

ARTISAN®
TECHNOLOGY GROUP

Your **definitive** source for quality pre-owned equipment.

Artisan Technology Group
(217) 352-9330 | sales@artisantg.com | artisantg.com

Full-service, independent repair center
with experienced engineers and technicians on staff.

We buy your excess, underutilized, and idle equipment
along with credit for buybacks and trade-ins.

Custom engineering
so your equipment works exactly as you specify.

- Critical and expedited services
- In stock / Ready-to-ship
- Leasing / Rentals / Demos
- ITAR-certified secure asset solutions

Expert team | Trust guarantee | 100% satisfaction

All trademarks, brand names, and brands appearing herein are the property of their respective owners.

Visit our website - *Click HERE*

40-110/115/120/125 User Manual

PXI Reed Relay Modules



PXI

Issue 5.5 January 2020

pickeringtest.com

© COPYRIGHT (2020) PICKERING INTERFACES. ALL RIGHTS RESERVED.

No part of this publication may be reproduced, transmitted, transcribed, translated or stored in any form, or by any means without the written permission of Pickering Interfaces.

Technical details contained within this publication are subject to change without notice.

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.

Worldwide Technical Support and Product Information

pickeringtest.com

Pickering Interfaces Headquarters

Stephenson Road Clacton-on-Sea CO15 4NL United Kingdom
Tel: +44 (0)1255-687900
E-Mail: sales@pickeringtest.com

USA
Tel: (West) +1 541 471 0700
Tel: (East) +1 781 897 1710
E-mail: ussales@pickeringtest.com

France
Tel +33 9 72 58 77 00
E-mail frsales@pickeringtest.com

Germany
Tel: +49 89 125 953 160
E-mail: desales@pickeringtest.com

Sweden
Tel: +46 340-69 06 69
E-mail: ndsales@pickeringtest.com

Czech Republic
Tel: +420 558 987 613
E-mail: desales@pickeringtest.com

China
Tel: +86 4008 799 765
E-mail: chinasales@pickeringtest.com

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

Section 3
Installation 3.1
- Pre Operation Checks 3.1
- Hardware Installation 3.2
- Software Installation 3.2
- Testing Operation 3.3

Section 4
Programming Guide 4.1
- Programming Options For Pickering PXI Modules 4.1
- Module Architecture - 40-110-021/121 ..... 4.2
- Module Architecture - 40-115-021/121 ..... 4.3
- Module Architecture - 40-115-022/122 ..... 4.4
- Module Architecture - 40-120-021 ..... 4.5
- Module Architecture - 40-125-121 ..... 4.6
- Programming The Module 4.7

Section 5
Connector Information 5.1

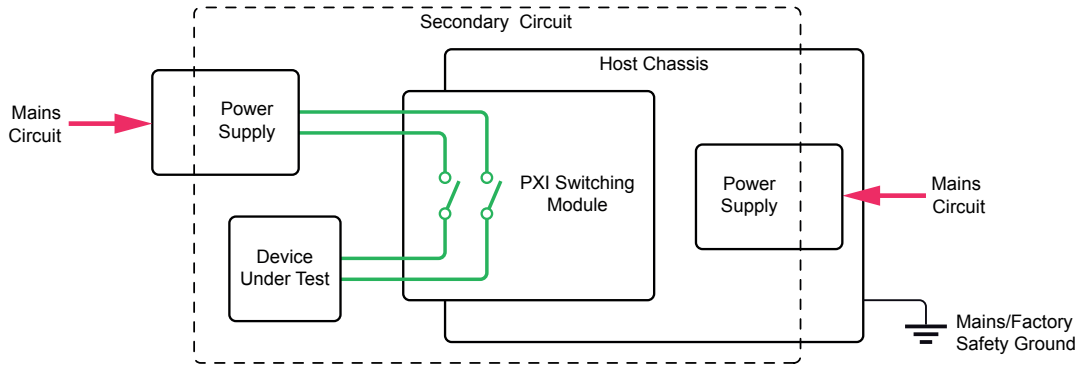
Section 6
Trouble Shooting 6.1

Section 7
Maintenance Information 7.1
- Switching System Test Tools 7.1
- Relay Lookup Table - 40-110-021/121 ..... 7.2
- Relay Lookup Table - 40-115-021/121 ..... 7.2
- Relay Lookup Table - 40-115-022/122 ..... 7.3
- Relay Lookup Table - 40-120-021 ..... 7.4
- Relay Lookup Table - 40-125-121 ..... 7.4

THIS PAGE INTENTIONALLY BLANK

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 host 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. Not to be used in safety critical circuits, refer to the Pickering Interfaces' terms & conditions of sale. This module must not be used for the switching of Mains Circuits. For the switching of voltages up to the module's full specification, Secondary Circuit power supplies and the Device Under Test must be fully isolated from the Mains Circuit and the safety earth. The host chassis must be correctly installed and be connected to mains or factory safety ground, please refer to your chassis installation manual.  **Diagram Showing Separation Between The Mains Circuit and Secondary Circuit / DUT** For the purposes of this document, a Mains Circuit is an installation classified as Overvoltage Category II up to 300V. Separation between the Secondary Circuit and Mains Circuit is achieved by a transformer in which the primary windings are separated from the secondary windings by reinforced insulation, double insulation, or a screen connected to the protective conductor terminal.	

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

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

SAFETY INSTRUCTIONS

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

SECTION 1 - TECHNICAL SPECIFICATION

- 16, 24 or 32 Reed Relays Per Module
- SPST, DPST and SPDT Configurations
- Ruthenium Reed Relays Suitable For Low Level Signals
- Uses High Reliability Pickering Reed Relays For Maximum Performance
- Fast Operating Speed 250µs Typical
- Switch up to 150V, 1.2A with 20W Max Power
- VISA, IVI & Kernel Drivers Supplied for Windows
- Supported by PXI or LXI Chassis
- Supported by *eBIRST* ™
- 3 Year Warranty



The 40-110/115 range of switching modules are available in both Changeover (SPDT) and Normally Open (SPST & DPST) configurations. Connections are made via a front panel 96-pin male micro-D connector.

General purpose reed relays are suitable for the construction of small switching networks, for slave switching larger relays or for operating external devices (e.g. lamps, solenoids etc.). To simplify inter-relay wiring, interconnection points are built onto the circuit board thus easing the construction of complicated wiring.

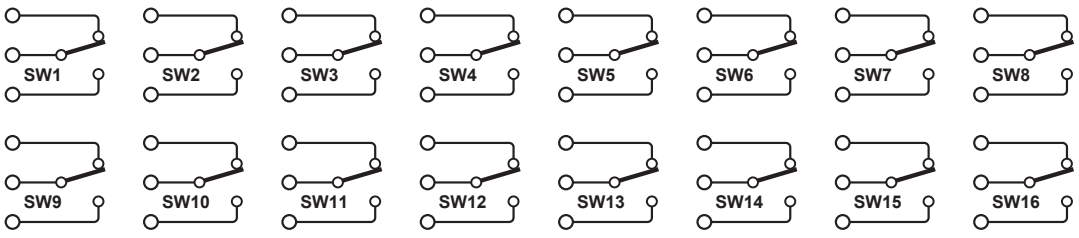
Range Description:

- 40-110-021 16 x SPDT Reed Relays.
- 40-110-121 32 x SPDT Reed Relays.
- 40-115-021 16 x SPST Reed Relays.
- 40-115-121 32 x SPST Reed Relays.
- 40-115-022 16 x DPST Reed Relays.
- 40-115-122 24 x DPST Reed Relays.

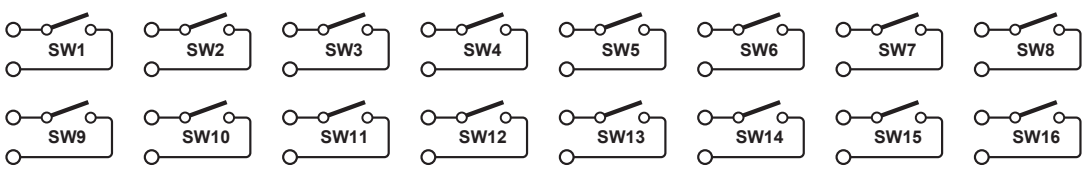
Supported by *eBIRST*

eBIRST switching system test tools simplify switching system fault-finding by quickly testing the system and graphically identifying the faulty relay.

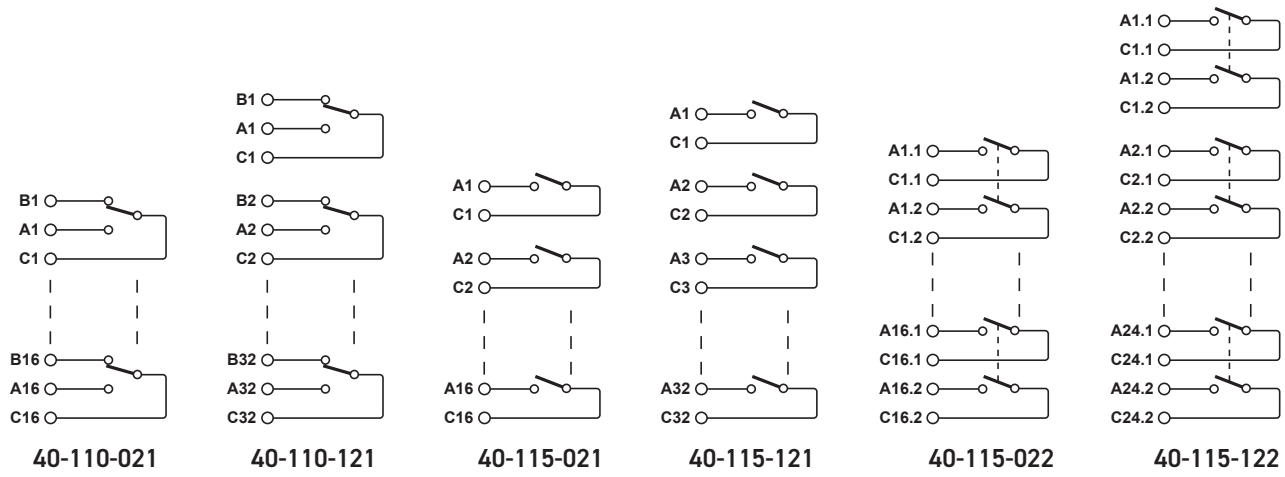
For more information go to: pickeringtest.com/ebirst



Schematic of 40-110 Relay Module – 16 x SPDT



Schematic of 40-115 Relay Module – 16 x SPST



Switching Diagrams for the 40-110/115 Reed Relay Modules

Relay Type

The 40-110 & 40-115 are fitted with Reed Relays (Ruthenium sputtered type), these offer very long life with good low level switching performance and excellent contact resistance stability. Spare Reed Relays are built onto the circuit board to facilitate easy maintenance with minimum downtime.

All reed relays are manufactured by our sister company Pickering Electronics: pickeringrelay.com

Switching Specification

Switch Type:	Ruthenium Reed
Max Switch Voltage:	150VDC/100VAC*
Max Power:	20W (SPST & DPST) 3W (SPDT)
Max Switch Current:	1A (SPST & DPST) 0.25A (SPDT)
Max Carry Current:	1.2A (SPST & DPST) 1A (SPDT)
Initial On Path Resistance:	<500mΩ
Off Path Resistance:	$>10^9\Omega$
Single-Ended Thermal Offset:	<10µV
Operate Time:	<0.5ms, 0.25ms typical
Release Time:	<0.5ms, 0.25ms typical
Expected Life, low power:	$1x10^9$ operations
Expected Life, high power:	$>1x10^6$ operations

* For full voltage rating, signal sources to be switched must be fully isolated from mains supply and safety earth.

Power Requirements

+3.3V	+5V	+12V	-12V
0	360mA (typ 280mA)	0	0

Mechanical Characteristics

Single slot 3U PXI (CompactPCI card).
Module weight: 200g (40-115-121).
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 96-pin male micro-D 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

16 x SPDT, Ruthenium Reed Relays	40-110-021
32 x SPDT, Ruthenium Reed Relays	40-110-121
16 x SPST, Ruthenium Reed Relays	40-115-021
32 x SPST, Ruthenium Reed Relays	40-115-121
16 x DPST, Ruthenium Reed Relays	40-115-022
24 x DPST, Ruthenium Reed Relays	40-115-122

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.

Customization can include:

- Alternative reed relay types
- Mixture of reed relay types
- Alternative number of relays
- Different performance specifications

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.

Support Products

eBIRST Switching System Test Tool

This product is supported by the *eBIRST* test tools which simplify the identification of failed relays, the required *eBIRST* tools are below. For more information go to: pickeringtest.com/ebirst

Product	Test Tool	Adaptor	Termination
40-110/115	93-002-001	93-002-226	93-016-103

Spare Relay Kits

Kits of replacement relays are available for the majority of Pickering's PXI switching products, simplifying servicing and reducing down-time.

Product	Relay Kit
40-110-021/121	91-100-061
40-115-021/121	91-100-045
40-115-022/122	91-100-017

For further assistance, please contact your local Pickering sales office.

Mating Connectors & Cabling

For connection accessories for the 40-110 series please refer to the 90-016D 96-pin micro-D 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

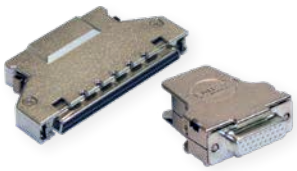
Pickering LXI or LXI/USB Modular Chassis—only accept our 1000+ PXI Switching & Simulation Modules:

- 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

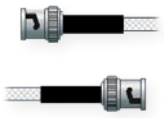
We provide a full range of supporting cable and connector solutions for all our switching products—20 connector families with 1200+ products. We offer everything from simple mating connectors to complex cables assemblies and terminal blocks. All assemblies are manufactured by Pickering and are guaranteed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



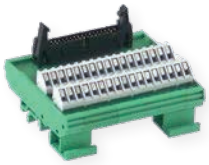
Connectors & Backshells



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 and OpenTAP
- **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

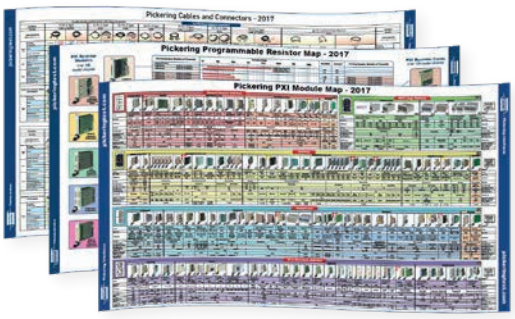
Three Year Warranty & Guaranteed Long-Term Support

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 on Switching Technology and for the PXI and LXI standards.







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

THIS PAGE INTENTIONALLY BLANK

SECTION 2 - TECHNICAL DESCRIPTION

FUNCTIONAL DESCRIPTION

A functional block diagram is provided in Figure 2.1. The Reed Relay Module is powered by a +5V input via Compact PCI connector J2. The interface to the user test equipment is via the front panel mounted 96-pin SCSI type connector, J1. The module comprises a PCB populated with single pole, double pole or screened reed relays, depending on the module type. The relays are energised via control signals from relay driver U8. The relay driver is addressed by PCI bridge U1 to output the required signal. Module configuration is determined by hardwired links and data stored in EEPROM U7. PCI Bridge U1 is configured by EEPROM U2.

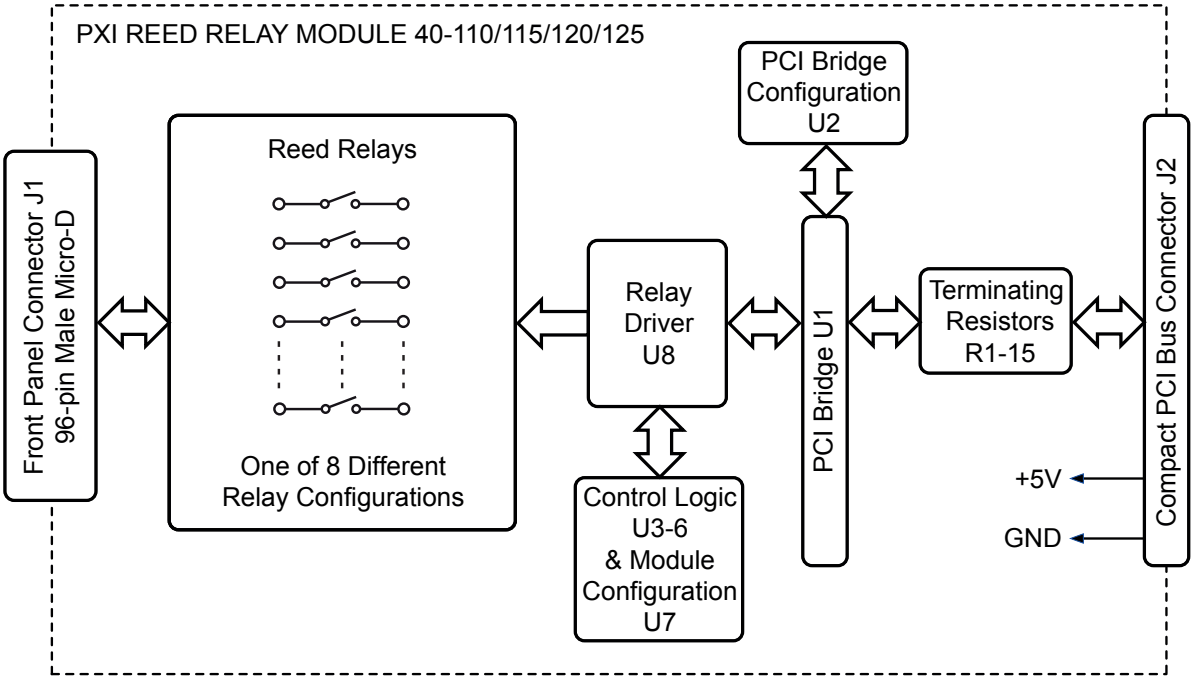


Figure 2.1 - Reed Relay Module 40-110/115/120/125: Functional Block Diagram

THIS PAGE INTENTIONALLY BLANK

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.

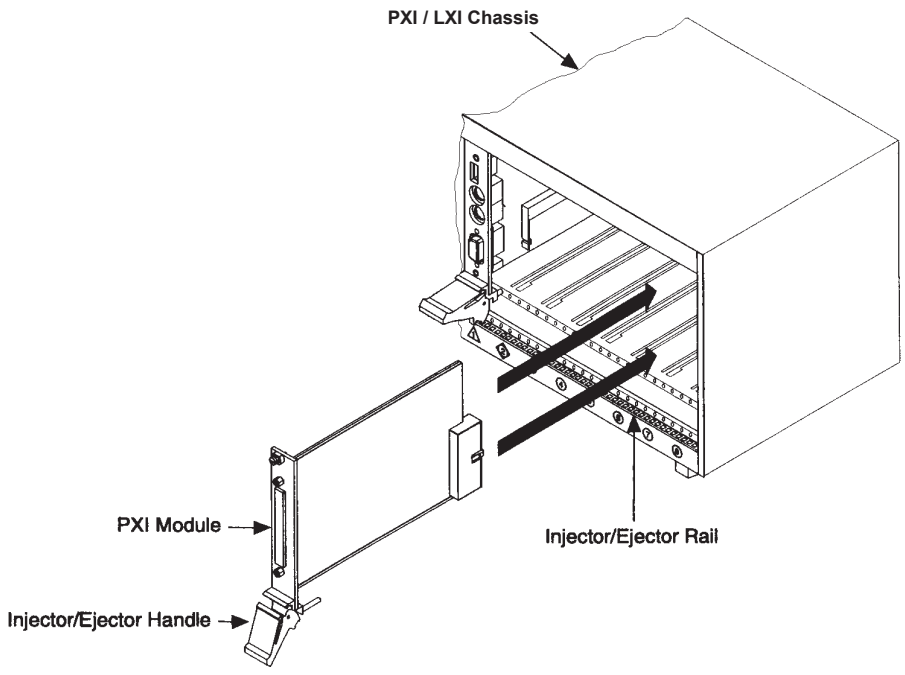


Figure 3.1 - Installing the Module into a PXI/cPCI/LXI Chassis

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.

TESTING OPERATION

After installation of the hardware and Pickering PXI Driver software package start the General Soft Front Panel (GSFP) using the desktop icon or via the Start menu (***Start Menu-> Pickering Interfaces Ltd -> General Soft Front Panel***).



Figure 3.2 - General Soft Front Panel Icon

A selector panel will appear, listing all installed Pickering PCI, PXI or LXI switch cards and resistor cards. Click on the card you wish to control, and a graphical control panel is presented allowing operation of the card. Panels can be opened simultaneously for all the installed cards.

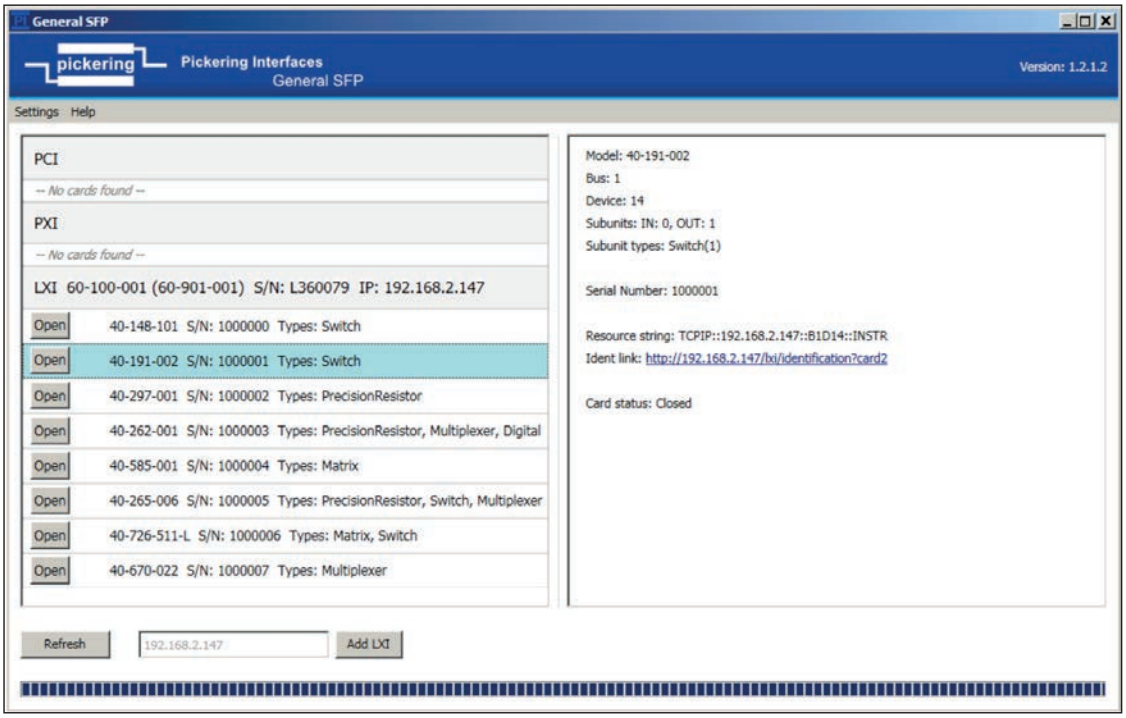


Figure 3.3 - General Soft Front Panel Selector

More details how to use the GSFP can be found in the manual, via menu ***Help\Manual***

THIS PAGE INTENTIONALLY BLANK

SECTION 4 - PROGRAMMING GUIDE

PROGRAMMING OPTIONS FOR PICKERING INTERFACES PXI MODULES

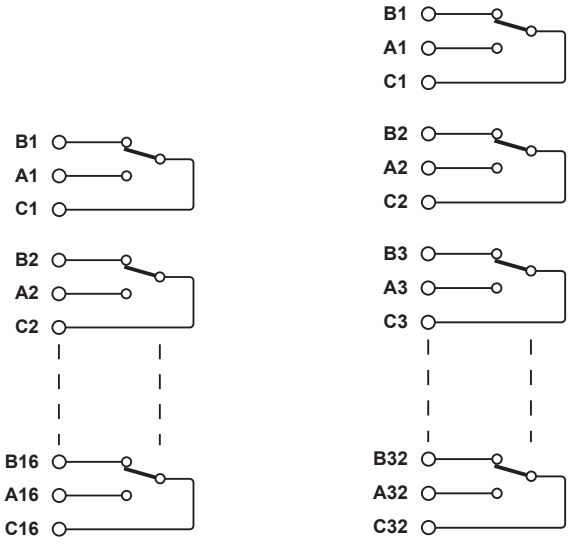
For information on the installation and use of drivers and the programming of Pickering's products in various software environments, please refer to the Software User Manual.

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

MODULE ARCHITECTURE - 40-110-021/121

The 40-110-021 is an array of 16, and the 40-110-121 is an array of 32 uncommitted changeover relays. In the default state, all signal paths are between the C terminal and the corresponding B terminal. Energising a particular relay disconnects the B terminal and creates a signal path between the C and A terminals. The relay module's switching architectures are shown in their default state in the diagram below:



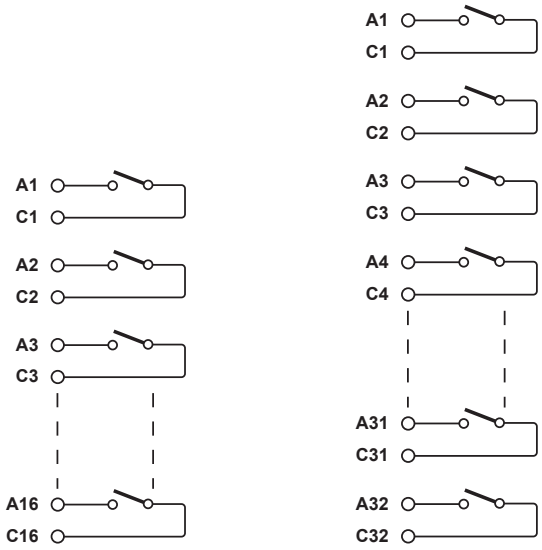
40-110-021 (16 x SPDT) **40-110-121 (32 x SPDT)**

One sub-unit is used to control all the module's relays as shown below. Enabling a particular bit opens the C to B signal path and closes the C to A signal path.

Sub-Unit	Bit	40-110-021 Signal Path (with relay energised)	40-110-121 Signal Path (with relay energised)
1	1	C1 to A1	C1 to A1
1	2	C2 to A2	C2 to A2
1	3	C3 to A3	C3 to A3
1	4	C4 to A4	C4 to A4
1	5	C5 to A5	C5 to A5
1	6	C6 to A6	C6 to A6
1	7	C7 to A7	C7 to A7
1	8	C8 to A8	C8 to A8
1	9	C9 to A9	C9 to A9
1	10	C10 to A10	C10 to A10
1	11	C11 to A11	C11 to A11
1	12	C12 to A12	C12 to A12
1	13	C13 to A13	C13 to A13
1	14	C14 to A14	C14 to A14
1	15	C15 to A15	C15 to A15
1	16	C16 to A16	C16 to A16
1	17	—	C17 to A17
1	18	—	C18 to A18
1	19	—	C19 to A19
1	20	—	C20 to A20
1	21	—	C21 to A21
1	22	—	C22 to A22
1	23	—	C23 to A23
1	24	—	C24 to A24
1	25	—	C25 to A25
1	26	—	C26 to A26
1	27	—	C27 to A27
1	28	—	C28 to A28
1	29	—	C29 to A29
1	30	—	C30 to A30
1	31	—	C31 to A31
1	32	—	C32 to A32

MODULE ARCHITECTURE - 40-115-021/121

The 40-115-021 is an array of 16, and the 40-115-121 is an array of 32 uncommitted SPST relays. In the default state, all signal paths are open. Energising a particular relay creates a signal path between the C and A terminals. The relay module's switching architectures are shown in their default state in the diagram below:



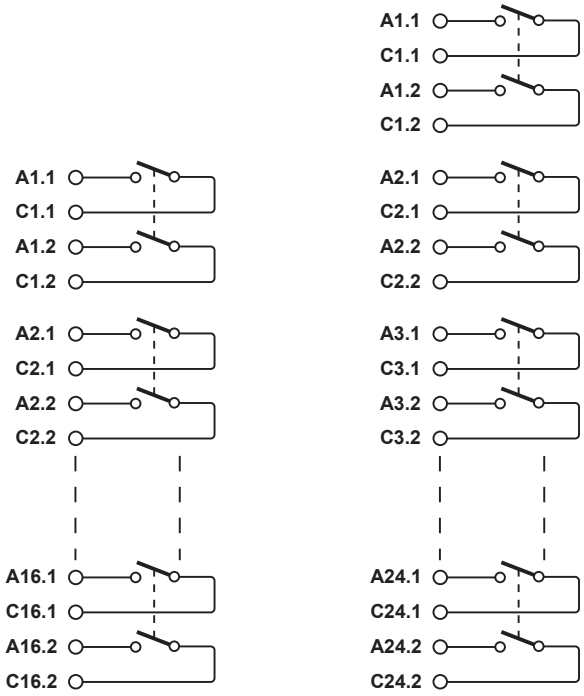
40-115-021 (16 x SPST) **40-115-121 (32 x SPST)**

One sub-unit is used to control all the module's relays as shown below. Enabling a particular bit closes the C to A signal path.

Sub-Unit	Bit	40-115-021 Signal Path (with relay energised)	40-115-121 Signal Path (with relay energised)
1	1	C1 to A1	C1 to A1
1	2	C2 to A2	C2 to A2
1	3	C3 to A3	C3 to A3
1	4	C4 to A4	C4 to A4
1	5	C5 to A5	C5 to A5
1	6	C6 to A6	C6 to A6
1	7	C7 to A7	C7 to A7
1	8	C8 to A8	C8 to A8
1	9	C9 to A9	C9 to A9
1	10	C10 to A10	C10 to A10
1	11	C11 to A11	C11 to A11
1	12	C12 to A12	C12 to A12
1	13	C13 to A13	C13 to A13
1	14	C14 to A14	C14 to A14
1	15	C15 to A15	C15 to A15
1	16	C16 to A16	C16 to A16
1	17	—	C17 to A17
1	18	—	C18 to A18
1	19	—	C19 to A19
1	20	—	C20 to A20
1	21	—	C21 to A21
1	22	—	C22 to A22
1	23	—	C23 to A23
1	24	—	C24 to A24
1	25	—	C25 to A25
1	26	—	C26 to A26
1	27	—	C27 to A27
1	28	—	C28 to A28
1	29	—	C29 to A29
1	30	—	C30 to A30
1	31	—	C31 to A31
1	32	—	C32 to A32

MODULE ARCHITECTURE - 40-115-022/122

The 40-115-022 is an array of 16, and the 40-115-122 is an array of 24 uncommitted DPST relays. In the default state, all signal paths are open. Energising a particular relay creates a signal path between the C and A terminals of both poles of the corresponding channel. The relay module's switching architectures are shown in their default state in the diagram below:



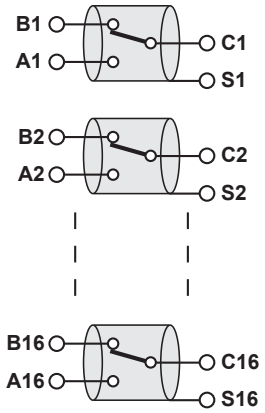
40-115-022 (16 x DPST) **40-115-122 (24 x DPST)**

One sub-unit is used to control all the module's relays as shown below. Enabling a particular bit closes both C to A signal paths of the corresponding channel.

Sub-Unit	Bit	40-115-022 Signal Path (with relay energised)	40-115-122 Signal Path (with relay energised)
1	1	C1.1 to A1.1 & C1.2 to A1.2	C1.1 to A1.1 & C1.2 to A1.2
1	2	C2.1 to A2.1 & C2.2 to A2.2	C2.1 to A2.1 & C2.2 to A2.2
1	3	C3.1 to A3.1 & C3.2 to A3.2	C3.1 to A3.1 & C3.2 to A3.2
1	4	C4.1 to A4.1 & C4.2 to A4.2	C4.1 to A4.1 & C4.2 to A4.2
1	5	C5.1 to A5.1 & C5.2 to A5.2	C5.1 to A5.1 & C5.2 to A5.2
1	6	C6.1 to A6.1 & C6.2 to A6.2	C6.1 to A6.1 & C6.2 to A6.2
1	7	C7.1 to A7.1 & C7.2 to A7.2	C7.1 to A7.1 & C7.2 to A7.2
1	8	C8.1 to A8.1 & C8.2 to A8.2	C8.1 to A8.1 & C8.2 to A8.2
1	9	C9.1 to A9.1 & C9.2 to A9.2	C9.1 to A9.1 & C9.2 to A9.2
1	10	C10.1 to A10.1 & C10.2 to A10.2	C10.1 to A10.1 & C10.2 to A10.2
1	11	C11.1 to A11.1 & C11.2 to A11.2	C11.1 to A11.1 & C11.2 to A11.2
1	12	C12.1 to A12.1 & C12.2 to A12.2	C12.1 to A12.1 & C12.2 to A12.2
1	13	C13.1 to A13.1 & C13.2 to A13.2	C13.1 to A13.1 & C13.2 to A13.2
1	14	C14.1 to A14.1 & C14.2 to A14.2	C14.1 to A14.1 & C14.2 to A14.2
1	15	C15.1 to A15.1 & C15.2 to A15.2	C15.1 to A15.1 & C15.2 to A15.2
1	16	C16.1 to A16.1 & C16.2 to A16.2	C16.1 to A16.1 & C16.2 to A16.2
1	17	—	C17.1 to A17.1 & C17.2 to A17.2
1	18	—	C18.1 to A18.1 & C18.2 to A18.2
1	19	—	C19.1 to A19.1 & C19.2 to A19.2
1	20	—	C20.1 to A20.1 & C20.2 to A20.2
1	21	—	C21.1 to A21.1 & C21.2 to A21.2
1	22	—	C22.1 to A22.1 & C22.2 to A22.2
1	23	—	C23.1 to A23.1 & C23.2 to A23.2
1	24	—	C24.1 to A24.1 & C24.2 to A24.2

MODULE ARCHITECTURE - 40-120-021

The 40-120-021 is an array of 16 uncommitted screened changeover relays. In the default state, all signal paths are between the C terminal and the corresponding B terminal. Energising a particular relay disconnects the B terminal and creates a signal path between the C and A terminals. The relay module's switching architectures are shown in their default state in the diagram below:



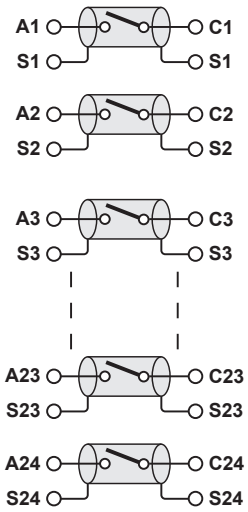
40-120-021 (16 x SPDT Screened)

One sub-unit is used to control all the module's relays as shown below. Enabling a particular bit opens the C to B signal path and closes the C to A signal path.

Sub-Unit	Bit	40-120-021 Signal Path (with relay energised)
1	1	C1 to A1
1	2	C2 to A2
1	3	C3 to A3
1	4	C4 to A4
1	5	C5 to A5
1	6	C6 to A6
1	7	C7 to A7
1	8	C8 to A8
1	9	C9 to A9
1	10	C10 to A10
1	11	C11 to A11
1	12	C12 to A12
1	13	C13 to A13
1	14	C14 to A14
1	15	C15 to A15
1	16	C16 to A16

MODULE ARCHITECTURE - 40-125-121

The 40-125-121 is an array of 24 uncommitted screened SPST relays. In the default state, all signal paths are open. Energising a particular relay creates a signal path between the C and A terminals. The relay module's switching architecture is shown in the default state in the diagram below:



40-125-121 (24 x SPST Screened)

One sub-unit is used to control all the module's relays as shown below. Enabling a particular bit closes the C to A signal path.

Sub-Unit	Bit	40-125-121 Signal Path (with relay energised)
1	1	C1 to A1
1	2	C2 to A2
1	3	C3 to A3
1	4	C4 to A4
1	5	C5 to A5
1	6	C6 to A6
1	7	C7 to A7
1	8	C8 to A8
1	9	C9 to A9
1	10	C10 to A10
1	11	C11 to A11
1	12	C12 to A12
1	13	C13 to A13
1	14	C14 to A14
1	15	C15 to A15
1	16	C16 to A16
1	17	C17 to A17
1	18	C18 to A18
1	19	C19 to A19
1	20	C20 to A20
1	21	C21 to A21
1	22	C22 to A22
1	23	C23 to A23
1	24	C24 to A24

PROGRAMMING THE MODULE

Here are examples of using the drivers with the 40-110-121 (32 x SPDT) module. Other modules in the range operate in the same way but have a different number of bits in the sub-unit.

Using PILPXI

To operate a relay the user could use the simple OpBit command or the WriteSub commands

OpBit

```
DWORD sub_unit = 1;
PIL_OpBit( card_num, sub_unit, 1, 1);    // Operates the A1/C1 relay
PIL_OpBit( card_num, sub_unit, 1, 0);    // Releases the A1/C1 relay
PIL_OpBit( card_num, sub_unit, 6, 1);    // Operates the A6/C6 relay
```

WriteSub

```
// Sub-unit is 32 bits wide, so 1 DWORD is needed to hold the pattern
DWORD data[1];
data[0] = 1;             // Sets lowest bit to 1, A1/C1 relay
PIL_WriteSub( card_num, sub_unit, data);

data[0] = 0x20;          // Sets 6th bit, A6/C6 relay
                         // All other relays are set to off
PIL_WriteSub( card_num, sub_unit, data);
```

Using PIPX40

setChannelState

```
ViUInt32 sub_unit = 1;
pipx40_setChannelState(vi, sub_unit, 1, VI_ON);     // Operates the A1/C1 relay
pipx40_setChannelState(vi, sub_unit, 1, VI_OFF);    // Releases the A1/C1 relay
pipx40_setChannelState(vi, sub_unit, 6, VI_ON);     // Operates the A6/C6 relay
```

setChannelPattern

```
// Sub-unit is 32 bits wide, so 1 ViUInt32 value is needed to hold the entire pattern

ViUInt32 data[1];
data[0] = 1;             // Sets lowest bit to 1, A1/C1 relay
pipx40_setChannelPattern( vi, sub_unit, data);

data[0] = 0x20;          // Sets 6th bit, A6/C6 relay
                         // All other relays are set to off
pipx40_setChannelPattern( vi, sub_unit, data);
```

Using pi40iv

The IVI driver has no special labelling for this card and treats the array of switches as a simple array, labelling the channels using the normal com./ch labelling tags.

```
pi40iv_Connect(vi, com1, ch1);      // Operates the A1/C1 relay
pi40iv_Disconnect(vi, com1, ch1);   // Releases the A1/C1 relay
pi40iv_Connect(vi, com6, ch6);      // Operates the A6/C6 relay
```

The IVI Swtch driver specification contains no bulk setting capabilities.

THIS PAGE INTENTIONALLY BLANK

SECTION 5 - CONNECTOR INFORMATION

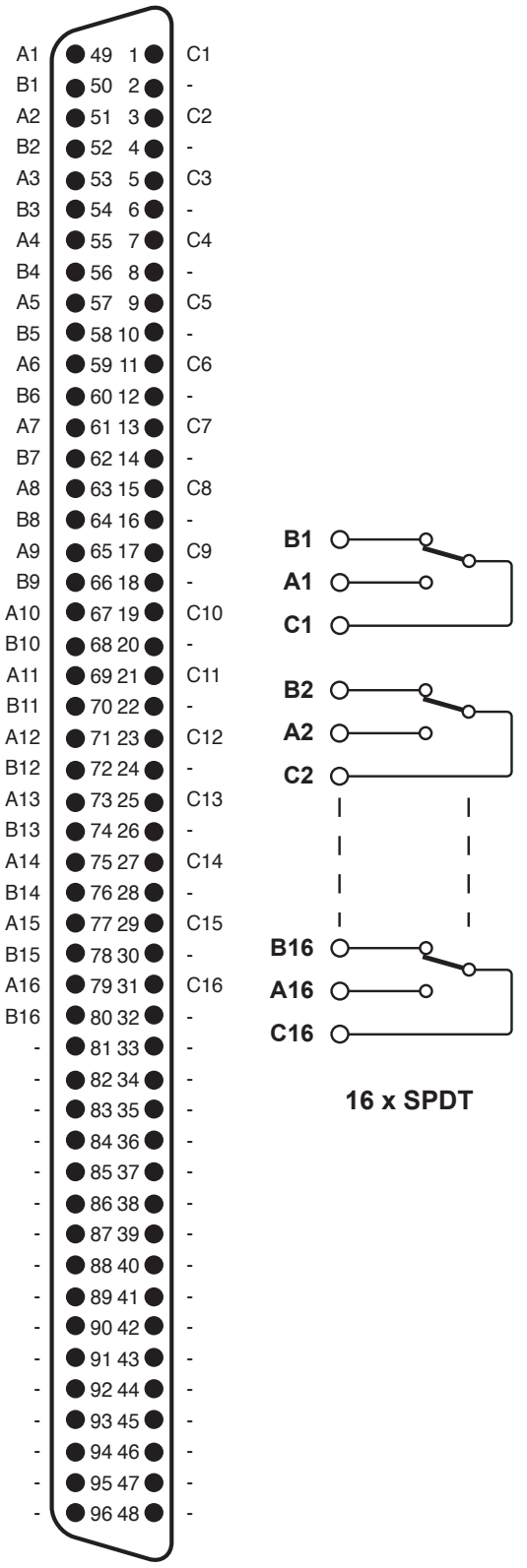


Figure 5.1 - Pinouts: 16xSPDT Reed Relay Module 40-110-021 (96-pin male micro-D connector viewed from front of module)

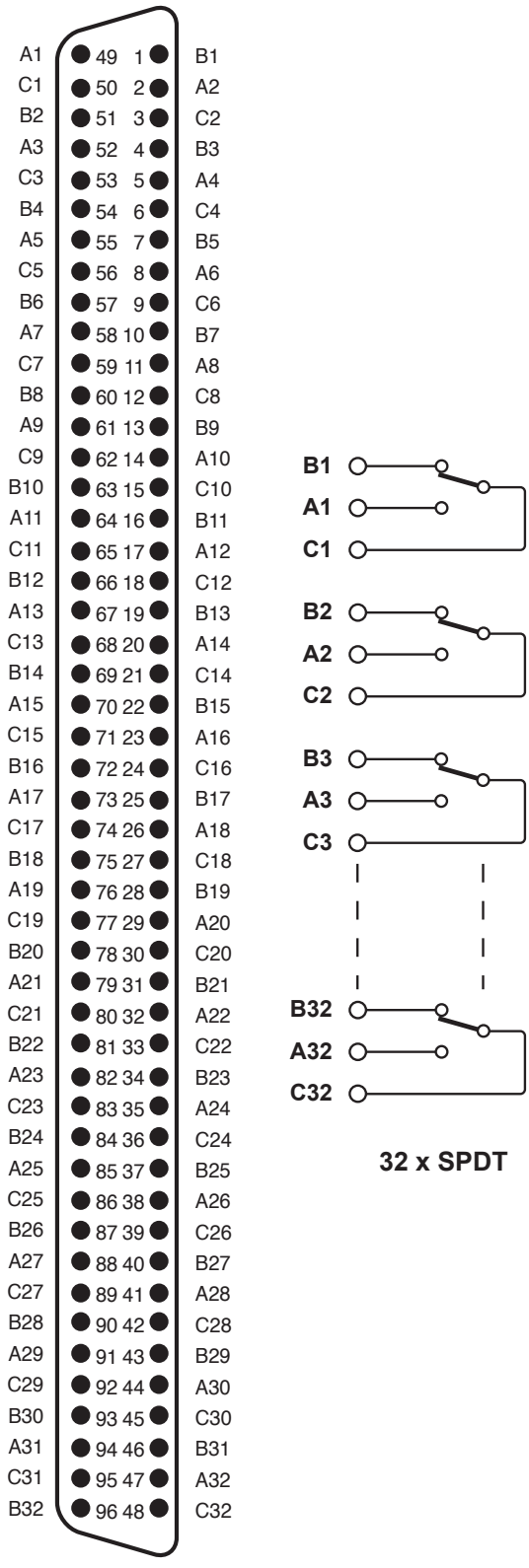


Figure 5.2 - Pinouts: 32xSPDT Reed Relay Module 40-110-121 (96-pin male micro-D connector viewed from front of module)

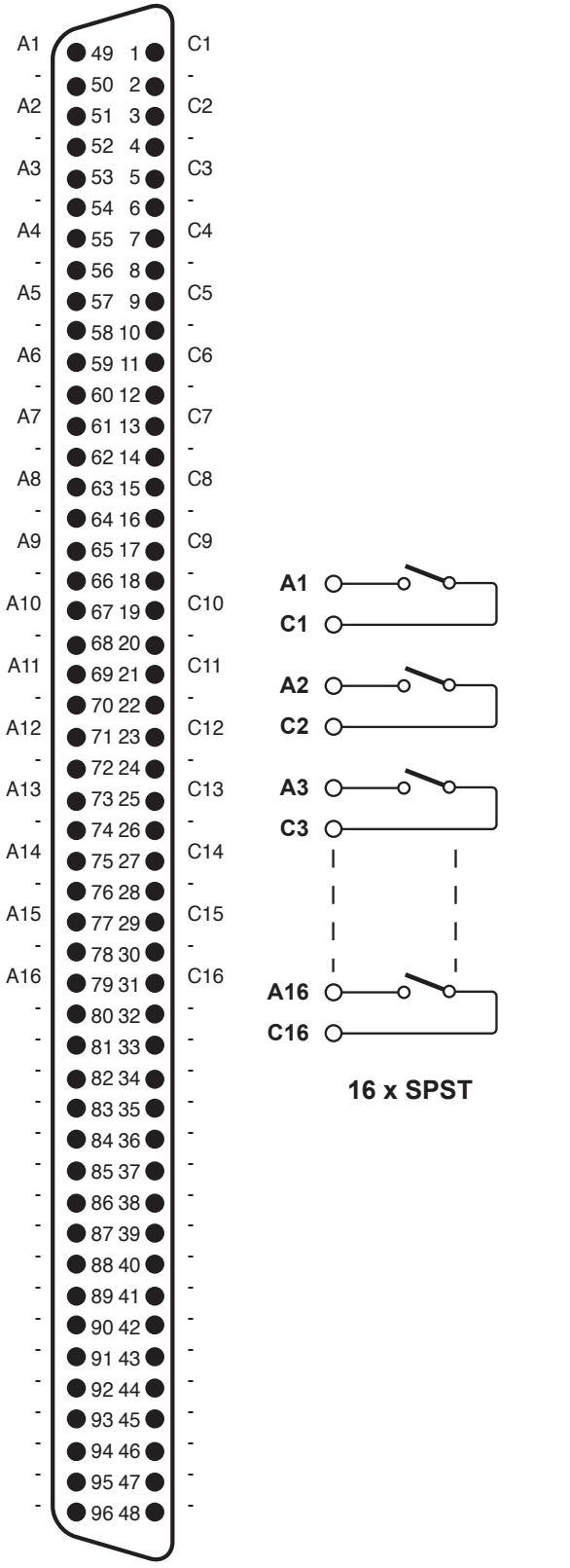


Figure 5.3 - Pinouts: 16xSPST Reed Relay Module 40-115-021 (96-pin male micro-D connector viewed from front of module)

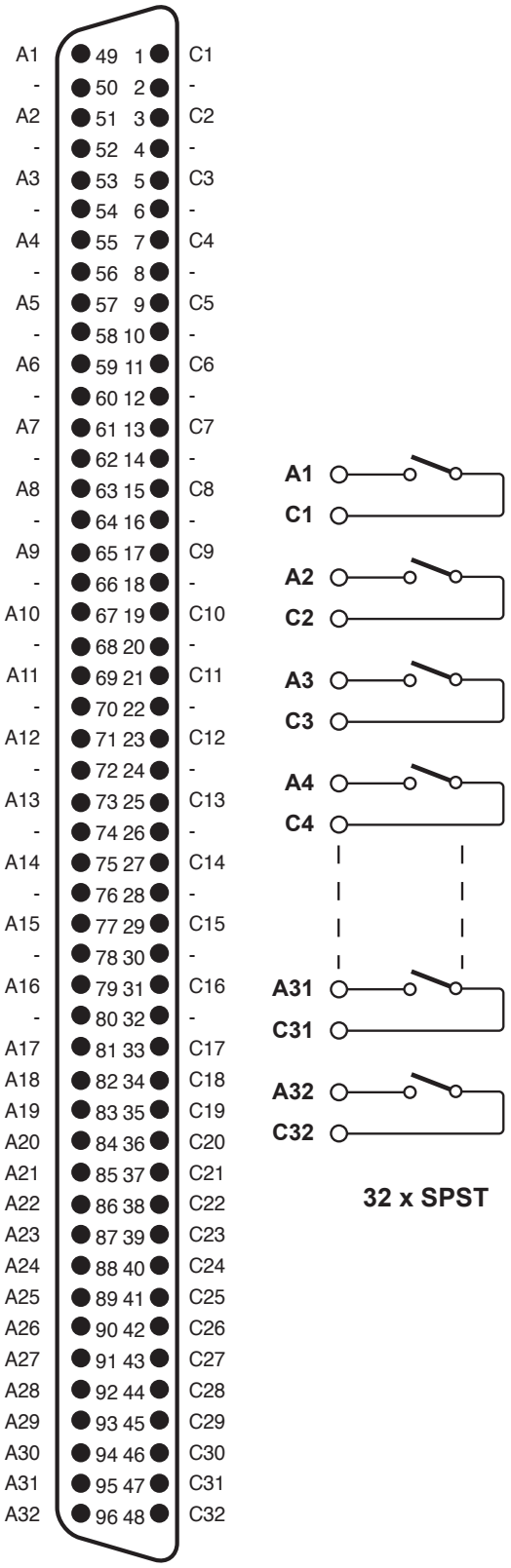


Figure 5.4 - Pinouts: 32xSPST Reed Relay Module 40-115-121 (96-pin male micro-D connector viewed from front of module)

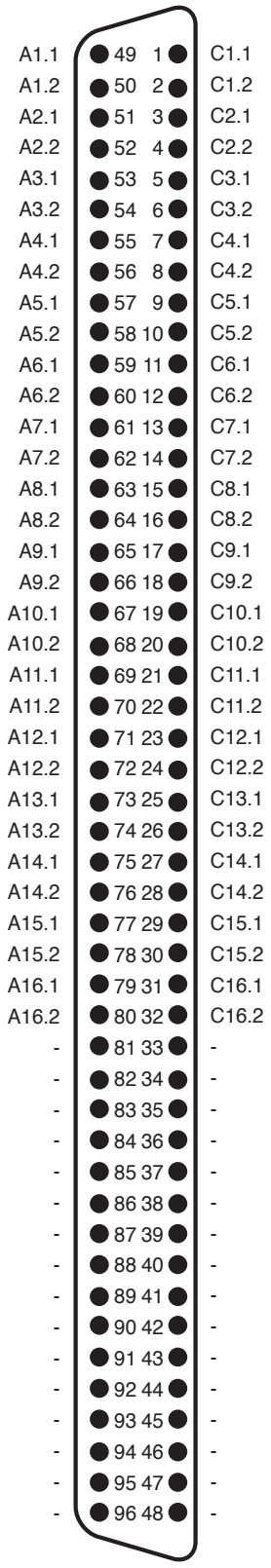


Figure 5.5 - Pinouts: 16xDPST Reed Relay Module 40-115-022 (96-pin male micro-D connector viewed from front of module)

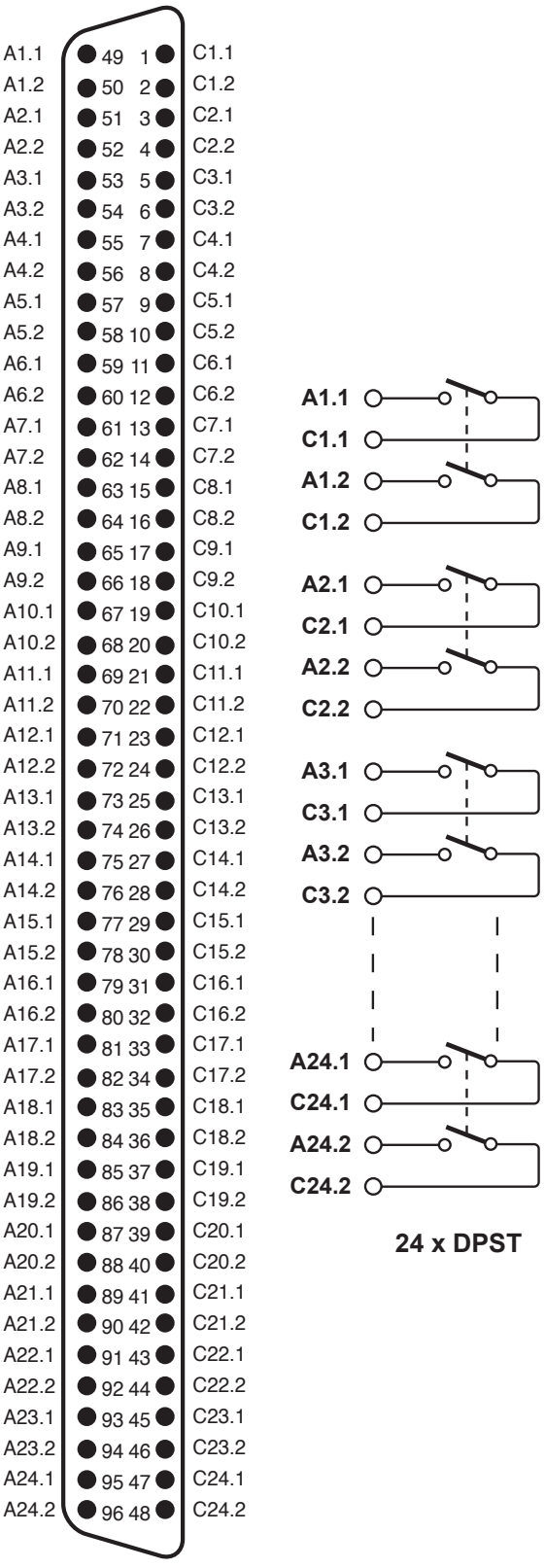


Figure 5.6 - Pinouts: 24xDPST Reed Relay Module 40-115-122 (96-pin male micro-D connector viewed from front of module)

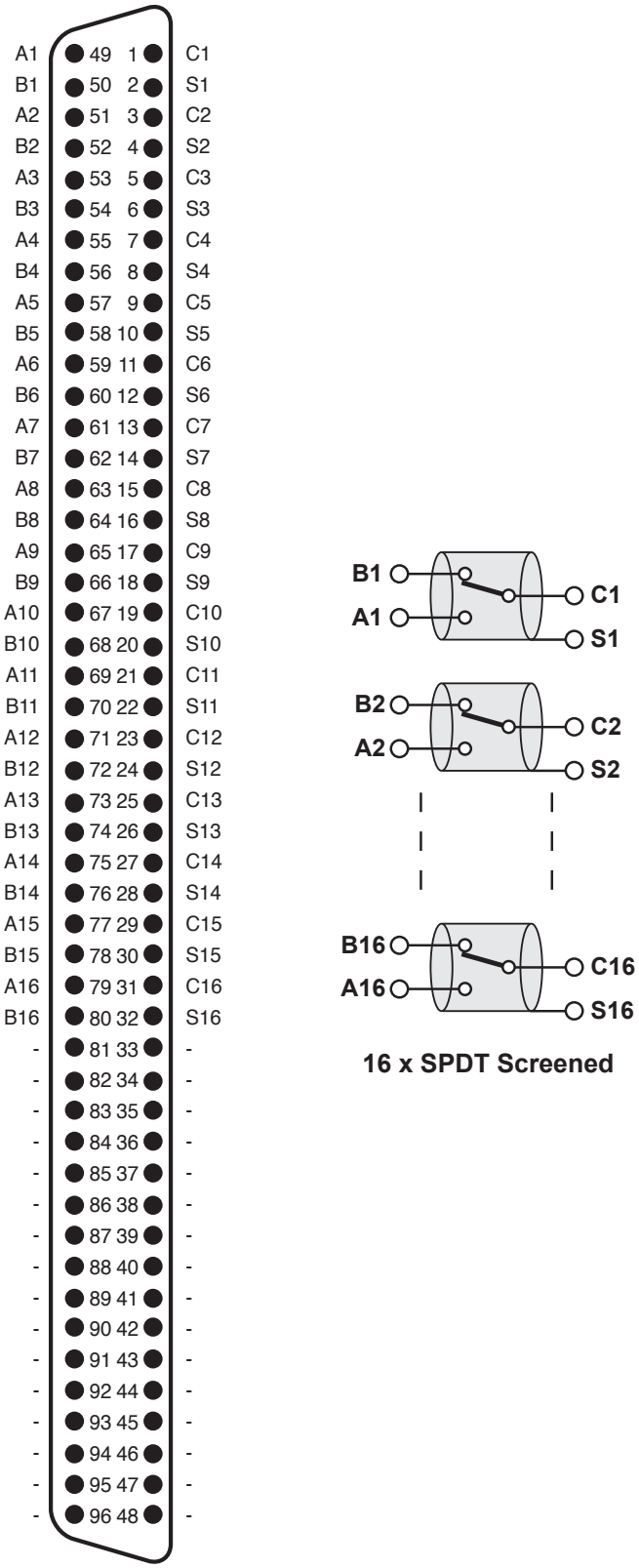


Figure 5.7 - Pinouts: 16xSPDT Screened Reed Relay Module 40-120-021
(96-pin male micro-D connector viewed from front of module)

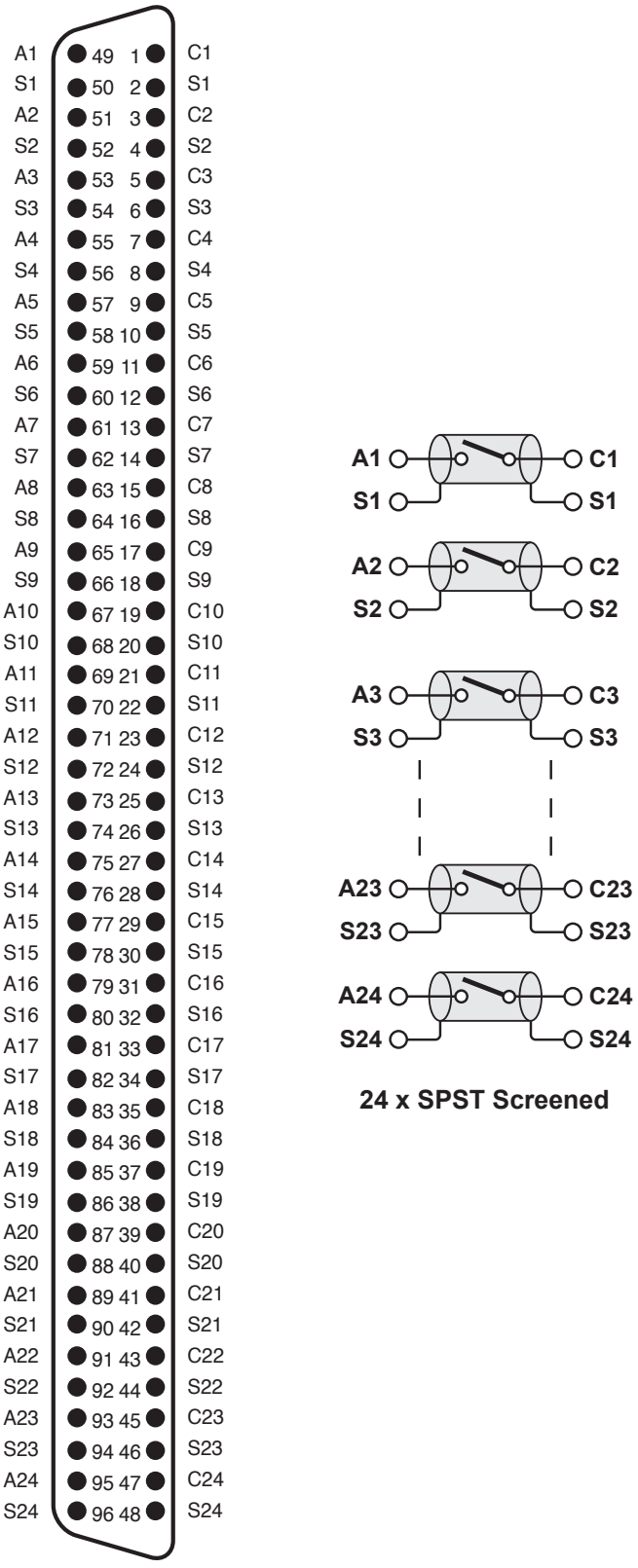


Figure 5.8 - Pinouts: 24xSPST Screened Reed Relay Module 40-125-121
(96-pin male micro-D connector viewed from front of module)

THIS PAGE INTENTIONALLY BLANK

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.

SWITCHING SYSTEM TEST TOOLS

Please refer to Section 7 - Maintenance Information.

THIS PAGE INTENTIONALLY BLANK

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.

SWITCHING SYSTEM TEST TOOLS

We recommend the use of ***eBIRST*** to provide a check of the correct operation of relays and to identify the location of any faulty relay. For more information on ***eBIRST*** click here.

RELAY LOOK-UP TABLES

The following pages provide a cross reference between the signal paths of the product and the physical relays on the PCB. The tables can be used in the fault finding process and should be used in conjunction with the corresponding PCB layout diagrams to identify the position of faulty relays. Users of ***eBIRST*** switching system test tools do not need to use this information to locate faulty relays.

TABLE 7.1 - Reed Relay Module 40-110-021/121 Relay Numbering

Signal Path (with relay energised)	Signal Path (with relay de-energised)	Relay No. 40-110-021	Relay No. 40-110-121
C1 to A1	C1 to B1	RL1	RL1
C2 to A2	C2 to B2	RL2	RL2
C3 to A3	C3 to B3	RL3	RL3
C4 to A4	C4 to B4	RL4	RL4
C5 to A5	C5 to B5	RL5	RL5
C6 to A6	C6 to B6	RL6	RL6
C7 to A7	C7 to B7	RL7	RL7
C8 to A8	C8 to B8	RL8	RL8
C9 to A9	C9 to B9	RL9	RL9
C10 to A10	C10 to B10	RL10	RL10
C11 to A11	C11 to B11	RL11	RL11
C12 to A12	C12 to B12	RL12	RL12
C13 to A13	C13 to B13	RL13	RL13
C14 to A14	C14 to B14	RL14	RL14
C15 to A15	C15 to B15	RL15	RL15
C16 to A16	C16 to B16	RL16	RL16
C17 to A17	C17 to B17	RL17 Not Fitted	RL17
C18 to A18	C18 to B18	RL18 Not Fitted	RL18
C19 to A19	C19 to B19	RL19 Not Fitted	RL19
C20 to A20	C20 to B20	RL20 Not Fitted	RL20
C21 to A21	C21 to B21	RL21 Not Fitted	RL21
C22 to A22	C22 to B22	RL22 Not Fitted	RL22
C23 to A23	C23 to B23	RL23 Not Fitted	RL23
C24 to A24	C24 to B24	RL24 Not Fitted	RL24
C25 to A25	C25 to B25	RL25 Not Fitted	RL25
C26 to A26	C26 to B26	RL26 Not Fitted	RL26
C27 to A27	C27 to B27	RL27 Not Fitted	RL27
C28 to A28	C28 to B28	RL28 Not Fitted	RL28
C29 to A29	C29 to B29	RL29 Not Fitted	RL29
C30 to A30	C30 to B30	RL30 Not Fitted	RL30
C31 to A31	C31 to B31	RL31 Not Fitted	RL31
C32 to A32	C32 to B32	RL32 Not Fitted	RL32

TABLE 7.2 - Reed Relay Module 40-115-021/121 Relay Numbering

Signal Path (with relay energised)	Relay No. 40-115-021	Relay No. 40-115-121		Signal Path (with relay energised)	Relay No. 40-115-021	Relay No. 40-115-121
C1 to A1	RL1	RL1		C17 to A17	RL17 Not Fitted	RL17
C2 to A2	RL2	RL2		C18 to A18	RL18 Not Fitted	RL18
C3 to A3	RL3	RL3		C19 to A19	RL19 Not Fitted	RL19
C4 to A4	RL4	RL4		C20 to A20	RL20 Not Fitted	RL20
C5 to A5	RL5	RL5		C21 to A21	RL21 Not Fitted	RL21
C6 to A6	RL6	RL6		C22 to A22	RL22 Not Fitted	RL22
C7 to A7	RL7	RL7		C23 to A23	RL23 Not Fitted	RL23
C8 to A8	RL8	RL8		C24 to A24	RL24 Not Fitted	RL24
C9 to A9	RL9	RL9		C25 to A25	RL25 Not Fitted	RL25
C10 to A10	RL10	RL10		C26 to A26	RL26 Not Fitted	RL26
C11 to A11	RL11	RL11		C27 to A27	RL27 Not Fitted	RL27
C12 to A12	RL12	RL12		C28 to A28	RL28 Not Fitted	RL28
C13 to A13	RL13	RL13		C29 to A29	RL29 Not Fitted	RL29
C14 to A14	RL14	RL14		C30 to A30	RL30 Not Fitted	RL30
C15 to A15	RL15	RL15		C31 to A31	RL31 Not Fitted	RL31
C16 to A16	RL16	RL16		C32 to A32	RL32 Not Fitted	RL32

TABLE 7.3 - Reed Relay Module 40-115-022/122 Relay Numbering

Signal Path (with relay energised)	Relay No. 40-115-021	Relay No. 40-115-121	Signal Path (with relay energised)	Relay No. 40-115-021	Relay No. 40-115-121
C1.1 to A1.1 & C1.2 to A1.2	RL1	RL1	C17.1 to A17.1 & C17.2 to A17.2	RL17 Not Fitted	RL17
C2.1 to A2.1 & C2.2 to A2.2	RL2	RL2	C18.1 to A18.1 & C18.2 to A18.2	RL18 Not Fitted	RL18
C3.1 to A3.1 & C3.2 to A3.2	RL3	RL3	—	RL19 Not Fitted	RL19
C4.1 to A4.1 & C4.2 to A4.2	RL4	RL4	—	RL20 Not Fitted	RL20
C5.1 to A5.1 & C5.2 to A5.2	RL5	RL5	C19.1 to A19.1 & C19.2 to A19.2	RL21 Not Fitted	RL21
C6.1 to A6.1 & C6.2 to A6.2	RL6	RL6	C20.1 to A20.1 & C20.2 to A20.2	RL22 Not Fitted	RL22
C7.1 to A7.1 & C7.2 to A7.2	RL7	RL7	—	RL23 Not Fitted	RL23
C8.1 to A8.1 & C8.2 to A8.2	RL8	RL8	—	RL24 Not Fitted	RL24
C9.1 to A9.1 & C9.2 to A9.2	RL9	RL9	C21.1 to A21.1 & C21.2 to A21.2	RL25 Not Fitted	RL25
C10.1 to A10.1 & C10.2 to A10.2	RL10	RL10	C22.1 to A22.1 & C22.2 to A22.2	RL26 Not Fitted	RL26
C11.1 to A11.1 & C11.2 to A11.2	RL11	RL11	—	RL27 Not Fitted	RL27
C12.1 to A12.1 & C12.2 to A12.2	RL12	RL12	—	RL28 Not Fitted	RL28
C13.1 to A13.1 & C13.2 to A13.2	RL13	RL13	C23.1 to A23.1 & C23.2 to A23.2	RL29 Not Fitted	RL29
C14.1 to A14.1 & C14.2 to A14.2	RL14	RL14	C24.1 to A24.1 & C24.2 to A24.2	RL30 Not Fitted	RL30
C15.1 to A15.1 & C15.2 to A15.2	RL15	RL15	—	RL31 Not Fitted	RL31
C16.1 to A16.1 & C16.2 to A16.2	RL16	RL16	—	RL32 Not Fitted	RL32

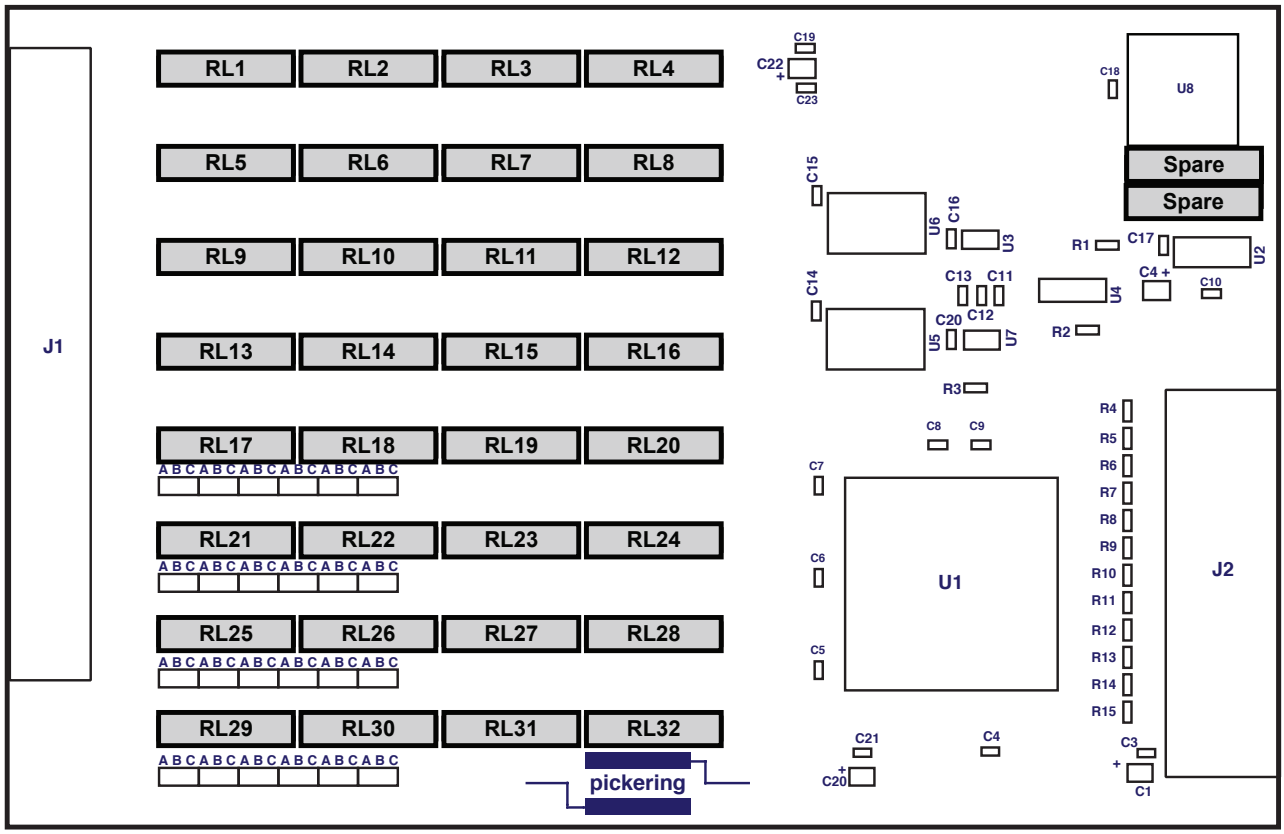


Figure 7.1 - 40-110/115 Reed Relay Module Component Layout

TABLE 7.4 - Reed Relay Module 40-120-021 Relay Numbering

Signal Path (with relay energised)	Signal Path (with relay de-energised)	Relay No. 40-120-021
C1 to A1	C1 to B1	RL1
C2 to A2	C2 to B2	RL2
C3 to A3	C3 to B3	RL3
C4 to A4	C4 to B4	RL4
C5 to A5	C5 to B5	RL5
C6 to A6	C6 to B6	RL6
C7 to A7	C7 to B7	RL7
C8 to A8	C8 to B8	RL8
C9 to A9	C9 to B9	RL9
C10 to A10	C10 to B10	RL10
C11 to A11	C11 to B11	RL11
C12 to A12	C12 to B12	RL12
C13 to A13	C13 to B13	RL13
C14 to A14	C14 to B14	RL14
C15 to A15	C15 to B15	RL15
C16 to A16	C16 to B16	RL16
—	—	RL17 Not Fitted
—	—	RL18 Not Fitted
—	—	RL19 Not Fitted
—	—	RL20 Not Fitted
—	—	RL21 Not Fitted
—	—	RL22 Not Fitted
—	—	RL23 Not Fitted
—	—	RL24 Not Fitted
—	—	RL25 Not Fitted
—	—	RL26 Not Fitted
—	—	RL27 Not Fitted
—	—	RL28 Not Fitted
—	—	RL29 Not Fitted
—	—	RL30 Not Fitted
—	—	RL31 Not Fitted
—	—	RL32 Not Fitted

TABLE 7.5 - Reed Relay Module 40-125-121 Relay Numbering

Signal Path (with relay energised)	Relay No. 40-125-121		Signal Path (with relay energised)	Relay No. 40-125-121
C1 to A1	RL1		C17 to A17	RL17
C2 to A2	RL2		C18 to A18	RL18
C3 to A3	RL3		C19 to A19	RL19
C4 to A4	RL4		C20 to A20	RL20
C5 to A5	RL5		C21 to A21	RL21
C6 to A6	RL6		C22 to A22	RL22
C7 to A7	RL7		C23 to A23	RL23
C8 to A8	RL8		C24 to A24	RL24
C9 to A9	RL9		—	RL25 Not Fitted
C10 to A10	RL10		—	RL26 Not Fitted
C11 to A11	RL11		—	RL27 Not Fitted
C12 to A12	RL12		—	RL28 Not Fitted
C13 to A13	RL13		—	RL29 Not Fitted
C14 to A14	RL14		—	RL30 Not Fitted
C15 to A15	RL15		—	RL31 Not Fitted
C16 to A16	RL16		—	RL32 Not Fitted

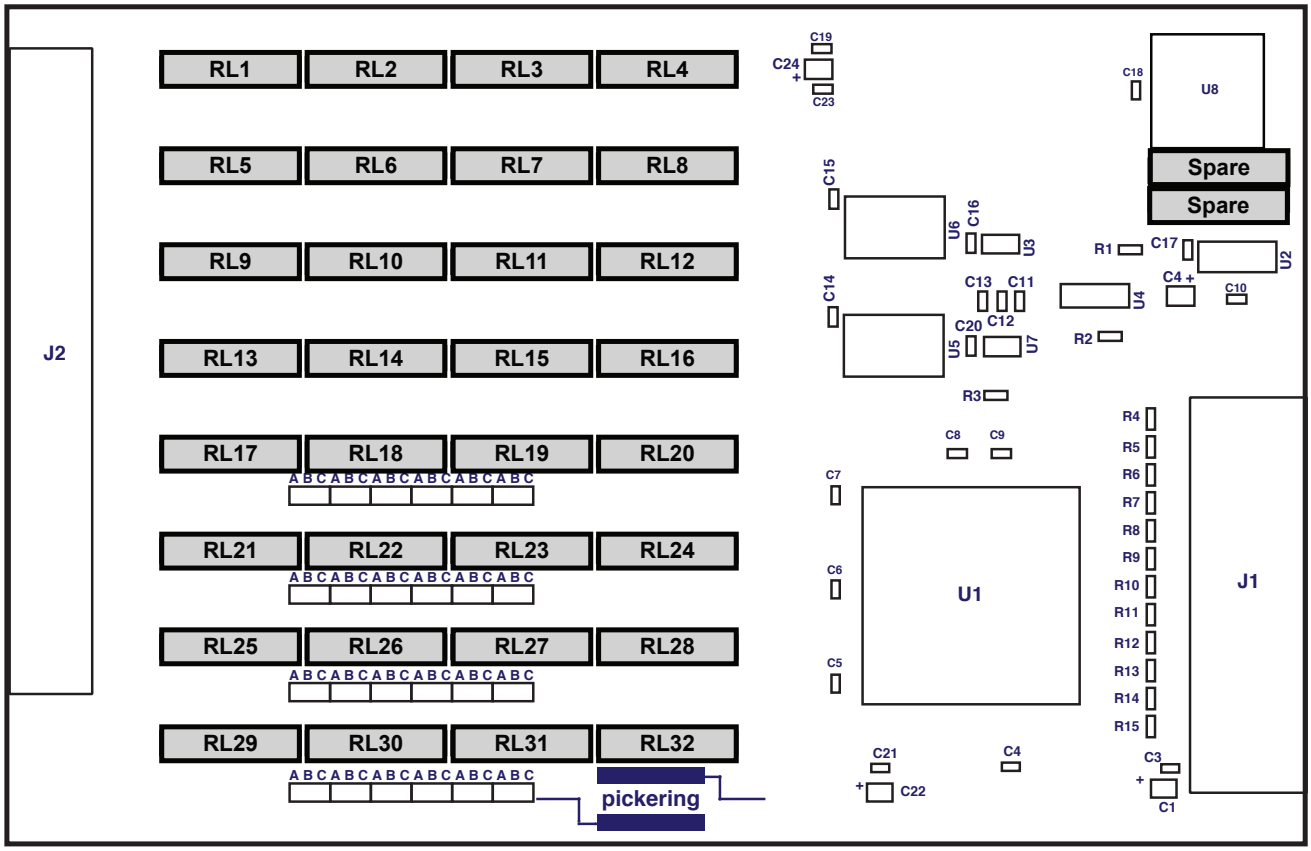


Figure 7.2 - 40-120/125 Reed Relay Module Component Layout

THIS PAGE INTENTIONALLY BLANK

Artisan Technology Group is an independent supplier of quality pre-owned equipment

Gold-standard solutions

Extend the life of your critical industrial, commercial, and military systems with our superior service and support.

We buy equipment

Planning to upgrade your current equipment? Have surplus equipment taking up shelf space? We'll give it a new home.

Learn more!

Visit us at **artisantg.com** for more info on price quotes, drivers, technical specifications, manuals, and documentation.

Artisan Scientific Corporation dba Artisan Technology Group is not an affiliate, representative, or authorized distributor for any manufacturer listed herein.

We're here to make your life easier. How can we help you today?

(217) 352-9330 | sales@artisantg.com | artisantg.com

ARTISAN® TECHNOLOGY GROUP