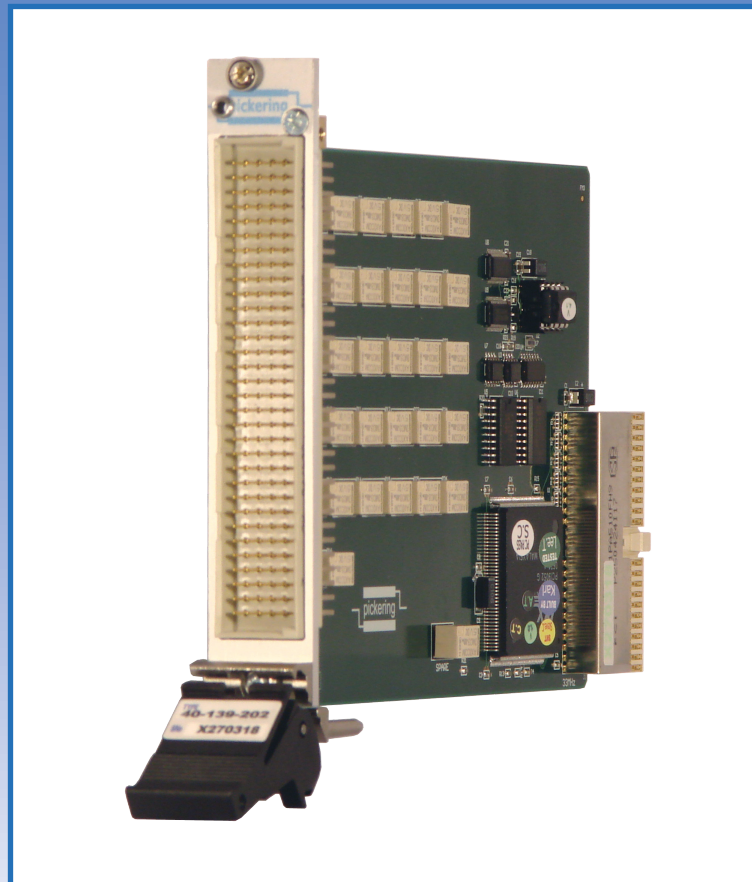


USER MANUAL



HIGH DENSITY 2A RELAY MODULE (Model No. 40-139)



Issue 5.1 November 2008

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Observe the Electrostatic Sensitive Device Caution detailed in Section 9.

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SECTION 1 - INTRODUCTION

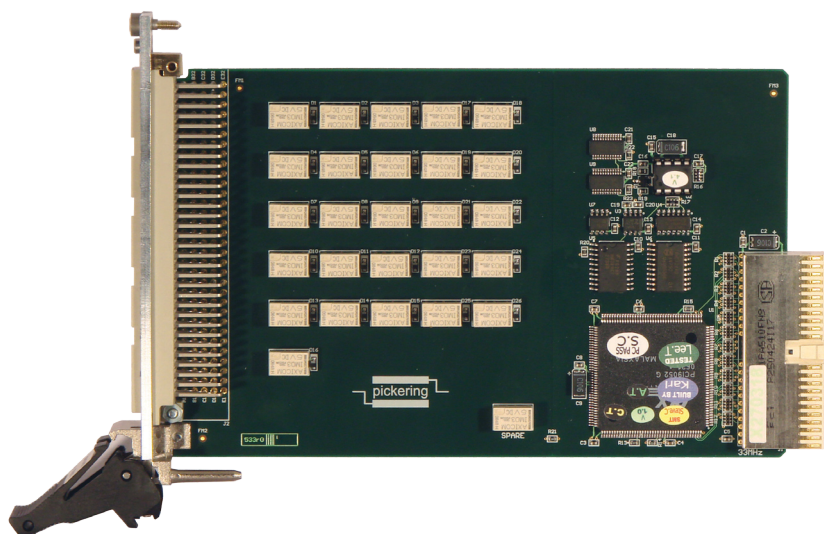
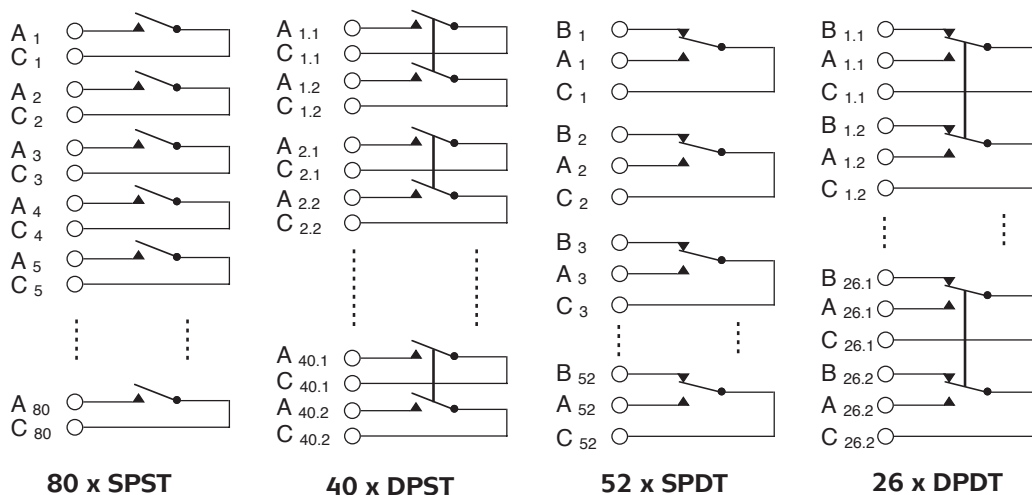
GENERAL

The 40-139 High Density 2A Versatile Relay Module forms part of the System 40 PXI Programmable Switching system. The module is capable of handling a maximum Current 2A Hot or Cold Switching and switching up to 300Volts DC with 60W Max Power or 250Volts AC at 62.5VA. Connections are made via a front panel mounted 160-way DIN 41612 high density connector.

Typical applications are in Automotive, Aerospace, Military and Power Cell Testing applications.

The module is provided in the following configurations:

- 80 x SPST (Single Pole Single Throw), Part Number 40-139-101
- 40 x DPST (Double Pole Single Throw), Part Number 40-139-102
- 52 x SPDT (Single Pole Double Throw), Part Number 40-139-201
- 26 x DPDT (Double Pole Double Throw), Part Number 40-139-202



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SECTION 2 - SPECIFICATION

Switch Specification (all versions)

Switch Type:	Electro-mechanical
Contact Type:	Palladium-Ruthenium, Gold Covered Bifurcated
Max Switch Voltage:	250Vac/300Vdc
Max Power:	60W/62.5VA
Max Switch Current:	2A
Max Carry Current:	2A
Initial Path Resistance, On:	< 350mΩ 150mΩ typical (1A measurement condition)
Initial Path Resistance, Off:	> 10 ⁹ Ω
Minimum Voltage:	100μV
Thermal Offset:	< 10μV
Operate Time:	< 3ms
Expected Life (operations)	
Very low power signal load:	> 10 ⁸
Low power load (2W):	> 1.5x10 ⁷ (0.1A 20Vdc)
Medium power load (30W):	> 5x10 ⁶ (1A, 30Vdc)
Full power load (60W):	> 1x10 ⁵ (2A, 30Vdc) > 1x10 ⁵ (0.2A, 300Vdc)

Programming

Pickering provide kernel, VISA and I/O drivers which are compatible with Windows 2000/XP operating systems, the VISA driver is also compatible with the LabVIEW RT operating system. These drivers may be used with a variety of programming environments and applications including :-

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

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

Agilent VEE

Mathworks Matlab

Other environments are also supported, please contact Pickering with specific enquiries.

Power Requirements

+3.3V	+5V	+12V	-12V
0	2.6A max (80 relays energised)	0	0

Width and Dimensions

Single slot 3U PXI (CompactPCI card).

PXI & CompactPCI Compliance

Compatible with PCI Express Hybrid Slot.

All Pickering Interfaces PXI modules comply with the PXI Specification 2.1. Local Bus, Interrupts, Trigger Bus and Star Trigger are not implemented.

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.

Connectors

PXI bus via 32 bit P1/J1 backplane connector.

Signals via front panel 160 Way DIN 41612 male connector, for pin outs please refer to the operating manual.

We recommend that Pickering mating connectors are used with this module which are designed to ensure there are no mechanical interference problems when used in a PXI chassis.

Product Order Codes

80 x SPST, 2A Relay Module	40-139-101
40 x DPST, 2A Relay Module	40-139-102
52 x SPDT, 2A Relay Module	40-139-201
26 x DPDT, 2A Relay Module	40-139-202
40 x DPDT Breakout Configuration	X40-139-302

Mating Connectors & Cabling

To ensure the best performance from the 40-139, connectors and cabling from Pickering are recommended as these include specially designed strain relief fixings:

40-960-160 160 way, 2A, crimp pin connector.

40-970-160-1M Cableform, 160 way DIN41612 Style, Female to Female, 2A, 1m Length.

40-967-160 DIN Rail Breakout, 160 way DIN41612 Style plug, to screw terminals.

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

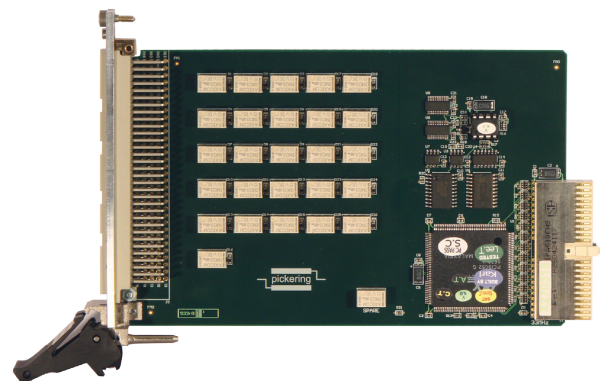
Operating/Storage Conditions

Operating Conditions

Operating Temperature:	0°C to 55°C
Humidity:	Up to 95% non-condensing
Altitude:	5000m

Storage and Transport Conditions

Storage Temperature:	-20°C to +75°C
Humidity:	Up to 95% non-condensing
Altitude:	15000m



40-139-202 Module Side View
(26 x Double Pole Double Throw Relays)

GUIDANCE ON POWER HANDLING (PXI CHASSIS)

The PXI standard recommends that each slot consumes less than 25 Watts to ensure that the chassis does not overheat. Some chassis may be capable of handling more than 25W per slot.

For the 40-139 there are three main contributing factors to the power consumption of the module:

- Fixed power from the PXI interface and relay controllers
- Relay coil power
- Power loss from the signal being switched due to path resistance.

Applications vary considerably as to how many relays may be closed and what current each contact carries. Users should consider how much power the module is likely to dissipate from all sources.

For the 40-139 the Figure 2.1 below provides guidance. It assumes that all contacts carry the same current and that every path has the maximum resistance value shown on the data sheet. It is therefore a worst case scenario. If your application is likely to load large numbers of contacts with currents over 0.7 Amps you should consult the graph to find the number of closures we recommend. In most applications this is of no concern since many contacts may be unused or are relatively lightly loaded.

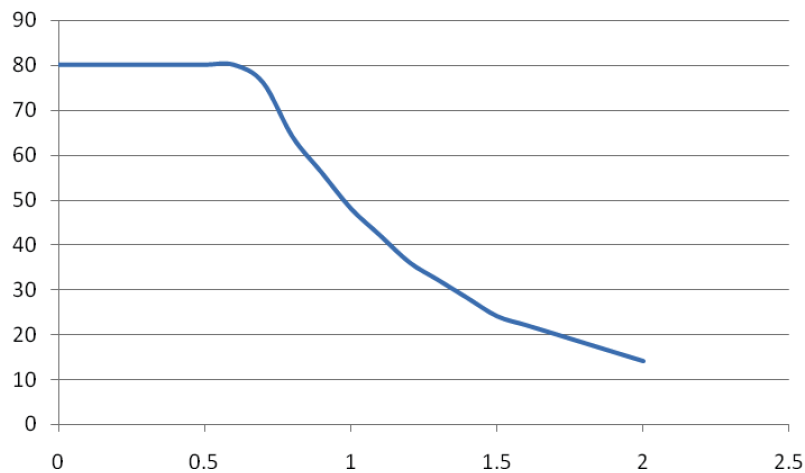


Figure 2.1 Plot of recommended number of closures of relays (vertical) versus carry current (horizontal, Amps). This assumes a maximum contact resistance of 350mΩ and a chassis capable of supporting the minimum 25W per slot recommended in the PXI standard.

A more representative example is shown in Figure 2.2 where the path resistance is assumed to be 200mΩ (above the average value) in a chassis with 25W capacity per slot.

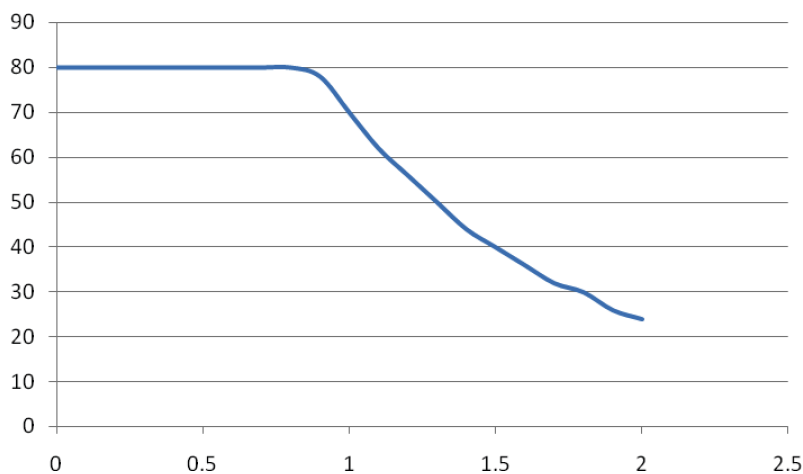


Figure 2.2 Plot of recommended number of closures of relays (vertical) versus carry current (horizontal, Amps). This assumes an average contact resistance of 200mΩ and a chassis capable of supporting the minimum 25W per slot recommended in the PXI standard.

The limitations described are thermal characteristics, and short term closure counts or current increases in excess of these numbers will not cause problems.

The closures noted refer to any setting which requires the relay state to be changed from its default (unpowered) condition.

- For SPST switching, this refers to the number of relays energised with the stated current flowing in the contact.
- For SPDT and DPDT switching, it refers to the relay being in the energised state and the stated current flowing in the closed contact, In the un-energised state the thermal load will be lower.
- For DPDT switching where current is flowing in both closed contacts, the recommendations count each switch as two closures.

It should be noted that users with a Pickering Interfaces 40-908, 40-914 or 40-918 PXI chassis mounted in accordance with the user instructions ensuring free air flow, can expect a capacity of 40W per slot.

Use in LXI Chassis 60-100

Users wishing to use the 40-139 in an LXI chassis should consult Pickering Interfaces for information on the maximum number of relay closures supported.

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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.

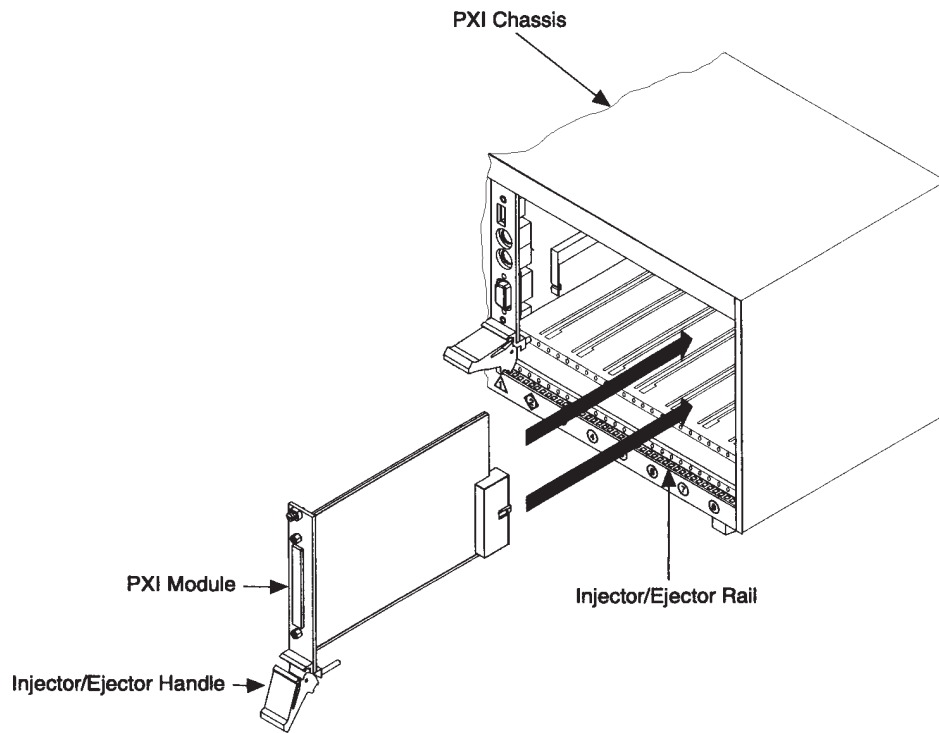


Figure 3.1 - Installing the module into a PXI/Compact PCI Chassis

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.

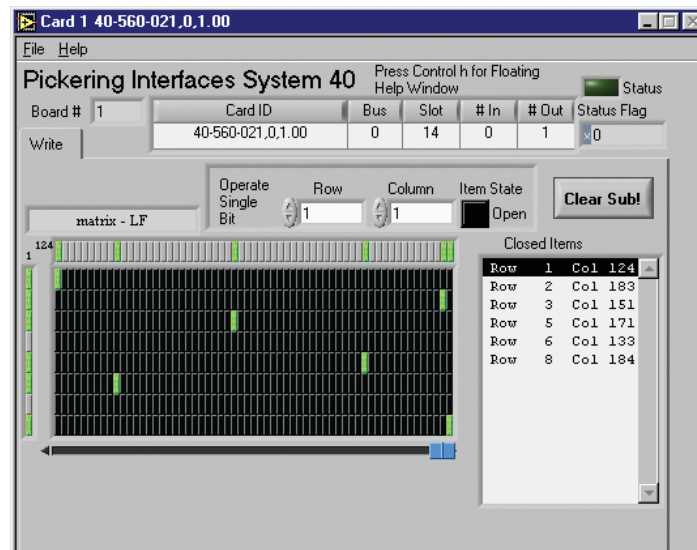


Figure 3.2 - Typical Test Panel Display

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 Basic
- Microsoft Visual 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.

Three 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 Iviswch 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 lists.

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 Iviswch 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 is required for the correct installation and operation of this driver.

VISA Driver for Windows - pipx40

The pipx40 driver conforms to the VISA (Virtual Instrument Software Architecture) standard for programmable instrumentation. Instrument control environments such as LabVIEW and LabWindows/CVI are based on VISA, and pipx40 support libraries are provided for them.

Prior installation of VISA from National Instruments is required for the operation of this driver.

Where VISA is available, pipx40 can also be used in general-purpose programming environments such as Visual C++ and Visual Basic. When IVI is not a system requirement this driver will often yield faster operation than the pi40iv driver.

Direct I/O Driver for Windows - Pilpxi

The Pilpxi driver accesses cards directly, without using the VISA software layer, while offering similar overall functionality to pipx40. It is most commonly used in general-purpose programming environments such as Visual C++ and Visual Basic. Operating speed of the VISA and Direct I/O drivers is generally comparable.

Register-level Programming

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

- If the functionality of the supplied drivers does not meet the application requirements.
- If security considerations demand full source-code for the application.
- In development environments that have alternate mechanisms for accessing PCibus.
- For operating systems other than Windows LabVIEW, LabWindows/CVI and Switch Executive are trademarks of National Instruments Corporation.

Details of the above drivers is available in separate documentation.

Card Architecture

Sub-units

Pickering PXI cards contain one or more independently addressable functional blocks, or sub-units. Sub-unit numbers begin at 1, and separate sequences are used for input and output functions. This number is used in function calls to access the appropriate block. Generally, sub-unit numbers correspond directly to the bank numbers specified in hardware documentation.

Sub-unit examples:

Model	Configuration	INPUT sub-unit #1	OUTPUT sub-unit #1	OUTPUT sub-unit #2	OUTPUT sub-unit #3
40-110-021	16 SPDT switches	None	16 SPDT switches	None	None
40-290-121	Dual Programmable resistors + 16 SPDT switches	None	Resistor #1	Resistor #2	16 SPDT switches
40-490-001	Digital I/O	16-channel inputs	32-channel outputs	None	None
40-511-021	Dual 12 x 4 matrix	None	12 x 4 matrix #1	12 x 4 matrix #2	None

Sub-unit characteristics

The numbers of input and output sub-units in a card can be obtained using functions from the libraries:

pipx40 pipx40_getSubCounts

pilpxi PIL_EnumerateSubs

pipx40 pipx40_getSubType, pipx40_getSubInfo

pilpxi PIL_SubType, PIL_SubInfo

For further detail of how to access and use Pickering drivers the user is advised to refer to the documentation provided with the installed drivers.

SECTION 5 - CONNECTOR PIN OUTS

Figures 5.1 to 5.4 provide pin outs for the High Density 2A Relay Module 40-139.

	A	B	C	D	E
32	1A	1C	5A	49A	49C
31	2A	2C	5C	50A	50C
30	3A	3C	6A	51A	51C
29	4A	4C	6C	52A	52C
28	7A	7C	11A	53A	53C
27	8A	8C	11C	54A	54C
26	9A	9C	12A	55A	55C
25	10A	10C	12C	56A	56C
24	13A	13C	17A	57A	57C
23	14A	14C	17C	58A	58C
22	15A	15C	18A	59A	59C
21	16A	16C	18C	60A	60C
20	19A	19C	23A	61A	61C
19	20A	20C	23C	62A	62C
18	21A	21C	24A	63A	63C
17	22A	22C	24C	64A	64C
16	25A	25C	29A	65A	65C
15	26A	26C	29C	66A	66C
14	27A	27C	30A	67A	67C
13	28A	28C	30C	68A	68C
12	31A	31C	35A	69A	69C
11	32A	32C	35C	70A	70C
10	33A	33C	36A	71A	71C
9	34A	34C	36C	72A	72C
8	37A	37C	41A	73A	73C
7	38A	38C	41C	74A	74C
6	39A	39C	42A	75A	75C
5	40A	40C	42C	76A	76C
4	43A	43C	47A	77A	77C
3	44A	44C	47C	78A	78C
2	45A	45C	48A	79A	79C
1	46A	46C	48C	80A	80C

Figure 5.1 - High Density 2A Relay Module 40-139-101 (80 x SPST): Pin Outs

	A	B	C	D	E
32	1.1A	1.1C	3.1A	25.1A	25.1C
31	1.2A	1.2C	3.1C	25.2A	25.2C
30	2.1A	2.1C	3.2A	26.1A	26.1C
29	2.2A	2.2C	3.2C	26.2A	26.2C
28	4.1A	4.1C	6.1A	27.1A	27.1C
27	4.2A	4.2C	6.1C	27.2A	27.2C
26	5.1A	5.1C	6.2A	28.1A	28.1C
25	5.2A	5.2C	6.2C	28.2A	28.2C
24	7.1A	7.1C	9.1A	29.1A	29.1C
23	7.2A	7.2C	9.1C	29.2A	29.2C
22	8.1A	8.1C	9.2A	30.1A	30.1C
21	8.2A	8.2C	9.2C	30.2A	30.2C
20	10.1A	10.1C	12.1A	31.1A	31.1C
19	10.2A	10.2C	12.1C	31.2A	31.2C
18	11.1A	11.1C	12.2A	32.1A	32.1C
17	11.2A	11.2C	12.2C	32.2A	32.2C
16	13.1A	13.1C	15.1A	33.1A	33.1C
15	13.2A	13.2C	15.1C	33.2A	33.2C
14	14.1A	14.1C	15.2A	34.1A	34.1C
13	14.2A	14.2C	15.2C	34.2A	34.2C
12	16.1A	16.1C	18.1A	35.1A	35.1C
11	16.2A	16.2C	18.1C	35.2A	35.2C
10	17.1A	17.1C	18.2A	36.1A	36.1C
9	17.2A	17.2C	18.2C	36.2A	36.2C
8	19.1A	19.1C	21.1A	37.1A	37.1C
7	19.2A	19.2C	21.1C	37.2A	37.2C
6	20.1A	20.1C	21.2A	38.1A	38.1C
5	20.2A	20.2C	21.2C	38.2A	38.2C
4	22.1A	22.1C	24.1A	39.1A	39.1C
3	22.2A	22.2C	24.1C	39.2A	39.2C
2	23.1A	23.1C	24.2A	40.1A	40.1C
1	23.2A	23.2C	24.2C	40.2A	40.2C

Figure 5.2 - High Density 2A Relay Module 40-139-102 (40 x DPST): Pin Outs

	A	B	C	D	E
32	1A	1C	1B	33A	35A
31	2A	2C	2B	33C	35C
30	3A	3C	3B	33B	35B
29	4A	4C	4B	34A	36A
28	5A	5C	5B	34C	36C
27	6A	6C	6B	34B	36B
26	7A	7C	7B	37A	39A
25	8A	8C	8B	37C	39C
24	9A	9C	9B	37B	39B
23	10A	10C	10B	38A	40A
22	11A	11C	11B	38C	40C
21	12A	12C	12B	38B	40B
20	13A	13C	13B	41A	43A
19	14A	14C	14B	41C	43C
18	15A	15C	15B	41B	43B
17	16A	16C	16B	42A	44A
16	17A	17C	17B	42C	44C
15	18A	18C	18B	42B	44B
14	19A	19C	19B	45A	47A
13	20A	20C	20B	45C	47C
12	21A	21C	21B	45B	47B
11	22A	22C	22B	46A	48A
10	23A	23C	23B	46C	48C
9	24A	24C	24B	46B	48B
8	25A	25C	25B	49A	51A
7	26A	26C	26B	49C	51C
6	27A	27C	27B	49B	51B
5	28A	28C	28B	50A	52A
4	29A	29C	29B	50C	52C
3	30A	30C	30B	50B	52B
2	31A	31C	31B	SGND	SGND
1	32A	32C	32B	SGND	SGND

Figure 5.3 - High Density 2A Relay Module 40-139-201 (52 x SPDT): Pin Outs

	A	B	C	D	E
32	1.1A	1.1C	1.1B	17.1A	17.2A
31	1.2A	1.2C	1.2B	17.1C	17.2C
30	2.1A	2.1C	2.1B	17.1B	17.2B
29	2.2A	2.2C	2.2B	18.1A	18.2A
28	3.1A	3.1C	3.1B	18.1C	18.2C
27	3.2A	3.2C	3.2B	18.1B	18.2B
26	4.1A	4.1C	4.1B	19.1A	19.2A
25	4.2A	4.2C	4.2B	19.1C	19.2C
24	5.1A	5.1C	5.1B	19.1B	19.2B
23	5.2A	5.2C	5.2B	20.1A	20.2A
22	6.1A	6.1C	6.1B	20.1C	20.2C
21	6.2A	6.2C	6.2B	20.1B	20.2B
20	7.1A	7.1C	7.1B	21.1A	21.2A
19	7.2A	7.2C	7.2B	21.1C	21.2C
18	8.1A	8.1C	8.1B	21.1B	21.2B
17	8.2A	8.2C	8.2B	22.1A	22.2A
16	9.1A	9.1C	9.1B	22.1C	22.2C
15	9.2A	9.2C	9.2B	22.1B	22.2B
14	10.1A	10.1C	10.1B	23.1A	23.2A
13	10.2A	10.2C	10.2B	23.1C	23.2C
12	11.1A	11.1C	11.1B	23.1B	23.2B
11	11.2A	11.2C	11.2B	24.1A	24.2A
10	12.1A	12.1C	12.1B	24.1C	24.2C
9	12.2A	12.2C	12.2B	24.1B	24.2B
8	13.1A	13.1C	13.1B	25.1A	25.2A
7	13.2A	13.2C	13.2B	25.1C	25.2C
6	14.1A	14.1C	14.1B	25.1B	25.2B
5	14.2A	14.2C	14.2B	26.1A	26.2A
4	15.1A	15.1C	15.1B	26.1C	26.2C
3	15.2A	15.2C	15.2B	26.1B	26.2B
2	16.1A	16.1C	16.1B	Not Used	Not Used
1	16.2A	16.2C	16.2B	Not Used	SGND

Figure 5.4 - High Density 2A Relay Module 40-139-202 (26 x DPDT): Pin Outs

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 its absence will be reported. This does not affect operation using the Direct I/O driver, and is not a problem unless you wish to use VISA. VISA is a component of National Instruments LabWindows/CVI and LabVIEW, or is available as a standalone environment.

If VISA is present and is of a sufficiently recent version, the section "Pipx40 information" should present a listing similar to "Pilpxi information".

Please note that the Diagnostic Utility cannot access cards if they are currently opened by some other application, such as the Test Panels or Terminal Monitor.

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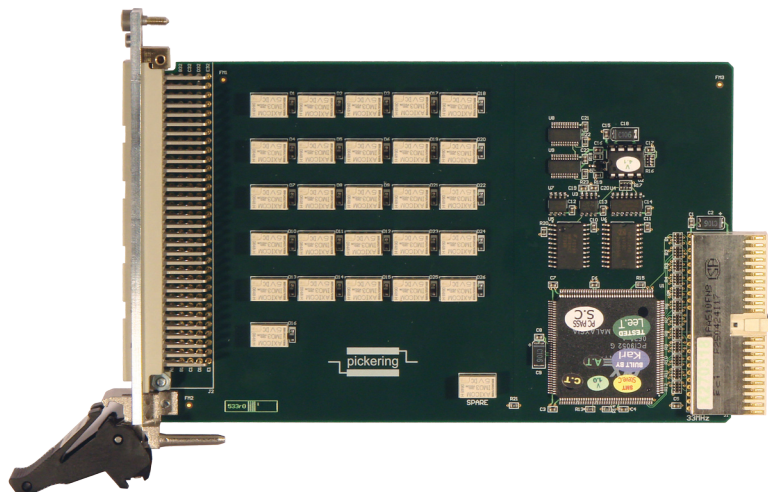
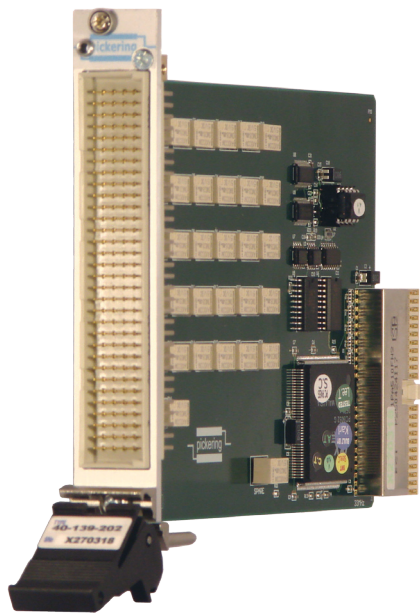
SECTION 7 - FUNCTIONAL DESCRIPTION

MECHANICAL DESCRIPTION

The 40-139 High Density 2A Relay Module conforms to the 3U height (128mm) Eurocard standard. The module comprises:

- CPCI Ejector Handle
- Front Panel mounted 160-way DIN41612 connector
- 80 x SPST, 40 x DPST, 52 x SPDT or 26 x DPDT Electro-Mechanical Relays
- One Spare relay
- Compact PCI backplane connector
- PCI Bridge (U1)
- Control Logic

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



FUNCTIONAL DESCRIPTION

A functional block diagram is provided in Figure 7.1. The High Density 2A 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 160-way DIN41612 connector, J1. The module comprises a PCB populated with SPST, DPST, SPDT or DPDT electro-mechanical relays. The relays are energised via control signals from relay drivers U8 to U12, which are addressed by PCI Bridge U1 to output the required signal. Module configuration is via data stored in EEPROM U3. PCI Bridge U1 is configured by EEPROM U2.

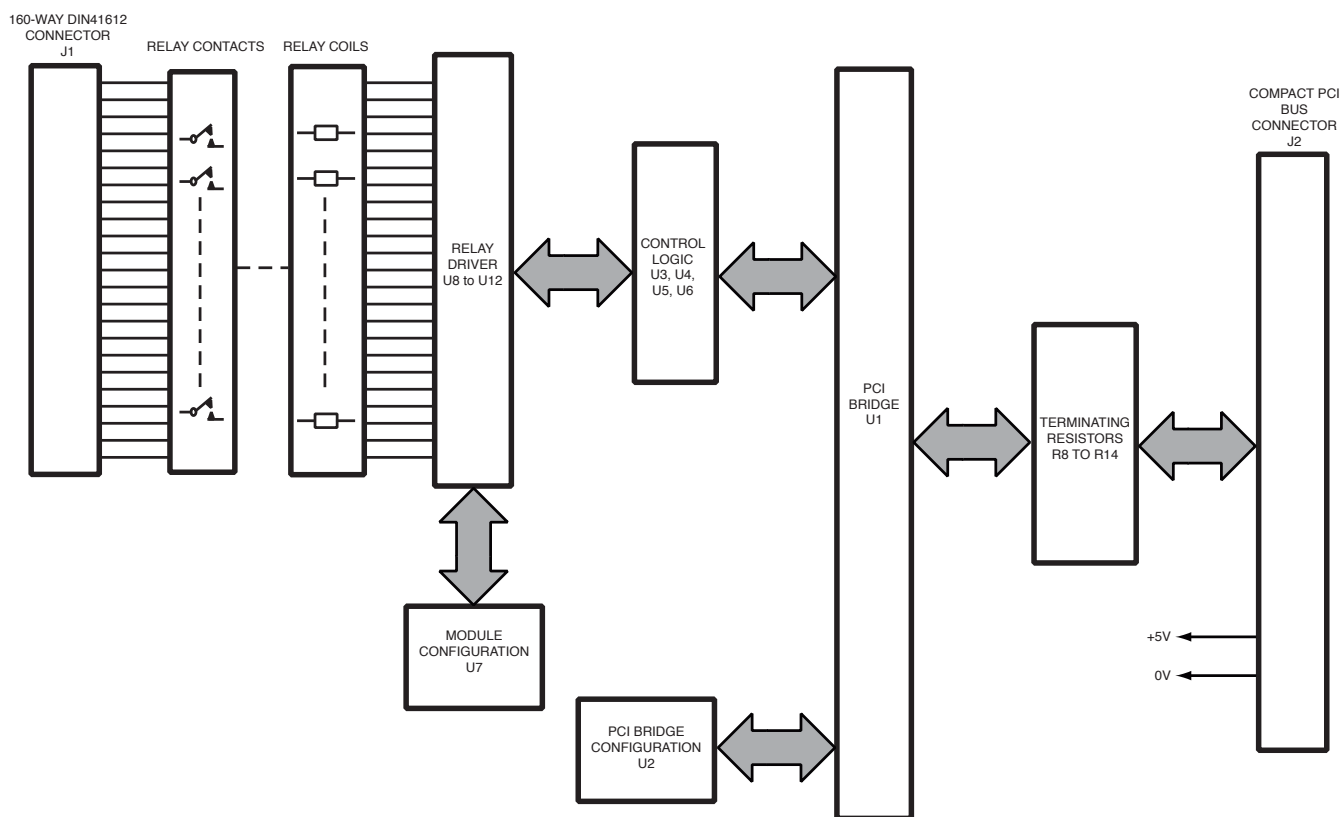


Figure 7.1 - High Density 2A Relay Module (40-139): Functional Block Diagram

SECTION 8 - PARTS LIST

The following pages provide a parts lists and component layout diagrams for the High Density 2A Relay Module 40-139.

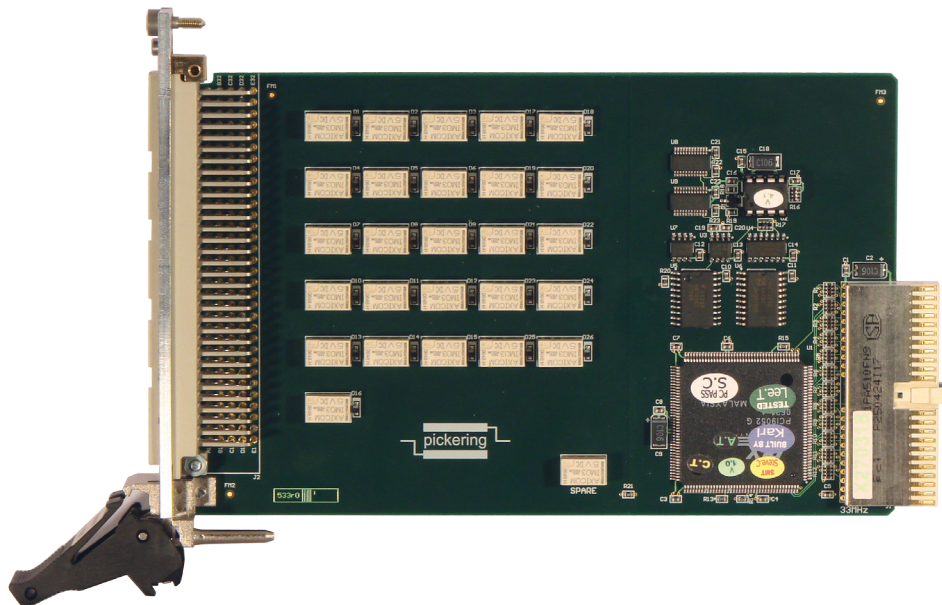
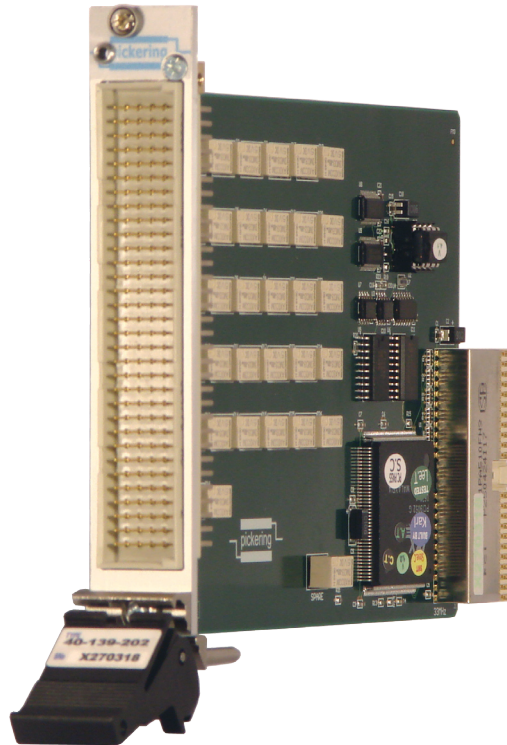


Table 8.1 provides a parts list and Figure 8.1 the component layout diagram for the 40-139-101 High Density 2A Relay Module.

TABLE 8.1 - 40-139-101 80xSPST Relay Module Parts List

Circuit Reference	Description	Value / Type	Part Number	Qty
	PCB	502r0	C/PC/502	1
R1,2	Resistor Network (4 res, 8 pins)	10K	C/RS/079	2
R3-14	Resistor Network (4 res, 8 pins)	10R	C/RS/102	12
R15	Resistor (1/16W, 1%)	10K	C/RS/152	1
R16-17	Resistor (1/16W, 1%)	1K	C/RS/148	2
R30	Resistor (1/16W, 1%)	100R	C/RS/147	1
R19-23	Resistor (1/16W, 1%)	560R	C/RS/447	5
C1,3-5,7-9,11-25	Capacitor, Ceramic	100nF	C/CP/034	22
C2,6,26	Capacitor, Tantalum	10uF, 16V	C/CP/024	3
Q5	Transistor, NPN	BCW60B	C/SC/035	1
D1-80	Diode, Small Signal	1SS355TE-17C	C/SC/056	80
U1	IC, PCI bus Interface device	PCI9050	C/IC/098	1
U2	IC, Serial EEPROM (See Note 1)	IS93CS46-3GR	C/IC/121	1
U20	IC, Serial EEPROM (See Note 1)	NM93CS46N	C/IC/099	1
For U2	IC Socket (See Note 1)	8-pin DIL	C/CN/035	1
U3	IC, Supply voltage supervisor	TL7705ACD	C/IC/056	1
U4	IC, Quad 2-input OR gate	74HCT32	C/IC/087	1
U5	IC, Octal D-type flip-flip	74HCT273	C/IC/100	1
U6	IC, Octal inverting 3-state buffer	74HCT244	C/IC/101	1
U7	IC, Serial EEPROM	M93CS86-MN6	C/IC/113	1
U8-12	IC, LED driver	MBI5026CP	C/IC/124	5
J1	Connector, PCB mount (right angle) female	150-pins	C/CN/355	1
For J1	Connector coding key	"brilliant blue"	C/MS/071	1
J2	Connector, PCB mount (right angle) male	160-way DIN 41612	C/CN/734	1
RL1-80	Relay, Electro-mech (DPCO, 2 form C)	DPDT	C/RL/199	80
Spare Relay	Relay, Electro-mech (DPCO, 2 form C)	DPDT	C/RL/199	1
	Metalwork, Front Panel	3U	C/FP/499	1
	Mounting Block, DIN 41612		C/FX/456	1

Note: Fit either U20 or U2 and IC socket

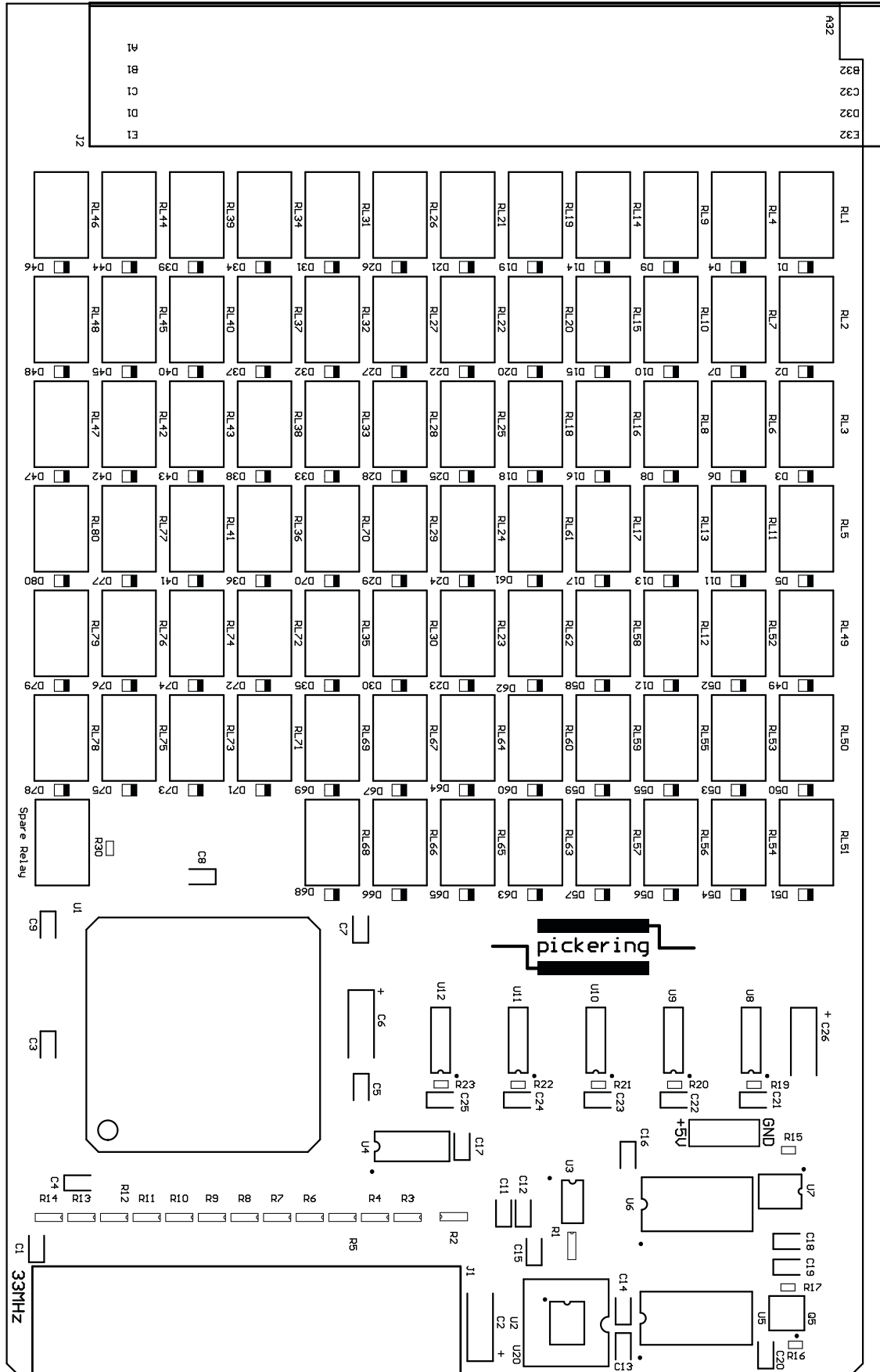


Figure 8.1 - 40-139-101 80xSPST Relay Module: Component Layout

Table 8.2 provides a parts list and Figure 8.2 the component layout diagram for the 40-139-201 High Density 2A Relay Module.

TABLE 8.2 - 40-139-201 52xSPDT Relay Module Parts List

Circuit Reference	Description	Value / Type	Part Number	Qty
	PCB	498r0	C/PC/498	1
R1,2	Resistor Network (4 res, 8 pins)	10K	C/RS/079	2
R3-14	Resistor Network (4 res, 8 pins)	10R	C/RS/102	12
R15	Resistor (1/16W, 1%)	10K	C/RS/152	1
R16-17	Resistor (1/16W, 1%)	1K	C/RS/148	2
R30	Resistor (1/16W, 1%)	100R	C/RS/147	1
R19-22	Resistor (1/16W, 1%)	560R	C/RS/447	4
C1,3-5,7-9,11-24	Capacitor, Ceramic	100nF	C/CP/034	21
C2,6,26	Capacitor, Tantalum	10uF, 16V	C/CP/024	3
Q5	Transistor, NPN	BCW60B	C/SC/035	1
D1-52	Diode, Small Signal	1SS355TE-17C	C/SC/056	52
U1	IC, PCI bus Interface device	PCI9050	C/IC/098	1
U2	IC, Serial EEPROM (See Note 1)	IS93CS46-3GR	C/IC/121	1
U20	IC, Serial EEPROM (See Note 1)	NM93CS46N	C/IC/099	1
For U2	IC Socket (See Note 1)	8-pin DIL	C/CN/035	1
U3	IC, Supply voltage supervisor	TL7705ACD	C/IC/056	1
U4	IC, Quad 2-input OR gate	74HCT32	C/IC/087	1
U5	IC, Octal D-type flip-flip	74HCT273	C/IC/100	1
U6	IC, Octal inverting 3-state buffer	74HCT244	C/IC/101	1
U7	IC, Serial EEPROM	M93CS86-MN6	C/IC/113	1
U8-12	IC, LED driver	MBI5026CP	C/IC/124	5
J1	Connector, PCB mount (right angle) female	150-pins	C/CN/355	1
For J1	Connector coding key	"brilliant blue"	C/MS/071	1
J2	Connector, PCB mount (right angle) male	160-way DIN 41612	C/CN/734	1
RL1-52	Relay, Electro-mech (DPCO, 2 form C)	DPDT	C/RL/199	52
Spare Relay	Relay, Electro-mech (DPCO, 2 form C)	DPDT	C/RL/199	1
	Metalwork, Front Panel	3U	C/FP/499	1
	Mounting Block, DIN 41612		C/FX/456	1

Note: Fit either U20 or U2 and IC socket

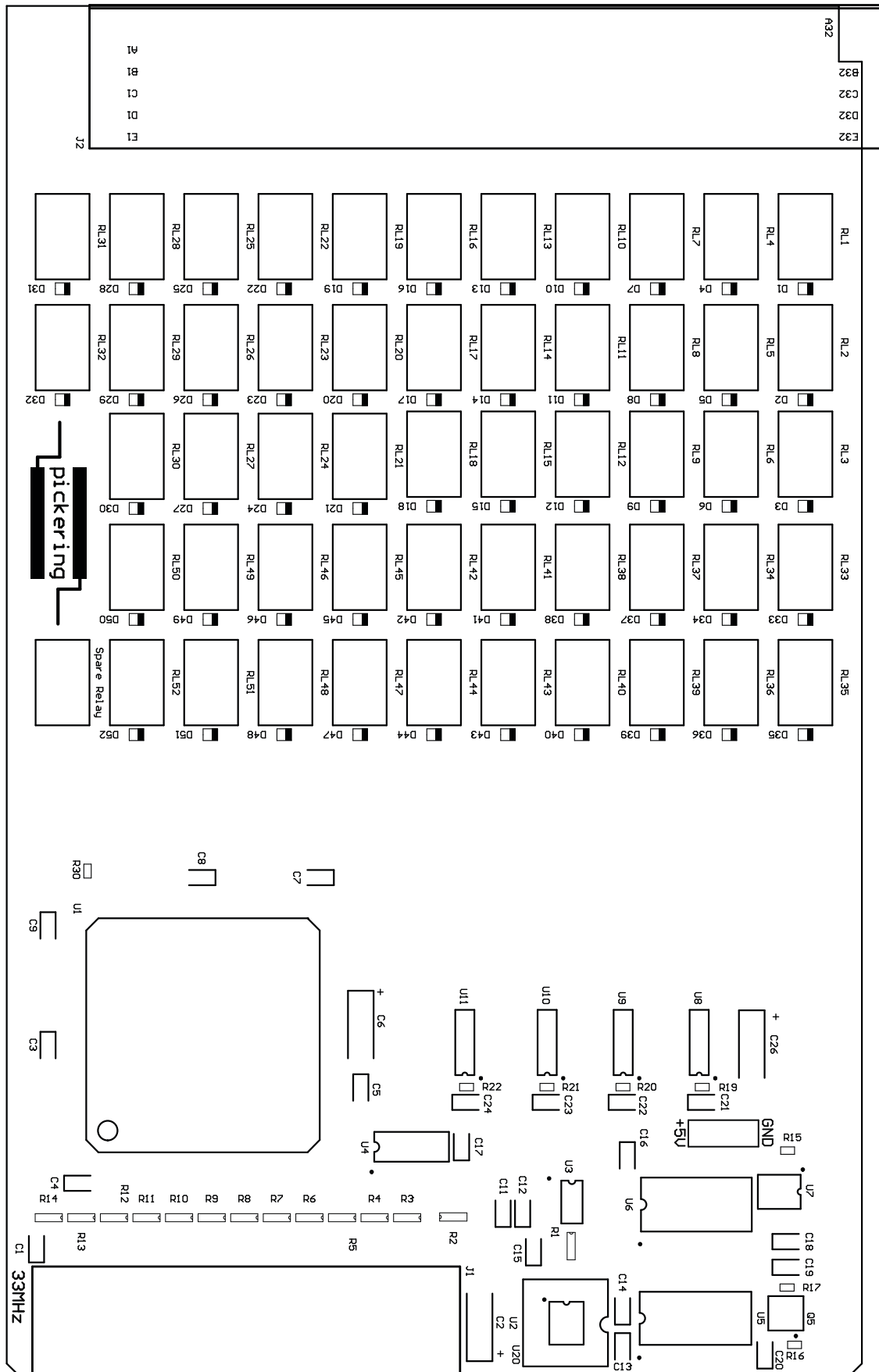


Figure 8.1 - 40-139-201 52xSPDT Relay Module: Component Layout

Table 8.3 provides a parts list and Figure 8.3 the component layout diagram for the 40-139-202 High Density 2A Relay Module.

TABLE 8.3 - 40-139-202 26xDPDT Relay Module Parts List

Circuit Reference	Description	Value / Type	Part Number	Qty
	PCB	533r0	C/PC/533	1
R1-12	Resistor Network (4 res, 8 pins)	10R	C/RS/102	12
R16,17	Resistor Network (4 res, 8 pins)	10K	C/RS/079	2
R13	Resistor (1/16W, 1%)	51R	C/RS/518	1
R21	Resistor (1/16W, 1%)	100R	C/RS/147	1
R22-23	Resistor (1/16W, 1%)	470R	C/RS/254	2
R14-15	Resistor (1/16W, 1%)	4K7	C/RS/146	2
R18-20	Resistor (1/16W, 1%)	10K	C/RS/152	3
C1,3-8,10-17,19-22	Capacitor, Ceramic	100nF	C/CP/034	19
C2,9,18	Capacitor, Tantalum	10uF, 16V	C/CP/024	3
Q1	Transistor, NPN	BCW60B	C/SC/035	1
D1-26	Diode, Small Signal	1SS355TE-17C	C/SC/056	26
U1	IC, PCI bus Interface device	PCI9052 G	C/IC/219	1
U2	IC, Serial EEPROM (See Note 1)	IS93CS46-3GR	C/IC/121	1
U2/	IC, Serial EEPROM (See Note 1)	NM93CS46N	C/IC/099	1
For U2	IC Socket (See Note 1)	8-pin DIL	C/CN/035	1
U3	IC, Supply voltage supervisor	TL7705ACD	C/IC/056	1
U4	IC, Quad 2-input OR gate	74HCT32	C/IC/087	1
U5	IC, Octal D-type flip-flip	74HCT273	C/IC/100	1
U6	IC, Octal inverting 3-state buffer	74HCT244	C/IC/101	1
U7	IC, Serial EEPROM	M93CS86-MN6	C/IC/113	1
U8-9	IC, LED driver	MBI5026CP	C/IC/124	2
J1	Connector, PCB mount (right angle) female	150-pins	C/CN/355	1
For J1	Connector coding key	"brilliant blue"	C/MS/071	1
J2	Connector, PCB mount (right angle) male	160-way DIN 41612	C/CN/734	1
RL1-27	Relay, Electro-mech (DPCO, 2 form C)	DPDT	C/RL/199	27
	Metalwork, Front Panel	3U	C/FP/499	1
	Mounting Block, DIN 41612		C/FX/456	1

Note: Fit either U2/ or U2 and IC socket

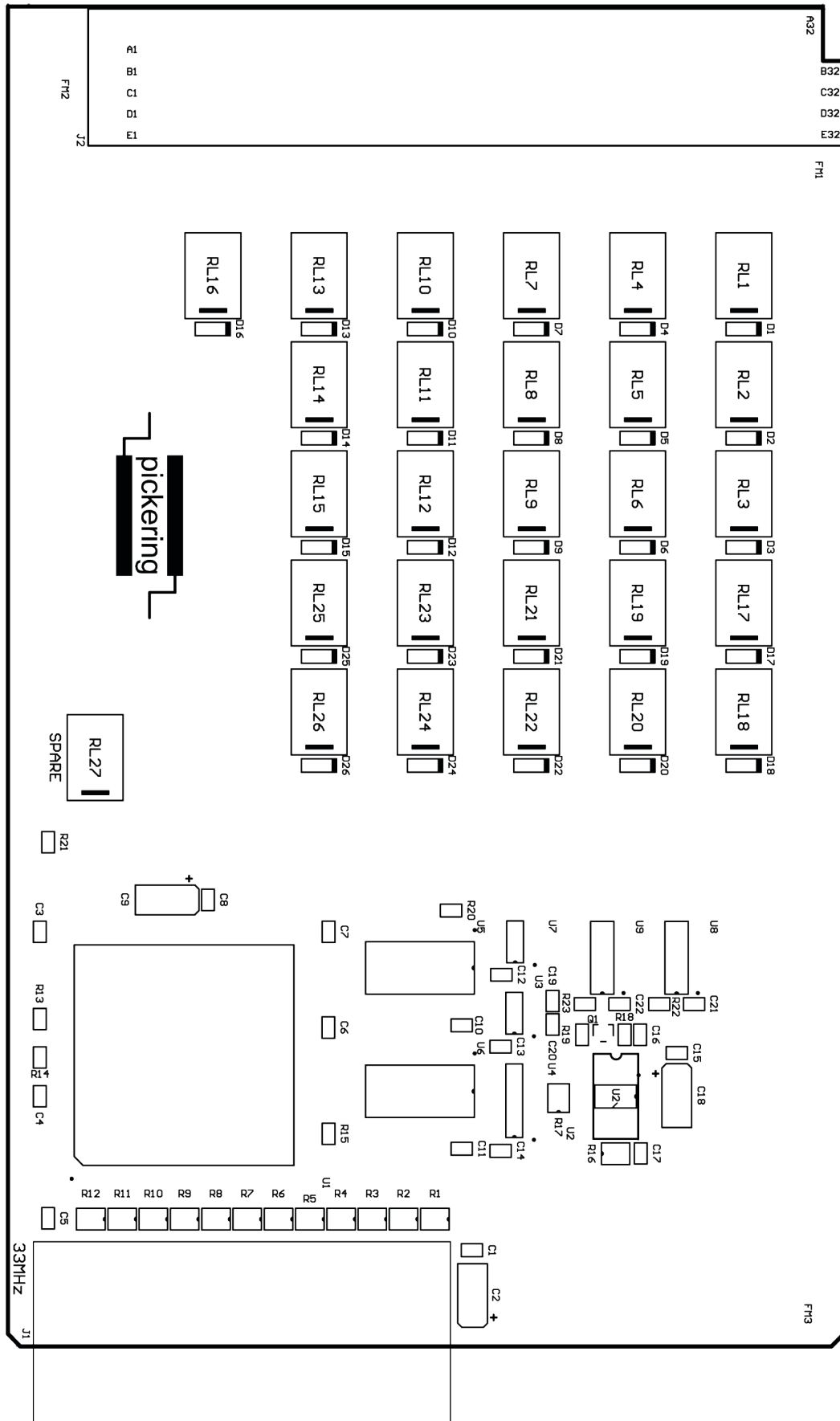


Figure 8.1 - 40-139-202 26xDPDT Relay Module: Component Layout

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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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