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User Manual

PXI

3GHz Programmable Step Attenuator Module
(Model No. 41-180)



Issue 4.1 May 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.

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.

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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.	

CONTENTS

Copyright Statement II

Technical Support and Warranty III

Product Safety IV

Contents (this page) V

Warnings and Cautions VII

Section 1
Technical Specification 1.1

Section 2
Technical Description 2.1
- Functional Description 2.1
- Cascading Attenuators 2.2

Section 3
Installation 3.1
- Pre Operation Checks 3.1
- Hardware Installation 3.2
- Software Installation 3.2

Section 4
Programming Guide 4.1
- Programming Options For Pickering PXI Cards 4.1
- Programming The Module 4.3
- Using Pickering Drivers in LabVIEW 4.4
- Programmable Attenuator Soft Front Panel 4.5

Section 5
Connector Information 5.1

Section 6
Trouble Shooting 6.1

Section 7
Maintenance Information 7.1
- Calibration 7.2

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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

41-180
DC to 3GHz Programmable Attenuator

- DC to 3GHz Attenuator
- 1dB Attenuation Resolution Ideal for Optimizing Signal Levels in Measuring Systems
- Maximum Attenuation 63dB
- Single or Dual Version in One PXI Slot
- Use of Switched Resistive Attenuator Pads Ensures High Linearity and True DC Coupled Operation
- Input and Output Connector Savers Easily Replaced if Damaged
- VISA, IVI & Kernel Drivers Supplied for Windows
- 3 Year Warranty



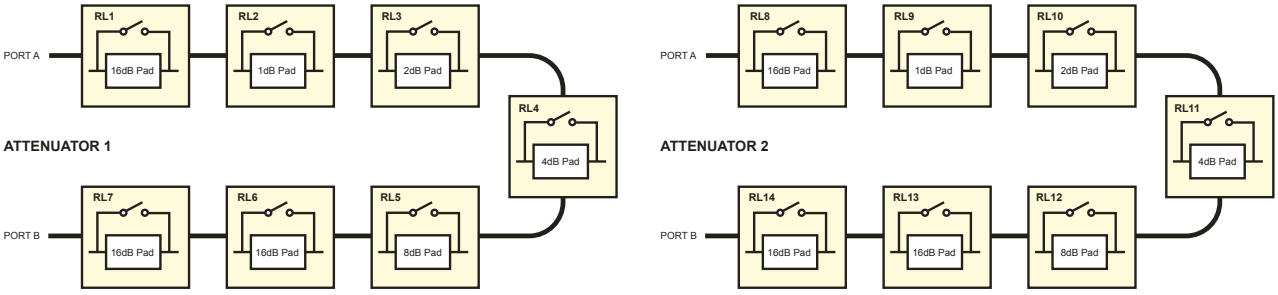
The 41-180 Programmable Attenuator Module is available with either one or two independently programmable attenuators in a single width 3U PXI module. Each attenuator uses high reliability mechanical switches to operate binary weight attenuator pads, providing attenuation values from 0 to 63dB in 1dB steps. Attenuator operating time is typically just 5ms, ensuring fast setting times.

The module is ideal for conditioning the signal levels from devices under test and ensuring that other measuring instruments are operating close to their optimum operating point for noise and linearity. The use of mechanically switched attenuators ensures broad operating bandwidth and freedom from non-linear behavior that might degrade the signals being measured.

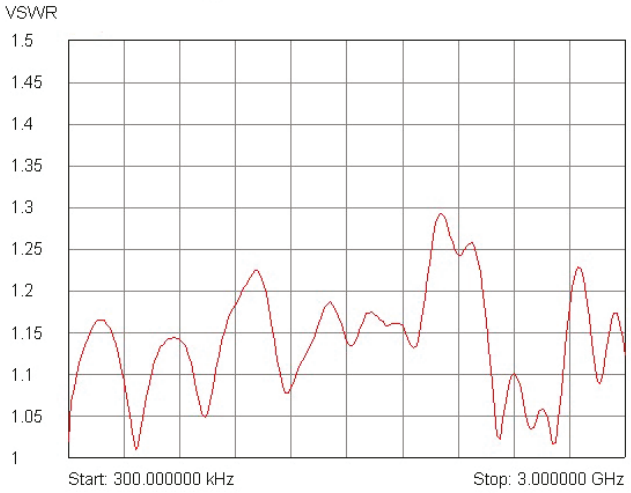
The attenuators can be used for back-to-back testing of RF products, allowing the signal levels to be adjusted to quantify the path loss that can be inserted before the communication efficiency degrades, providing a quick indication of receiver sensitivity.

The 41-180 Programmable Attenuator Module is ideal for conditioning the output level of special to type sources, saving the systems integrator the time and effort of providing a variable output level. The use of a PXI solution for variable attenuation requirements minimizes the need for components and cables located outside the PXI chassis, saving time and development costs for systems integrators.

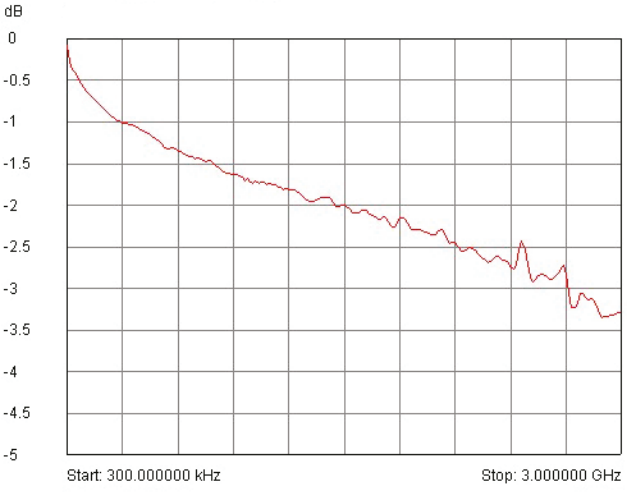
The input and output connectors of the attenuators can be interchanged and the design allows the user to change the front panel connectors quickly and easily in the event of damage occurring. The attenuators can be connected in series to increase the total available attenuation.



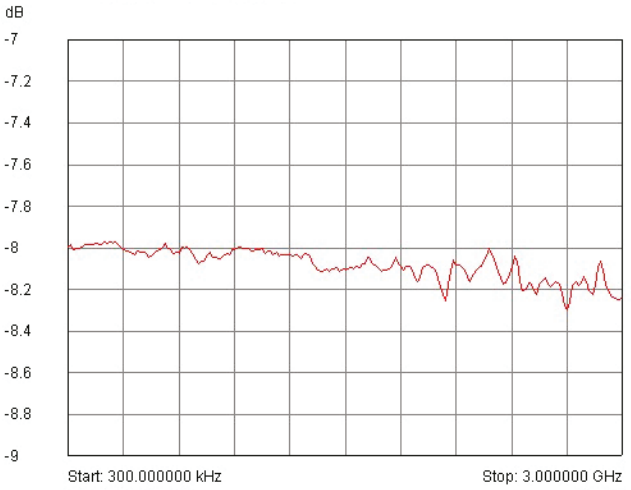
Dual DC to 3GHz Attenuator Block Diagram



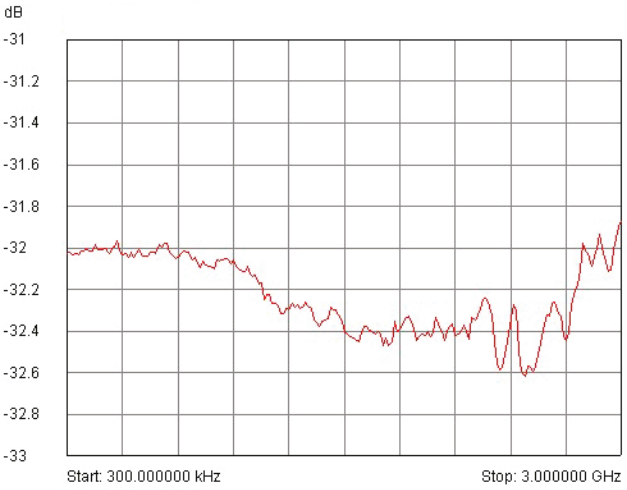
Typical VSWR Versus Frequency With No Attenuation Set



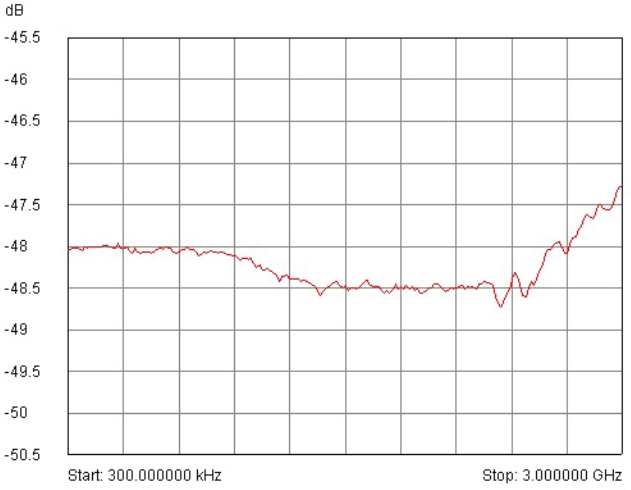
Typical Insertion Loss Versus Frequency With No Attenuation Set



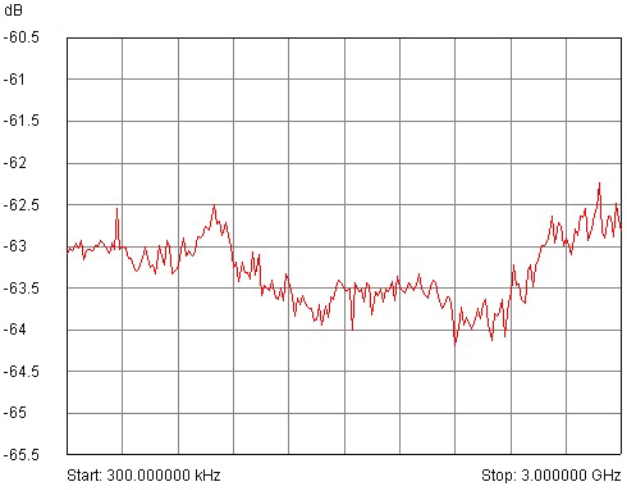
Attenuation Accuracy Versus Frequency With 8dB of Attenuation Set



Attenuation Accuracy Versus Frequency With 32dB of Attenuation Set



Attenuation Accuracy Versus Frequency With 48dB of Attenuation Set



Attenuation Accuracy Versus Frequency With 63dB Set

General Characteristics

Frequency range:	DC to 3GHz.
Maximum Input Power:	1 Watt continuous.
Input Impedance:	50Ω, DC coupled.
VSWR (SMA connector):	Less than 1.5, typically less than 1.3
RF Connectors:	SMA, input and output connections are interchangeable. Versions with SMB connectors can be made available.
Contact Life (each pad):	Typically $1x10^7$ operations. At max power $1x10^6$ operations.
Switching Time (each pad):	Typically 2ms. Maximum 4ms.

Attenuation

The attenuator is made up of 1, 2, 4, 8 and 16dB (3 off) switched pads, attenuation is set to 0dB with no power applied.

Insertion Loss (0dB set):	Typically 3.6dB at 3GHz
Attenuation Range:	0 to 63dB in 1dB steps relative to 0dB condition.

Attenuation Accuracy (individual pads measured in 50Ω system referenced to 0dB condition):

Attenuator Pad	DC to 1GHz		1GHz to 3GHz	
	Maximum	Typical	Maximum	Typical
1dB	±0.05dB	±0.05dB	±0.3dB	±0.12dB
2dB	±0.1dB	±0.08dB	±0.35dB	±0.2dB
4dB	±0.2dB	±0.15dB	±0.5dB	±0.4dB
8dB	±0.2dB	±0.15dB	±0.48dB	±0.4dB
16dB	±0.24dB	±0.24dB	±0.96dB	±0.5dB

Power Requirements

+3.3V	+5V	+12V	-12V
0	100mA	200mA	0

Width and Dimensions

Single width 3U PXI/CompactPCI instrument module.
3D models for all versions in a variety of popular file formats are available on request.

Connectors

PXI bus:	32-bit P1/J1 backplane connector.
RF Signals:	Front panel SMA connectors. Versions with SMB connectors can be made available.

Product Order Codes

Single DC to 3GHz Attenuator	**41-180-021**
Dual DC to 3GHz Attenuator	**41-180-022**

Latest Details

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

Mating Connectors & Cabling

For connection accessories for the 41-180 module please refer to the **90-011D** RF Cable Assemblies data sheet where a complete list and documentation can be found for accessories, or refer to the Connection Solutions catalog.



Dual DC to 3GHz Programmable Attenuator
41-180-022

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

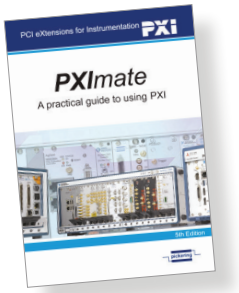
Please refer to our Web Site for Latest Product Details.
www.pickeringtest.com



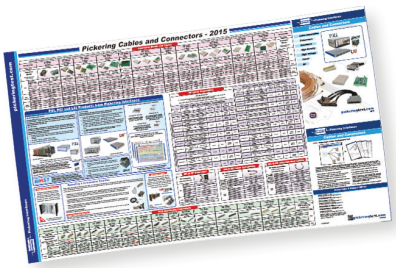
Please refer to the 200 page Pickering Interfaces "**Connection Solutions**" catalog for the full list of connector/cabling options, including drawings, photos and specifications. Available in either print or as a download.
Alternatively our web site has dynamically linked connector/cabling options,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



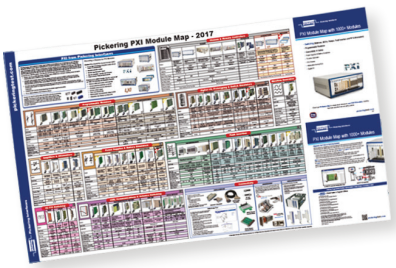
"**The Big PXI Catalog**" gives full details of Pickering's entire range of PXI switch modules, instrument modules and support products.
At over 500 pages, the Big PXI Catalog is available on request or can be downloaded from the Pickering website.



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.

SECTION 2 - TECHNICAL DESCRIPTION

FUNCTIONAL DESCRIPTION

The 41-180 Programmable 0 to 63 dB Attenuator Module which forms part of the System 40 PXI RF Instrumentation range comprises either one or two independently programmable attenuators in a single width 3U PXI module. Each attenuator comprises seven attenuator pads ranging in value from 1 dB to 16dB. A combination of attenuator pads are mechanically switched-in to provide attenuation values from 0 to 63 dB in 1 dB steps.

The signal paths are bi-directional so that the input can be applied at Port or Port B.

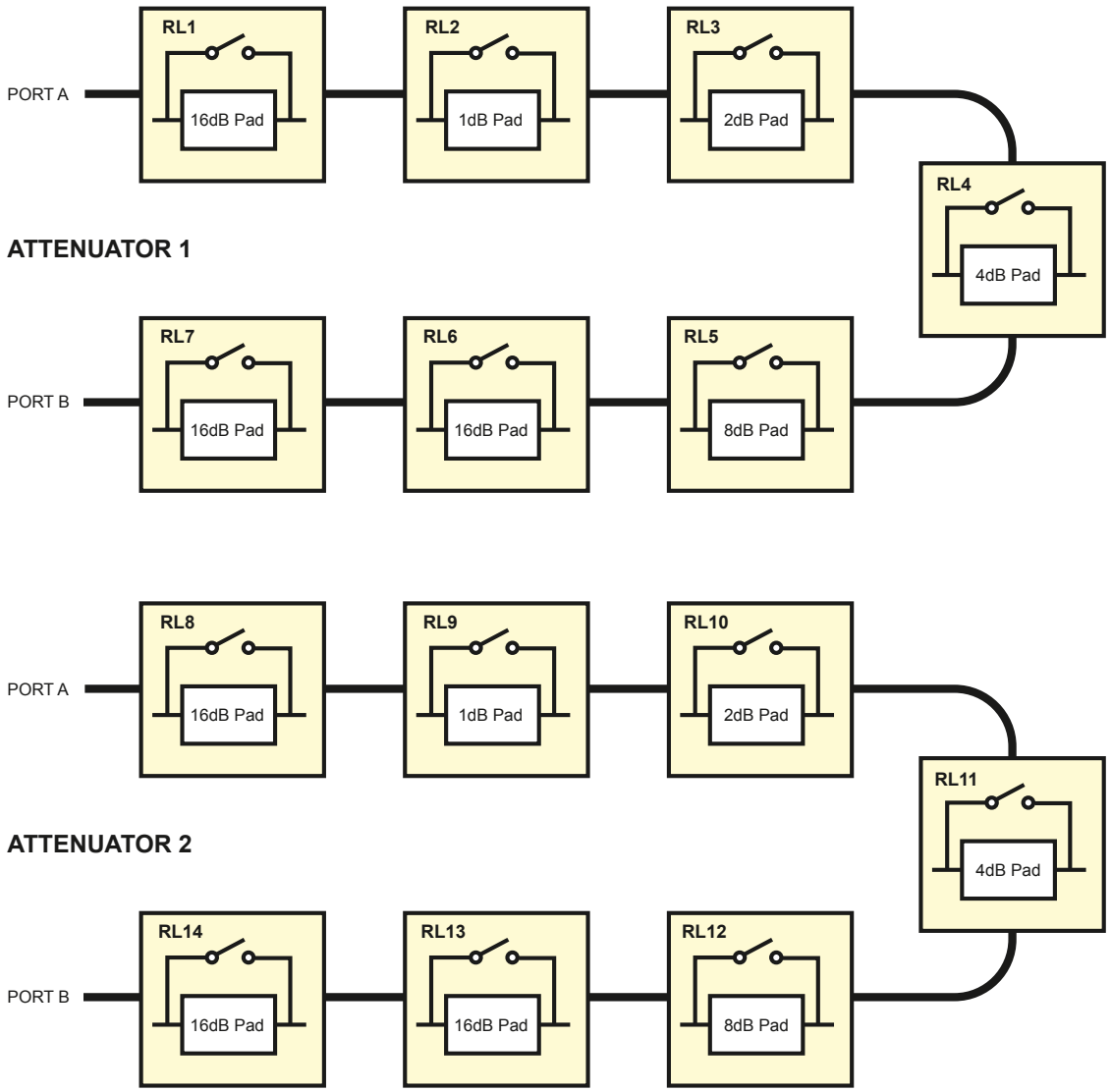


Figure 2.1 - Schematic Diagram

CASCADING ATTENUATORS

The attenuators can be connected in series to increase the total available attenuation. The signal paths are bi-directional so that the input can be applied at Port or Port B. A typical example of modules connected in series is shown in Figure 2.2

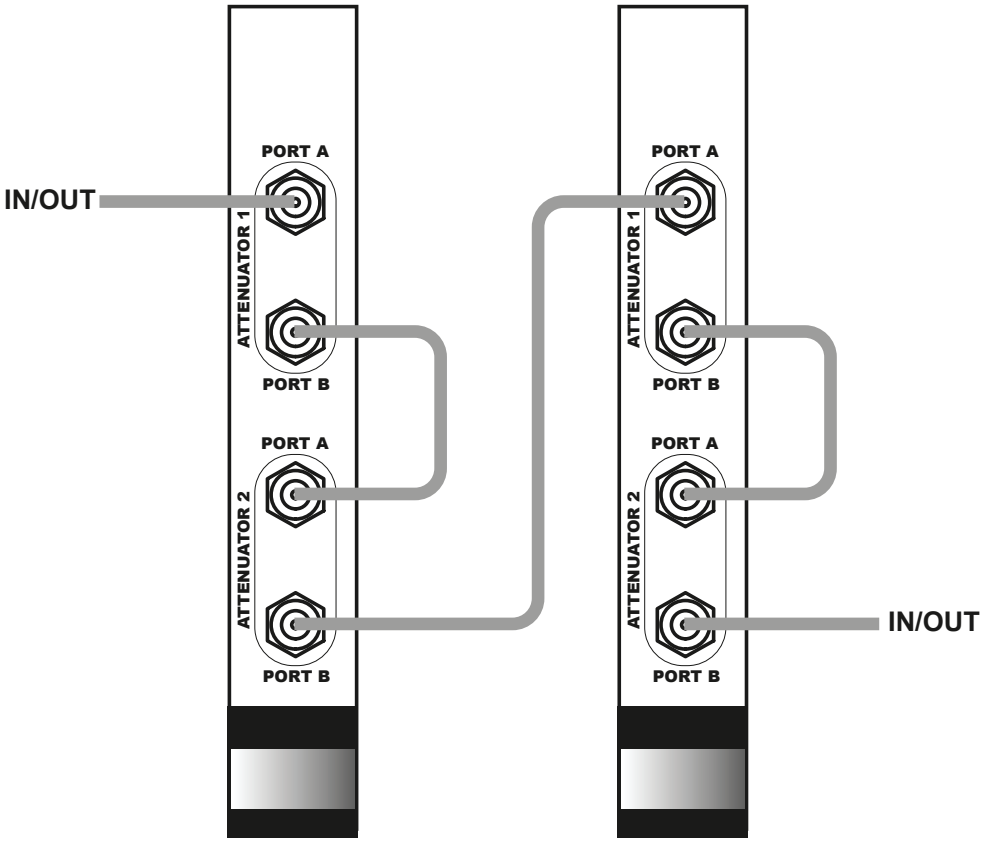


Figure 2.2 - Typical Series Connection Of Attenuator Modules

The attenuation value is set via a soft panel which allows the operator to set the value using a sliding scale (which automatically switches-in the required attenuator pads), or manually switch-in the desired attenuator pads to set the value (refer to Figure 3.4).

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.

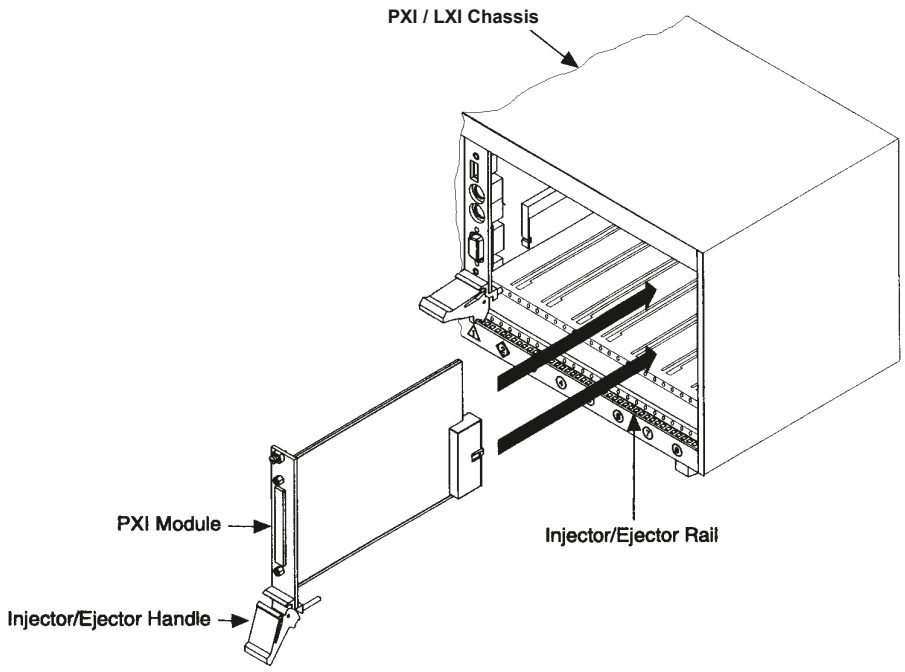


Figure 3.1 - Installing the Module into a PXI/cPCI/LXI Chassis

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.

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

Using The Direct Driver or VISA Driver

This section provides some code fragments which show how to control the Attenuator using the Direct Driver or the VISA Driver.

Once the drivers are installed the manual “Sys40Prg.pdf” and driver help files which fully describes these functions can be found in the Pickering folder(s) or the Pickering entries on your Start Menu.

The card must be opened before use and closed after using the following function calls:

Direct Driver - Open with `PIL_OpenCards` or `PIL_OpenSpecifiedCard` and close with `PIL_CloseCards` or `PIL_CloseSpecifiedCards` respectively.

VISA Driver - Open with `pipx40_init`, and close with, `pipx40_close`.

Using PILPXI (Direct)

There are a number of functions provided specifically for controlling and interrogating Pickering attenuator instruments as follows:

PIL_AttenType(); - get attenuator sub-unit information (in string format)
PIL_AttenInfo(); - get attenuator sub-unit information (numeric format)
PIL_AttenSetAttenuation(); - set attenuation value
PIL_AttenGetAttenuation(); - get attenuation value
PIL_AttenPadValue(); - get the attenuation value associated with a numbered pad

This example shows how to set the attenuation assuming the instrument/card handle “CardNum” is already obtained:

```
DWORD SubNum = 1;    //set the channel/pad parameter to channel 1
float Atten = 8.25;  //set the attenuation parameter to 8.25dB
PIL_AttenSetAttenuation(CardNum, SubNum, Atten); //set the attenuation
```

Using PIPX40 (VISA)

There are a number of functions provided specifically for controlling and interrogating Pickering attenuator instruments as follows:

pipx40_attenGetType() - Get attenuator sub-unit information (in string format)
pipx40_attenGetInfo() - Get attenuator sub-unit information (numeric format)
pipx40_attenSetAttenuation() - Set attenuation value
pipx40_attenGetAttenuation() - Get attenuation value
pipx40_attenGetPadValue() - Get the attenuation value associated with a numbered pad

This example shows how to set the attenuation assuming the instrument handle “vi” is already obtained:

```
ViUInt32 subUnit = 1;                //set the channel/pad parameter to channel 1
ViReal32 atten = 8.25;               //set the attenuation parameter to 8.25dB
pipx40_attenSetAttenuation(vi,subUnit,atten);   //set the attenuation
```

USING PICKERING DRIVERS IN LabVIEW

Most Pickering drivers include a LabVIEW wrapper to permit full operation of the Pickering product from the LabVIEW environment. These wrappers are normally installed to the current LabVIEW folder system during installation of the Pickering driver.

The process of controlling a Pickering product normally consists of the following steps:

1. Open a control session on the product
2. Use functions in the library to operate the product
3. Close the control session

Following is a simple example of the use of the most common Pickering drivers:

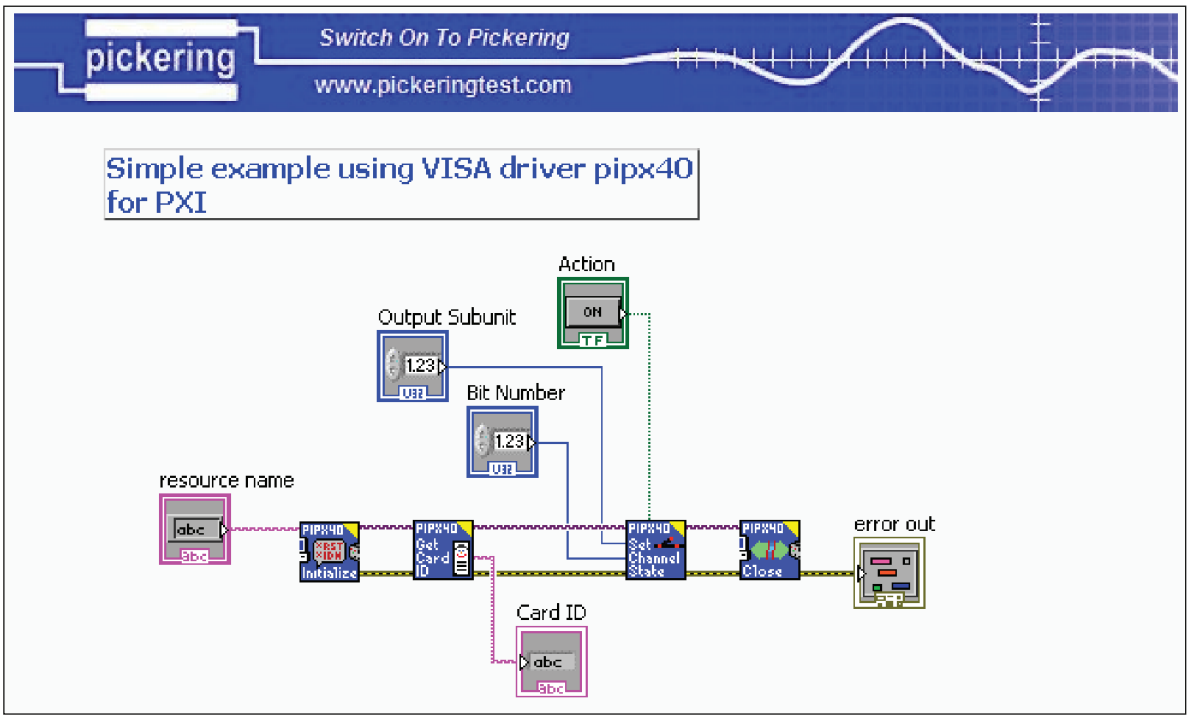


Figure 4.4 - Example Use of Pickering Drivers in LabVIEW

To download LabVIEW examples, please go to:

http://wiki.pickeringtest.net/Using+Pickering+Drivers+in+LabView

PROGRAMMABLE ATTENUATOR SOFT FRONT PANEL

A dedicated Soft Front Panel application is available on the Pickering distribution disk and from the Pickering web-site. On the disk it can be found in the /Applications/Soft Front Panels/ folder, on the web-site it is located at:
http://downloads.pickeringtest.info/downloads/Soft_Front_Panels/Programmable%20Attenuator%20v1.1.2.exe

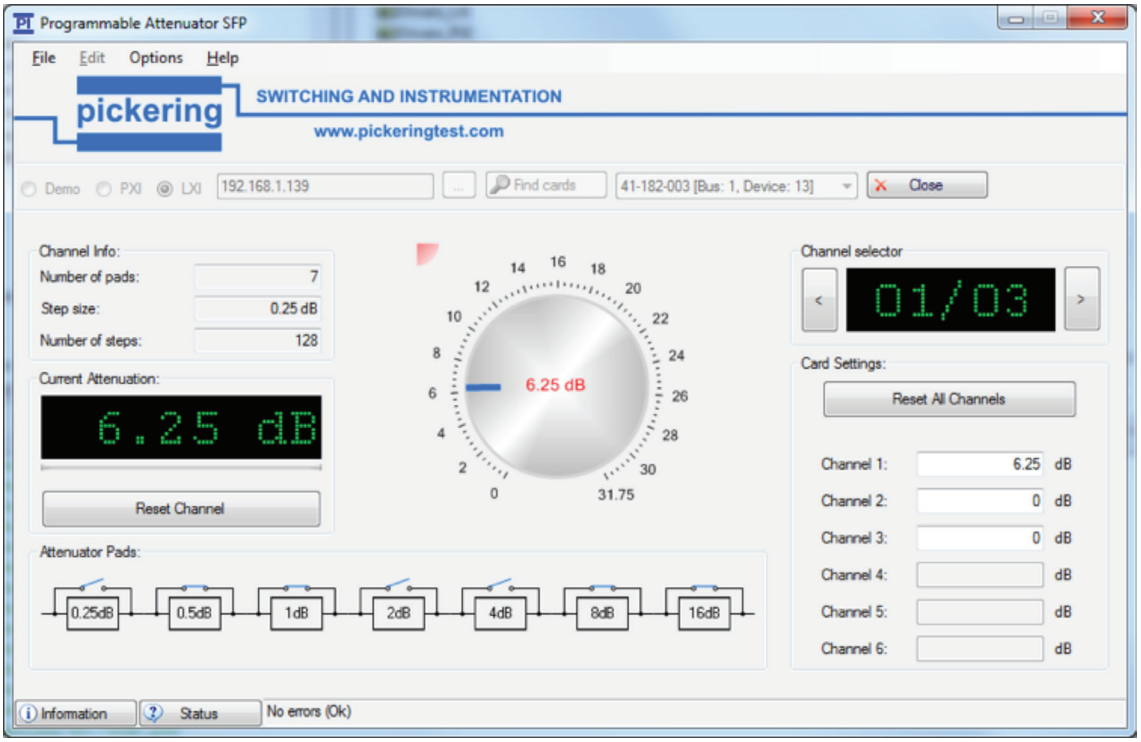


Figure 4.5 - Soft Front Panel Supplied With The Programmable Attenuator

This soft front panel will operate with models:

41-181-021
41-181-022
41-180-022
41-182-003
41-182-006

With the cards mounted in either a PXI or an LXI chassis.

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SECTION 5 - CONNECTOR INFORMATION

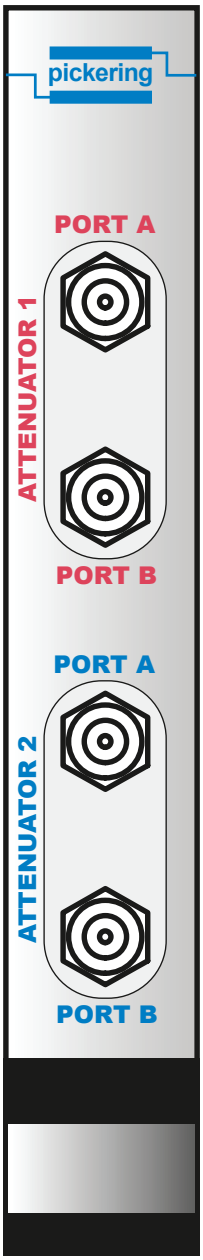


Figure 5.1 - 41-180-022 Dual Programmable Attenuator Module: Connector Positions

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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

The 41-180 contains no user adjustable parts. In normal use it does not need regular calibration but for applications where the attenuators are required to be regularly calibrated we suggest an interval of one year or longer.

VNA Test Procedure

Calibration requires access to a suitable Vector Network Analyzer (VNA) with coverage to at least 3GHz.

Before starting measurement, perform a full calibration on the VNA using a back to back SMA connector to link the VNA ports. The connection must use good quality SMA terminated leads to avoid measurement errors.

To measure the insertion loss of a 41-180, connect the selected attenuator channel to the VNA ports using the leads used to calibrate the VNA, set the VNA to measure S21 and observe the insertion loss at 3GHz. Insertion loss is stated at typically 3.6dB, this would not be expected to be more than 4.5dB

Normalise the VNA plot to show 0dB loss with the through path selected on the 41-180 channel under test (0dB - no attenuator pads selected)

Select each attenuator pad in turn. Check that the change in insertion loss (compared to the thru path) is in accordance with the limits in the data sheet.

Record the result in the table overleaf.

Repeat the test on the second attenuator channel if fitted.

Alternative Procedure

An alternative procedure can be based on the use of a signal generator and a wide dynamic range receiver, such as Agilent 8902.

For this procedure to be used, the signal generator MUST be connected to the attenuator channel under test via a precision fixed attenuator pad with 10dB attenuation or more in order to remove VSWR errors from the signal generator. The precision fixed attenuator should be placed on the attenuator under test input.

The procedure is performed in a similar way at spot frequencies of 1GHz and 3GHz.

First normalise the through path using a back to back SMA cable to provide a reference level.

Then insert the attenuator channel to be tested and measure the 0dB thru path to record the insertion loss.

Normalise the subsequent measurements to the 0dB thru path.

Measure each of the attenuator pads in turn at 1GHz and 3GHz.

Record the result in the table overleaf.

Repeat the test on the second attenuator channel if fitted.

Table 7.1 - Calibration Test Results For 41-180

Serial Number:	
Attenuator Chan:	
Date of Test:	
Operator's Name:	
Test Equipment Used:	

Attenuator Path	Frequency	Measured Attenuation	Specification	Result (delete as appropriate)
Thru path	3GHz		<4.5dB	Pass / Fail
16dB (pad 1)	1GHz		16dB ±0.24dB	Pass / Fail
	3GHz		16dB ±0.5dB	Pass / Fail
1dB (pad 2)	1GHz		1dB ±0.05dB	Pass / Fail
	3GHz		1dB ±0.3dB	Pass / Fail
2dB (pad 3)	1GHz		2dB ±0.1dB	Pass / Fail
	3GHz		2dB ±0.35dB	Pass / Fail
4dB (pad 4)	1GHz		4dB ±0.15dB	Pass / Fail
	3GHz		4dB ±0.4dB	Pass / Fail
8dB (pad 5)	1GHz		8dB ±0.15dB	Pass / Fail
	3GHz		8dB ±0.4dB	Pass / Fail
16dB (pad 6)	1GHz		16dB ±0.24dB	Pass / Fail
	3GHz		16dB ±0.5dB	Pass / Fail
16dB (pad 7)	1GHz		16dB ±0.24dB	Pass / Fail
	3GHz		16dB ±0.5dB	Pass / Fail

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