USER MANUAL

PXI

HIGH DENSITY PRECISION RESISTOR MODULE
(MODEL No. 40-297)

Issue 2.6 October 2011

TECHNICAL SUPPORT

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

WARRANTY

All products manufactured by Pickering Interfaces are warranted against defective materials and workmanship for a period of two years, excluding PXI chassis, 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, fax, 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.

Observe the Electrical Hazard Warning detailed in Section 8.

Observe the Electrostatic Sensitive Device Caution detailed in Section 8.

Worldwide Technical Support and Product Information

http://www.pickeringtest.com

Pickering Interfaces Headquarters

Stephenson Road Clacton-on-Sea CO15 4NL United Kingdom
Tel: +44 (0)1255-687900
Fax: +44 (0)1255-425349
E-Mail: sales@pickeringtest.com

Pickering Interfaces Inc.
2900 Northwest Vine Street
Grants Pass
Oregon 97526
USA

Tel: +1 541 471 0700
Fax: +1 541 471 8828
E-Mail: ussales@pickeringtest.com

Pickering Interfaces GmbH
Johann-Karg-Straße 30
D-85540
Haar-Salmdorf
Germany

Tel: +49 89 125 953 160
Fax: +49 89 125 953 189
E-Mail: desales@pickeringtest.com

Pickering Interfaces AB
Karl Nordströmsväg 31
432 53
Varberg
Sweden

Tel: +46 340-69 06 69
Fax: +46 340-69 06 68
E-Mail: ndsales@pickeringtest.com

Pickering Interfaces Inc.
(East Coast Regional Office)
12 Alfred Street Suite 300-3
Woburn Massachusetts 01801
USA

Tel: +1 781 897 1710
Fax: +1 781 897 1701
E-mail: useastsales@pickeringtest.com

Pickering Interfaces s.r.o.
Smetanova 525
Třinec
739 61
Czech Republic

Tel: +42 0558 339 168
Fax: +42 0558 340 888
E-mail: cesales@pickeringtest.com

Pickering Interfaces SARL
6 Rue De La Mare Blanche
77186 Noisiel
Marne Le Vallee
France

Tel +33 1 60 53 55 50
Fax +33 1 60 53 55 99
email frsales@pickeringtest.com

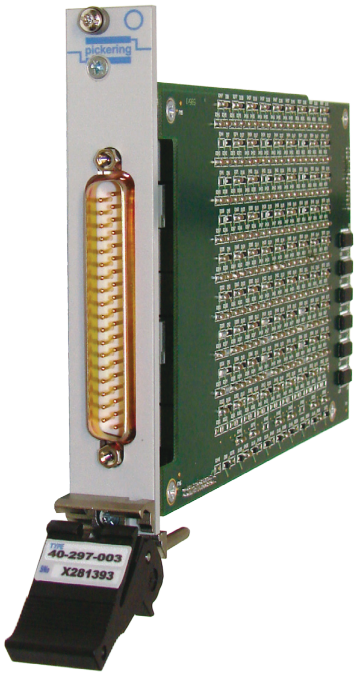
THIS PAGE INTENTIONALLY BLANK

CONTENTS

THIS PAGE INTENTIONALLY BLANK

SECTION 1 - TECHNICAL SPECIFICATION

40-297
High Density Precision Resistor Module



- High Density Resistor Simulation
- Up To 18 Channels in a One Slot Module
- Short and Open Simulation
- Simple Software Control Through Resistance Calls
- VISA & Kernel Drivers Supplied for Windows 2000/XP/Vista
- Supported by PXI or LXI Chassis
- 2 Year Warranty

The 40-297 provides a simple solution for applications requiring accurate simulation of resistive sensors. The 40-297 is available in a variety of resistance ranges and resolution capabilities that meet the needs of most functional test systems. It is particularly well suited to applications such as the testing of engine controllers where resistive sensors provide information on parameters such as temperature.

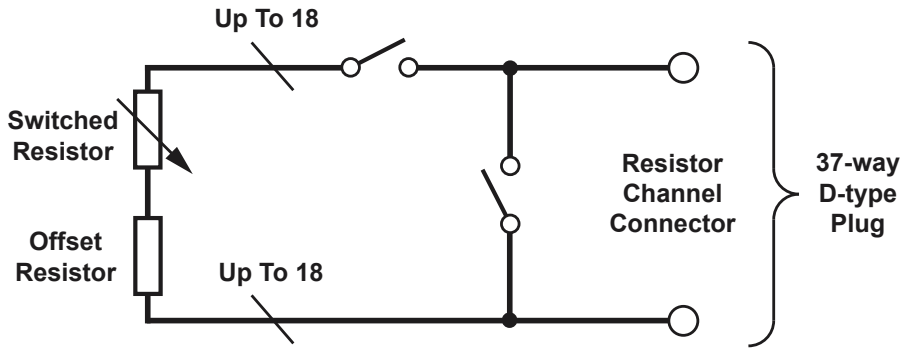
Each channel of the 40-297 module is able to simulate the common short circuit and open circuit conditions that can be experienced in a system due to faulty wiring or sensors.

Software control of the 40-297 is simplified by the use of simple resistor value calls. The module works out the channel setting closest to the requested value and sets that value. The user can interrogate the module to find the actual resistance setting used by the module.

A calibration cable assembly is attached to the module to enable an external DMM to be connected to each channel in turn to support the process of verification. This considerably simplifies the effort required to check the module's calibration. Verification is performed with the UUT disconnected from the module.

The 40-297 is available in three standard builds - a narrow range 18 channel version, a medium range 9 channel version and a wide range 6 channel fine resolution version - that suit the most common configurations required.

For applications requiring greater resolution and accuracy, or to support calibration with the UUT connected, users should consider the **40-260 series Precision resistor Modules**.



Functional Diagram for the 40-297 High Density Precision Resistor Module

Specification

Resistance Channels

Model Number	40-297-001	40-297-002	40-297-003
Resistance Range	1Ω to 230Ω	2Ω to 13.5kΩ	3Ω to 1.5MΩ
Setting Resolution	1Ω	0.25Ω	0.125Ω
Number of Channels per Module	18	9	6

Accuracy:	resolution ±0.2%
Fault Simulation:	Open and short circuit (typically <0.3Ω)
Power:	0.5W maximum
Temperature Stability:	<50ppm
Number of Operations:	100 million (10mA)
Maximum Voltage:	100V or as limited by power
Settling time:	<3ms
Software Control:	By resistance calls to module for selected channel.
Calibration:	4-wire resistance measurement of selected channel for verification purposes with UUT removed and a special cable assembly attached. Factory calibration data is stored in the module.

Power Requirements

+3.3V	+5V	+12V	-12V
0	4.3A max	0	0

Physical Parameters

Physical characteristics:	One slot, 3U PXI. 3D models for all versions in a variety of popular file formats are available on request.
PCI Interface:	33MHz, 32 bit address, 16 bit data.
Signal Connectors:	Male 37-way D-type

Other Resistor Modules

Pickering Interfaces manufacture a range of variable resistor modules in the PXI format. If you have a requirement for a variable resistor module please contact your local sales office with the information below and we will advise you on the best solution for your application.

Lowest Resistance †	
Highest Resistance	
Resistance Resolution	
Overall Accuracy	
Maximum Power/Current	
Number of Channels (variable resistors)	

† Resistance is as measured across the user connector terminals, minimum resistance must have a non-zero value.

Product Order Codes

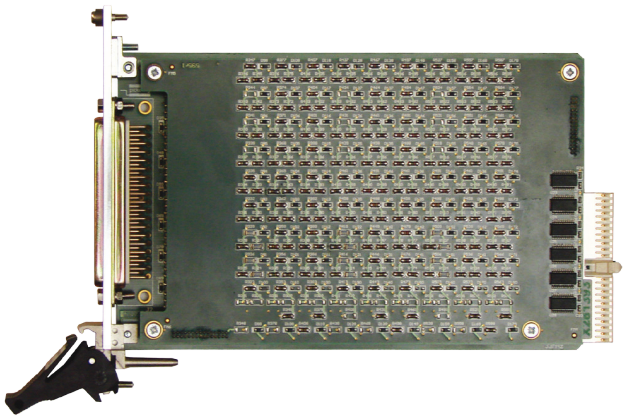
18 Channel Precision Resistor	**40-297-001**
9 Channel Precision Resistor	**40-297-002**
6 Channel Precision Resistor	**40-297-003**

Accessories:

Calibration lead for 4-wire resistance measurement using DMM - 37-way D-type socket to shrouded 4mm bayonet plugs, 1Meter length	**40-975-037-1M**

Mating Connectors & Cabling

For connection accessories for the 40-297 please refer to the **90-007D** 37 way D-type Connector Accessories data sheet where a complete list and documentation can be found for accessories, or refer to the Connection Solutions catalog.



Programming

Pickering provide kernel and VISA (NI and Agilent) drivers which are compatible with Windows 2000/XP/Vista operating systems. The VISA driver is also compatible with Real-Time Operating Systems such as LabVIEW RT. Additionally, QNX is fully supported, for other RTOS support contact Pickering.

These drivers may be used with a variety of programming environments and applications including:

National Instruments products (LabVIEW/LabWindows/CVI/MAX/TestStand etc.)

Microsoft Visual Studio products (Visual Basic/Visual C+)

Agilent VEE

Mathworks Matlab

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 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 Switching chassis. For information on driving your switching solution in an LXI environment refer to the LXI Short Form Catalog.

Latest Details

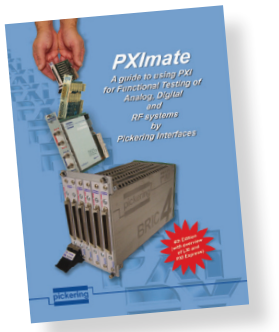
Please refer to our Web Site for Latest Product Details.

www.pickeringtest.com

Please refer to the Pickering Interfaces "**Connection Solutions**" catalog for the full list of connector/cabling options, including drawings, photos and specifications. This is 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.

Refer to the "**PXI Product Guide**" for descriptions of Pickering Interfaces' comprehensive range of PXI switching and instrumentation modules, including specifications and product selection guides.

The Product Guide 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 "**PXI Product Catalog**" gives full details of Pickering's entire range of PXI switch modules, instrument modules and support products.

The PXI Product Catalog is available on request or can be downloaded from the Pickering website.

THIS PAGE INTENTIONALLY BLANK

SECTION 2 - TECHNICAL DESCRIPTION

FUNCTIONAL DESCRIPTION

A functional block diagram is provided in Figure 2.1. The Programmable Resistor Module is powered by +5V inputs via Compact PCI connector J1. The interface to the user test equipment is via the front panel mounted 37 way D type connector, J2. The module comprises two PCBs populated with resistor chains which are switched via dual pole relays. The two PCBs are connected via a plug and socket connector arrangement. The relays are energised via control signals from relay drivers which are addressed by PCI bridge U1, via the control logic. to output the required signal. Module configuration is determined by data stored in EEPROM U9 PCI Bridge U1 is configured by EEPROM U2.

Each resistor chain includes an offset resistor that can be used to set the minimum resistance value as well as relay contacts to hold the channel open circuit or short circuit.

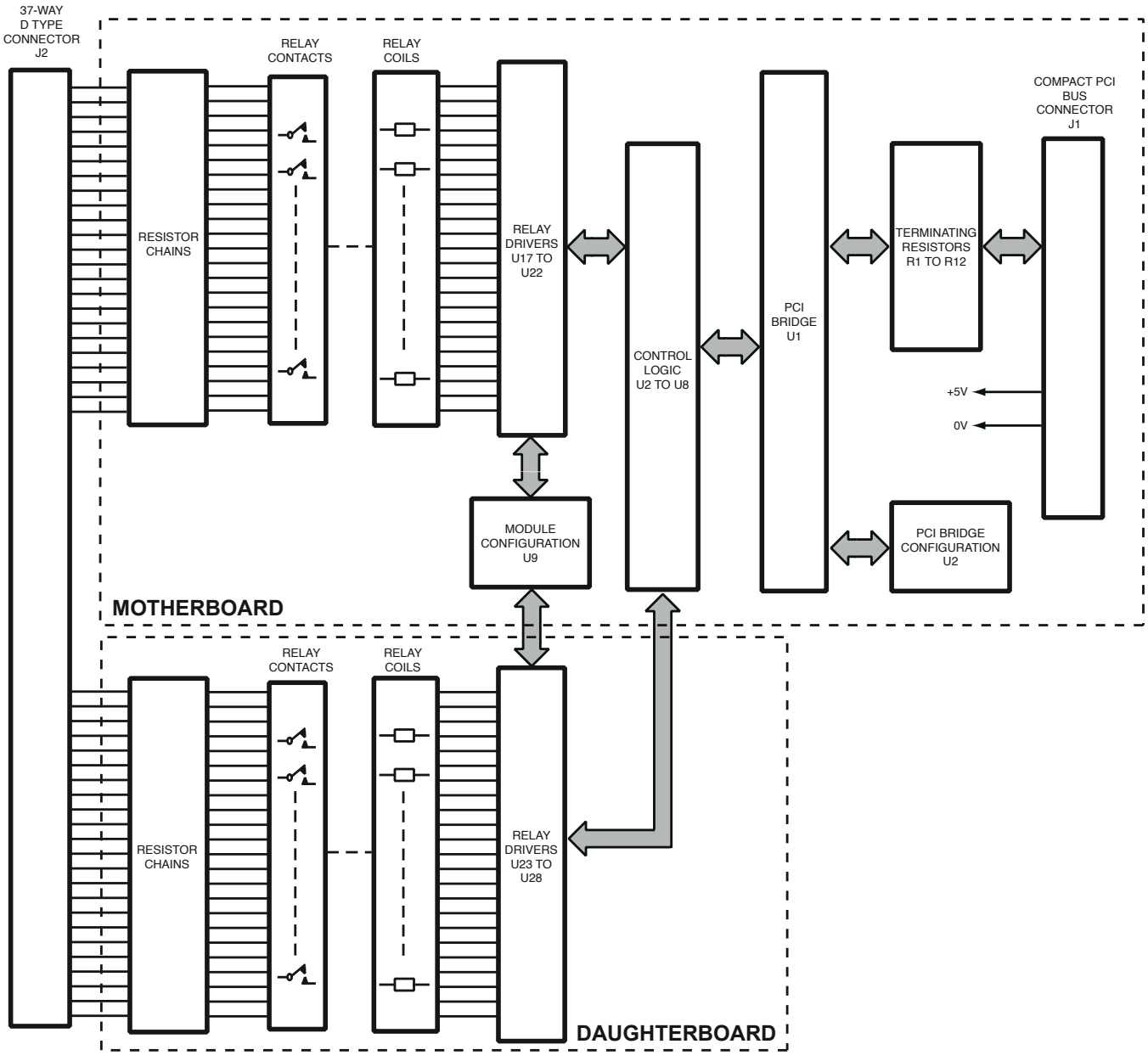


Figure 2.1 - Precision Programmable Resistor Module 40-297: Functional Block Diagram

GUIDANCE ON USING THE MODULE

The 40-297 behaves as a precise but adjustable in value resistor. The circuit elements in the design use switch resistors with electro-mechanical relays. It can be used to simulate the type of variable resistor found in many control systems that indicate the value of a parameter, such as temperature, strain or pressure.

The 40-297 responds directly to a request for a particular value of resistance and is therefore very easy to use in a system. Applications programs are easily generated to convert, for example, temperature requests to resistance values for different types of RTD that are to be emulated.

Each resistor channel has an “input” connection and an “output” connection. There is no significance in the label “input” and “output” other than to identify them. The resistor channel schematic is shown in Figure 2.2.

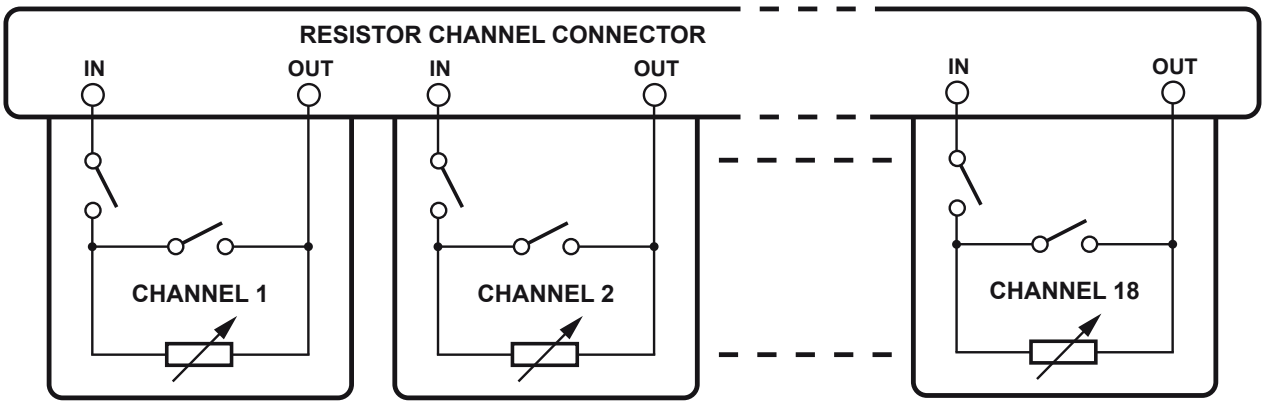


Figure 2.2 - Resistor Channels for 40-297 18-Channel Precision Programmable Resistor

The module uses fixed resistor values switched by relays. There are no user adjustable parts

A table containing calibration data is used to convert requests for specific resistance values to a setting which most closely corresponds to the value requested. The module contains two versions of the calibration table, one created by Pickering Interfaces at the point of manufacture and an alternate table which can be created by the user. The Pickering Interfaces table cannot be overwritten by the user. The user can select which table is being is used, in the majority of applications we recommend the Pickering Interfaces table is used, creation of a user table requires accurate measurements of many points within the module and requires a program to create with confidence. A program is available for this purpose from Pickering Interfaces but requires the use of a specific DMM range.

For applications requiring the greatest accuracy Pickering Interfaces does offer a range of other resistor modules with better accuracy.

Potentiometer Operation

The 40-297 can be used to simulate a potentiometer by using the two channels connected in series. The user should decide on the value of the potentiometer to be simulated and program two channels so that the sum of their resistances is always the same. For example, if a 5kΩ potentiometer is needed with a wiper position at 1kΩ, set one channel to 1kΩ and the other to 4kΩ.

SECTION 3 - INSTALLATION

HARDWARE INSTALLATION

CAUTION

Electrostatic discharge can damage the components on the module. To avoid such damage in handling the board, touch the anti-static bag to a metal part of the chassis before removing the board from the bag.

Ensure that there is adequate ventilation in accordance with the PXI Specification.

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.

WARNING: Do not raise the injector/ejector handle whilst inserting the module. The module will not insert properly unless the handle is in its downward position.

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. Screw the front panel of the module to the front panel mounting rail.
8. In a system employing MXI-3 to connect a desktop PC to a PXI chassis or to link multiple chassis, power-up the system as follows:
   a. For a system comprising a PC and one chassis, power up the chassis before powering up the PC.
   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 PC or chassis containing the system controller.
9. For Pickering Interfaces modular LXI installation there is no requirement to use any particular power up sequence.

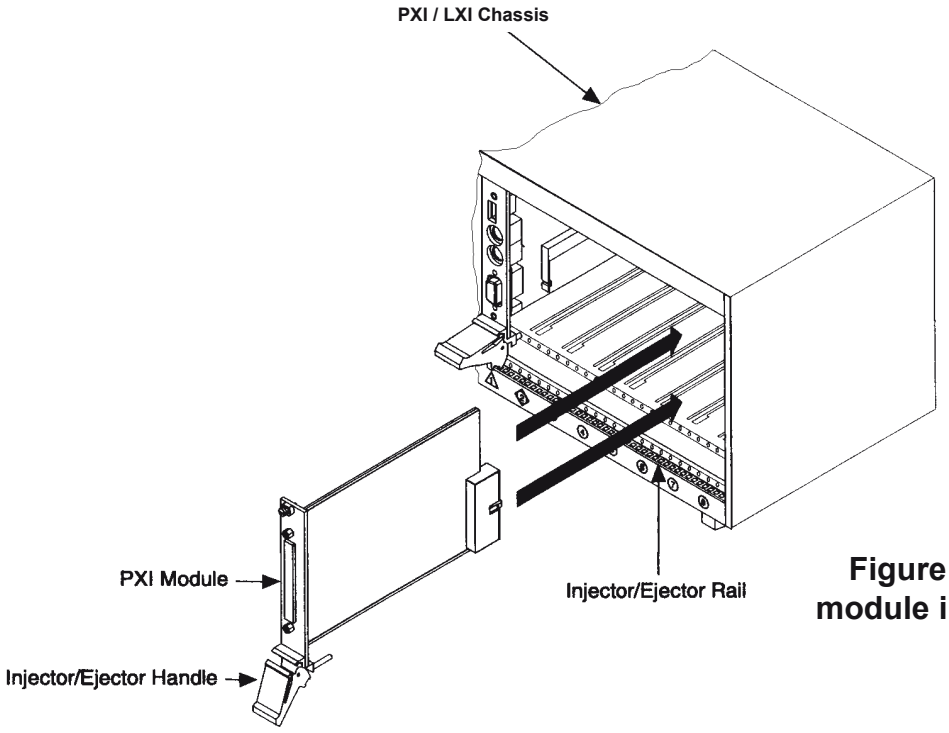


Figure 3.1 - Installing the module into a PXI / cPCI / LXI Chassis

SOFTWARE INSTALLATION

First install the appropriate Pickering PXI switch card drivers by running the installer program Setup.exe, either from the CD-ROM supplied, or by downloading the latest version from our website http://www.pickeringtest.com - the recommended method. There are different versions of the Setup program to suit different Windows versions and software environments. Setup is accompanied by a ReadMe file containing additional installation information. A single installation covers all cards in the System 40, System 45 and System 50 ranges.

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

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

SOFT FRONT PANEL INSTALLATION

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

1. Locate and run the installer package in the folder ***DVD:\Applications\Soft Front Panels***. Run the installer ***Setup_40-26X-SFP.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 40-26X soft front panel*** menu item in ***Programs\Pickering\40-26X***

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

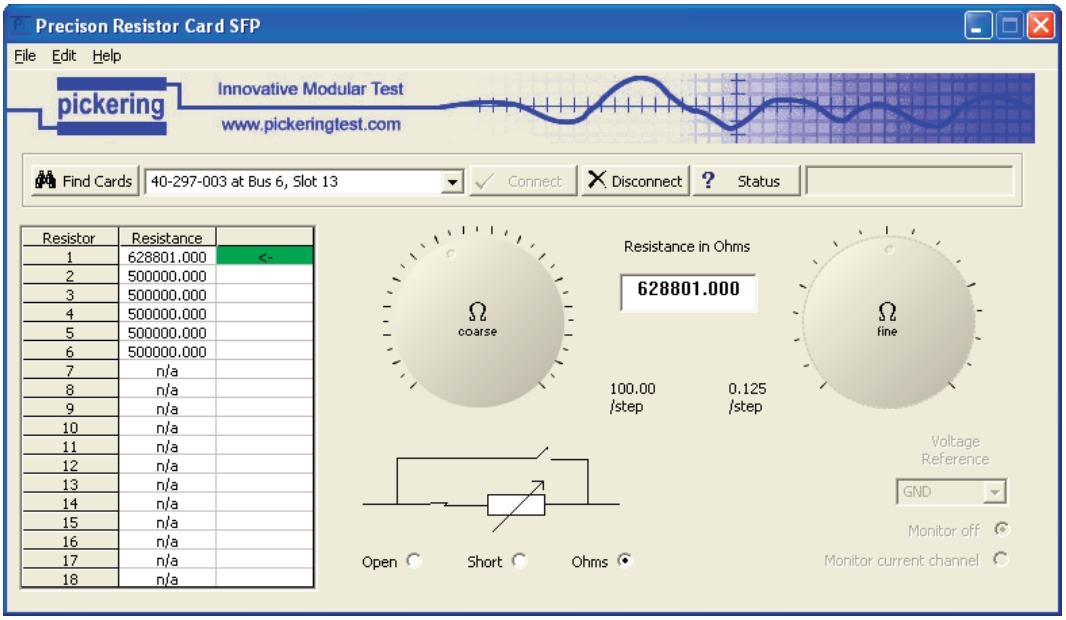


Figure 3.2 - Soft Front Panel For The 40-297

SECTION 4 - PROGRAMMING GUIDE

PROGRAMMING OPTIONS FOR PICKERING INTERFACES PXI CARDS

Software drivers are supplied for Microsoft Windows 2000/XP 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/ODriver 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

Register level programming for this module is not available because of the hardware techniques and the firmware algorithms used to convert resistance calls into specific hardware instruction based on the calibration files stored in the module.

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/ODriver for Windows - Piplx

The piplx driver is based on the PXI Direct IO 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 IO 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.

MODULE ARCHITECTURE

These resistor modules expose a total of 6, 9 or 18 sub-units as detailed below:

Sub-Unit Number	Type	Sub-Unit Size			Use
		40-297-001	40-297-002	40-297-003	
1	Resistor	10	19	28	Resistor 1
2	Resistor	10	19	28	Resistor 2
3	Resistor	10	19	28	Resistor 3
4	Resistor	10	19	28	Resistor 4
5	Resistor	10	19	28	Resistor 5
6	Resistor	10	19	28	Resistor 6
7	Resistor	10	19	—	Resistor 7
8	Resistor	10	19	—	Resistor 8
9	Resistor	10	19	—	Resistor 9
10	Resistor	10	—	—	Resistor 10
11	Resistor	10	—	—	Resistor 11
12	Resistor	10	—	—	Resistor 12
13	Resistor	10	—	—	Resistor 13
14	Resistor	10	—	—	Resistor 14
15	Resistor	10	—	—	Resistor 15
16	Resistor	10	—	—	Resistor 16
17	Resistor	10	—	—	Resistor 17
18	Resistor	10	—	—	Resistor 18

PROGRAMMING THE MODULE

Resistance Control

In practice the control of resistance is not performed by controlling of the sub-units directly but rather using the SetResistance() functions provided in the driver.

In pilpxi:

```
DWORD PIL_ResSetResistance(DWORD card, DWORD channel, DWORD Mode, double
resistance)
```

Or, in pipx40:

```
ViStatus pipx40_resSetResistance(ViSession vi, ViUint32 subUnit, ViUInt32 mode,
ViReal64 resistance)
```

These functions accept a floating point value of resistance and calculate the appropriate settings of the sub-units required to achieve that resistance.

To set short circuit (nominally zero ohms) use a floating point value of 0.0, and to set open circuit use a floating point value of “HUGE_VAL” (using C requires #include <math.h>, other languages should provide similar libraries).

LabVIEW

LabVIEW VIs are provided for the control of the resistance channels.

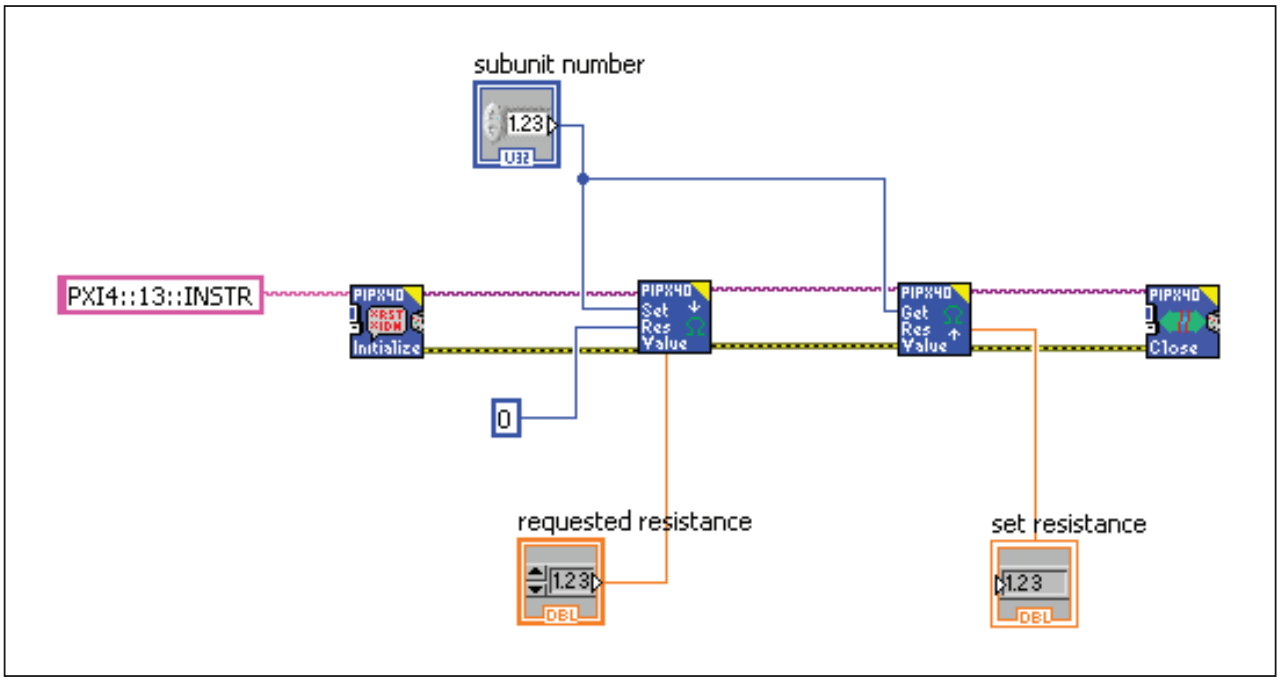


Figure 4.1 - Example LabVIEW VI Supplied With The Precision Resistor Module

USING THE SOFT FRONT PANEL

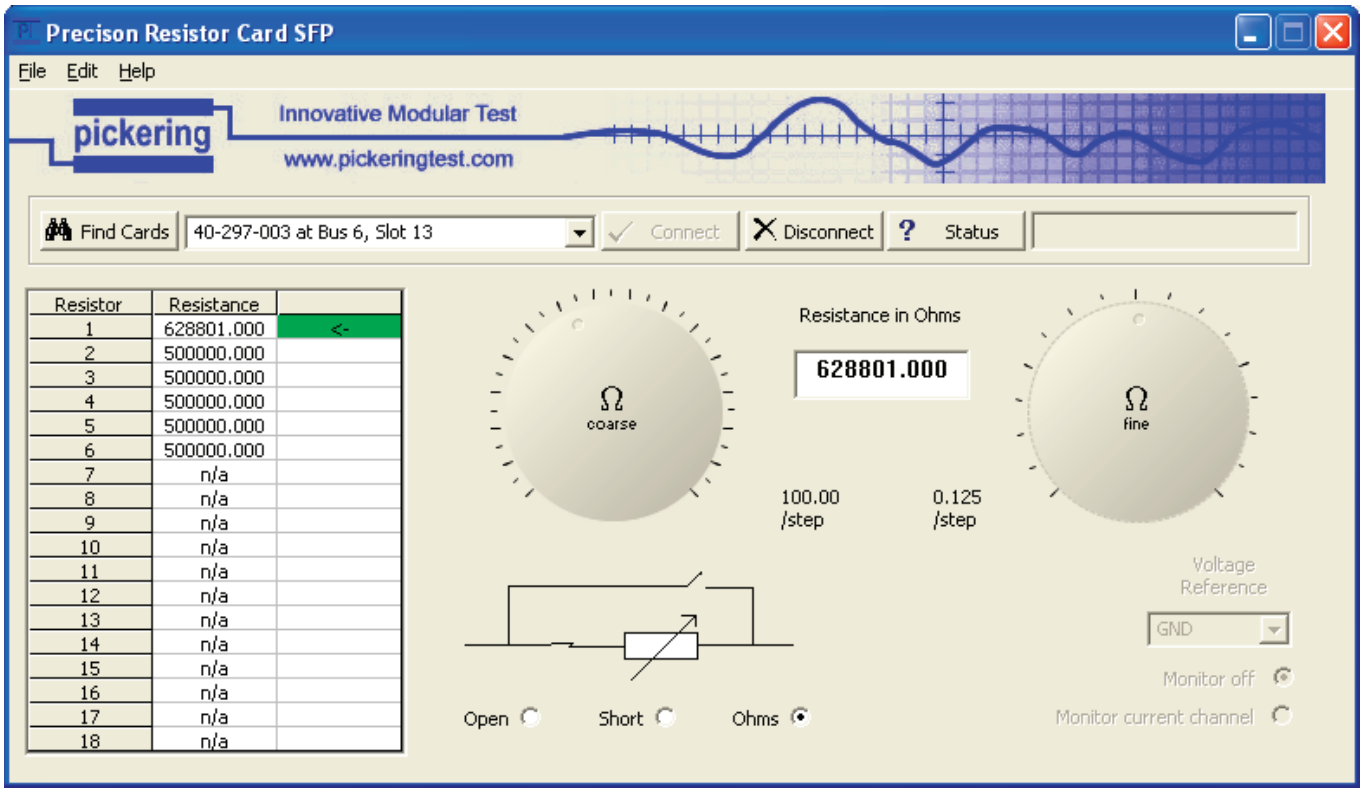


Figure 4.2 - Example Soft Front Panel Supplied With The Precision Resistor Modules

Resistor Channels

To control a card, first press the 'Find Cards' button to locate all suitable resistor cards in the PCI/PXI system.

Select the required card from the pull-down list then press the 'Connect' button to establish a control session on the selected card.

There are buttons on the right hand side of the soft front panel, one for each of the card's programmable resistor channels, select the required resistor tab.

The coarse control allows the resistor to be set to a precision of 1Ω between the minimum and maximum values. The fine control offers a range of +/- 1Ω with a precision of 0.01Ω.

These rotary controls may be operated using the mouse, however for closer control, the keyboard 'Page Up' and 'Page Down' keys will change the setting by 100Ω and 50mΩ respectively. The keyboard up-arrow and down-arrow keys will change the setting by 1Ω and 10mΩ respectively.

Three 'radio buttons' on the SFP allow the currently selected resistor element to be set as open circuit, short circuit or the displayed resistance value.

In the SFP 'File' menu, there are options to save and load card settings to file.

Note: The "Voltage Reference" pull-down list and the "Monitor" control buttons on the right hand side of the SFP are not applicable to the 40-297 module.

THIS PAGE INTENTIONALLY BLANK

SECTION 5 - CONNECTOR INFORMATION

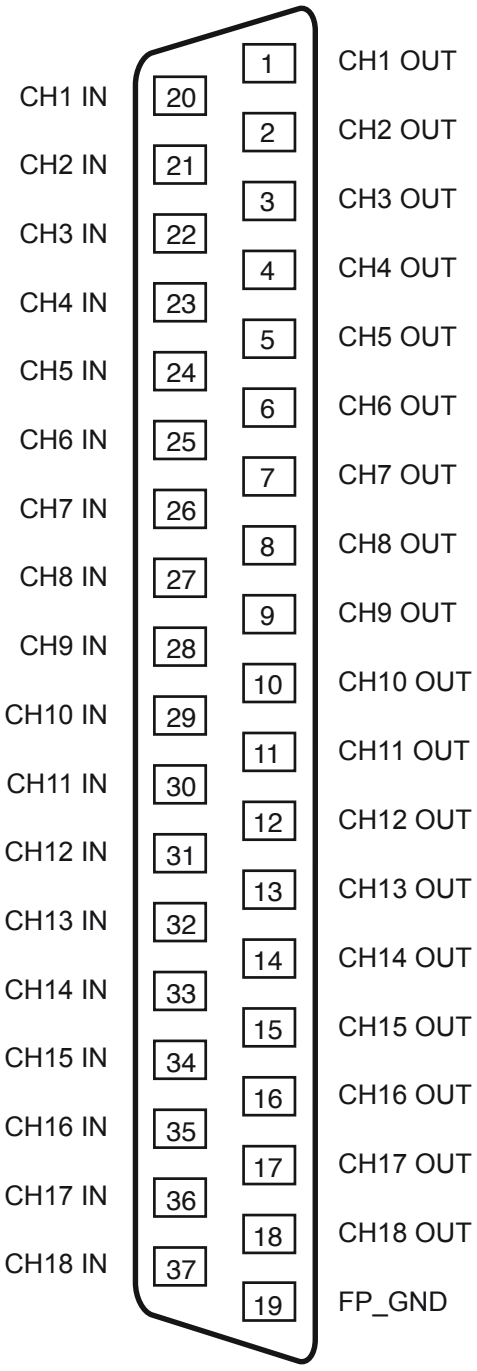


Figure 5.1 - Pin Outs: 18-Channel Precision Resistor Module 40-297-001 (37-pin male D-type)

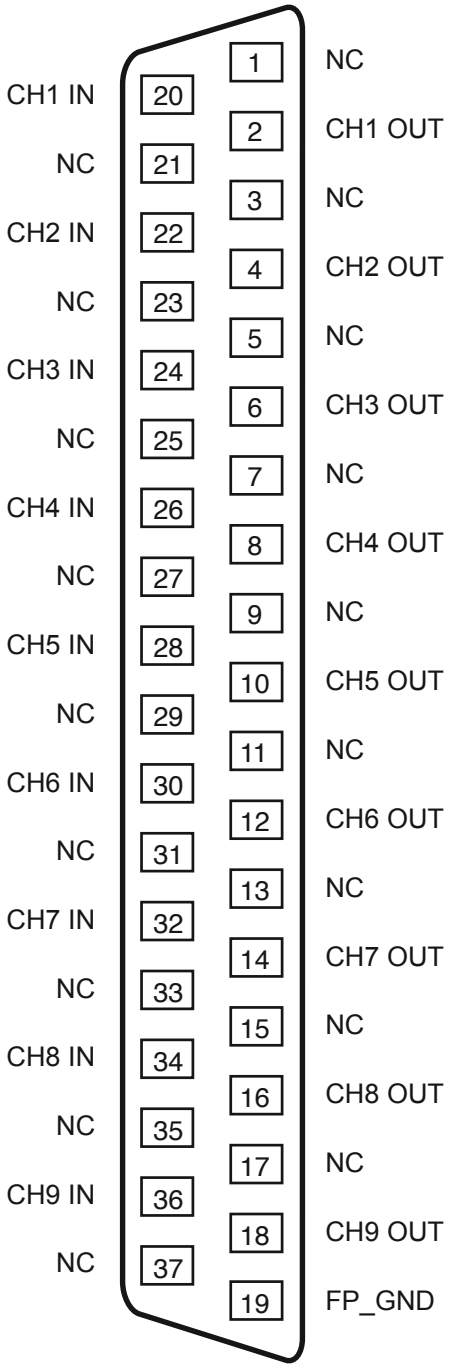


Figure 5.2 - Pin Outs: 9-Channel Precision Resistor Module 40-297-002 (37-pin male D-type)

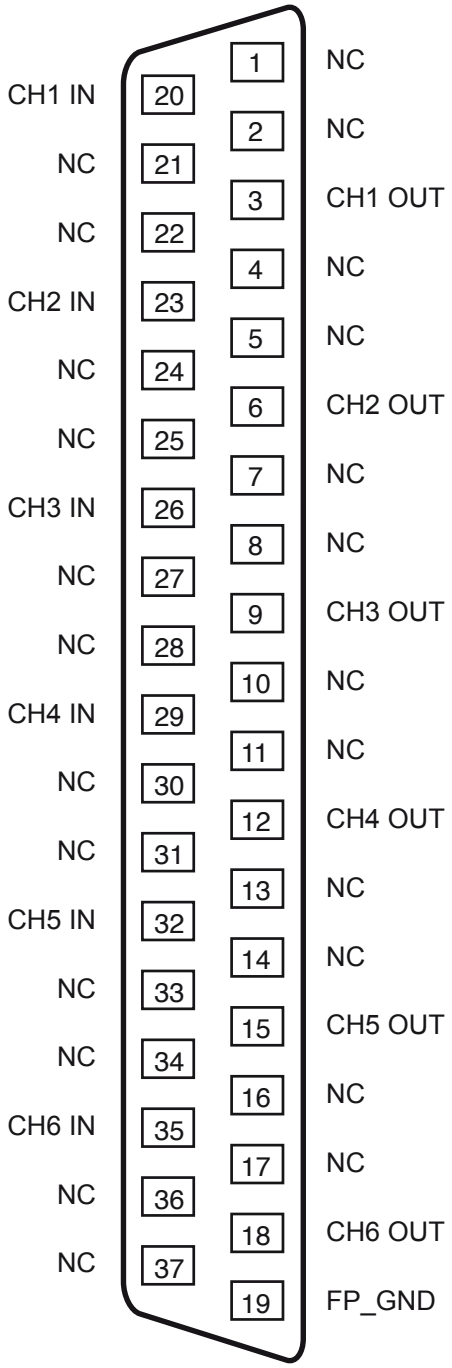


Figure 5.3 - Pin Outs: 6-Channel Precision Resistor Module 40-297-003 (37-pin male D-type)

SECTION 6 - TROUBLESHOOTING

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 MXI-3 you should check the integrity of all MXI-3 links. When the system is powered up, and during Windows start-up, you should expect to see periodic activity on the MXI-3 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 it's 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.

THIS PAGE INTENTIONALLY BLANK

SECTION 7 - MAINTENANCE INFORMATION

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 www.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 60-102 and 60-103) 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.

VERIFICATION & ADJUSTMENT PROCEDURE

This section provides a procedure for verifying that the 40-297 is performing to specification and guidance on adjustment.

In normal use the 40-297 does not require regular adjustment. Where procedures require regular verification checks of instrumentation in a system Pickering Interfaces recommend a 1 year interval between tests. In many applications much longer calibration intervals can be used.

Verification

Depending on the customer's requirements a verification check can be made periodically by connecting to the front panel resistor channel port to check the module is within specification. The module has an internal date counter that shows a message in the diagnostics after this time but will not effect the cards operation. The customer has the option to read and reset the verification/calibration date as required via the following programming functions:

PIL_ReadCalDate

PIL_WriteCalDate

The module also has two internal calibration stores User_Store & Factory_Store which contain the same calibration information when leaving the factory. Resistance calls are made using the calibration values in the User_Store, in nearly all cases no changes to either store will be required, if the User_Store is accidently modified the Factory_Store can be copied to the User_Store to recover the factory calibration.

Verification Procedure

The verification procedure is describes a set of measurements that is adequate to check that the module is performing to specification.

Calibration/verification of the 40-297 requires the use of a precision DMM capable of 4 terminal resistance measurements.

Measurement of the 40-297 can be simplified by use of the cable assembly shown in Fig 7.3. connected to the DMM.

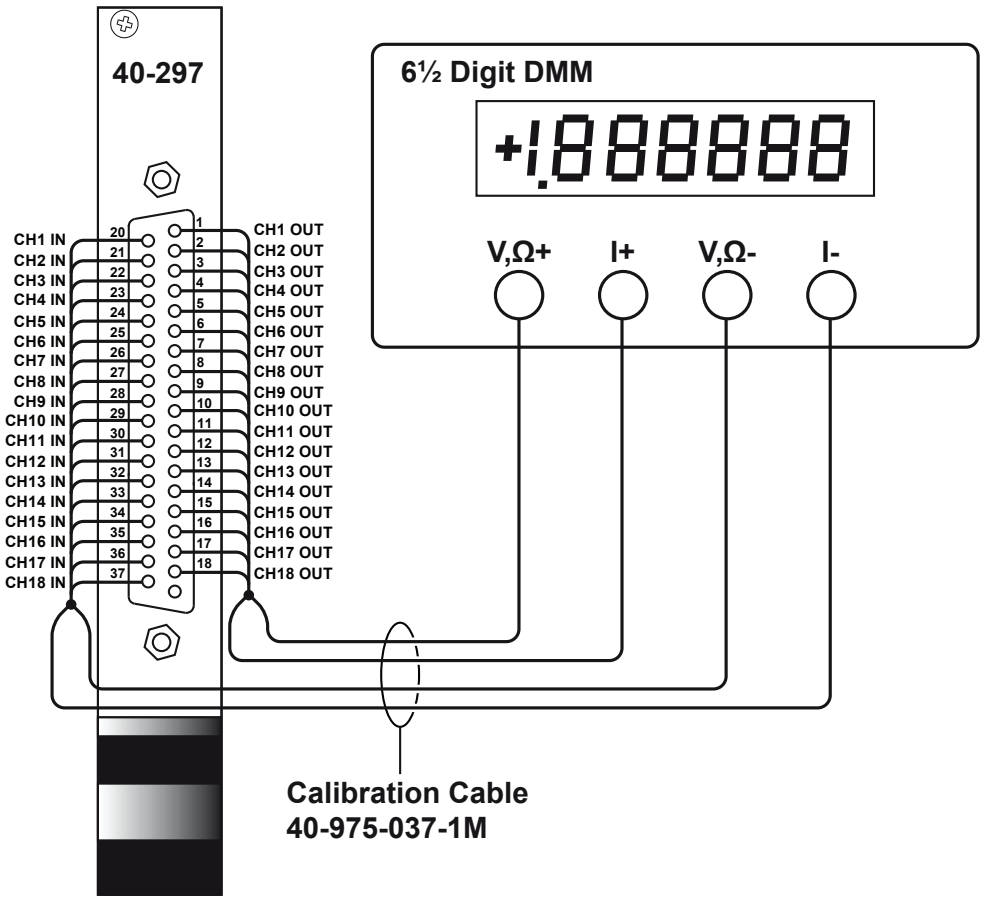


Figure 7.1 - Calibration of the 40-297 using a DMM with 4-wire resistance measurement and the 40-975-037-1M cable

Each “input” and each “output” is linked together so all the installed channels are in parallel. Once connected in this way, the user can check each channel of the module in turn by setting all channels to the open position except for the single channel to be measured.

The DMM is then used to measure the resistance with the module settings shown in Table 7.1 for each channel. The resistance settings are model dependent as shown.

Table 7.1 - Calibration Resistance Settings For Each Model

40-297-001	40-297-002	40-297-003
Short (0Ω)	Short (0Ω)	Short (0Ω)
1Ω	2Ω	3Ω
1.5Ω	2.15Ω	3.06Ω
2.5Ω	2.4Ω	3.2Ω
3.5Ω	2.75Ω	3.375Ω
7.5Ω	3.75Ω	4.875Ω
15.5Ω	5.75Ω	5.875Ω
31.5Ω	9.75Ω	7.875Ω
63.5Ω	17.75Ω	11.875Ω
127.5Ω	33.75Ω	19.875Ω
230Ω	65.75Ω	35.875Ω
—	129.75Ω	67.875Ω
—	256Ω	128Ω
—	512Ω	256Ω
—	1024Ω	512Ω
—	2048Ω	1024Ω
—	4096Ω	2048Ω
—	8000Ω	4096Ω
—	13500Ω	8000Ω
—	—	16000Ω
—	—	32000Ω
—	—	64000Ω
—	—	128000Ω
—	—	256000Ω
—	—	512000Ω
—	—	1024000Ω
—	—	1500000Ω

For convenience, Tables 7.2, 7.3 and 7.4 on the following pages are provided for a means of recording calibration results for one channel of each model.

Adjustment Procedure

The 40-297 contains no user adjustable parts, it uses a calibration table that is used to allow the module to respond to requests for specific values of resistance. Two tables are supported, a factory table and a user table. For normal use we recommend that only the factory table is used. For applications requiring better accuracy we suggest using one of the 40-260 series modules.

Although it is possible to modify the calibration table we recommend that modifications to calibration information is carried out by Pickering Interfaces. Calibration table alterations are only normally required in the event of having to replace a resistor.

VERIFICATION TEST RESULTS

Table 7.2 - Calibration Test Results For 40-297-001

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

Resistance Setting	Measured Value	Specification Limit, 0.2% ±1Ω		Result (delete as appropriate)
		Max	Min	
Short (0Ω)		<.5Ω	0Ω	Pass / Fail
1Ω		2.002Ω	0Ω	Pass / Fail
1.5Ω		2.503Ω	0.497Ω	Pass / Fail
2.5Ω		3.505Ω	1.495Ω	Pass / Fail
3.5Ω		4.507Ω	2.493Ω	Pass / Fail
7.5Ω		8.515Ω	6.485Ω	Pass / Fail
15.5Ω		16.531Ω	14.469Ω	Pass / Fail
31.5Ω		32.563Ω	30.437Ω	Pass / Fail
63.5Ω		64.627Ω	62.373Ω	Pass / Fail
127.5Ω		128.755Ω	126.245Ω	Pass / Fail
230Ω		231.46Ω	228.54Ω	Pass / Fail

Table 7.3 - Calibration Test Results For 40-297-002

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

Resistance Setting	Measured Value	Specification Limit, 0.2% ±0.25Ω		Result (delete as appropriate)
		Max	Min	
Short (0Ω)		<.5Ω	0Ω	Pass / Fail
2Ω		2.254Ω	1.746Ω	Pass / Fail
2.15Ω		2.4043Ω	1.8957Ω	Pass / Fail
2.4Ω		2.6548Ω	2.1452Ω	Pass / Fail
2.75Ω		3.0055Ω	2.4945Ω	Pass / Fail
3.75Ω		4.0075Ω	3.4925Ω	Pass / Fail
5.75Ω		6.0115Ω	5.4885Ω	Pass / Fail
9.75Ω		10.0195Ω	9.4805Ω	Pass / Fail
17.75Ω		18.0355Ω	17.4645Ω	Pass / Fail
33.75Ω		34.0675Ω	33.4325Ω	Pass / Fail
65.75Ω		66.1315Ω	65.3685Ω	Pass / Fail
129.75Ω		130.2595Ω	129.2405Ω	Pass / Fail
256Ω		256.762Ω	255.238Ω	Pass / Fail
512Ω		513.274Ω	510.726Ω	Pass / Fail
1024Ω		1026.298Ω	1021.702Ω	Pass / Fail
2048Ω		2052.346Ω	2043.654Ω	Pass / Fail
4096Ω		4104.442Ω	4087.558Ω	Pass / Fail
8000Ω		8016.25Ω	7983.75Ω	Pass / Fail
13500Ω		13527.25Ω	13472.75Ω	Pass / Fail

Table 7.4 - Calibration Test Results For 40-297-003

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

Resistance Setting	Measured Value	Specification Limit, 0.2% ±0.125Ω		Result (delete as appropriate)
		Max	Min	
Short (0Ω)		<.5Ω	0Ω	Pass / Fail
3Ω		3.131Ω	2.869Ω	Pass / Fail
3.06Ω		3.19112Ω	2.92888Ω	Pass / Fail
3.2Ω		3.3314Ω	3.0686Ω	Pass / Fail
3.375Ω		3.50675Ω	3.24325Ω	Pass / Fail
4.875Ω		5.00975Ω	4.74025Ω	Pass / Fail
5.875Ω		6.01175Ω	5.73825Ω	Pass / Fail
7.875Ω		8.01575Ω	7.73425Ω	Pass / Fail
11.875Ω		12.02375Ω	11.72625Ω	Pass / Fail
19.875Ω		20.03975Ω	19.71025Ω	Pass / Fail
35.875Ω		36.07175Ω	35.67825Ω	Pass / Fail
67.875Ω		68.13575Ω	67.61425Ω	Pass / Fail
128Ω		128.381Ω	127.619Ω	Pass / Fail
256Ω		256.637Ω	255.363Ω	Pass / Fail
512Ω		513.149Ω	510.851Ω	Pass / Fail
1024Ω		1026.173Ω	1021.827Ω	Pass / Fail
2048Ω		2052.221Ω	2043.779Ω	Pass / Fail
4096Ω		4104.317Ω	4087.683Ω	Pass / Fail
8000Ω		8016.125Ω	7983.875Ω	Pass / Fail
16000Ω		16032.125Ω	15967.875Ω	Pass / Fail
32000Ω		32064.125Ω	31935.875Ω	Pass / Fail
64000Ω		64128.125Ω	63871.875Ω	Pass / Fail
128000Ω		128256.125Ω	127743.875Ω	Pass / Fail
256000Ω		256512.125Ω	255487.875Ω	Pass / Fail
512000Ω		513024.125Ω	510975.875Ω	Pass / Fail
1024000Ω		1026048.125Ω	1021951.875Ω	Pass / Fail
1500000Ω		1503000.125Ω	1496999.875Ω	Pass / Fail

RELAY LOOK-UP TABLES

The following pages provide a cross reference between the programmable bits for each channel of the Precision Resistor Module and the physical relays on the mother and daughter PCBs. These tables can be used in the fault finding process and should be used in conjunction with the PCB layout diagrams in Figures7.2 and 7.3 to identify the position of faulty relays.

18-Channel 8-Bit Precision Resistor Module (40-297-001)

Chan.	Use	Relay	Chan.	Use	Relay	Chan.	Use	Relay	Chan.	Use	Relay
1	Bit 1	RL1	5	Bit 6	RL46	10	Bit 1	RL91	14	Bit 6	RL136
1	Bit 2	RL2	5	Bit 7	RL47	10	Bit 2	RL92	14	Bit 7	RL137
1	Bit 3	RL3	5	Bit 8	RL48	10	Bit 3	RL93	14	Bit 8	RL138
1	Bit 4	RL4	5	Short	RL49	10	Bit 4	RL94	14	Short	RL139
1	Bit 5	RL5	5	Isolation	RL50	10	Bit 5	RL95	14	Isolation	RL140
1	Bit 6	RL6	6	Bit 1	RL51	10	Bit 6	RL96	15	Bit 1	RL141
1	Bit 7	RL7	6	Bit 2	RL52	10	Bit 7	RL97	15	Bit 2	RL142
1	Bit 8	RL8	6	Bit 3	RL53	10	Bit 8	RL98	15	Bit 3	RL143
1	Short	RL9	6	Bit 4	RL54	10	Short	RL99	15	Bit 4	RL144
1	Isolation	RL10	6	Bit 5	RL55	10	Isolation	RL100	15	Bit 5	RL145
2	Bit 1	RL11	6	Bit 6	RL56	11	Bit 1	RL101	15	Bit 6	RL146
2	Bit 2	RL12	6	Bit 7	RL57	11	Bit 2	RL102	15	Bit 7	RL147
2	Bit 3	RL13	6	Bit 8	RL58	11	Bit 3	RL103	15	Bit 8	RL148
2	Bit 4	RL14	6	Short	RL59	11	Bit 4	RL104	15	Short	RL149
2	Bit 5	RL15	6	Isolation	RL60	11	Bit 5	RL105	15	Isolation	RL150
2	Bit 6	RL16	7	Bit 1	RL61	11	Bit 6	RL106	16	Bit 1	RL151
2	Bit 7	RL17	7	Bit 2	RL62	11	Bit 7	RL107	16	Bit 2	RL152
2	Bit 8	RL18	7	Bit 3	RL63	11	Bit 8	RL108	16	Bit 3	RL153
2	Short	RL19	7	Bit 4	RL64	11	Short	RL109	16	Bit 4	RL154
2	Isolation	RL20	7	Bit 5	RL65	11	Isolation	RL110	16	Bit 5	RL155
3	Bit 1	RL21	7	Bit 6	RL66	12	Bit 1	RL111	16	Bit 6	RL156
3	Bit 2	RL22	7	Bit 7	RL67	12	Bit 2	RL112	16	Bit 7	RL157
3	Bit 3	RL23	7	Bit 8	RL68	12	Bit 3	RL113	16	Bit 8	RL158
3	Bit 4	RL24	7	Short	RL69	12	Bit 4	RL114	16	Short	RL159
3	Bit 5	RL25	7	Isolation	RL70	12	Bit 5	RL115	16	Isolation	RL160
3	Bit 6	RL26	8	Bit 1	RL71	12	Bit 6	RL116	17	Bit 1	RL161
3	Bit 7	RL27	8	Bit 2	RL72	12	Bit 7	RL117	17	Bit 2	RL162
3	Bit 8	RL28	8	Bit 3	RL73	12	Bit 8	RL118	17	Bit 3	RL163
3	Short	RL29	8	Bit 4	RL74	12	Short	RL119	17	Bit 4	RL164
3	Isolation	RL30	8	Bit 5	RL75	12	Isolation	RL120	17	Bit 5	RL165
4	Bit 1	RL31	8	Bit 6	RL76	13	Bit 1	RL121	17	Bit 6	RL166
4	Bit 2	RL32	8	Bit 7	RL77	13	Bit 2	RL122	17	Bit 7	RL167
4	Bit 3	RL33	8	Bit 8	RL78	13	Bit 3	RL123	17	Bit 8	RL168
4	Bit 4	RL34	8	Short	RL79	13	Bit 4	RL124	17	Short	RL169
4	Bit 5	RL35	8	Isolation	RL80	13	Bit 5	RL125	17	Isolation	RL170
4	Bit 6	RL36	9	Bit 1	RL81	13	Bit 6	RL126	18	Bit 1	RL171
4	Bit 7	RL37	9	Bit 2	RL82	13	Bit 7	RL127	18	Bit 2	RL172
4	Bit 8	RL38	9	Bit 3	RL83	13	Bit 8	RL128	18	Bit 3	RL173
4	Short	RL39	9	Bit 4	RL84	13	Short	RL129	18	Bit 4	RL174
4	Isolation	RL40	9	Bit 5	RL85	13	Isolation	RL130	18	Bit 5	RL175
5	Bit 1	RL41	9	Bit 6	RL86	14	Bit 1	RL131	18	Bit 6	RL176
5	Bit 2	RL42	9	Bit 7	RL87	14	Bit 2	RL132	18	Bit 7	RL177
5	Bit 3	RL43	9	Bit 8	RL88	14	Bit 3	RL133	18	Bit 8	RL178
5	Bit 4	RL44	9	Short	RL89	14	Bit 4	RL134	18	Short	RL179
5	Bit 5	RL45	9	Isolation	RL90	14	Bit 5	RL135	18	Isolation	RL180

9-Channel 16-Bit Precision Resistor Module (40-297-002)

Chan.	Use	Relay	Chan.	Use	Relay	Chan.	Use	Relay	Chan.	Use	Relay
1	Bit 1	RL1	3	Bit 6	RL46	5	Bit 9	RL91	7	Bit 14	RL136
1	Bit 2	RL2	3	Bit 7	RL47	5	Bit 10	RL92	7	Bit 15	RL137
1	Bit 3	RL3	3	Bit 8	RL48	5	Bit 11	RL93	7	Bit 16	RL138
1	Bit 4	RL4	3	Short	RL49	5	Bit 12	RL94	7	Short	RL139
1	Bit 5	RL5	3	Isolation	RL50	5	Bit 13	RL95	—	—	RL140
1	Bit 6	RL6	3	Bit 9	RL51	5	Bit 14	RL96	8	Bit 1	RL141
1	Bit 7	RL7	3	Bit 10	RL52	5	Bit 15	RL97	8	Bit 2	RL142
1	Bit 8	RL8	3	Bit 11	RL53	5	Bit 16	RL98	8	Bit 3	RL143
1	Short	RL9	3	Bit 12	RL54	5	Short	RL99	8	Bit 4	RL144
1	Isolation	RL10	3	Bit 13	RL55	—	—	RL100	8	Bit 5	RL145
1	Bit 9	RL11	3	Bit 14	RL56	6	Bit 1	RL101	8	Bit 6	RL146
1	Bit 10	RL12	3	Bit 15	RL57	6	Bit 2	RL102	8	Bit 7	RL147
1	Bit 11	RL13	3	Bit 16	RL58	6	Bit 3	RL103	8	Bit 8	RL148
1	Bit 12	RL14	3	Short	RL59	6	Bit 4	RL104	8	Short	RL149
1	Bit 13	RL15	—	—	RL60	6	Bit 5	RL105	8	Isolation	RL150
1	Bit 14	RL16	4	Bit 1	RL61	6	Bit 6	RL106	8	Bit 9	RL151
1	Bit 15	RL17	4	Bit 2	RL62	6	Bit 7	RL107	8	Bit 10	RL152
1	Bit 16	RL18	4	Bit 3	RL63	6	Bit 8	RL108	8	Bit 11	RL153
1	Short	RL19	4	Bit 4	RL64	6	Short	RL109	8	Bit 12	RL154
—	—	RL20	4	Bit 5	RL65	6	Isolation	RL110	8	Bit 13	RL155
2	Bit 1	RL21	4	Bit 6	RL66	6	Bit 9	RL111	8	Bit 14	RL156
2	Bit 2	RL22	4	Bit 7	RL67	6	Bit 10	RL112	8	Bit 15	RL157
2	Bit 3	RL23	4	Bit 8	RL68	6	Bit 11	RL113	8	Bit 16	RL158
2	Bit 4	RL24	4	Short	RL69	6	Bit 12	RL114	8	Short	RL159
2	Bit 5	RL25	4	Isolation	RL70	6	Bit 13	RL115	—	—	RL160
2	Bit 6	RL26	4	Bit 9	RL71	6	Bit 14	RL116	9	Bit 1	RL161
2	Bit 7	RL27	4	Bit 10	RL72	6	Bit 15	RL117	9	Bit 2	RL162
2	Bit 8	RL28	4	Bit 11	RL73	6	Bit 16	RL118	9	Bit 3	RL163
2	Short	RL29	4	Bit 12	RL74	6	Short	RL119	9	Bit 4	RL164
2	Isolation	RL30	4	Bit 13	RL75	—	—	RL120	9	Bit 5	RL165
2	Bit 9	RL31	4	Bit 14	RL76	7	Bit 1	RL121	9	Bit 6	RL166
2	Bit 10	RL32	4	Bit 15	RL77	7	Bit 2	RL122	9	Bit 7	RL167
2	Bit 11	RL33	4	Bit 16	RL78	7	Bit 3	RL123	9	Bit 8	RL168
2	Bit 12	RL34	4	Short	RL79	7	Bit 4	RL124	9	Short	RL169
2	Bit 13	RL35	—	—	RL80	7	Bit 5	RL125	9	Isolation	RL170
2	Bit 14	RL36	5	Bit 1	RL81	7	Bit 6	RL126	9	Bit 9	RL171
2	Bit 15	RL37	5	Bit 2	RL82	7	Bit 7	RL127	9	Bit 10	RL172
2	Bit 16	RL38	5	Bit 3	RL83	7	Bit 8	RL128	9	Bit 11	RL173
2	Short	RL39	5	Bit 4	RL84	7	Short	RL129	9	Bit 12	RL174
—	—	RL40	5	Bit 5	RL85	7	Isolation	RL130	9	Bit 13	RL175
3	Bit 1	RL41	5	Bit 6	RL86	7	Bit 9	RL131	9	Bit 14	RL176
3	Bit 2	RL42	5	Bit 7	RL87	7	Bit 10	RL132	9	Bit 15	RL177
3	Bit 3	RL43	5	Bit 8	RL88	7	Bit 11	RL133	9	Bit 16	RL178
3	Bit 4	RL44	5	Short	RL89	7	Bit 12	RL134	9	Short	RL179
3	Bit 5	RL45	5	Isolation	RL90	7	Bit 13	RL135	—	—	RL180

6-Channel 24-Bit Precision Resistor Module (40-297-003)

Chan.	Use	Relay	Chan.	Use	Relay	Chan.	Use	Relay	Chan.	Use	Relay
1	Bit 1	RL1	2	Bit 14	RL46	4	Bit 1	RL91	5	Bit 14	RL136
1	Bit 2	RL2	2	Bit 15	RL47	4	Bit 2	RL92	5	Bit 15	RL137
1	Bit 3	RL3	2	Bit 16	RL48	4	Bit 3	RL93	5	Bit 16	RL138
1	Bit 4	RL4	2	Short	RL49	4	Bit 4	RL94	5	Short	RL139
1	Bit 5	RL5	—	—	RL50	4	Bit 5	RL95	—	—	RL140
1	Bit 6	RL6	2	Bit 17	RL51	4	Bit 6	RL96	5	Bit 17	RL141
1	Bit 7	RL7	2	Bit 18	RL52	4	Bit 7	RL97	5	Bit 18	RL142
1	Bit 8	RL8	2	Bit 19	RL53	4	Bit 8	RL98	5	Bit 19	RL143
1	Short	RL9	2	Bit 20	RL54	4	Short	RL99	5	Bit 20	RL144
1	Isolation	RL10	2	Bit 21	RL55	4	Isolation	RL100	5	Bit 21	RL145
1	Bit 9	RL11	2	Bit 22	RL56	4	Bit 9	RL101	5	Bit 22	RL146
1	Bit 10	RL12	2	Bit 23	RL57	4	Bit 10	RL102	5	Bit 23	RL147
1	Bit 11	RL13	2	Bit 24	RL58	4	Bit 11	RL103	5	Bit 24	RL148
1	Bit 12	RL14	2	Short	RL59	4	Bit 12	RL104	5	Short	RL149
1	Bit 13	RL15	—	—	RL60	4	Bit 13	RL105	—	—	RL150
1	Bit 14	RL16	3	Bit 1	RL61	4	Bit 14	RL106	6	Bit 1	RL151
1	Bit 15	RL17	3	Bit 2	RL62	4	Bit 15	RL107	6	Bit 2	RL152
1	Bit 16	RL18	3	Bit 3	RL63	4	Bit 16	RL108	6	Bit 3	RL153
1	Short	RL19	3	Bit 4	RL64	4	Short	RL109	6	Bit 4	RL154
—	—	RL20	3	Bit 5	RL65	—	—	RL110	6	Bit 5	RL155
1	Bit 17	RL21	3	Bit 6	RL66	4	Bit 17	RL111	6	Bit 6	RL156
1	Bit 18	RL22	3	Bit 7	RL67	4	Bit 18	RL112	6	Bit 7	RL157
1	Bit 19	RL23	3	Bit 8	RL68	4	Bit 19	RL113	6	Bit 8	RL158
1	Bit 20	RL24	3	Short	RL69	4	Bit 20	RL114	6	Short	RL159
1	Bit 21	RL25	3	Isolation	RL70	4	Bit 21	RL115	6	Isolation	RL160
1	Bit 22	RL26	3	Bit 9	RL71	4	Bit 22	RL116	6	Bit 9	RL161
1	Bit 23	RL27	3	Bit 10	RL72	4	Bit 23	RL117	6	Bit 10	RL162
1	Bit 24	RL28	3	Bit 11	RL73	4	Bit 24	RL118	6	Bit 11	RL163
1	Short	RL29	3	Bit 12	RL74	4	Short	RL119	6	Bit 12	RL164
—	—	RL30	3	Bit 13	RL75	—	—	RL120	6	Bit 13	RL165
2	Bit 1	RL31	3	Bit 14	RL76	5	Bit 1	RL121	6	Bit 14	RL166
2	Bit 2	RL32	3	Bit 15	RL77	5	Bit 2	RL122	6	Bit 15	RL167
2	Bit 3	RL33	3	Bit 16	RL78	5	Bit 3	RL123	6	Bit 16	RL168
2	Bit 4	RL34	3	Short	RL79	5	Bit 4	RL124	6	Short	RL169
2	Bit 5	RL35	—	—	RL80	5	Bit 5	RL125	—	—	RL170
2	Bit 6	RL36	3	Bit 17	RL81	5	Bit 6	RL126	6	Bit 17	RL171
2	Bit 7	RL37	3	Bit 18	RL82	5	Bit 7	RL127	6	Bit 18	RL172
2	Bit 8	RL38	3	Bit 19	RL83	5	Bit 8	RL128	6	Bit 19	RL173
2	Short	RL39	3	Bit 20	RL84	5	Short	RL129	6	Bit 20	RL174
2	Isolation	RL40	3	Bit 21	RL85	5	Isolation	RL130	6	Bit 21	RL175
2	Bit 9	RL41	3	Bit 22	RL86	5	Bit 9	RL131	6	Bit 22	RL176
2	Bit 10	RL42	3	Bit 23	RL87	5	Bit 10	RL132	6	Bit 23	RL177
2	Bit 11	RL43	3	Bit 24	RL88	5	Bit 11	RL133	6	Bit 24	RL178
2	Bit 12	RL44	3	Short	RL89	5	Bit 12	RL134	6	Short	RL179
2	Bit 13	RL45	—	—	RL90	5	Bit 13	RL135	—	—	RL180

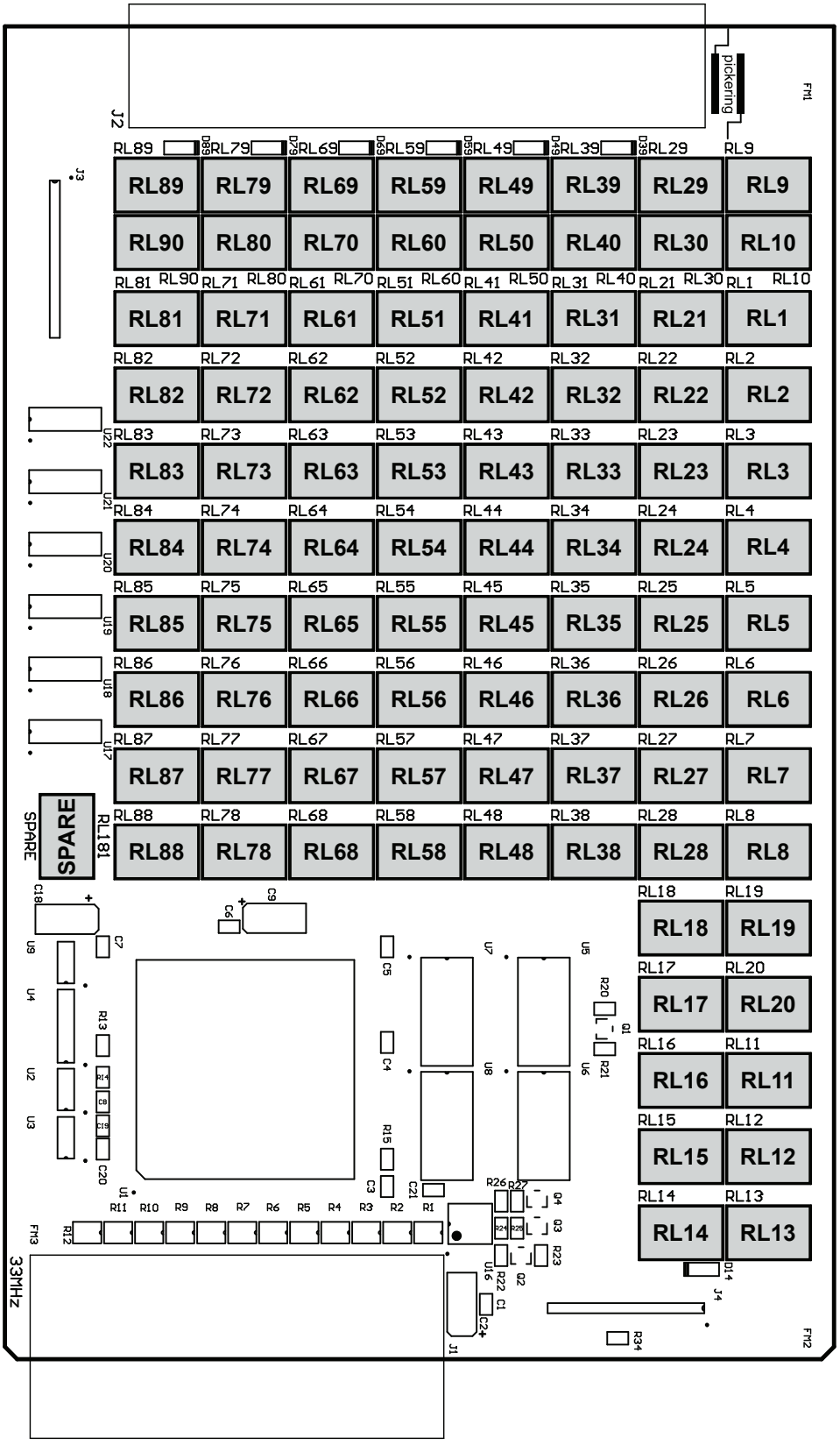


Figure 7.2 - 40-297 Motherboard Component Layout

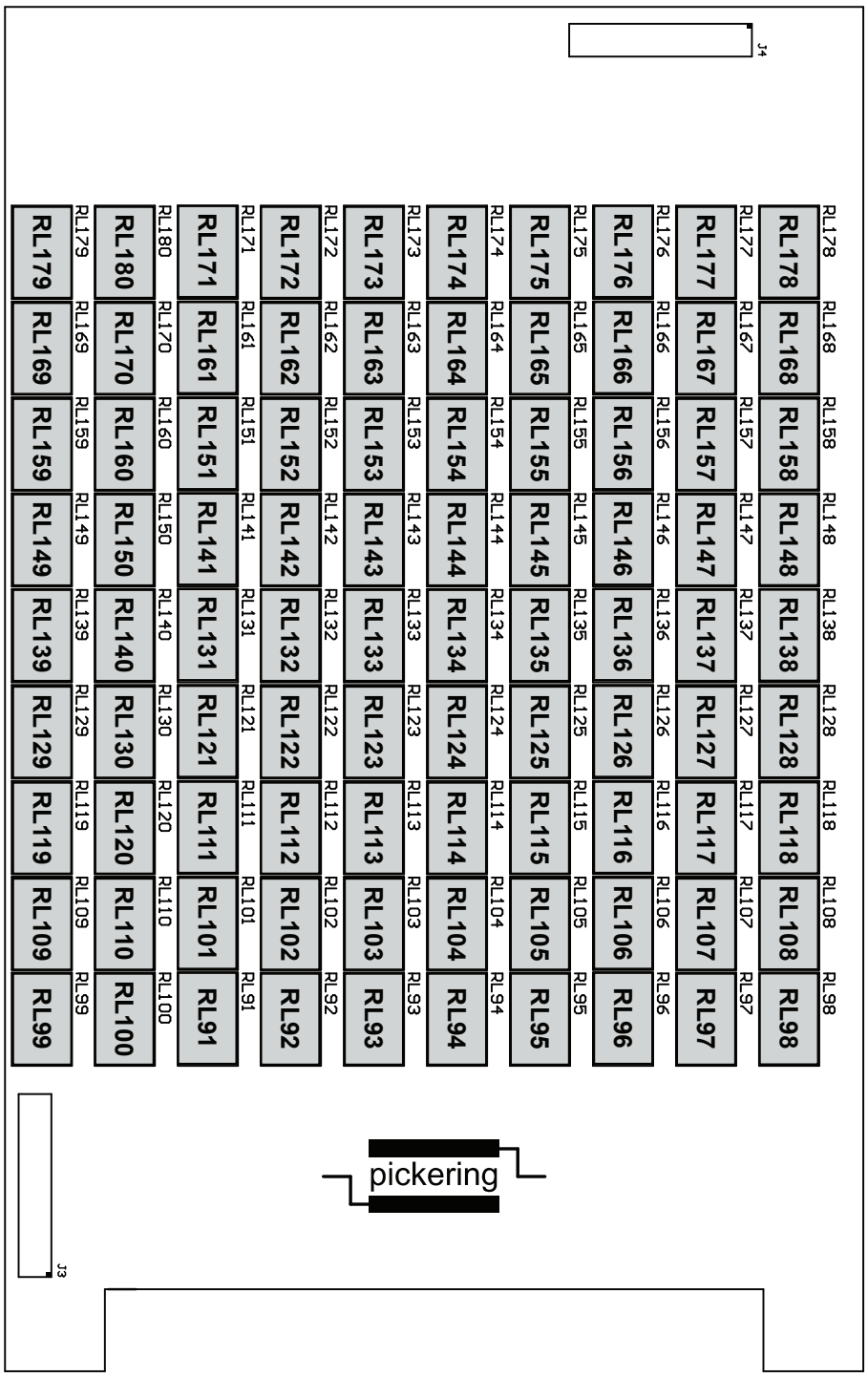
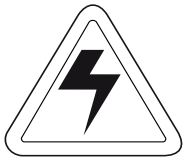


Figure 7.3 - 40-297 Daughterboard Component Layout

SECTION 8 - WARNINGS AND CAUTIONS



WARNING - DANGER OF ELECTRIC SHOCK

THIS MODULE MAY CONTAIN HAZARDOUS VOLTAGES. BEFORE REMOVING THE MODULE FROM THE RACK REMOVE ALL SUPPLIES.

CAUTION
Handling of Electrostatic-Sensitive Semiconductor Devices

Certain semiconductor devices used in the equipment are liable to damage due to static voltage. Observe the following precautions when handling these devices in their unterminated state, or sub-units containing these devices:

(1) Persons removing sub-units from an 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.

THIS PAGE INTENTIONALLY BLANK