load conditions. The data sheet indicates the backplane current requirements for each module under the highest rated load conditions (all channels). The current demand for each voltage can be deduced from the number of modules fitted to the chassis.

If the chassis supports speed controlled fans it is recommended that the speed of the cooling fans is set to maximum rather than left under automatic control. Information on how to set the speed control (if present) should be in the manual.

Users should ensure that when rack mounting or bench mounting adequate ventilation space is allowed. Users should follow the chassis vendor recommendations.

Pickering Interfaces strongly recommends the use of 60-103 (LXI) or 40-923 (PXI) chassis for applications requiring large numbers of 41-752 modules. These chassis have adequate PSU and cooling capacity to be fully populated by 41-752 modules and are the chassis that Pickering Interfaces has tested the modules in. The chassis should be set to maximum fan speed, and if desk mounted, the front feet should be raised to allow maximum air flow.

41-752 INTERLOCK SYSTEM

The 41-752 can be used for simulating large numbers of series connected batteries which can potentially generate high output voltages relative to PXI ground. The user connector has an interlock feature that can be used to inhibit the generation of output voltage if the user connector is not in place.

The user connector has the following control pins:

- A 3.3V output from a 100Ω series protection resistor
- A connection to PXI Front Panel Ground
- An Enable pin which is by default pulled low by a 10kΩ resistor. NO OUTPUT VOLTAGE WILL BE GENERATED BY THE BATTERY SIMULATOR UNLESS THIS PIN VOLTAGE IS RAISED TO 3.3V. The pin can be raise to 3.3V by connecting to the supplied 3.3V pin above. This is a global Enable for all 6 channels on the module. If the Enable pin is allowed to be set low then the 41-752 will continue to disable its battery simulator outputs until the software resets the channels to be on.
- A Status Readback pin which is raised to 3.3V when the Enable pin is set high AND the software has reset the 41-752 to enable the battery simulator output. This is available as physical signal on the user connector and its status can be read back over the PCI interface by the software driver.

In addition the software driver can turn individual battery simulator channels on and off.

The interlock can be used in a variety of ways when multiple modules are used in a system:

- All the Enable pins can be linked together and a single switch used to pull the Enable high to 3.3V. The enable pin can be pulled high using a user connection. The software driver can then enable or disable individual channels.
- All but one of the Enable pins can be connected together and connected to the Readback Status pin of one of the modules (Master Module). The Master Module then has its Enable pin connected high (3.3V). To restart the system the software driver would then have to enable each module through the Master Module's Module Enable and then turn on each battery simulator through its Module Enable. To avoid high dynamic loads on the chassis backplane Pickering Interfaces recommends that each module is restarted in a sequence that avoids an excessively high rate of PSU load change.
- Each module can be independently controlled by linking its Enable pin to its 3.3V pin, if the user connector is disconnected the battery simulator will shut down and will require restarting through its software driver control. The act of removing the user connection will in any case remove that module from the serial chain and disrupt the generation of output voltage.
- The Status Readback output from one module can be connected to the Enable of the next module in the series chain. Disconnection of the user connector will result in all modules further down the chain being turned off. As in the previous cases when the user connection is re-established the software drive will need to restart the system.

It should be emphasized that if the Enable pin of the module is set low, even temporarily, the 41-752 will not automatically turn back on when the Enable returns high. The software driver must be used to turn the channels back on.

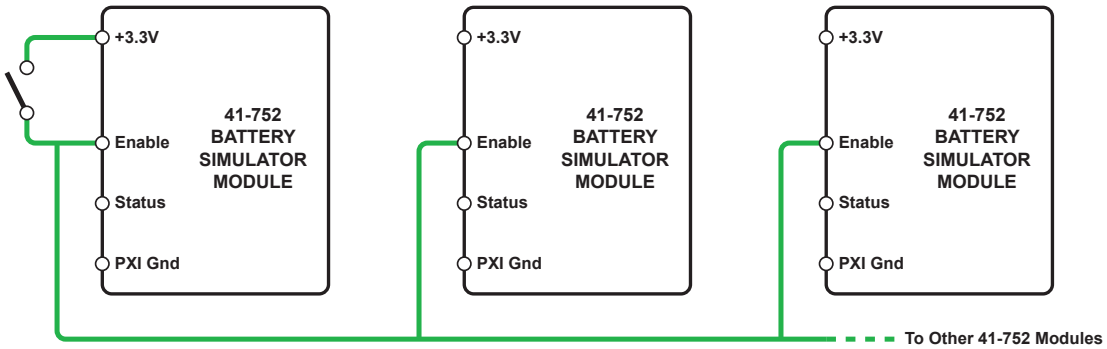


Figure 2.4 - All 41-752 Modules Enabled by a Common Signal

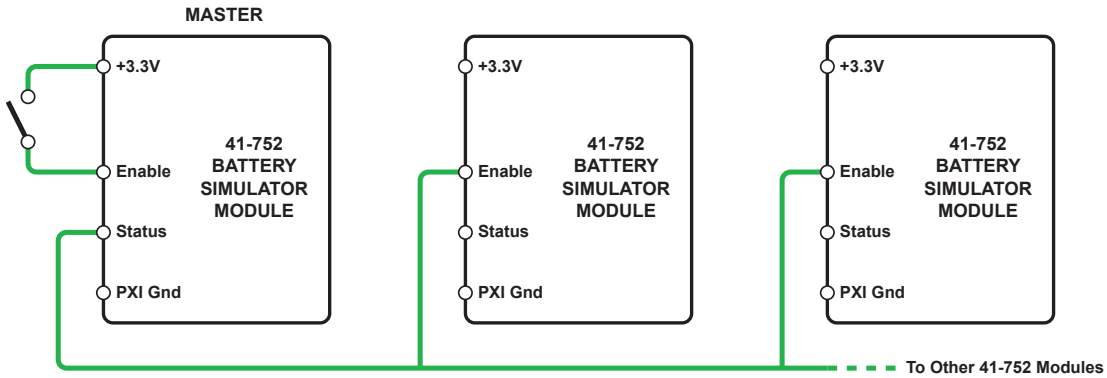


Figure 2.5 - 41-752 Modules Enabled by a Master Module

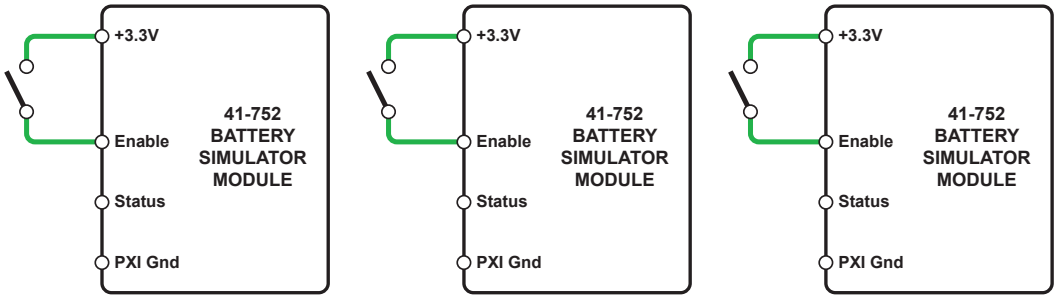


Figure 2.6 - Each 41-752 Module Enabled Independently

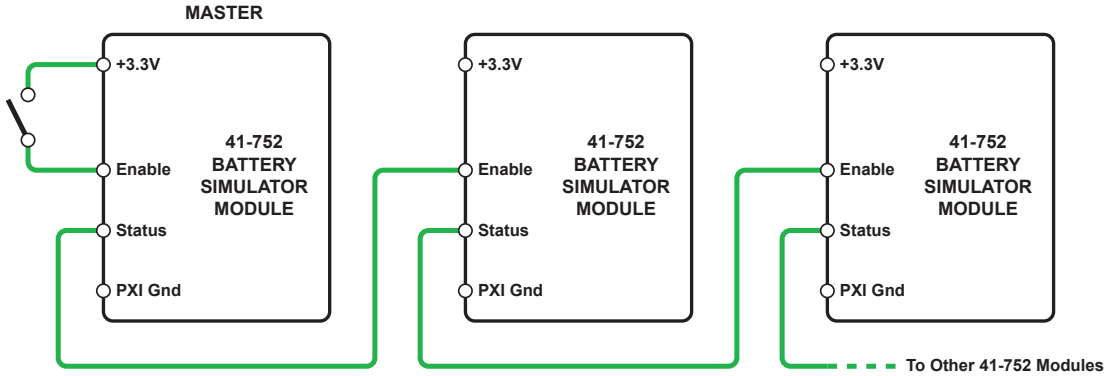


Figure 2.7 - 41-752 Module Enables Daisy-Chained From a Master

CONNECTING BATTERY SIMULATOR CHANNELS IN SERIES

Each channel of the 41-752 is fully isolated from PXI ground and from each other, allowing users to connect channels in series and simulate battery stacks typically seen in automotive electric drive systems.

To connect the channels in series, simply connect the positive terminal of one channel to the negative terminal of another. In a typical application 16 modules can be connected in series to simulate a 96 channel battery stack. Pickering Interfaces recommends that the 6 channels of the 41-752 are wired together (so each module provides a contiguous stack of 6 battery channels in series) in order to make the operation of the system easier to understand and to minimize the inter-channel voltage on each module. It also provides a more logical behaviour in using the Interlock System and minimizes wiring lengths.

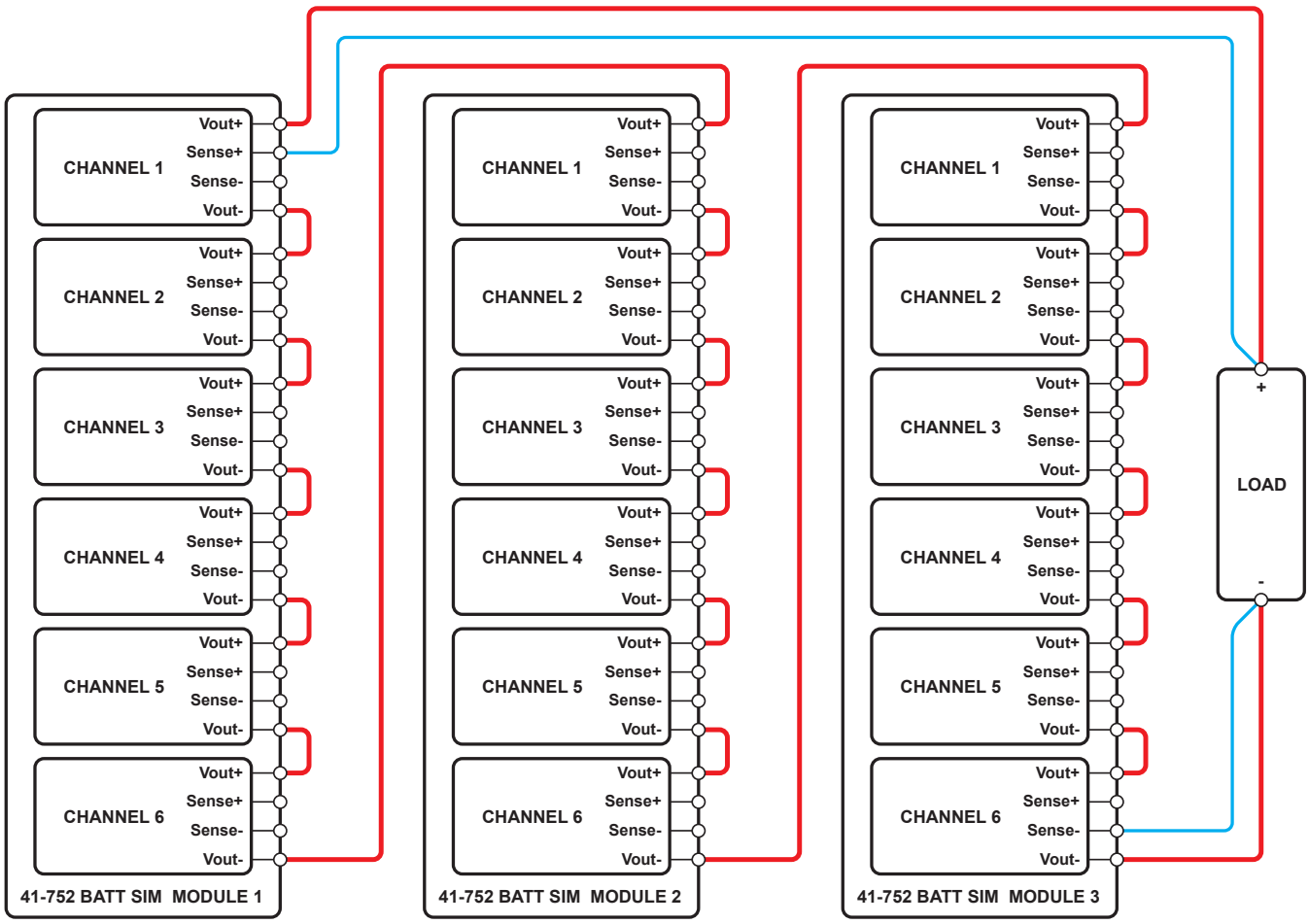


Figure 2.8 - 18 Battery Simulator Channels Connected In Series with sense lines at each end connected to the remote load

The sense connections on each channel can either be left uncommitted, in which the battery simulator will regulate the voltage at the user terminals or connected to a load. If the wring length is short when connecting in series this is usually the best method. However, the channels at the extreme ends of the chain can connect their sense line (positive at the positive end of the chain, the negative at the negative end of the chain) to a reference point (typically the load or the defined battery interface).

When using battery channels in series it is recommended that all the battery channels are turned on and set to a realistic output voltage. The behaviour of battery channels when turned off, as described in the following section, should be noted.

BATTERY SIMULATOR ON/OFF CONTROL

Each channel of the 41-752 can be independently turned off. Users need to recognise real life batteries do not “turn off” in the way a relay (for example) does. If a channel is off it cannot provide any current to the load and it will effectively disconnect the entire battery stack from the load. To prevent damage to the channel each output from the 41-752 includes a diode that conducts if a negative voltage is applied to its output. In the event that a channel is turned off in a chain of series connected channels a negative voltage will appear across channel output due to this diode. This effect is not destructive. The diode can carry currents of up to 3A without damage, significantly greater than the current that can be generated in the battery simulator.

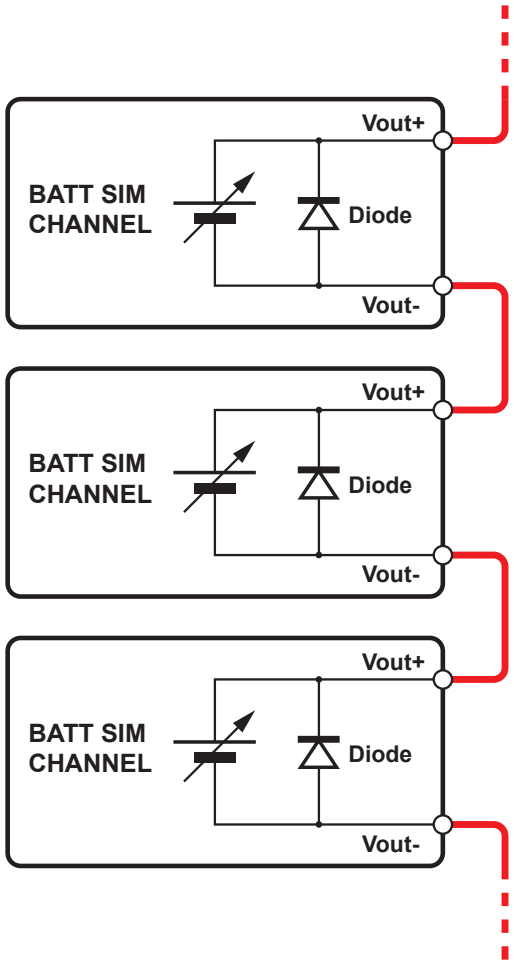


Figure 2.9 - Battery Simulator Output Protection Diode

In typical applications to avoid confusing behaviour of a battery stack we recommend that rather than turning a channel off, the user sets the channel to a convenient low value of output voltage, typically between 0V and 1V.

ACCESSORIES

Pickering Interfaces offer a range of break out boxes that support all the connectors used on its products. These break out boxes provide a simple way of connecting to fully enclosed terminal blocks rather than directly to the D-type connector and they incorporate cable grips to resist wire breakage. For the 41-752, which uses a 37-pin D-type connector, Part Number 40-965-037 can be used.

HOWEVER, FOR APPLICATIONS WHERE MANY SERIES CHANNELS ARE USED TO GENERATE A HIGH VOLTAGE BATTERY STACK, WE DO NOT RECOMMEND THE USE OF CONNECTOR BLOCKS. THE USE OF HIGH VOLTAGE CABLE PARTS IS RECOMMENDED TO AVOID SAFETY ISSUES AND TO MINIMISE THE RISK OF VOLTAGE BREAKDOWN BETWEEN THE BATTERY SIMULATOR CHANNELS AND FRONT PANEL GROUND.



Figure 2.10 - 37-pin D-type Breakout Box

Pickering can also provide cables for extending the 37-pin D-type connection to a remote point.

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.

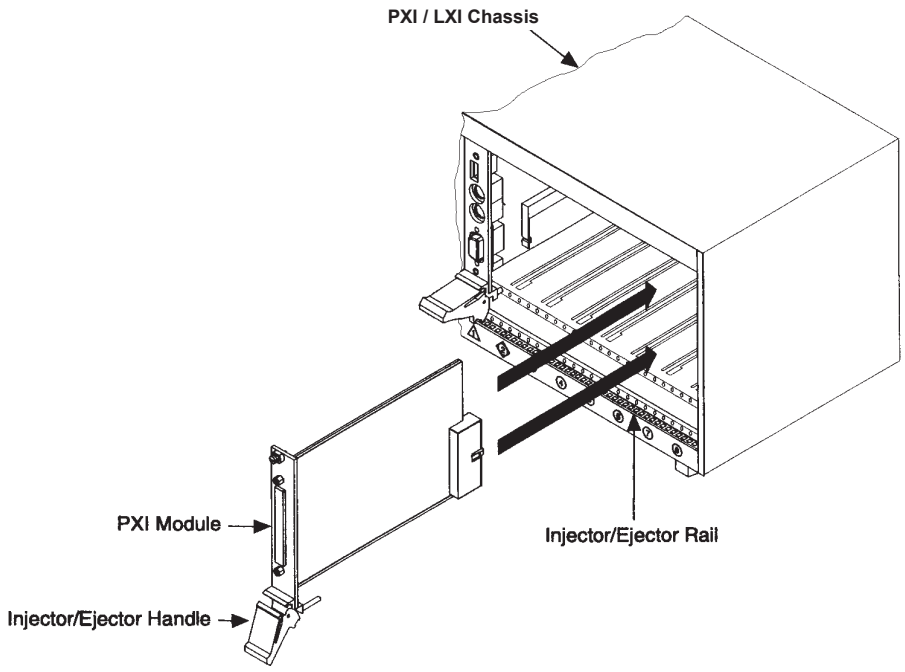


Figure 3.1 - Installing the Module into a PXI/cPCI/LXI Chassis

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.

1. Locate and run the installer package titled '41-752 Soft Front Panel Setup.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' 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 41-752 soft front panel' menu item in 'Programs > Pickering > 41-752'

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

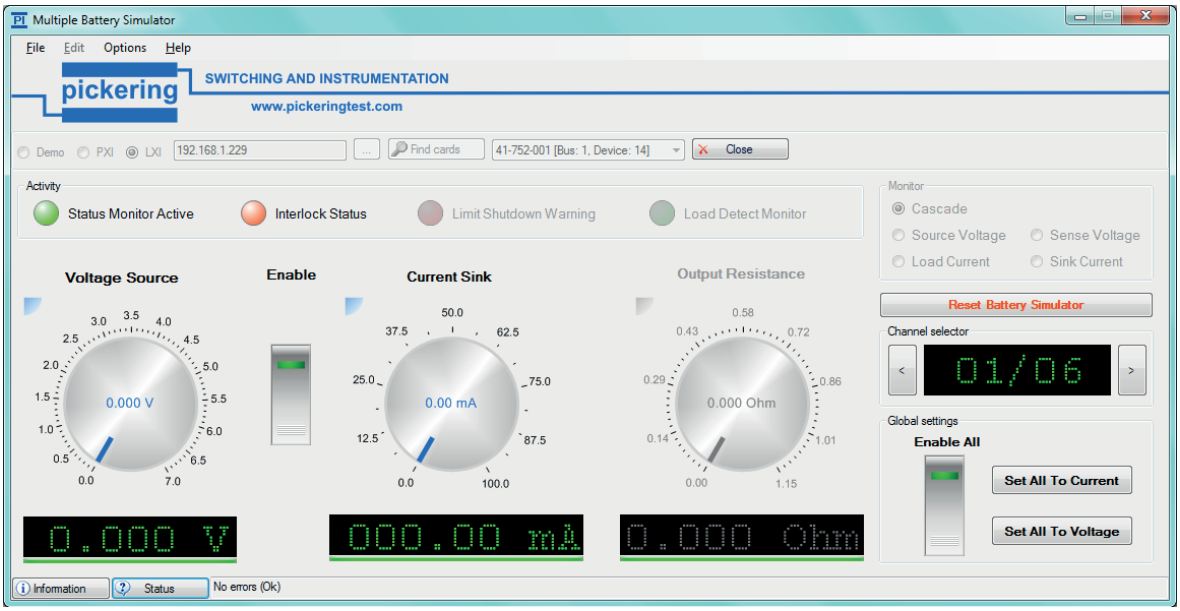


Figure 3.2 - Soft Front Panel For The Battery Simulator

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SECTION 4 - PROGRAMMING GUIDE

PROGRAMMING OPTIONS FOR PICKERING INTERFACES PXI CARDS

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

PROGRAMMING THE 41-752

The 41-752 Battery Simulator uses the same driver software as the Pickering range of switches, pilpxi or pipx40, requiring version 3.05 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 41-752 contains 13 output sub-units. The purpose of each of these is described below:

Sub-Unit	Size (Bits)	Purpose
Output 1-6	14	Channels 1 to 6 Voltage DACs (raw binary access)
Output 7-12	16	Channels 1 to 6 Current Sink (raw binary access)
Output 13	6	Output Enables for Channels 1 to 6 (raw binary access) 000001B = Channel 1 enable 000010B = Channel 2 enable 000100B = Channel 3 enable 001000B = Channel 4 enable 010000B = Channel 5 enable 100000B = Channel 6 enable

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

SET AND READ BACK AN OUTPUT VOLTAGE

C code example using the Direct Driver (requires Pilpxi.h and Pilpxi.lib found in the Pickering folder structure)

```
DWORD     l_CardNum;     //assumed you have opened the card using OpenCards() or OpenSpecifiedCard()
DWORD     l_SubUnit;
double l_Val;

SubUnit = 3;                                                    //Select the 3rd channel
l_RetCode = PIL_BattSetEnable(l_CardNum, l_SubUnit, 1);         //enable the output for channel 3
l_Val = 5.43;                                                   //request 5.43 volts
l_RetCode = PIL_BattSetVoltage(l_CardNum, l_SubUnit, l_Val); //select voltage specified in l_Val

l_RetCode = PIL_BattGetVoltage(l_CardNum, l_SubUnit, &l_Val);//get the current voltage into l_Val
                                                                //rounded to nearest obtainable value

SubUnit = 0;                                                    //Select all channels
l_RetCode = PIL_BattSetEnable(l_CardNum, l_SubUnit, 0x3F);   //enable output for channels 1 to 6
l_Val = 5.43;                                                   //request 5.43 volts
l_RetCode = PIL_BattSetVoltage(l_CardNum, l_SubUnit, l_Val); //select voltage specified in l_Val
```

SET AND READ BACK A SINK CURRENT

C code example using the Direct Driver (requires Pilpxi.h and Pilpxi.lib found in the Pickering folder structure)

```
DWORD     l_CardNum;     //assumed you have opened the card using OpenCards() or OpenSpecifiedCard()
DWORD     l_SubUnit;
double l_Val;

SubUnit = 3;                                                    //Select the 3rd channel
l_Val = .03;                                                    //request to sink .03Amps
l_RetCode = PIL_BattSetCurrent(l_CardNum, l_SubUnit, l_Val); //select the Sink Current in l_Val

l_RetCode = PIL_BattGetCurrent(l_CardNum, l_SubUnit, &l_Val);//get the current sink current l_Val
                                                                //rounded to nearest obtainable value

SubUnit = 0;                                                    //Select all channels
l_Val = .03;                                                    //request to sink .03Amps
l_RetCode = PIL_BattSetCurrent(l_CardNum, l_SubUnit, l_Val); //select the Sink Current in l_Val
```

READ THE INTERLOCK STATE

C code example using the Direct Driver (requires Pilpxi.h and Pilpxi.lib found in the Pickering folder structure)

```
DWORD     l_CardNum;     //assumed you have opened the card using OpenCards() or OpenSpecifiedCard()
DWORD     l_SubUnit;
double l_Val;
BOOL l_InterlockState;

SubUnit = 0;                                                    //0 to 6 returns the same value
l_RetCode = PIL_BattReadInterlockState(l_CardNum, l_SubUnit, &l_InterlockState);
                                                                //Battery interlock state
```

CALIBRATION

The 40-752 is calibrated before leaving Pickering, but periodically you may want to re-calibrate this device. This can be carried out very simply using the “Soft Front Panel” provided, alternatively you may wish to code your own program to achieve this. Calibration is the only process which requires use of the raw binary functions described later in this section.

C code example using the Direct Driver (requires Pilpxi.h and Pilpxi.lib found in the Pickering folder structure)

```
DWORD     l_CardNum;     //assumed you have opened the card using OpenCards() or OpenSpecifiedCard()
DWORD     l_SubUnit;
DWORD l_CalInd;
DWORD l_Val;
//DWORD   l_WriteEnable;

SubUnit = 3;                                                    //calibrating the 3rd channel

l_RetCode = PIL_BattSetEnable(l_CardNum, l_SubUnit, 1);       //enable the output for channel 3
//this would also enable channel 3 output using a raw write to sub unit 13
//l_WriteEnable = 0x0004;                                       //bit 3 on = enable channel 3 only
//l_RetCode = PIL_WriteSub(l_CardNum, 13, &l_WriteEnable);    //raw write
```

```
//Start a loop
//prompts for a test value to be placed in l_Val 0=low voltage 0x3fff is highest voltage
//exit the loop if 0 Volts achieved
     l_RetCode = PIL_WriteSub(l_CardNum, l_SubUnit, &l_Val); //write the value in l_Val to the DAC
//Use a DMM to check voltage on channel 3 output pins is 0 volts
//loop for another test

CalInd= 1;                                                    //set 0 volt calibration value
l_RetCode = PIL_WriteCal(l_CardNum, l_SubUnit, l_CalInd, l_Val);//set calibration value  in l_Val
//Start a loop
//prompts for a test value to be placed in l_Val 0=low voltage 0x3fff is highest voltage
//exit the loop if 0 Volts achieved
     l_RetCode = PIL_WriteSub(l_CardNum, l_SubUnit, &l_Val); //write the value in l_Val to the DAC
//Use a DMM to check voltage on channel 3 output pins is 7 volts
//loop for another test

CalInd= 2;                                                    //set 7 volt calibration value
l_RetCode = PIL_WriteCal(l_CardNum, l_SubUnit, l_CalInd, l_Val);//set calibration value  in l_Val
```

RAW SUB-UNIT ACCESS

Output Sub-UnitS 1 to 6 - Voltage Sources

WARNING: You should only use this function during calibration

Each of these sub-units appears as a 14 bit register which can be set to any binary value between 0 and 16383 (0x3FFF hexadecimal). The range of values controls the output voltage between its minimum and maximum values, nominally 0-7 Volts.

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

Driver	Command
pilpxi (kernel)	DWORD dac[1]; dac[0] = 0x3fff; PIL_WriteSub(cardNum, 3, dac);
pipx40 (VISA)	ViUInt32 pattern[1]; pattern[0] = 0x3fff; pipx40_setChannelPattern (vi, 3, pattern);
PIPLX (LXI)	DWORD dac[1]; dac[0] = 0x3fff; PIPLX_WriteSub(session, cardNum, 3, dac 1);
SOAP (LXI)	my $data = (0x3fff); $device -> WriteSub(3, $data);

Output Sub-UnitS 7 to 12 - Current Sinks for channels 1 to 6

Each of these sub-units appear as a 16 bit register, each bit represents one element of a bank of parallel current sinks, each element draws current (nominally 6.25mA) from the input. With all bits set high, all current sinks are enabled and will sink the maximum 100mA, 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[1]; data[0] = 0xffff; PIL_WriteSub(cardNum, subunit, data);
pipx40 (VISA)	ViUInt32 pattern[1]; pattern[0] = 0xffff; pipx40_setChannelPattern (vi, subunit, pattern);
PIPLX (LXI)	DWORD data[1]; data[0] = 0xffff; PIPLX_WriteSub(session, cardNum, subunit, data 1);
SOAP (LXI)	my @data = (0xffff) $device -> WriteSub(subunit, @data);

Output Sub-Unit 13 - Channel 1 to 6 Output Enable

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

This example turns the output on for channels 1 and 6.

Driver	Command
pilpxi (kernel)	DWORD data[1]; data[0] = 0x21; PIL_WriteSub(cardNum, 13, data);
pipx40 (VISA)	ViUInt32 pattern[1]; pattern[0] = 0x21; pipx40_setChannelPattern (vi, 13, pattern);
PIPLX (LXI)	DWORD data[1]; data[0] = 0x21; PIPLX_WriteSub(session, cardNum, 13, dac 1);
SOAP (LXI)	my $data = (0x21); $device -> WriteSub(13, $data);

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.

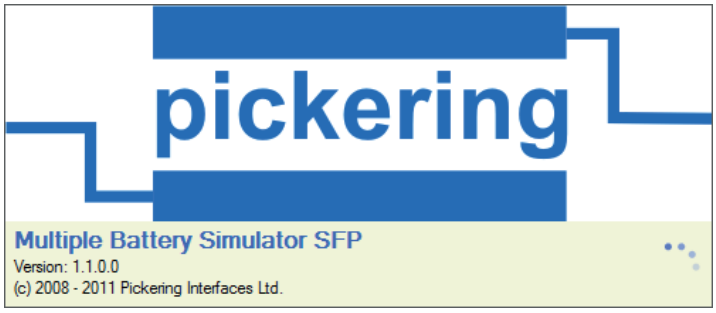


Figure 4.1 - Loading window of the Pickering Interfaces Multiple Battery Simulator SFP

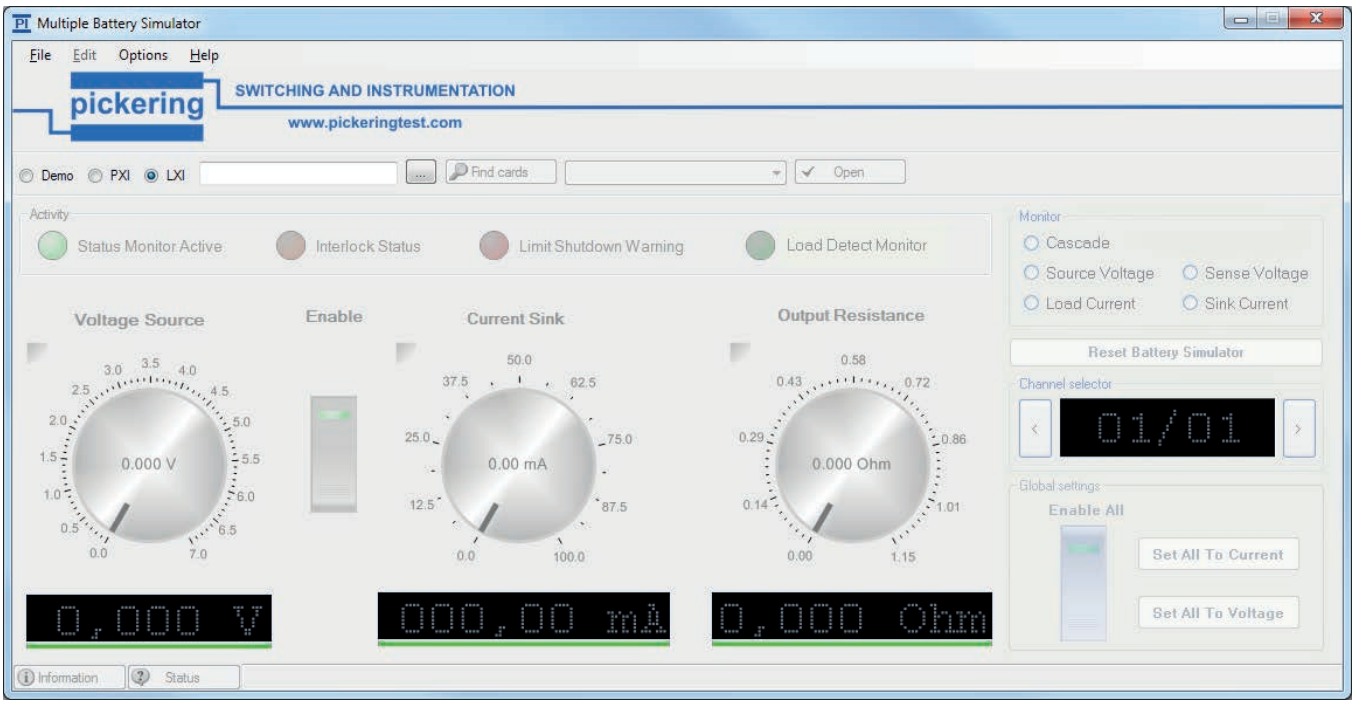


Figure 4.2 - Initial screen of the SFP after startup

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).

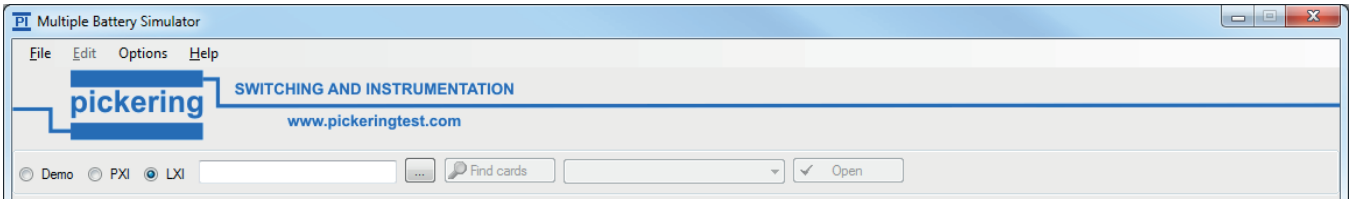


Figure 4.3 - Main controls of the SFP after startup

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).

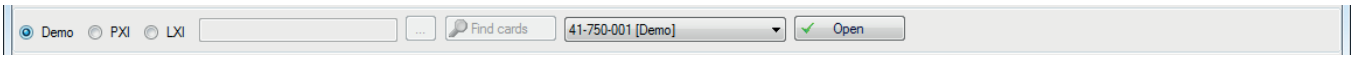


Figure 4.4 - Main controls of the SFP with Demo mode selected

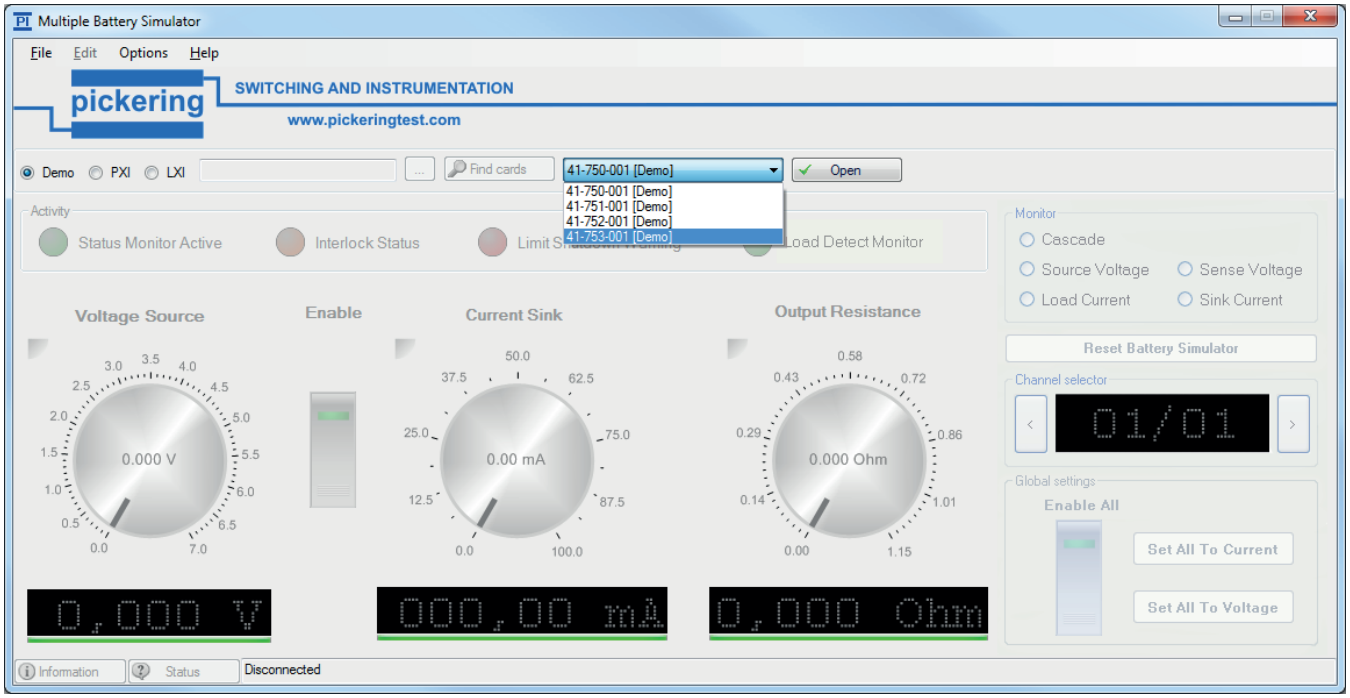


Figure 4.5 - The SFP window during the selection of a card for simulation

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)

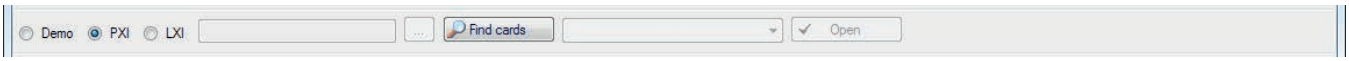


Figure 4.6 - Main controls of the SFP with PXI mode selected

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).

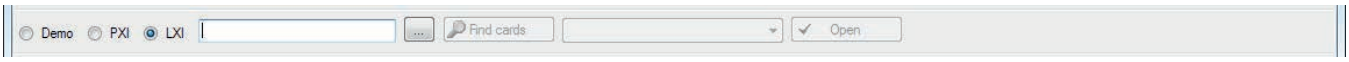


Figure 4.7: Main controls of the SFP with LXI mode selected



Figure 4.8a: Windows XP security alert window

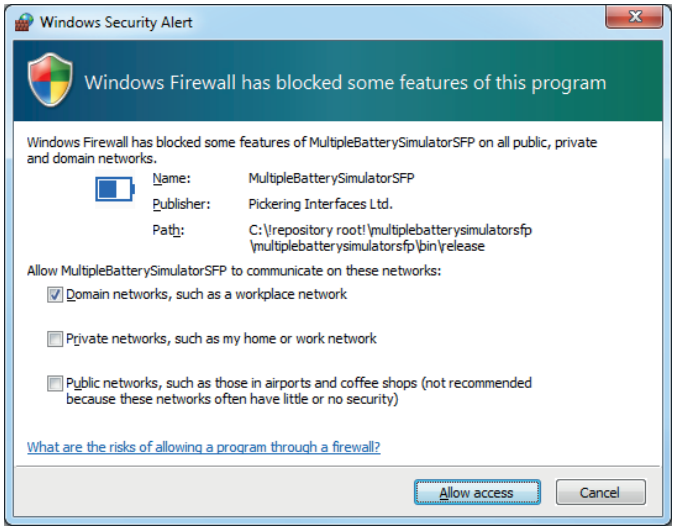


Figure 4.8b: Windows 7 security alert window

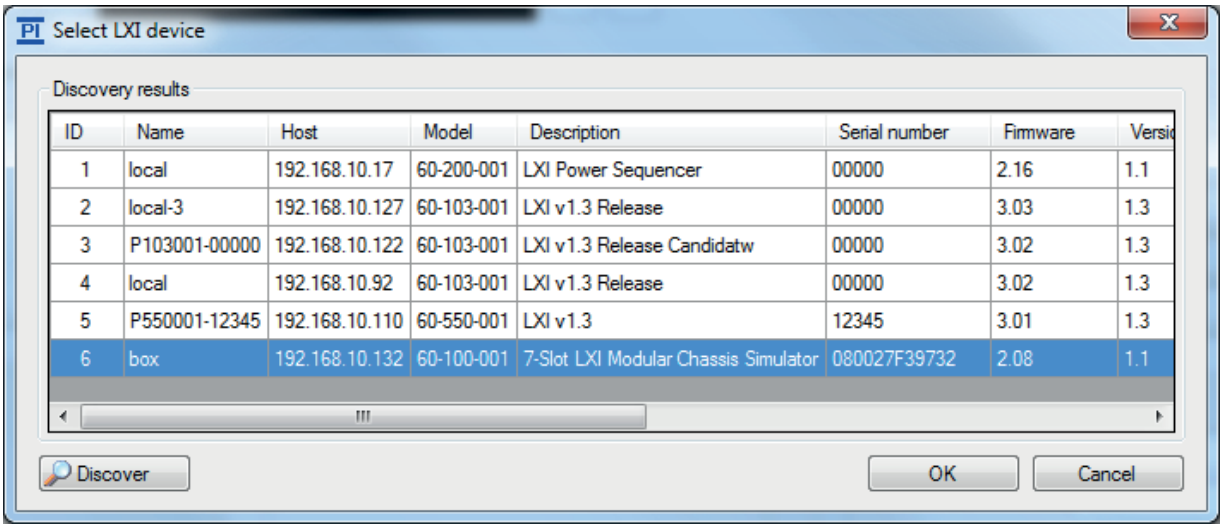


Figure 4.9 - The discovery window

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).

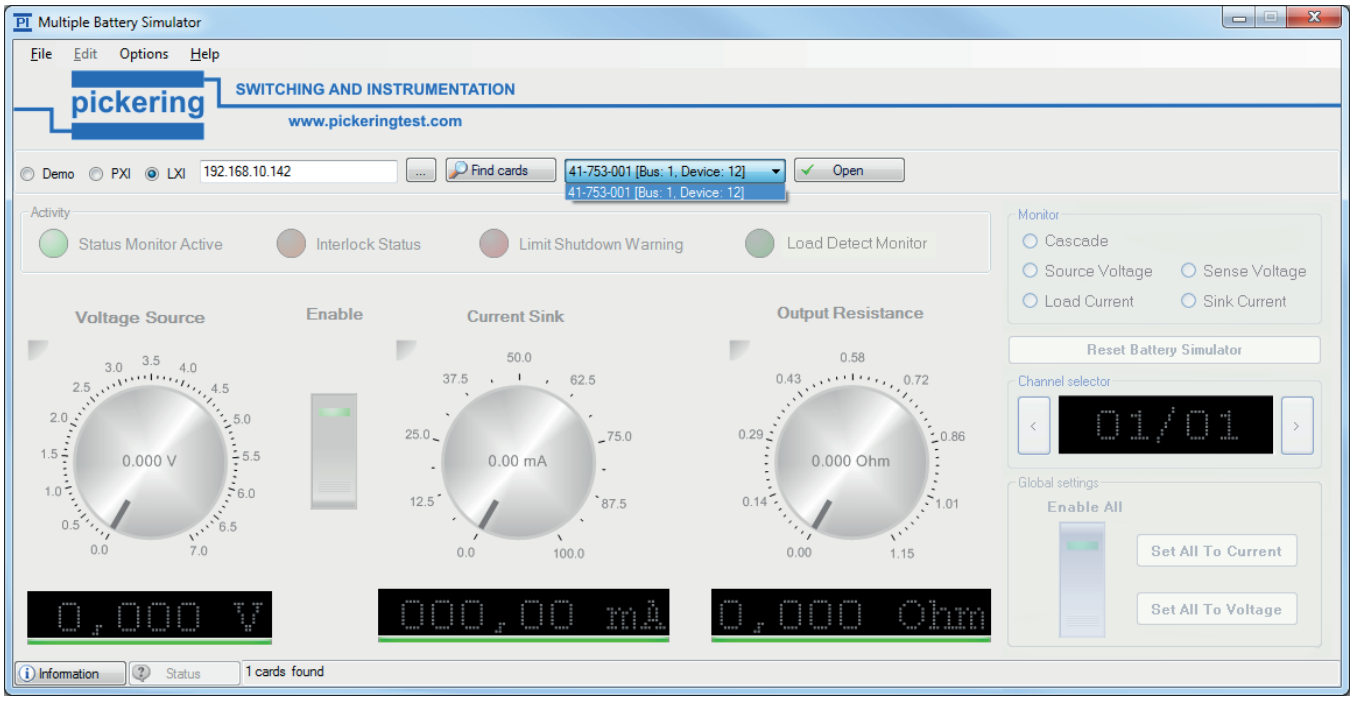


Figure 4.10 - The SFP window during selection of the Battery Simulator cards available in the specified LXI device

Controlling The Card

To control the card, 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 card.

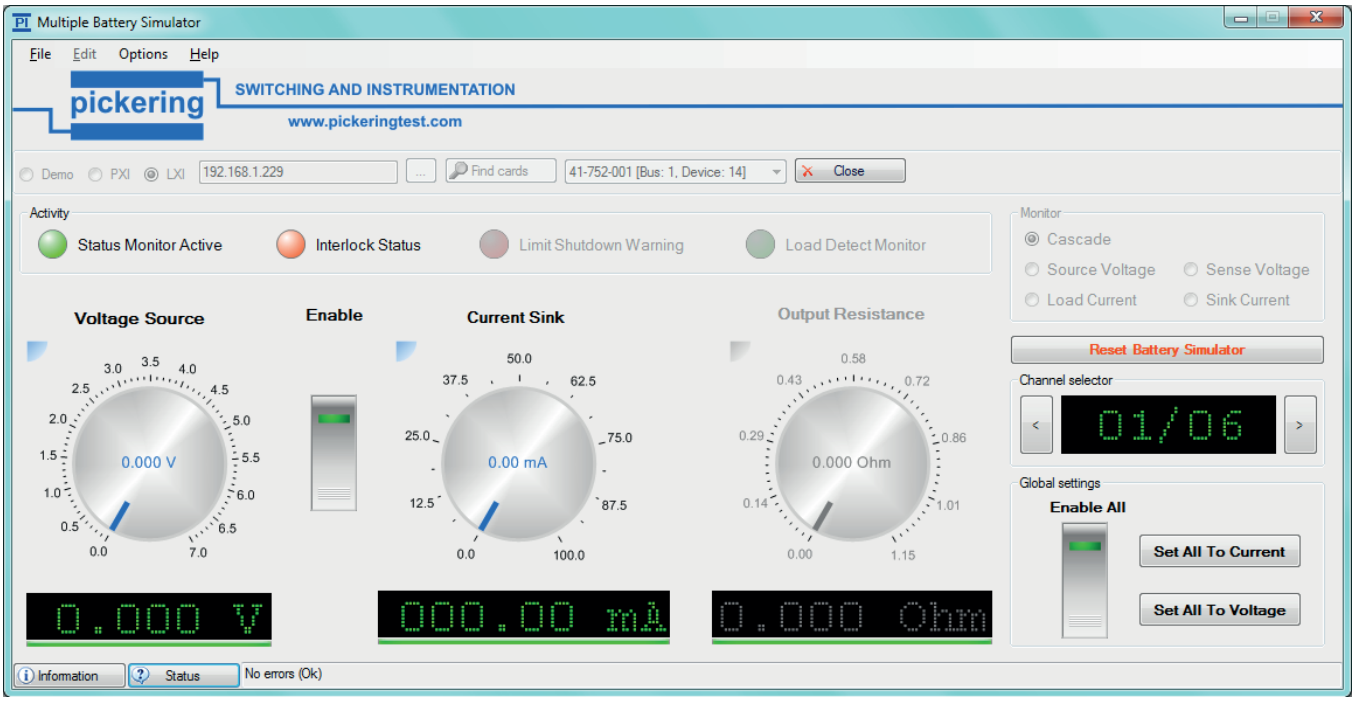


Figure 4.11 - The SFP with a Battery Simulator card opened

The activity LEDs (Figure 4.12) are enabled or disabled depending on the type of Battery Simulator card. 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.

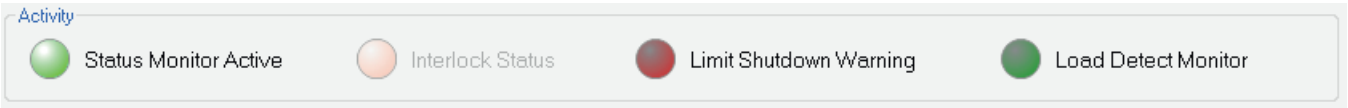


Figure 4.12 - The activity LEDs on the SFP

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 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 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 card. 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 card 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.

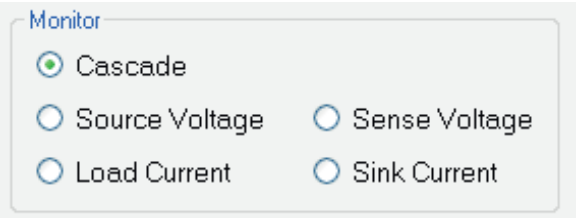


Figure 4.15 - Monitor controls display on the SFP

If the Battery Simulator card 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.

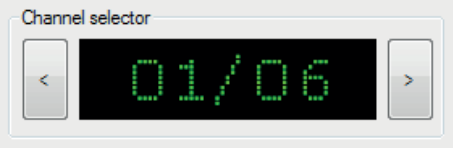


Figure 4.16 - The channel selector box of the SFP

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

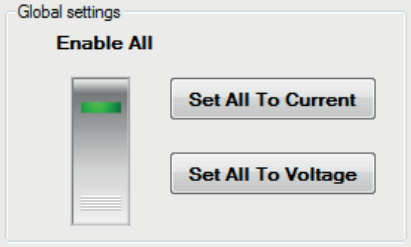


Figure 4.17 - The global settings control of the SFP

Some models of Battery Simulator card 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 card 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 card simply click on the **Status** button.

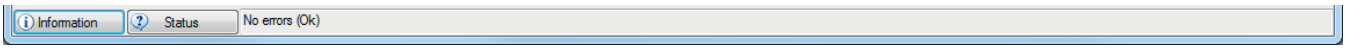


Figure 4.19 - The bottom part of the SFP

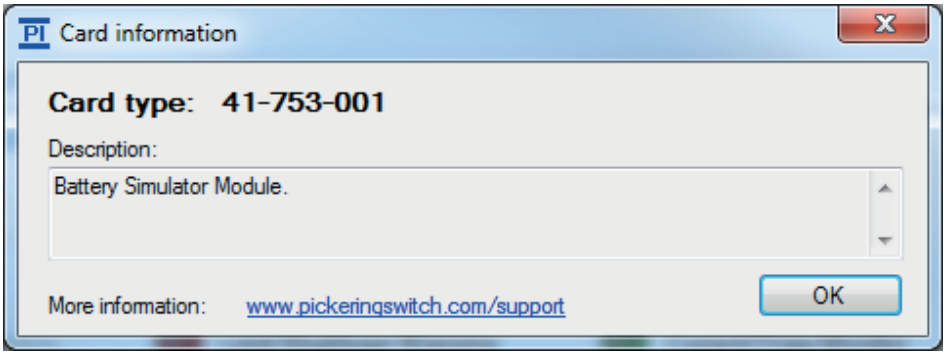


Figure 4.20 - The information window showing the card currently controlled by the SFP, in this case, a 41-753-001 Multiple Battery Simulator

Calibration

WARNING: FOR AUTHORIZED PERSONEL ONLY

All Battery Simulator cards 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.

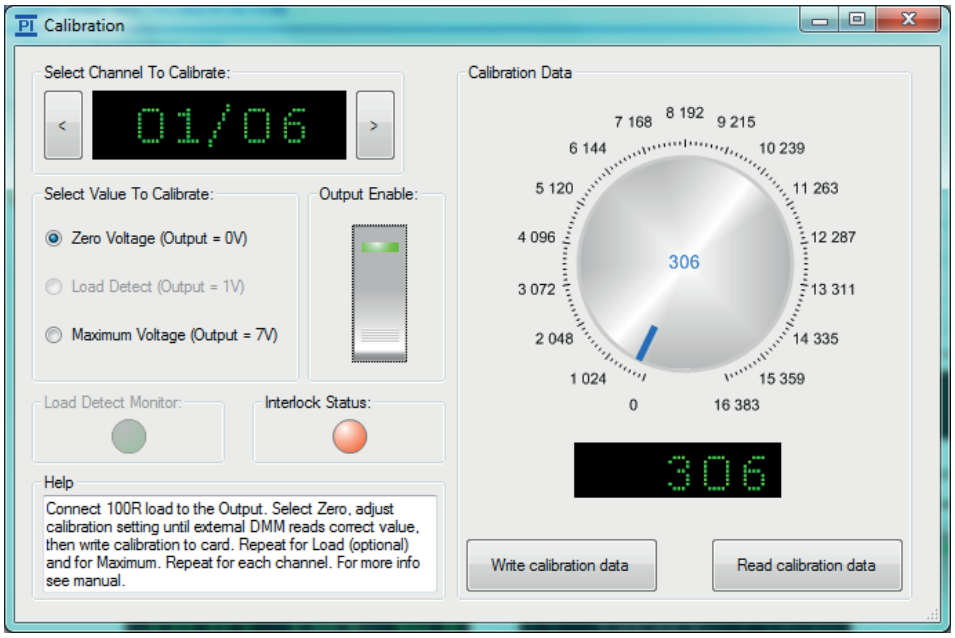


Figure 4.21 - The calibration window of the Battery Simulator SFP

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.

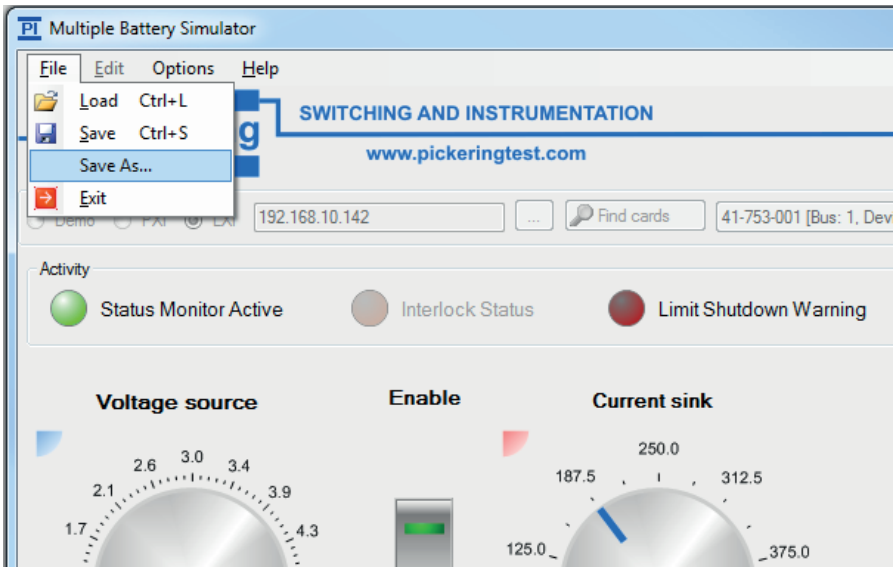


Figure 4.22 - The File menu of the SFP with "Save As..." selected

Settings

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

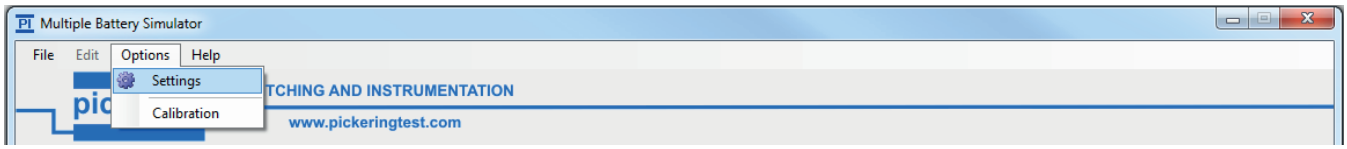


Figure 4.23 - The Options menu of the SFP with "Settings" selected

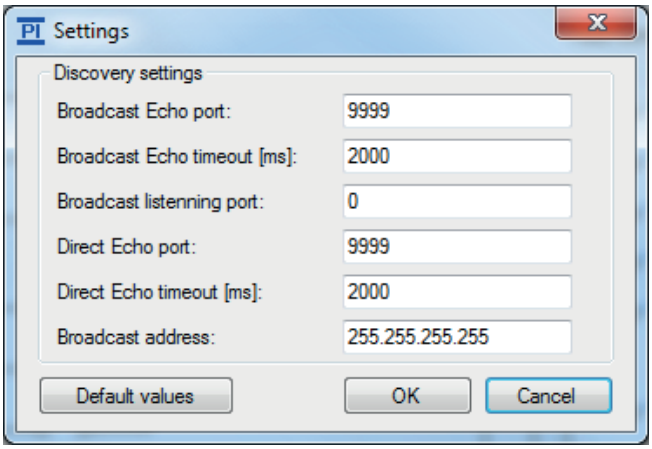


Figure 4.24 - The Settings window of the SFP

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 cards supported by the SFP and the assemblies used. You can also get information about the system by clicking on the **System Info** button.

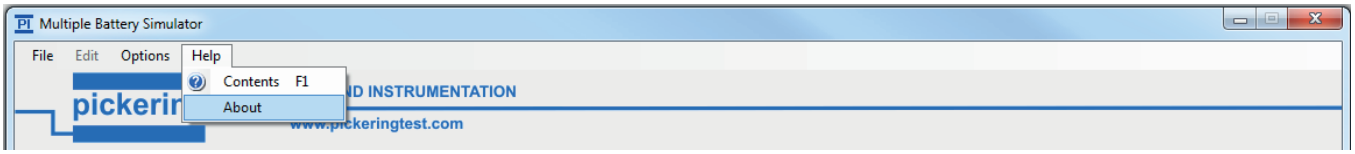


Figure 4.25 - Help menu of the SFP with "About" selected

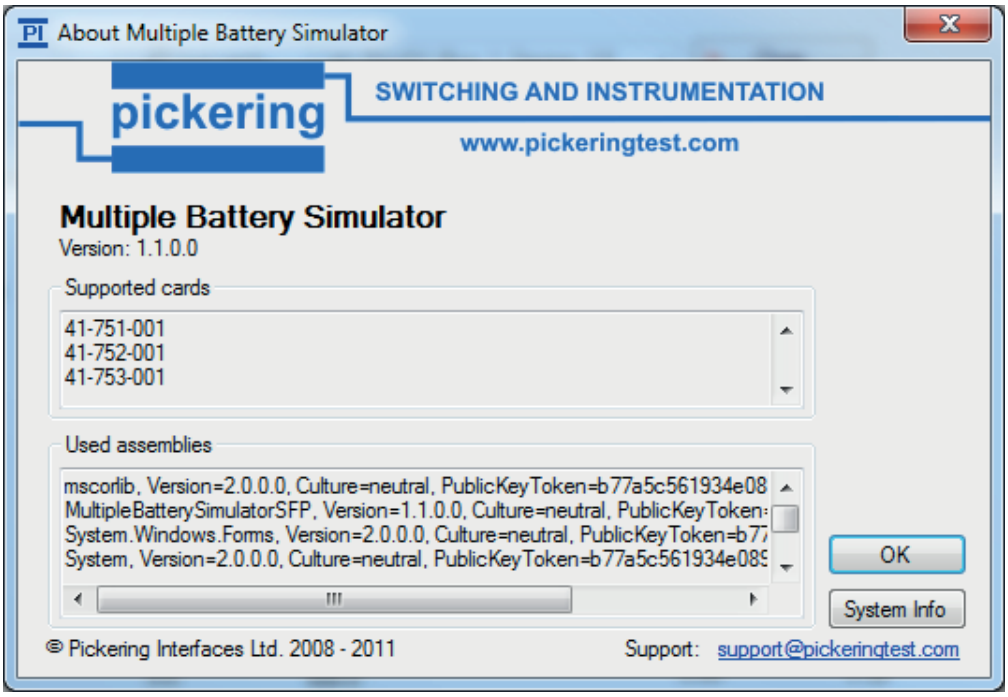
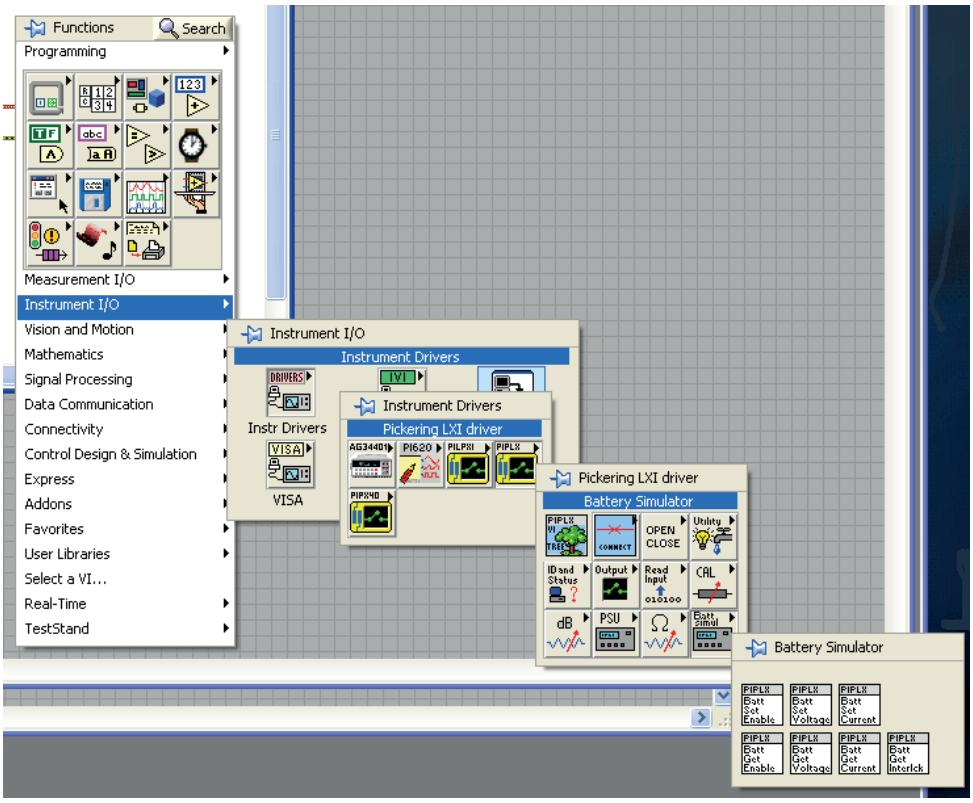


Figure 4.26 - About window of the SFP

USING THE BATTERY SIMULATOR IN LabVIEW

Finding the Driver

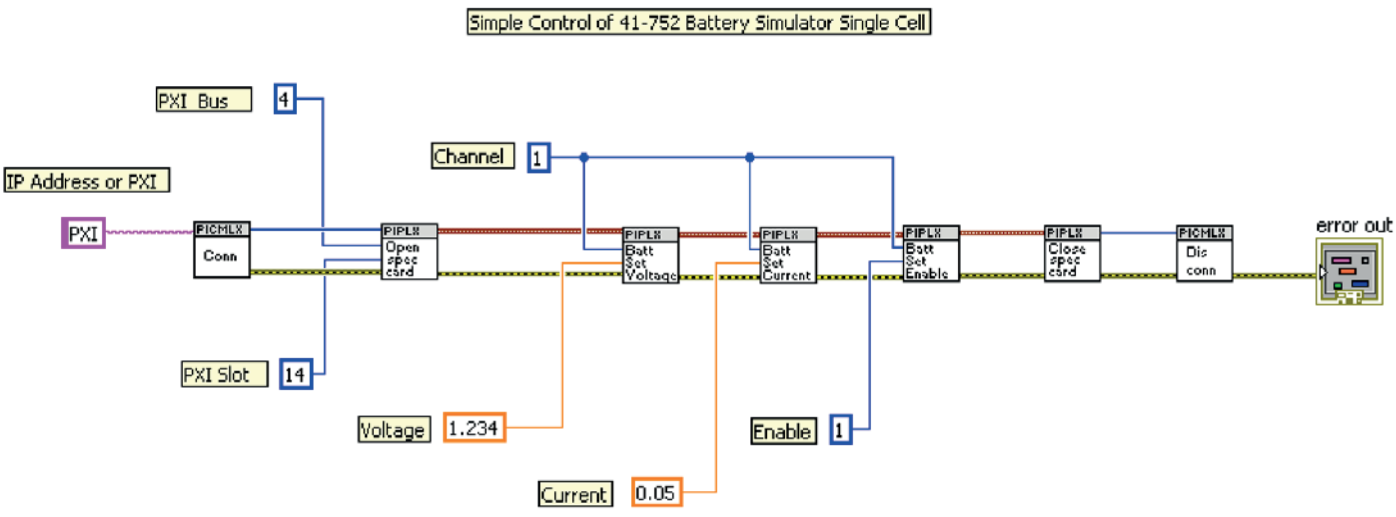
During driver installation Pickering LabVIEW libraries are installed into the 'instr.lib' folder of the LabVIEW installation. This is accessed from the 'Instrument I/O' – 'Instr Drivers' palette in LabVIEW.



The LXI driver package is shown above, however similar palettes are available from the pipx40 (PXI-VISA) palette and from the pilpxi (PXI-non-VISA) palette.

Example Program

A simple LabVIEW program to control the Battery Simulator is shown below.



First a connection is made to the chassis containing the Battery Simulator, in the example shown the card is mounted in a locally connected PXI chassis, so the address 'PXI' is provided. If the card were in an LXI chassis then the IP address of that chassis would be used instead.

Next a card is opened, in this example the 'Open Specified Card' function is used. Alternatively the 'Open Cards' function could be used, however this call opens all cards in the connected chassis making them unavailable to all other potential users. The 'Open Specified Card' function leaves all other cards available for use. Open Specified Card requires the precise bus and device (slot) location of the card. In the example the card is located at bus 4, device 14.

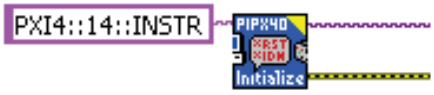
Next follows a series of commands specific to the Battery Simulator: Set Voltage, Set Current and Set Enable.

Finally the card is closed, then the session on the chassis is closed.

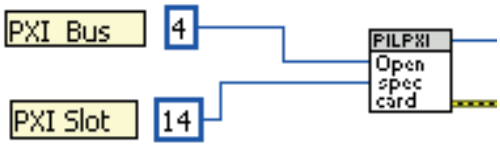
Opening a Card

The method of opening a card varies between the 3 different drivers.

PIPX40 – VISA Driver:



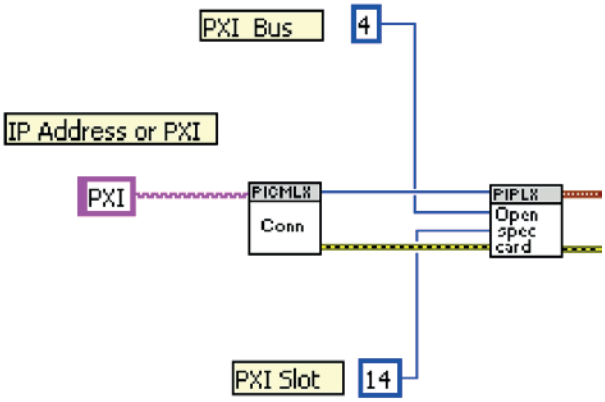
PILPXI – Non-VISA Driver:



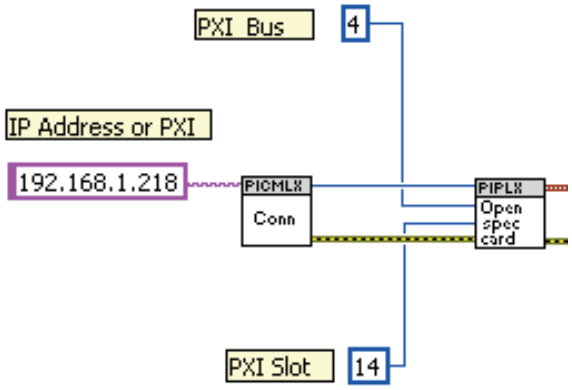
PIPLX LXI Driver:

The LXI driver requires an additional function to provide the connectivity to the chassis.

Local PXI Connection:



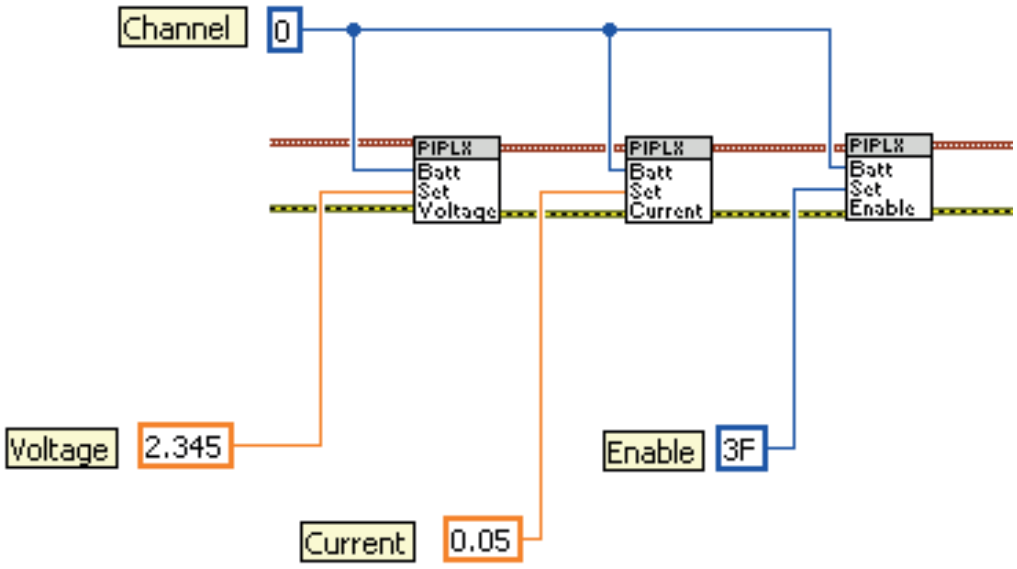
Remote LXI Connection:



NB – there are additional inputs to the Connect function to control the connection which are not shown above. These may be used to control aspects of the connection such as the port to be used and a timeout period.

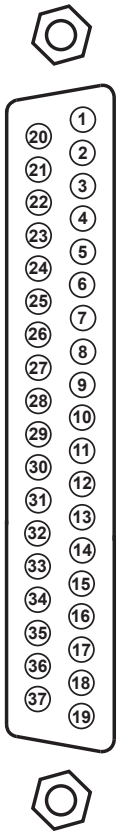
Controlling Multiple Channels on a Card

The previous example controlled a single channel of the Battery Simulator, however many functions may also be used to set all channels simultaneously.



In this example, the channel number is set to 0, which is taken to mean 'all channels' by the driver. So, in this example, all channels will be set to 2.345V and 0.05A. The Set Enable function in this case takes a 6-bit pattern in which each bit corresponds to a channel, above all 6 channels are enabled.

SECTION 5 - CONNECTOR INFORMATION



37-pin D-type Plug			
Pin No.	Signal Name	Pin No.	Signal Name
20	-Output CH1	1	+Output CH1
21	-Sense CH1	2	+Sense CH1
22	-Output CH2	3	+Output CH2
23	-Sense CH2	4	+Sense CH2
24	-Output CH3	5	+Output CH3
25	-Sense CH3	6	+Sense CH3
26	-Output CH4	7	+Output CH4
27	-Sense CH4	8	+Sense CH4
28	-Output CH5	9	+Output CH5
29	-Sense CH5	10	+Sense CH5
30	-Output CH6	11	+Output CH6
31	-Sense CH6	12	+Sense CH6
32	FP_GND	13	FP_GND
33	FP_GND	14	FP_GND
34	FP_GND	15	FP_GND
35	FP_GND	16	HW Enable +3.3V
36	FP_GND	17	HW Enable
37	FP_GND	18	HW Enable Status
		19	FP_GND

Figure 5.1 - Battery Simulator User Connections: Male 37-pin D-type

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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 41-752 Battery Simulator for compliance to its specification. The test is designed to ensure that the product is fully functional.

The procedure assumes the 41-752 is correctly installed in a suitable chassis and the soft front panel described in this manual has been launched.

Required test Equipment

- One or two DMM's, 100µV or better resolution on DC voltage. Most 5½ digit DMM's will meet the requirement.
- 37-pin D-type connector assembly, recommended Pickering part: 40-965-037

Test Procedure

Output Voltage Check

Connect a load to the output connector of the 41-752 module as shown in Figure 7.1.

Measure the voltage across the output terminals of the 41-752 module as below using a DMM, record the results and check against the specification limit value.

Set Output Voltage	Measured Output Voltage	Specification Limit ±0.2% ±20mV	
		Max	Min
1.0V		1.022	0.978
1.1V		1.1222	1.0778
1.2V		1.2224	1.1776
1.3V		1.3226	1.2774
1.4V		1.4228	1.3772
1.5V		1.523	1.477
1.6V		1.6232	1.5768
1.7V		1.7234	1.6766
1.8V		1.8236	1.7764
1.9V		1.9238	1.8762
2.0V		2.024	1.976
3.0V		3.026	2.974
4.0V		4.028	3.972
5.0V		5.03	4.97
6.0V		6.032	5.968
7.0V		7.034	6.966

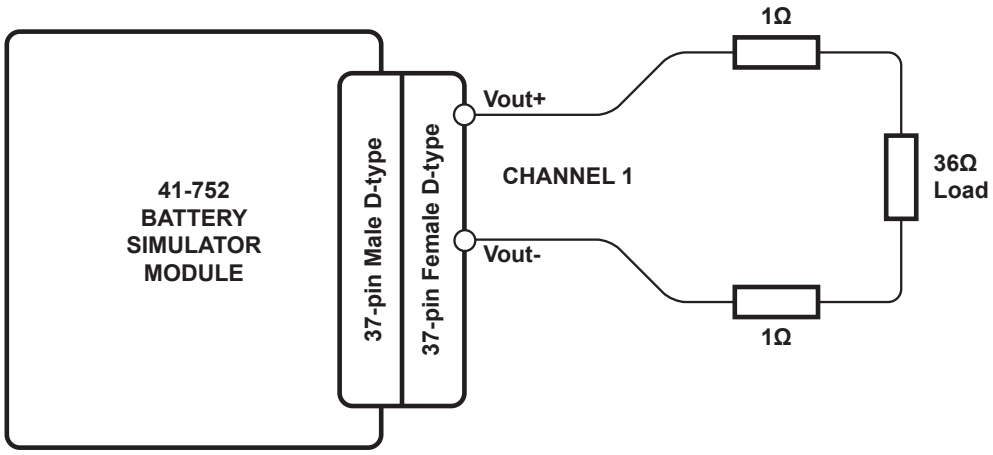


Figure 7.1 - Load Connection For Testing 41-752 Battery Simulator

Sense Line Operation

Connect the load as shown in Figure 7.1 to the channel under test.

Set the output voltage to +5V, and check that the voltage at the output terminals of the 41-752 is 5 Volts.

Check the voltage across the 36Ω load resistor, it should be approximately 4.74 Volts.

Connect the sense wires to the load resistor as shown in Figure 7.2.

Check the voltage across the 36Ω load resistor, it should now be 5 Volts.

Repeat the above test on all channels.

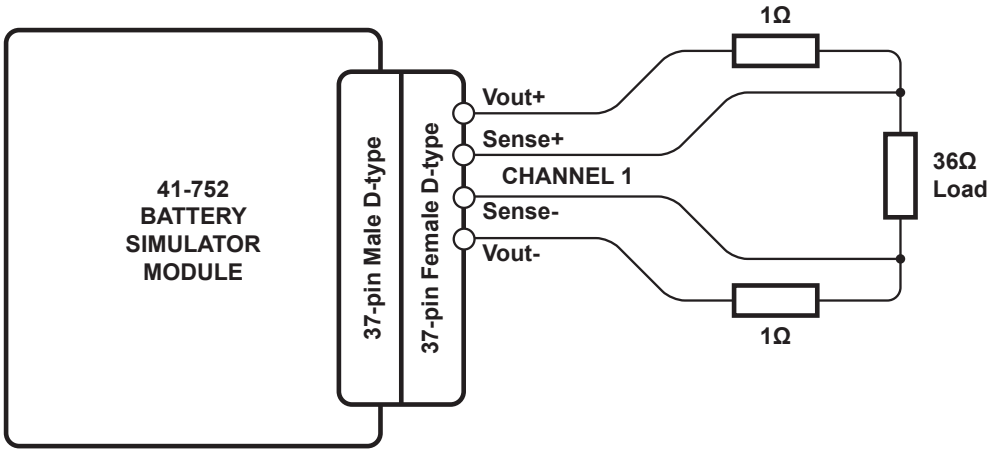


Figure 7.2 - Sense Connections For Testing 41-752 Battery Simulator

Sense Line Operation

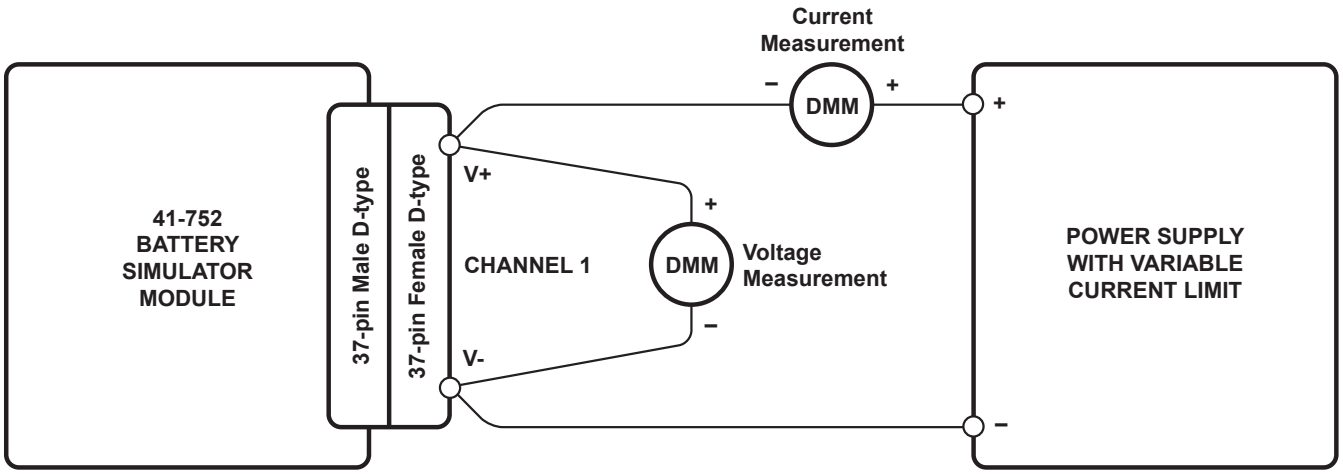


Figure 7.3 - Setup For Testing The 41-752 Battery Simulator's Current Sink

Connect the channel under test to a power supply with variable current limit, set the power supply current limit to 0mA (or <10mA) and the output voltage to 6V

Set the 41-752 channel under test to 4V output.

Set the 41-752 channel under test current sink to 50mA.

The voltage measuring DMM should indicate 4V nominal, record value.

Set the power supply current limit to 40mA. The output voltage should change by less than 20mV.

Set the power supply current limit to 65mA. The output voltage should rise by >20mV.

Reset the PSU current limit to 0mA.

Set the 41-752 channel under test current sink to 100mA.

The voltage measuring DMM should indicate 4V nominal, record value.

Set the power supply current limit to 90mA. The output voltage should change by less than 20mV.

Set the power supply current limit to 120mA. The output voltage should rise by >20mV.

Repeat for all 6 channels.

TEST RESULTS

The following pages can be printed and used to record the results of the calibration procedure.

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

CHANNEL 1				
Set Output Voltage	**Measured Output Voltage**	**Specification Limit ±0.2% ±20mV**		**Result (delete as appropriate)**
		Max	**Min**	
1.0V		1.022	0.978	Pass / Fail
1.1V		1.1222	1.0778	Pass / Fail
1.2V		1.2224	1.1776	Pass / Fail
1.3V		1.3226	1.2774	Pass / Fail
1.4V		1.4228	1.3772	Pass / Fail
1.5V		1.523	1.477	Pass / Fail
1.6V		1.6232	1.5768	Pass / Fail
1.7V		1.7234	1.6766	Pass / Fail
1.8V		1.8236	1.7764	Pass / Fail
1.9V		1.9238	1.8762	Pass / Fail
2.0V		2.024	1.976	Pass / Fail
3.0V		3.026	2.974	Pass / Fail
4.0V		4.028	3.972	Pass / Fail
5.0V		5.03	4.97	Pass / Fail
6.0V		6.032	5.968	Pass / Fail
7.0V		7.034	6.966	Pass / Fail

Sense Line Operation	Pass / Fail

50mA Current Sink Test					Pass / Fail
Voltage at 0mA	**Voltage at 40mA**	**Limit**	**Voltage at 65mA**	**Limit**	
		Change ±20mV maximum		Change by >20mV	

100mA Current Sink Test					Pass / Fail
Voltage at 0mA	**Voltage at 90mA**	**Limit**	**Voltage at 120mA**	**Limit**	
		Change ±20mV maximum		Change by >20mV	

CHANNEL 2				
Set Output Voltage	Measured Output Voltage	Specification Limit ±0.2% ±20mV		Result (delete as appropriate)
		Max	Min	
1.0V		1.022	0.978	Pass / Fail
1.1V		1.1222	1.0778	Pass / Fail
1.2V		1.2224	1.1776	Pass / Fail
1.3V		1.3226	1.2774	Pass / Fail
1.4V		1.4228	1.3772	Pass / Fail
1.5V		1.523	1.477	Pass / Fail
1.6V		1.6232	1.5768	Pass / Fail
1.7V		1.7234	1.6766	Pass / Fail
1.8V		1.8236	1.7764	Pass / Fail
1.9V		1.9238	1.8762	Pass / Fail
2.0V		2.024	1.976	Pass / Fail
3.0V		3.026	2.974	Pass / Fail
4.0V		4.028	3.972	Pass / Fail
5.0V		5.03	4.97	Pass / Fail
6.0V		6.032	5.968	Pass / Fail
7.0V		7.034	6.966	Pass / Fail

Sense Line Operation	Pass / Fail

50mA Current Sink Test					Pass / Fail
Voltage at 0mA	Voltage at 40mA	Limit	Voltage at 65mA	Limit	
		Change ±20mV maximum		Change by >20mV	

100mA Current Sink Test					Pass / Fail
Voltage at 0mA	Voltage at 90mA	Limit	Voltage at 120mA	Limit	
		Change ±20mV maximum		Change by >20mV	

CHANNEL 3				
Set Output Voltage	Measured Output Voltage	Specification Limit ±0.2% ±20mV		Result (delete as appropriate)
		Max	Min	
1.0V		1.022	0.978	Pass / Fail
1.1V		1.1222	1.0778	Pass / Fail
1.2V		1.2224	1.1776	Pass / Fail
1.3V		1.3226	1.2774	Pass / Fail
1.4V		1.4228	1.3772	Pass / Fail
1.5V		1.523	1.477	Pass / Fail
1.6V		1.6232	1.5768	Pass / Fail
1.7V		1.7234	1.6766	Pass / Fail
1.8V		1.8236	1.7764	Pass / Fail
1.9V		1.9238	1.8762	Pass / Fail
2.0V		2.024	1.976	Pass / Fail
3.0V		3.026	2.974	Pass / Fail
4.0V		4.028	3.972	Pass / Fail
5.0V		5.03	4.97	Pass / Fail
6.0V		6.032	5.968	Pass / Fail
7.0V		7.034	6.966	Pass / Fail

Sense Line Operation	Pass / Fail

50mA Current Sink Test					Pass / Fail
Voltage at 0mA	Voltage at 40mA	Limit	Voltage at 65mA	Limit	
		Change ±20mV maximum		Change by >20mV	

100mA Current Sink Test					Pass / Fail
Voltage at 0mA	Voltage at 90mA	Limit	Voltage at 120mA	Limit	
		Change ±20mV maximum		Change by >20mV	

CHANNEL4				
Set Output Voltage	Measured Output Voltage	Specification Limit ±0.2% ±20mV		Result (delete as appropriate)
		Max	Min	
1.0V		1.022	0.978	Pass / Fail
1.1V		1.1222	1.0778	Pass / Fail
1.2V		1.2224	1.1776	Pass / Fail
1.3V		1.3226	1.2774	Pass / Fail
1.4V		1.4228	1.3772	Pass / Fail
1.5V		1.523	1.477	Pass / Fail
1.6V		1.6232	1.5768	Pass / Fail
1.7V		1.7234	1.6766	Pass / Fail
1.8V		1.8236	1.7764	Pass / Fail
1.9V		1.9238	1.8762	Pass / Fail
2.0V		2.024	1.976	Pass / Fail
3.0V		3.026	2.974	Pass / Fail
4.0V		4.028	3.972	Pass / Fail
5.0V		5.03	4.97	Pass / Fail
6.0V		6.032	5.968	Pass / Fail
7.0V		7.034	6.966	Pass / Fail

Sense Line Operation	Pass / Fail

50mA Current Sink Test					Pass / Fail
Voltage at 0mA	Voltage at 40mA	Limit	Voltage at 65mA	Limit	
		Change ±20mV maximum		Change by >20mV	

100mA Current Sink Test					Pass / Fail
Voltage at 0mA	Voltage at 90mA	Limit	Voltage at 120mA	Limit	
		Change ±20mV maximum		Change by >20mV	

CHANNEL 5				
Set Output Voltage	Measured Output Voltage	Specification Limit ±0.2% ±20mV		Result (delete as appropriate)
		Max	Min	
1.0V		1.022	0.978	Pass / Fail
1.1V		1.1222	1.0778	Pass / Fail
1.2V		1.2224	1.1776	Pass / Fail
1.3V		1.3226	1.2774	Pass / Fail
1.4V		1.4228	1.3772	Pass / Fail
1.5V		1.523	1.477	Pass / Fail
1.6V		1.6232	1.5768	Pass / Fail
1.7V		1.7234	1.6766	Pass / Fail
1.8V		1.8236	1.7764	Pass / Fail
1.9V		1.9238	1.8762	Pass / Fail
2.0V		2.024	1.976	Pass / Fail
3.0V		3.026	2.974	Pass / Fail
4.0V		4.028	3.972	Pass / Fail
5.0V		5.03	4.97	Pass / Fail
6.0V		6.032	5.968	Pass / Fail
7.0V		7.034	6.966	Pass / Fail

Sense Line Operation	Pass / Fail

50mA Current Sink Test					Pass / Fail
Voltage at 0mA	Voltage at 40mA	Limit	Voltage at 65mA	Limit	
		Change ±20mV maximum		Change by >20mV	

100mA Current Sink Test					Pass / Fail
Voltage at 0mA	Voltage at 90mA	Limit	Voltage at 120mA	Limit	
		Change ±20mV maximum		Change by >20mV	

CHANNEL6				
Set Output Voltage	Measured Output Voltage	Specification Limit ±0.2% ±20mV		Result (delete as appropriate)
		Max	Min	
1.0V		1.022	0.978	Pass / Fail
1.1V		1.1222	1.0778	Pass / Fail
1.2V		1.2224	1.1776	Pass / Fail
1.3V		1.3226	1.2774	Pass / Fail
1.4V		1.4228	1.3772	Pass / Fail
1.5V		1.523	1.477	Pass / Fail
1.6V		1.6232	1.5768	Pass / Fail
1.7V		1.7234	1.6766	Pass / Fail
1.8V		1.8236	1.7764	Pass / Fail
1.9V		1.9238	1.8762	Pass / Fail
2.0V		2.024	1.976	Pass / Fail
3.0V		3.026	2.974	Pass / Fail
4.0V		4.028	3.972	Pass / Fail
5.0V		5.03	4.97	Pass / Fail
6.0V		6.032	5.968	Pass / Fail
7.0V		7.034	6.966	Pass / Fail

Sense Line Operation	Pass / Fail

50mA Current Sink Test					Pass / Fail
Voltage at 0mA	Voltage at 40mA	Limit	Voltage at 65mA	Limit	
		Change ±20mV maximum		Change by >20mV	

100mA Current Sink Test					Pass / Fail
Voltage at 0mA	Voltage at 90mA	Limit	Voltage at 120mA	Limit	
		Change ±20mV maximum		Change by >20mV	

ALIGNMENT PROCEDURE

Caution: Adjustment of this module is not routinely required; if a user adjustment is performed then it is done so at the users' risk, corruption of calibration data stored within the module could result in a return to factory event.

Install the module in the chassis and launch the Battery Simulator Soft Front Panel (further information on the Soft Front Panel can be found on page 4.7). Next, launch the Calibration Panel by selecting *Calibration* from the *Options* menu.

The Calibration Soft Front Panel will pop up as shown in Figure 7.1.

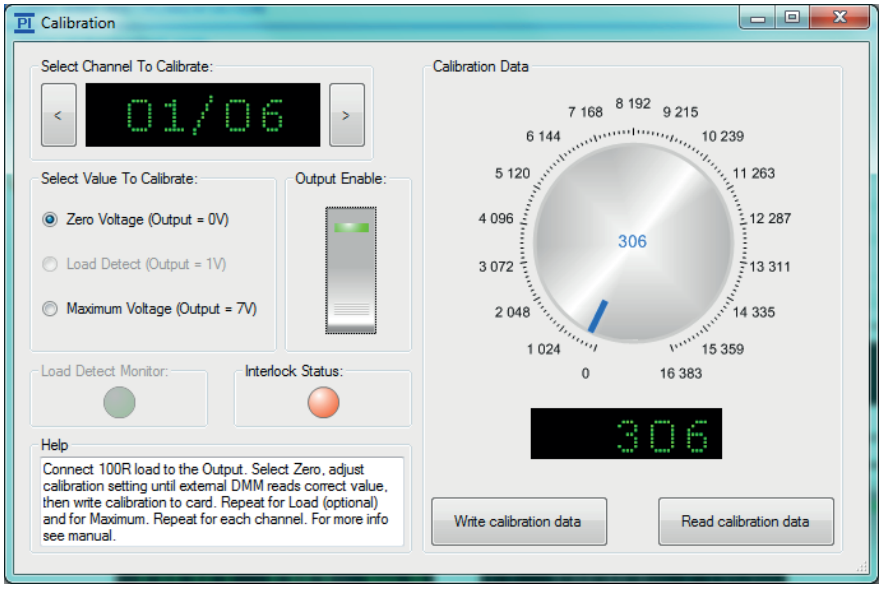


Figure 7.1 - Windows Calibration Soft Front Panel

This panel provides three additional controls for the user to select: *Zero Voltage*, *Load Detect* and *Maximum Voltage* buttons at the left side of the panel. *Zero Voltage* and *Maximum Voltage* are used to set the minimum and maximum voltage output from the module. *Load Detect* is not implemented on this module and so the control is not available.

Note: It is recommended that the existing calibration data is recorded before any adjustment is performed, the table overleaf can be used for this purpose. Data can be read for each channel in turn by selecting *Zero Voltage* and *Maximum Voltage* and clicking *Read Calibration Data* for each, the calibration data can be read from the calibration window.

Connect a 100Ω load to the channel that is to be adjusted and connect a DMM across this load. Also ensure that the safety interlock system is enabled (further information on the safety interlock system can be found on page 2.5). Enable the channel's output using the *Output Enable* rocker switch within the Calibration Panel.

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, this should be the point at which the DMM no longer shows a decrease in voltage. Users should note that this is unlikely to be absolute zero volts and may be a few mV, the Calibration Data should also not carry a value of zero. When complete, click the *Write Calibration Data* button to write the value to 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 7 Volts as possible. When complete, click the *Write Calibration Data* button to write the value to non-volatile memory.

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

Once the calibration of the channel in question is complete, the channel can be disabled using the *Output Enable* rocker switch within the Calibration Panel.

Note: After adjustment of the calibration data the module will require re-initialisation. This can be achieved by closing the module within the Soft Front Panel and then opening again.

The Alignment data should be verified once complete. This can be achieved by using the Output Voltage Check on Page 7.2.

Each Battery Simulation channel can be independently adjusted in turn using the procedure described above.

ALIGNMENT TEST RECORD

Part Number:	
Serial Number:	
Date of Alignment:	
Operator Name:	
Test Equipment Used:	

CHANNEL 1		
	Previous setting	New setting
Zero Voltage adjustment		
Maximum Voltage adjustment		

CHANNEL 2		
	Previous setting	New setting
Zero Voltage adjustment		
Maximum Voltage adjustment		

CHANNEL 3		
	Previous setting	New setting
Zero Voltage adjustment		
Maximum Voltage adjustment		

CHANNEL 4		
	Previous setting	New setting
Zero Voltage adjustment		
Maximum Voltage adjustment		

CHANNEL 5		
	Previous setting	New setting
Zero Voltage adjustment		
Maximum Voltage adjustment		

CHANNEL 6		
	Previous setting	New setting
Zero Voltage adjustment		
Maximum Voltage adjustment		