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# USER MANUAL

PXI

## POWER RELAY MODULE
## (MODEL No. 40-150 / 151)




Issue 1.3 February 2009

pickering

www.pickeringtest.com

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Reg No. FM38792

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# SECTION 1 - INTRODUCTION

## GENERAL

Pickering Interfaces have a range of power switching PXI modules, available in relay, matrix or multiplexer configurations.

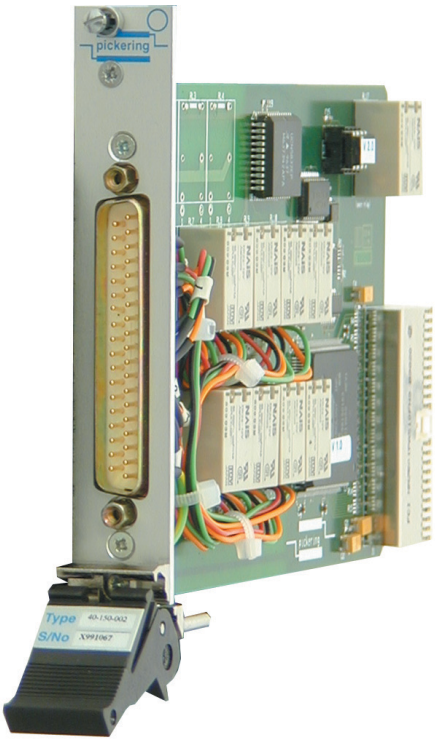
Model 40-150/151 has 8 x DPST or 12 x DPST Power Relays, suitable for switching inductive/capacitive loads up to 5A at 250V AC. Connections are made via a front panel 37 or 50 Way D-Type male connectors.

Power Relay Modules are intended for switching heavy AC or DC loads or for slaving up to large external relays, contactors and solenoids. The 40-150 series of Power Relay Module are suitable for applications requiring switching of either mains voltage or DC current.

### Power Relay Type

The 40-150/151 is fitted with electro-mechanical power relays, gold-flash over silver alloy. A Spare Relay is built onto the circuit board to facilitate easy maintenance with minimum downtime. Two versions are available as follows:

- 8-Channel Power Relay Module (Part Number 40-150-002)
- 12-Channel Power Relay Module (Part Number 40-151-002)



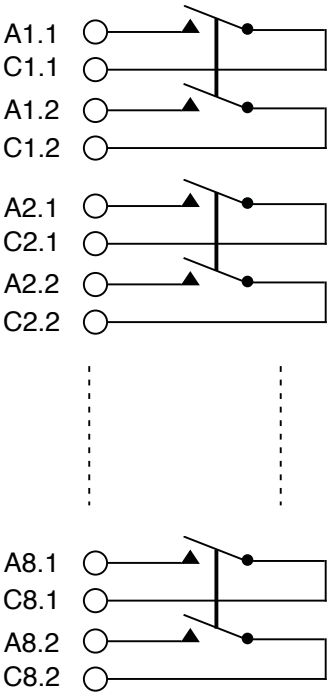




**Figure 1.1 - Switching Diagram For 8-Channel DPST Power Relay Module (40-150-002)**

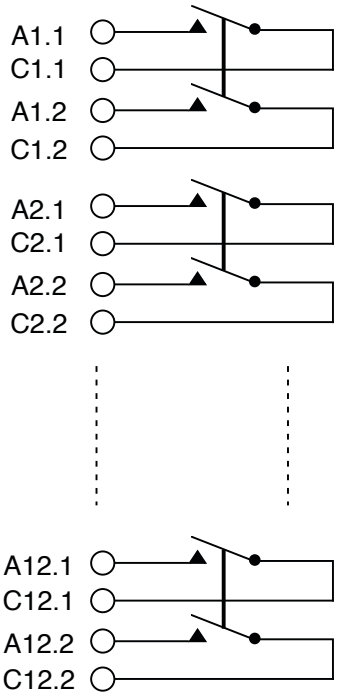
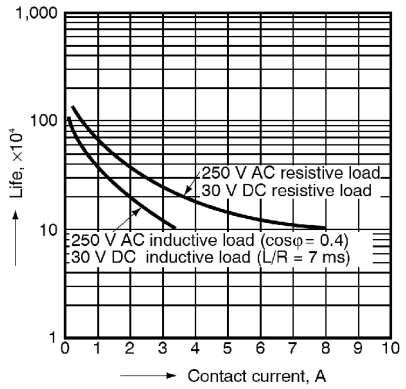


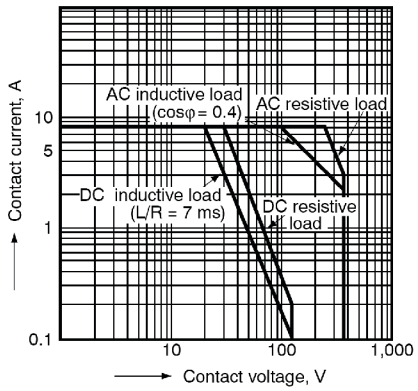

**Figure 1.2 - Switching Diagram For 12-Channel DPST Power Relay Module (40-151-002)**

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# SECTION 2 - SPECIFICATION




**40-150 Current/Operating Life Curve**




**40-150 Current/Voltage Curve**

## Power Requirements

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

## Connectors

PXI bus via 32 bit P1/J1 backplane connector.
40-150 and 40-155: front panel 37-pin male D-type.
40-151 and 40-156: front panel 50-pin male D-type.

## Width and Dimensions

Single slot 3U PXI (CompactPCI card).

## PXI & CompactPCI Compliance

All Pickering Interfaces PXI modules comply with the PXI Specification 2.2. Local Bus, Interrupts, Trigger Bus and Star Trigger are not implemented.

## 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.



## Switching Specification

| | |
|---|---|
| Relay Type: | Electro-mechanical<br>Gold flash over silver alloy contact |
| Max Voltage:<br><br>Max Switch Current:<br>Max Switch Power: | 250Vac/125Vdc (DPST versions)<br>250Vac/35Vdc (SPDT versions)<br>5A<br>1250VA/175W |
| Path Resistance, On:<br>Path Resistance, Off:<br>Thermal Offset: | <250mΩ<br>$>10^9$Ω<br><20µV |
| Bandwidth: | >20MHz |
| Operate Time:<br>Release Time: | <5ms<br><4ms |
| Expected Life<br>Low power load:<br>Full power load: | <br>$>5x10^7$ operations<br>$>1x10^5$ operations |

## 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.

## Product Order Codes

| | |
|---|---|
| 8 x DPST Power Relay Module | **40-150-002** |
| 12 x DPST Power Relay Module | **40-151-002** |
| 8 x SPDT Power Relay Module | **40-155-001** |
| 16 x SPDT Power Relay Module | **40-156-001** |

## Mating Connectors & Cabling

Examples of connectors and cabling for the 40-150 series are:

| | |
|---|---|
| **40-960-037** | 37 way 5A D-type connector, solder. |
| **40-960-050** | 50 way 5A D-type connector, solder. |
| **40-972-037-1M** | Cableform, 37 way D subminiature Female to unterminated, 5A, 1m Length |
| **40-970-050-1M** | Cableform, 50 way D subminiature Female to female, 5A, 1m Length |
| **40-965-037** | Connector block, 37 way D subminiature, Module mounted. |
| **40-965-050** | Connector block, 50 way D subminiature, Module mounted. |

Please refer to the Pickering Interfaces "**Interconnection 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.

## Latest Details

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

## 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 |

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# SECTION 3 - INSTALLATION

## 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.

## 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.

### CAUTION

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.

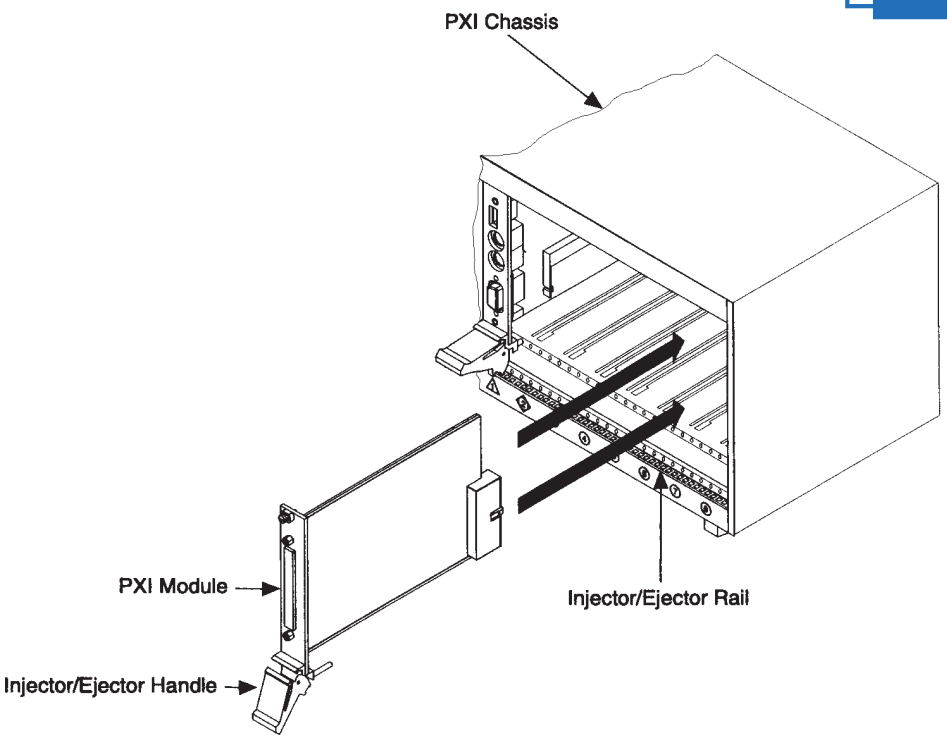



**Figure 3.1 - Installing the module into a PXI/Compact PCI Chassis**

## TESTING OPERATION

Start the Test Panels application from the Programs>>Pickering>>PXI Utilities menu. If you are a LabVIEW user, run “Test Panels (LabVIEW VI)”; if not, run “Test Panels (EXE)”. A selector panel will appear, listing all installed Pickering PXI switch 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.

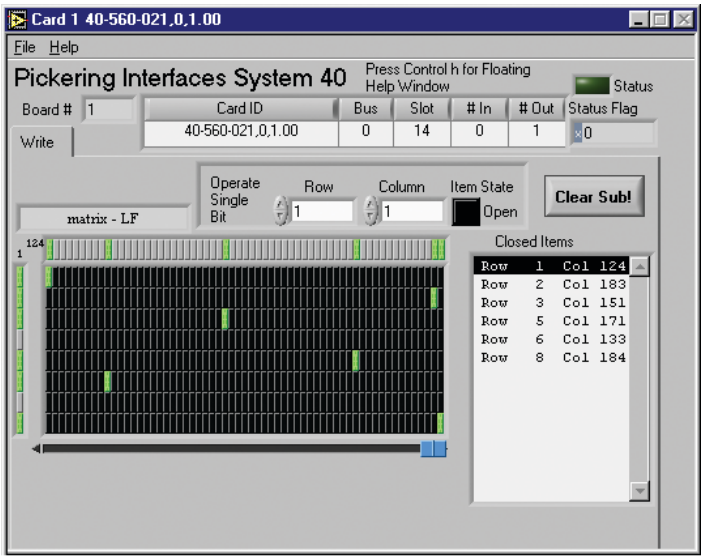



**Figure 3.2 - Typical Test Panel Display**

As an alternative to the Test Panels, the simple Terminal Monitor program PILMon (again on the Programs>>Pickering>>PXI Utilities menu) allows access to all functions of Pickering switch cards through a command-line interface. In PILMon, enter “HE” for help on it’s commands.

Please note that both the Test Panels and Terminal Monitor gain exclusive access to the cards, and so only one of them can be operational at any time.

# SECTION 4 - PROGRAMMING

## 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

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

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

## Programming for LXI

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

### IVI Driver for Windows - pi40iv

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

### Direct I/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.

# SECTION 5 - CONNECTOR PIN OUTS

Figures 5.1 and 5.2 provide the pin out information for the Power Relay Modules.

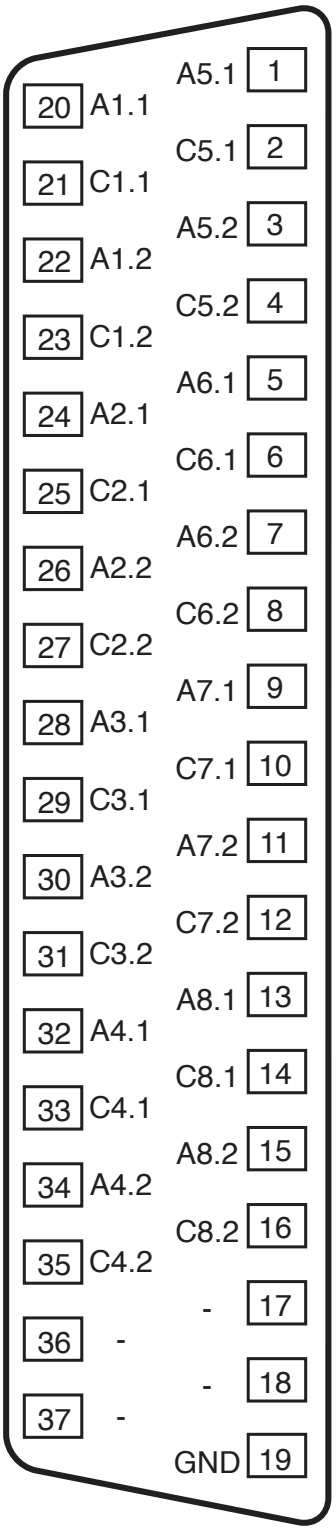



**Figure 5.1 - Power Relay Module (40-150-002): Pin Outs, 37-Way D-Type Plug**

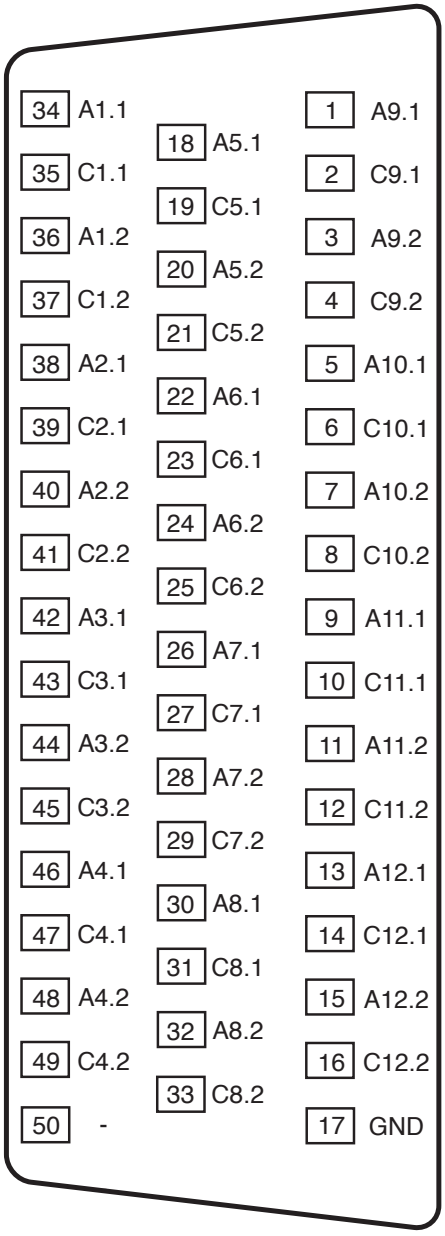



**Figure 5.2 - Power Relay Module (40-151-002): Pin Outs, 50-Way D-Type Plug**

# 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.

Tables 5.1 and 5.2 provide relay locations and associated channels for the two versions.

### TABLE 5.1 - Power Relay Module (40-150-002) Relay Layout

| Relay Location | Channel Number |
|---|---|
| RL10 | 1 |
| RL16 | 2 |
| RL9 | 3 |
| RL15 | 4 |
| RL8 | 5 |
| RL14 | 6 |
| RL7 | 7 |
| RL13 | 8 |

## TABLE 5.2 - Power Relay Module (40-151-002) Relay Layout

| Relay Location | Channel Number |
|---|---|
| RL10 | 1 |
| RL16 | 2 |
| RL9 | 3 |
| RL15 | 4 |
| RL8 | 5 |
| RL14 | 6 |
| RL7 | 7 |
| RL13 | 8 |
| RL6 | 9 |
| RL12 | 10 |
| RL5 | 11 |
| RL11 | 12 |

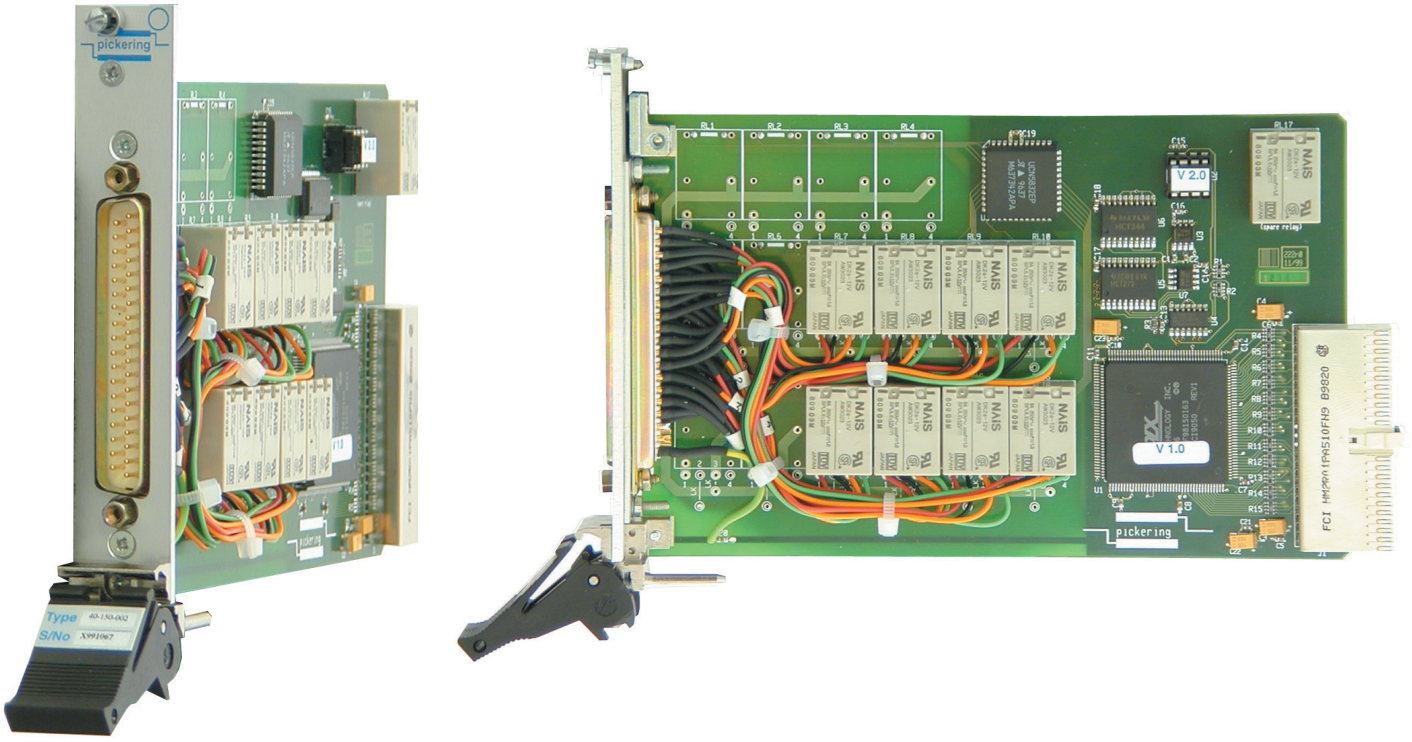
# SECTION 7 - FUNCTIONAL DESCRIPTION

## MECHANICAL DESCRIPTION

The Power Relay Module conforms to the 3U height (128mm) Eurocard standard and comprises the following:

- CPCI Ejector Handle
- Front Panel mounted 37-way or 50-way D Type connector
- Eight or twelve 12V relays
- One spare relay
- Compact PCI backplane connector
- PCI Bridge (U1)
- Control Logic

The front panel is secured to the PCB by two M2.5 x 6mm pan-head posi-drive screws.



## FUNCTIONAL DESCRIPTION

A functional block diagram is provided in Figure 7.1. The Power Relay Module is powered by -12V, +5V and +12V inputs via Compact PCI connector J1. The interface to the user test equipment is via the front panel mounted 37-way or 50-way D type connector, J2. The module comprises a PCB populated with 12V relays. The relays are energised via control signals from relay driver U8. The relay driver is addressed by PCI bridge U1, via the control logic, to output the required signal. Module configuration is determined by hardwired links and data stored in EEPROM U8. PCI Bridge U1 is configured by EEPROM U2.

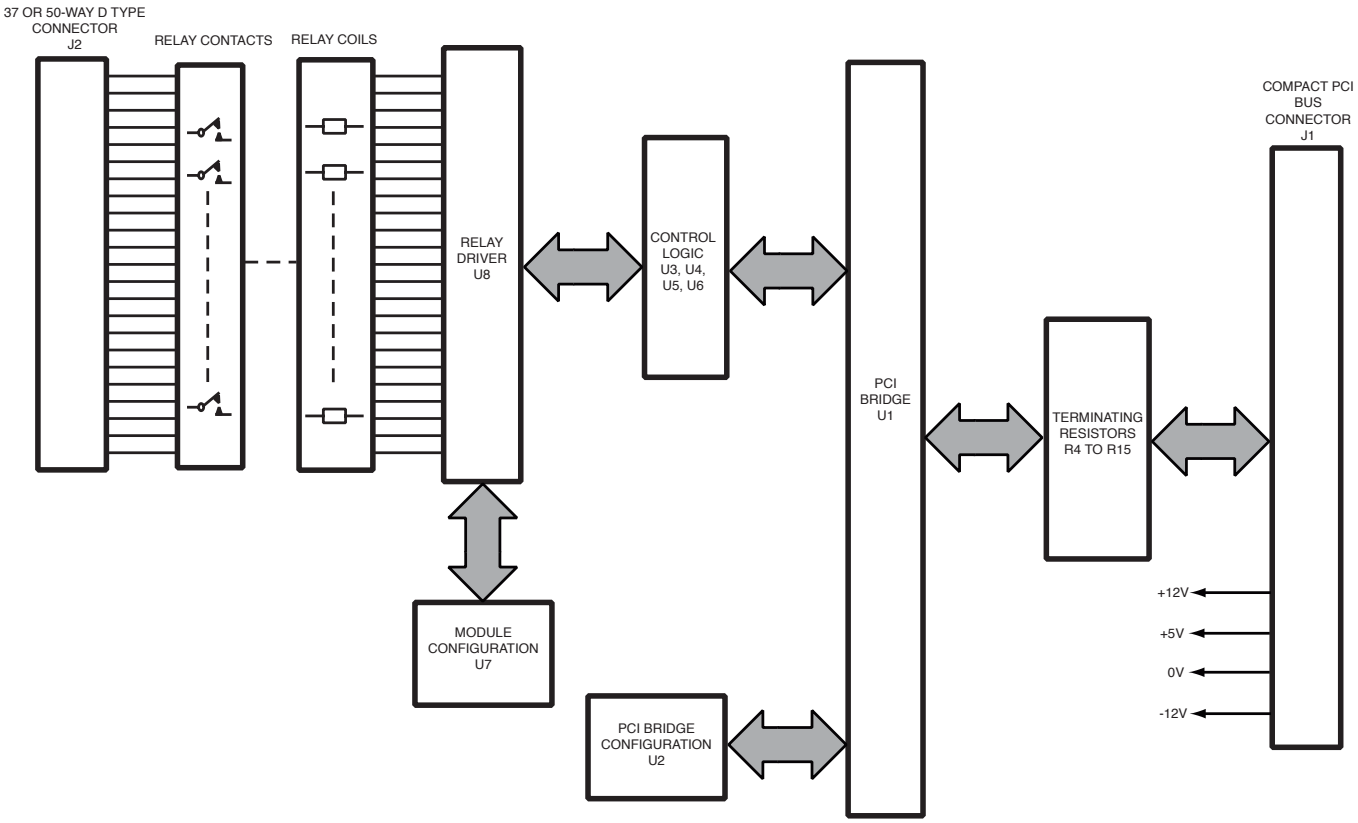
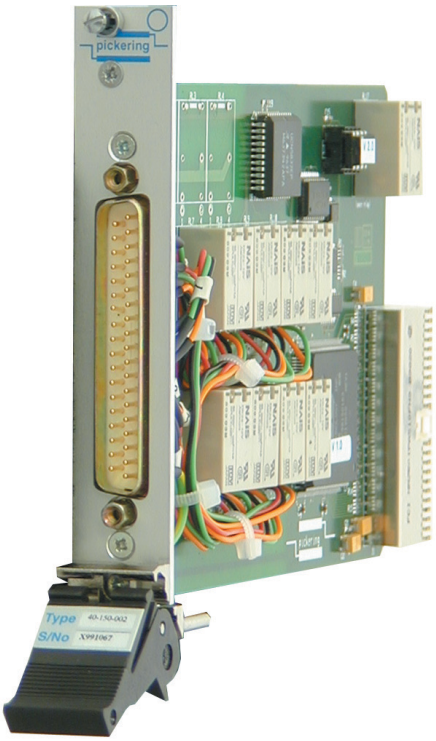



**Figure 7.1 - Power Relay Module (40-150/151): Functional Block Diagram**

# SECTION 8 - PARTS LIST

The following pages provide parts lists and component layout diagrams for Power Relay Modules 40-150-002 and 40-151-002.



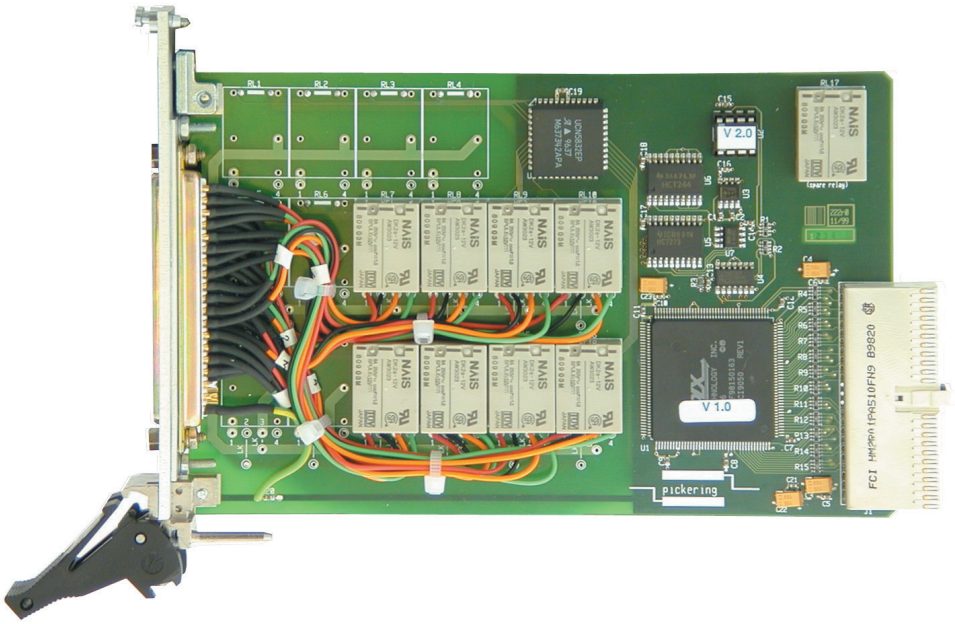
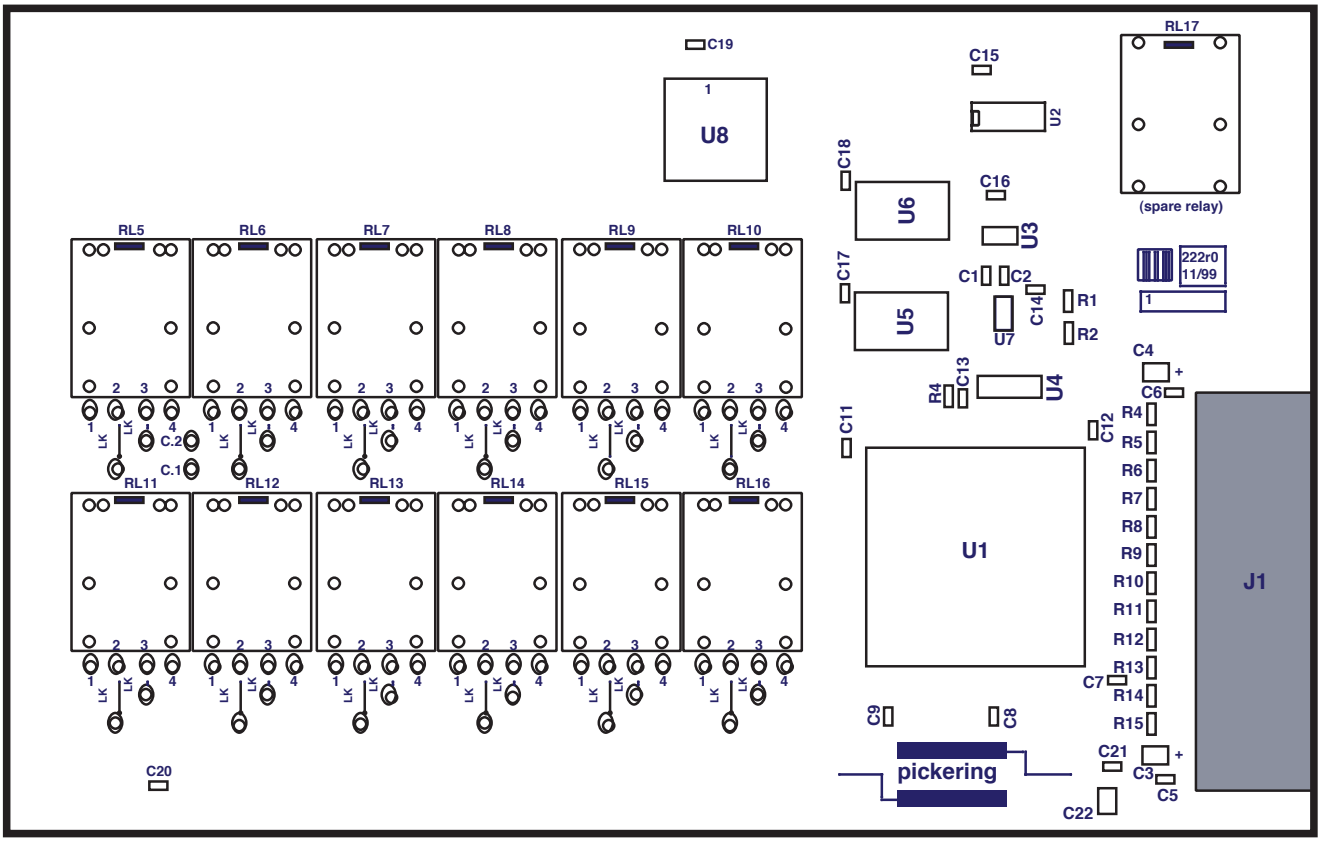



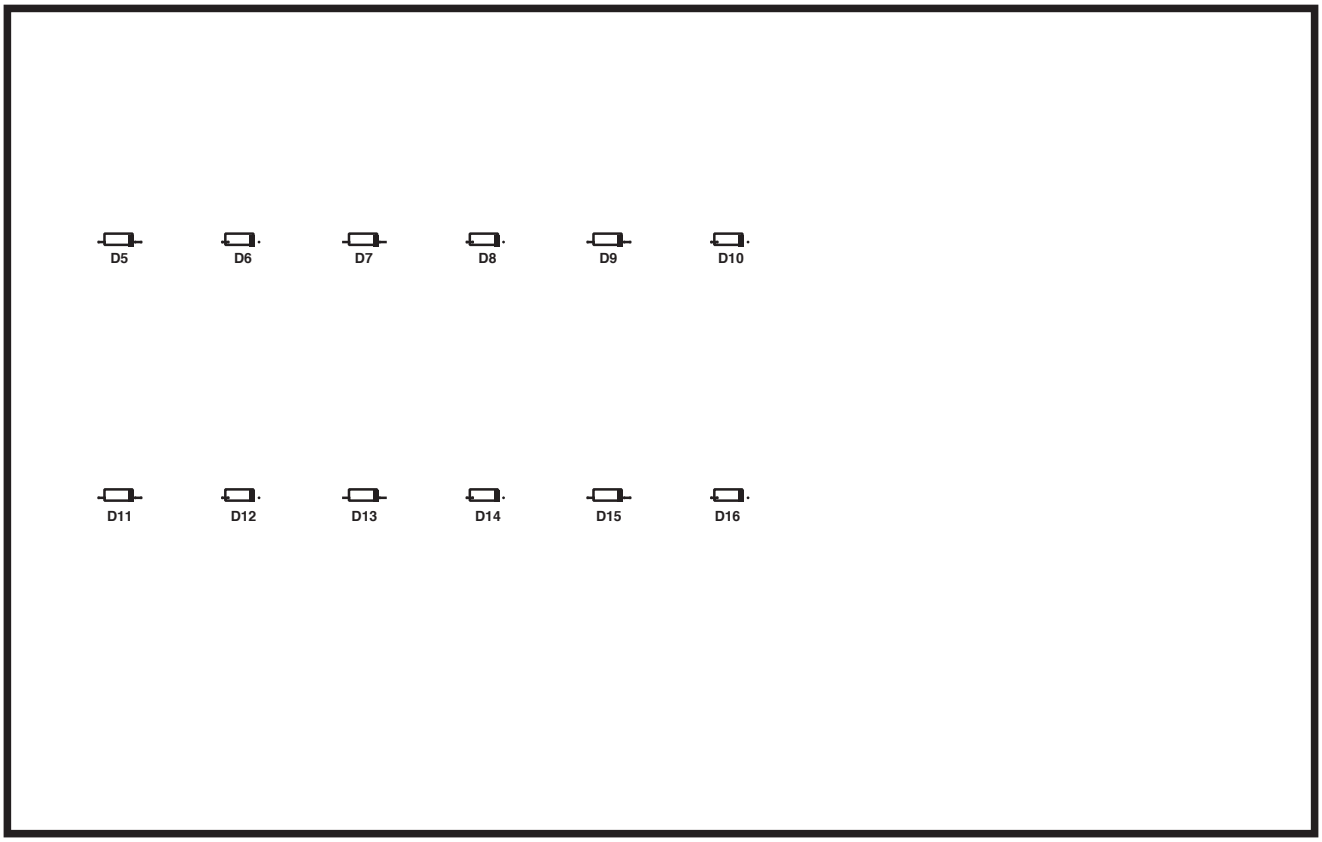
Table 8.1 provides a parts list and Figure 8.1 a component layout diagram for Power Relay Module (40-150/151-002).

## TABLE 8.1 - Power Relay Module 40-150/151-002: Parts List

| PCB Legend | Module | Pickering Part Number | Part description | Quantity |
|---|---|---|---|---|
| **Capacitors** | | | | |
| C1, C2, C5-C21 | All Modules in range | C/CP/034 | Cap 100nF x7R Cer SMT (0603) | 19 |
| C3, C4, C22, C23 | All Modules in range | C/CP/024 | Cap 10uF 16V tant SMT (C_Case) | 4 |
| | | | | |
| **Resistors** | | | | |
| R1, R2 | All Modules in range | C/RS/079 | Res n/w 4x10K (SMT) 1206 | 2 |
| R3 | All Modules in range | C/RS/085 | Res 10K 0805 | 1 |
| R4 to R14 | All Modules in range | C/RS/102 | Res n/w 4x10R (SMT) 1206 | 12 |
| | | | | |
| **Diodes** | | | | |
| D7-D10, D13 to D16 | 40-150-002 | C/SC/045 | LS4148 Diode quadro melf | 8 |
| D5 - D16 | 40-151-002 | C/SC/045 | LS4148 Diode quadro melf | 12 |
| | | | | |
| **Connectors** | | | | |
| J1 | All Modules in range | C/CN/355 | PCI Female 150 pins pcb r/a | 1 |
| | All Modules in range | C/MS/071 | Female coding Key brilliant blue, 5V | 1 |
| No Ident | 40-150-002 | C/CN/209 | 37 Way D-type solder bucket | 1 |
| No Ident | 40-151-002 | C/CN/117 | 50 Way D-type solder bucket | 1 |
| | | | | |
| **Integrated circuits** | | | | |
| U1 | All Modules in range | C/IC/098 | PCI9050 160 pin SMT (QFP16025) | 1 |
| U2 | All Modules in range | C/IC/099 | 93CS46 DIP | 1 |
| | All Modules in range | C/CN/035 | 8 pin DIP Skt | 1 |
| U3 | All Modules in range | C/IC/056 | TL7705 SMT | 1 |
| U4 | All Modules in range | C/IC/087 | 74HCT32 logic IC SMT (SO14) | 1 |
| U5 | All Modules in range | C/IC/100 | 74HCT273 SMT (SO20) | 1 |
| U6 | All Modules in range | C/IC/101 | 74HCT244 SMT (SO20) | 1 |
| U7 | All Modules in range | C/IC/090 | 93C56 SMT (SO8) | 1 |
| U8 | All Modules in range | C/IC/081 | IC UCN-5832EP Line Driver | 1 |
| | | | | |
| **Relays** | | | | |
| RL7 - 10, RL13 to RL17 + spare | 40-150-002 | C/RL086 | POWER RELAY | 9 |
| RL5 - 17 + spare | 40-151-002 | C/RL086 | POWER RELAY | 13 |




COMPONENT SIDE

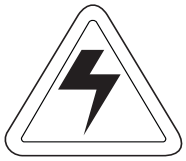



NON COMPONENT SIDE

**Figure 8.1 - Power Relay Module 40-150/151-002: Component Layout**

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# SECTION 9 - 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.

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