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Find the *Pickering 40-220-001* at our website: ***Click HERE***

USER MANUAL

PXI

DIGITAL I/O BREADBOARD/PROTOTYPE MODULE
(MODEL No. 40-220 / 225)



Issue 9.0 February 2018

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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

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SECTION 1 - TECHNICAL SPECIFICATION

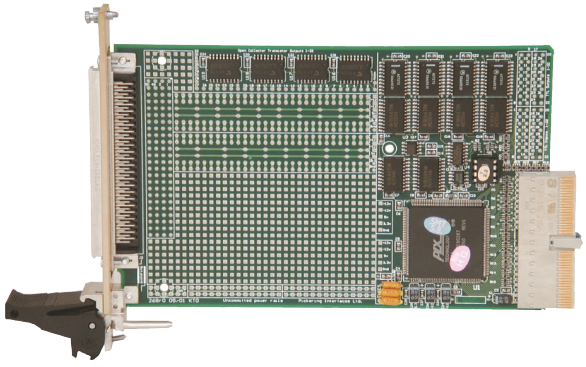
- Versatile PXI Breadboard with 65^{2}cm (10 Sq In) of Prototype Area
- Access to All PXI Power Supplies (+3.3V, +5V, +12V and -12V)
- Built-In Digital I/O, 32-Bits In, 32-Bits Out - TTL & Open Collector
- Programmable By Bit, Byte or Word
- TTL Outputs Suitable for Driving External Logic
- Open Collector Transistor Outputs Suitable for Driving Internal or External Relay Coils
- Operating Speed <10µs
- VISA, IVI & Kernel Drivers Supplied for Windows
- 3 Year Warranty

- 40-225 Prototype Module Has All Circuitry Removed



The 40-220 series of breadboard modules allow the user to construct their own circuit in situations where a PXI module is not available. For example, when it is required to integrate a non-switching function into a PXI chassis. The module is ideal for creating custom circuitry that can be housed in on a 3U board, or to build special one-off switching modules.

Two choices of output driver are available: TTL for interfacing with external logic and Open Collector Transistors for operating external devices with voltages up to 50VDC and current up to 500mA.



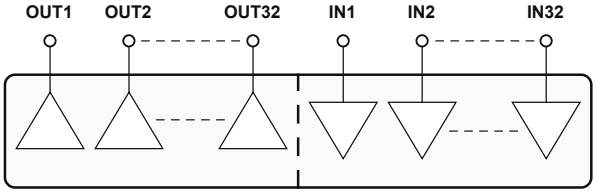
Top view of the 40-220 Breadboard PCB showing the circuit construction area. If required, the user can fit their own daughter card using the fixing holes provided.

To simplify programming, reading and writing data for the digital I/O can be done at bit, byte or word level. I/O applications include generating control signals or reading stimulus and sensing status from digital devices.

Pickering can construct and test breadboard circuits to your exact specifications, please contact sales office to discuss your application in detail.

Typical Applications

- Construction of Special One-Off Circuits
- Programmable Amplifiers
- Programmable Attenuators
- Filters
- Special Circuits to Drive External Relays
- Mounting Special Relay Types
- Dummy Multiplexer Channels for Calibration Purposes



Digital I/O Capabillity Of The 40-220 Breadboard Module

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General Specification (40-220)

TTL Output Driver	
Maximum Drive:	15 TTL Inputs
Maximum Voltage:	7V
Maximum Current Drive:	Sink 8mA, Source 0.4mA
Operate/Release Time:	<10µs

Open Collector Transistor	
Driver Device:	ULN2803LW o.c. driver
Maximum Standoff Volts:	50V
Maximum Power per o/p:	1.0W
Maximum Power per byte:	1.6W
Maximum Current Drive:	500mA
Operate/Release Time:	<10µs

Digital Input (All Models)	
Maximum Standoff Volts:	7V
Nominal True Voltage:	>2.0V
Maximum Power per byte:	<0.8V
Data is strobed when the read operation executes	

Note: Care must be taken when interfacing the 40-220 module with external circuits which may produce high voltage spikes or RF interference. Additional noise protection may be required, please contact Pickering if you wish to discuss your requirement.

40-225 PXI Prototype Module

The 40-255 is a “stripped down“ version of the 40-220. This is a very basic, low cost, prototype module. It has no PXI interface, but does have access to the PXI backplane power supplies via on-board fuses.

The 40-225 is available with either a 1 slot or 2 slot front panel. The front panel can be supplied blank or fitted with a 96-pin micro-D plug.

General Breadboard Details

Square pad and DIP construction areas. Approximately 65^{2}cm (10 sq inches) of prototype area. 0.1” grid spacing.

Maximum Component Height: 13mm

Maximum Lead Length Below PCB: 1.52mm (defined by PXI)

Power Supply

All four PXI system voltages are available (+3.3V, +5V & ±12V) up to 1 Amp each (within the overall limit of the power supply). The power supplies are protected with on-board fuses rated at 1A.

The 5V and Ground lines are routed around the workspace area to facilitate easy circuit construction.

Power Requirements

Power consumption from the 5V backplane supply is as follows:
0.9W + 0.25W from User 5V.

Mechanical Characteristics

Single or Dual slot 3U PXI (CompactPCI card).
3D models for all versions in a variety of popular file formats are available on request.

Connectors

PXI bus via 32-bit P1/J1 backplane connector.
Signals via front panel 96-pin male micro-D connector, for pin outs please refer to the operating manual.

Operating/Storage Conditions

Operating Conditions

Operating Temperature:	0°C to +55°C
Humidity:	Up to 90% non-condensing
Altitude:	5000m

Storage and Transport Conditions

Storage Temperature:	-20°C to +75°C
Humidity:	Up to 90% non-condensing
Altitude:	15000m

PXI & CompactPCI Compliance

The module is compliant with the PXI Specification 2.2. Local Bus, Trigger Bus and Star Trigger are not implemented.

Uses a 33MHz 32-bit backplane interface.

Safety & CE Compliance

All modules are fully CE compliant and meet applicable EU directives: Low-voltage safety EN61010-1:2001,
EMC Immunity EN61000-6-1:2001, Emissions EN55011:1998.

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Product Order Codes

Breadboard Module 32 In/32 Out (TTL & Open Collector Outputs), 1 Slot	40-220-001
Prototype Modules Bare PCB with Blank Front Panel (Without I/O), 1 Slot	40-225-001
Bare PCB with Blank Front Panel (Without I/O), 2 Slot	40-225-002
Bare PCB with 96-Pin Micro-D Plug, (Without I/O), 1 Slot	40-225-101
Bare PCB with 96-Pin Micro-D Plug, (Without I/O), 2 Slot	40-225-102

Other options are available. Please contact the sales office to discuss you requirements.

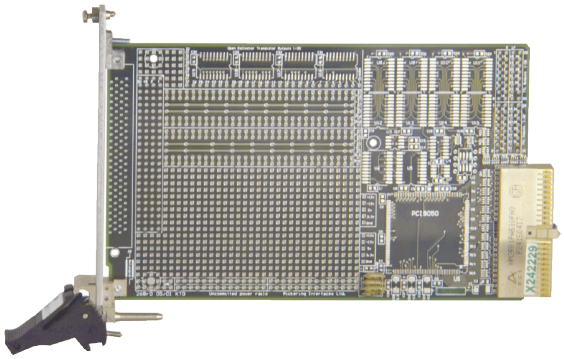
Product Customization

Pickering PXI modules are designed and manufactured on our own flexible manufacturing lines, giving complete product control and enabling simple customization to meet very specific requirements.

All customized products are given a unique part number, fully documented and may be ordered at any time in the future. Please contact your local sales office to discuss.

Mating Connectors & Cabling

For connection accessories for the 40-220/225 series please refer to the 90-016D 96-pin micro-D Connector Accessories data sheet where a complete list and documentation can be found for accessories, or refer to the Connection Solutions catalog.



The 40-225-001 Prototype Module.
This module is for the construction of circuits which do not need an active PXI interface, just power supply access.



The 40-225-101 Prototype Module.
This is the same as above with a 96-pin micro-D plug fitted.

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Chassis Compatibility

This PXI module must be used in a suitable chassis. It is compatible with the following chassis types:

- All chassis conforming to the 3U PXI and 3U Compact PCI (cPCI) specification
- Legacy and Hybrid Peripheral slots in a 3U PXI Express (PXIe) chassis
- Pickering Interfaces LXI or LXI/USB Modular Chassis



Chassis Selection Guide

Standard PXI or hybrid PXIe Chassis from any Vendor:

- Mix our 1000+ PXI switching & simulation modules with any vendor's PXI insturmentation
- Embedded or remote Windows PC control
- Real-time Operating System Support
- High data bandwidths, especially with PXI Express
- Integrated module timing and synchronization

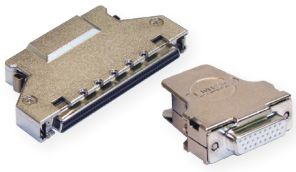
Pickering LXI or LXI/USB Modular Chassis—only accept our 1000+ PXI Switching & Simulation Modules:

- Ethernet or USB control enables remote operation
- Low-cost control from practically any controller
- LXI provides manual control via Web browsers
- Driverless software support
- Power sequencing imuunity
- Ethernet provides chassis/controller voltage isolation
- Independence from Windows operating system



Connectivity Solutions

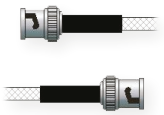
We provide a full range of supporting cable and connector solutions for all our switching products—20 connector families with 1200+ products. We offer everything from simple mating connectors to complex cables assemblies and terminal blocks. All assemblies are manufactured by Pickering and are guaranteed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



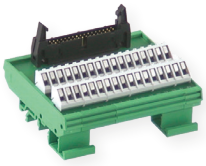
Connectors & Backshells



Multiway Cable Assemblies

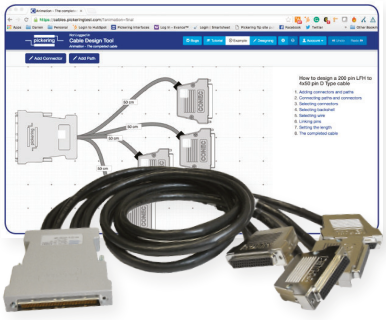


RF Cable Assemblies



Connector Blocks

We also offer customized cabling and have a free online Cable Design Tool that can be used to create custom cable solutions for many applications.
Visit: pickeringtest.com/cdt to start your design.



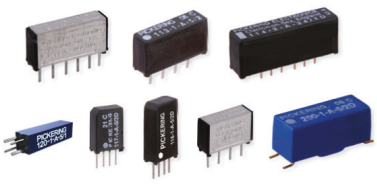
Mass Interconnect

We recommend the use of a mass interconnect solution when an Interchangeable Test Adapter (ITA) is required for a PXI or LXI based test system. Our modules are are fully supported by both Virginia Panel and MacPanel.

Pickering Reed Relays

We are the only switch provider with in-house reed relay manufacturing capability via our sister company, Pickering Electronics. These instrument grade reed relays feature ***SoftCenter***® technology, ensuring long service life and repeatable contact performance

To learn more, please go to: pickeringrelay.com



Programming

Pickering provide kernel, IVI and VISA (NI & Keysight) drivers which are compatible with all Microsoft supported versions of Windows and popular older versions. For a list of all supporting operating systems, please see: pickeringtest.com/os

The VISA driver is also compatible with Real-Time Operating Systems such as LabVIEW RT. For other RTOS support contact Pickering. These drivers may be used with a variety of programming environments and applications including:

- **Pickering Interfaces Switch Path Manager**
- **National Instruments** products (LabVIEW, LabWindows/CVI, Switch Executive, MAX, TestStand, VeriStand, etc.)
- **Microsoft Visual Studio** products (Visual Basic, Visual C+)
- **Keysight** VEE
- **Mathworks** Matlab
- **Marvin** ATEasy
- **MTQ Testsolutions** Tecap Test & Measurement Suite

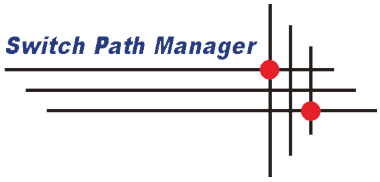
Drivers for popular Linux distributions are available, other environments are also supported, please contact Pickering with specific enquiries.

We provide Soft Front Panels (SFPs) for our products for familiarity and manual control, as well as comprehensive documentation and example programs to help you develop test routines with ease.

To learn more about software drivers and development environments, please go to: pickeringtest.com/software

Signal Routing Software

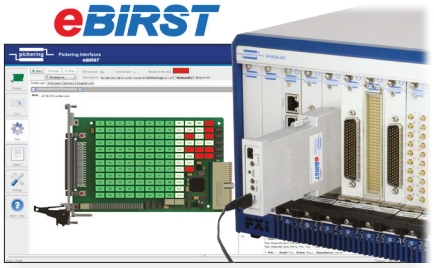
Our signal routing software, Switch Path Manager, automatically selects and energises switch paths through Pickering switching systems. Signal routing is performed by simply defining test system endpoints to be connected together, greatly accelerating Test System software development.



To learn more, please go to: pickeringtest.com/spm

Diagnostic Relay Test Tools

eBIRST Switching System Test Tools are designed specifically for our PXI, PCI or LXI products, these tools simplify switching system fault-finding by quickly testing the system and graphically identifying the faulty relay.



To learn more, please go to: pickeringtest.com/ebirst

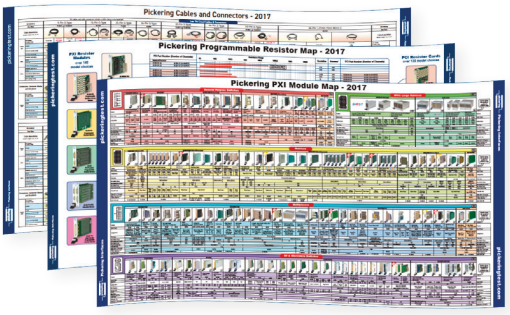
Three Year Warranty

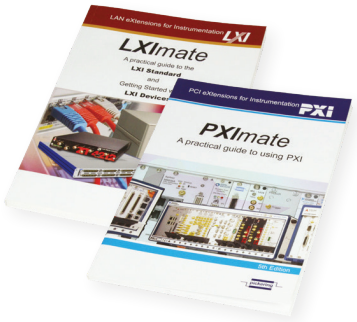
All standard products manufactured by Pickering Interfaces are warranted against defective materials and workmanship for a period of three years from the date of delivery to the original purchaser. Extended warranty and service agreements are available for all our modules and systems with various levels to suit your requirements.

Available Product Resources

We have a large library of product resources including success stories, product and support videos, articles, as well as complete product catalogs and product reference maps to assist when looking for the switching, simulation and cable and connector solutions you need. We have also published handy reference books for the PXI and LXI standards.







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

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SECTION 2 - TECHNICAL DESCRIPTION

MECHANICAL DESCRIPTION

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

- CPCI Ejector Handle
- Front Panel mounted 96-pin micro-D connector
- Four 32 bit TTL I/O Drivers (40-220 only)
- Four 32 bit Open Collector I/O Drivers (40-220 only)
- Breadboard area
- Compact PCI backplane connector
- PCI Bridge (U1) (40-220 only)
- Control Logic (40-220 only)

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

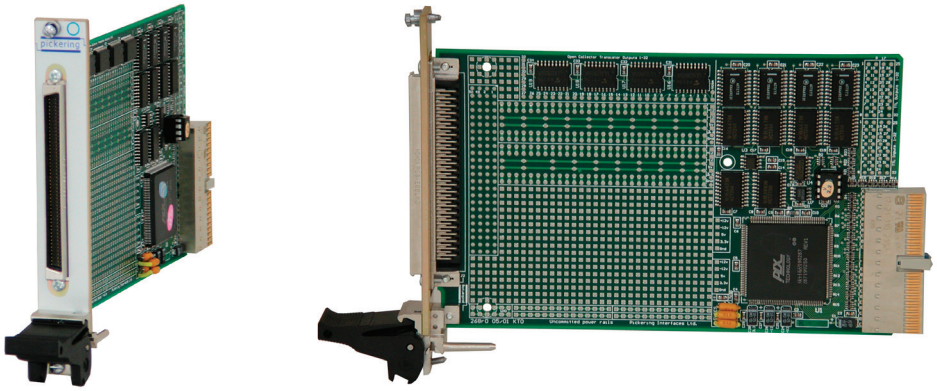


Figure 2.1 - 40-220-001 Breadboard Module

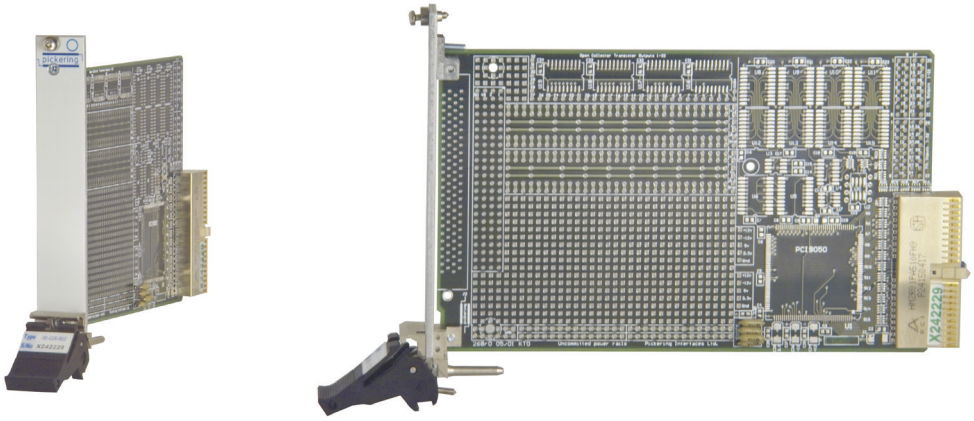


Figure 2.2 - 40-225-001 Prototype Module

FUNCTIONAL DESCRIPTION

A functional block diagram for the 40-220 Breadboard Module is provided in Figure 2.3. The Module accepts +12V, -12V, +5V, +3.3V supplies from the PXI backplane via Compact PCI connector J1, these power rails are protected by 1A fuses. The interface to the user test equipment is via the front panel mounted 96-pin micro-D connector, J2. The module comprises a PCB breadboard workspace area, to facilitate custom circuit construction, Open Collector output drivers U16 to U19, TTL input/output drivers U8 to U15, control logic U3 to U4, configuration EEPROMS U2 and U7 and PCI Bridge U1. The +12V, -12V, +5V, +3.3V supplies are fused and available for the breadboard area. The TTL output drivers, as well as providing TTL outputs, provide drive for the open collector outputs.The module configuration, is determined by data stored in EEPROM U7. U16 to U19 and U8 to U15 are addressed by PCI bridge U1 to output the required signal. PCI Bridge U1 is configured by EEPROM U2.

The 40-225 Prototype Module uses the same PCB with all components removed except for the 1A fuses on the power rails.

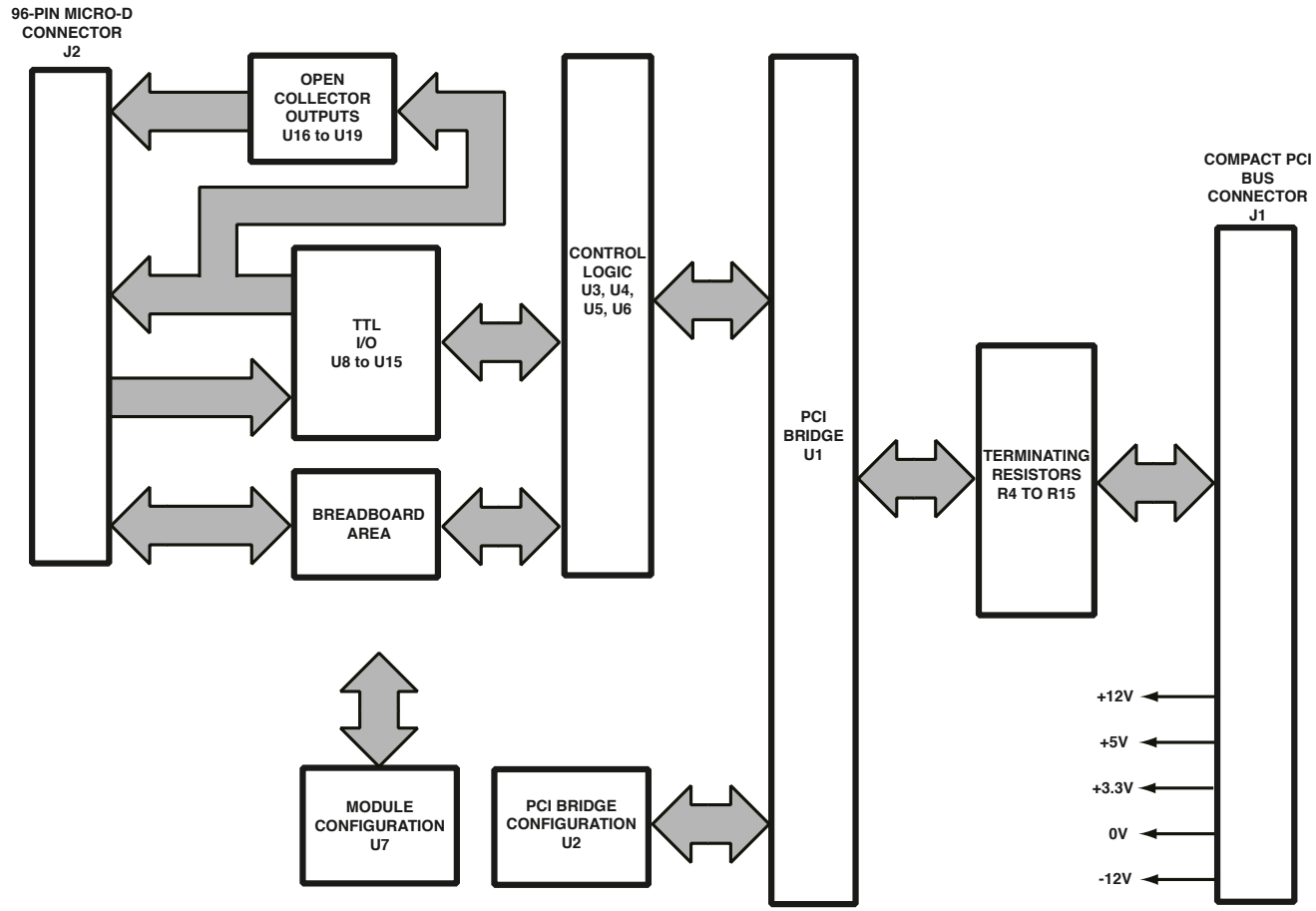


Figure 2.3 - Breadboard Module 40-220: Functional Block Diagram

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GUIDANCE ON USING THE MODULE

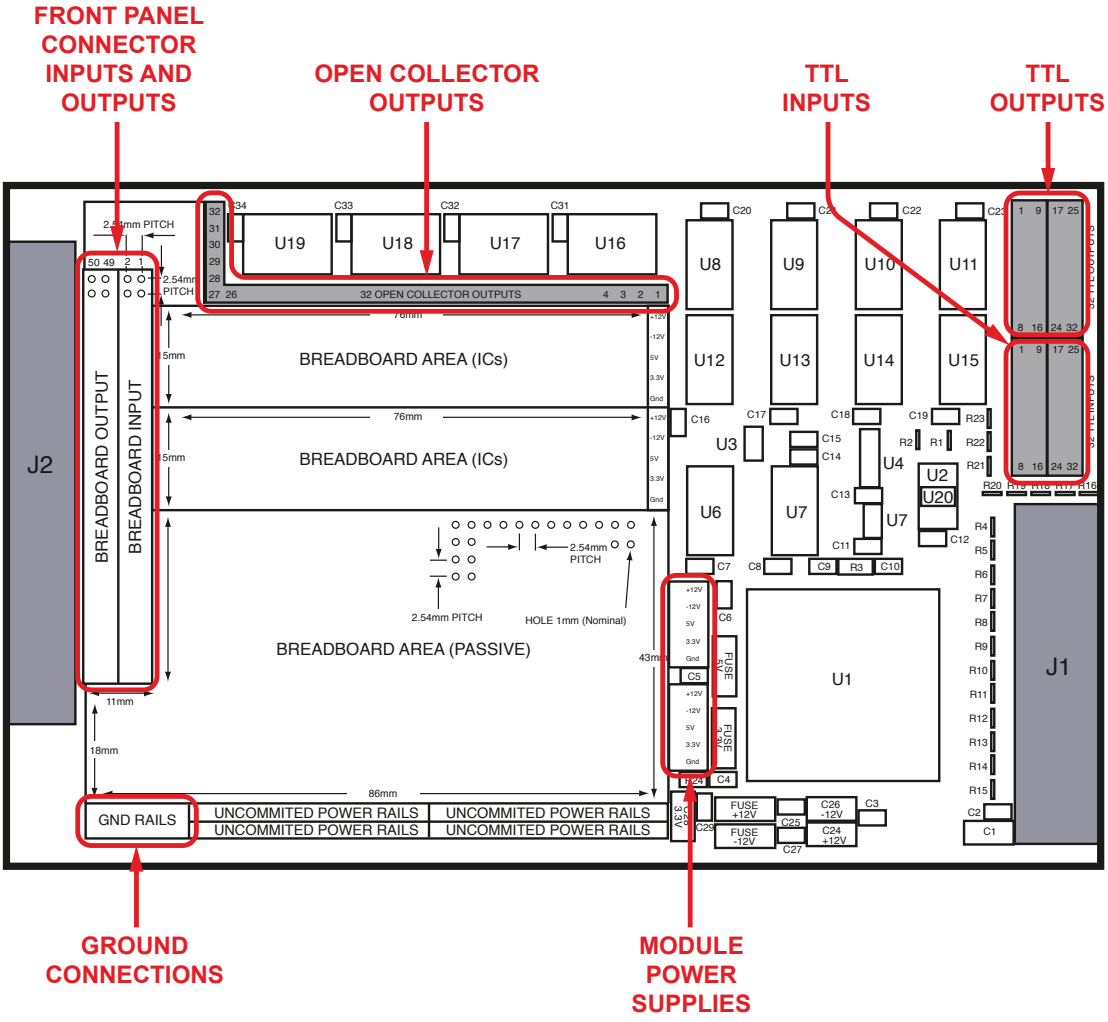


Figure 2.4 - Breadboard/Prototyping Module Component Layout

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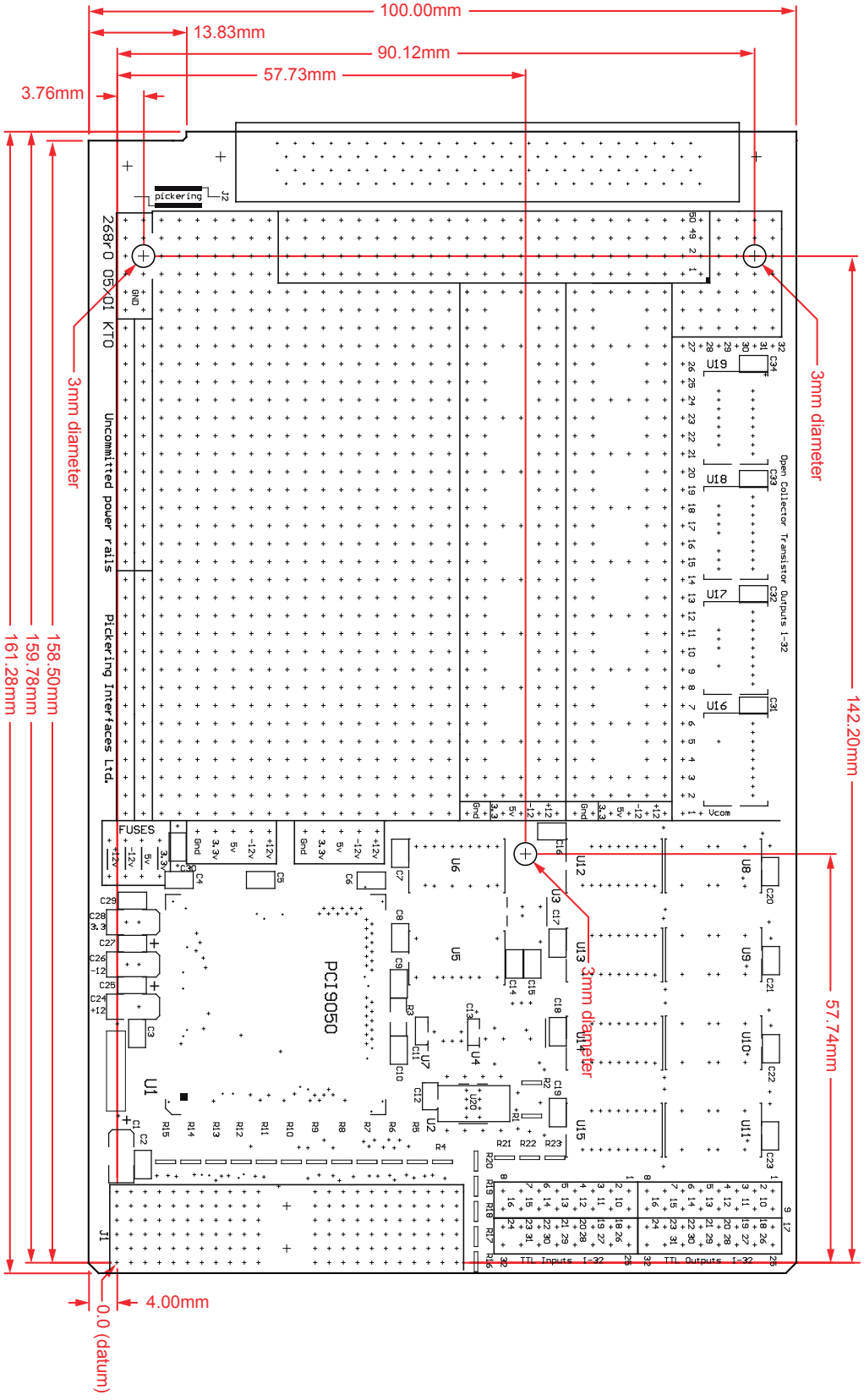


Figure 2.5 - Breadboard/Prototyping Module - Dimensions Including Location of Holes For Mounting a Daughterboard

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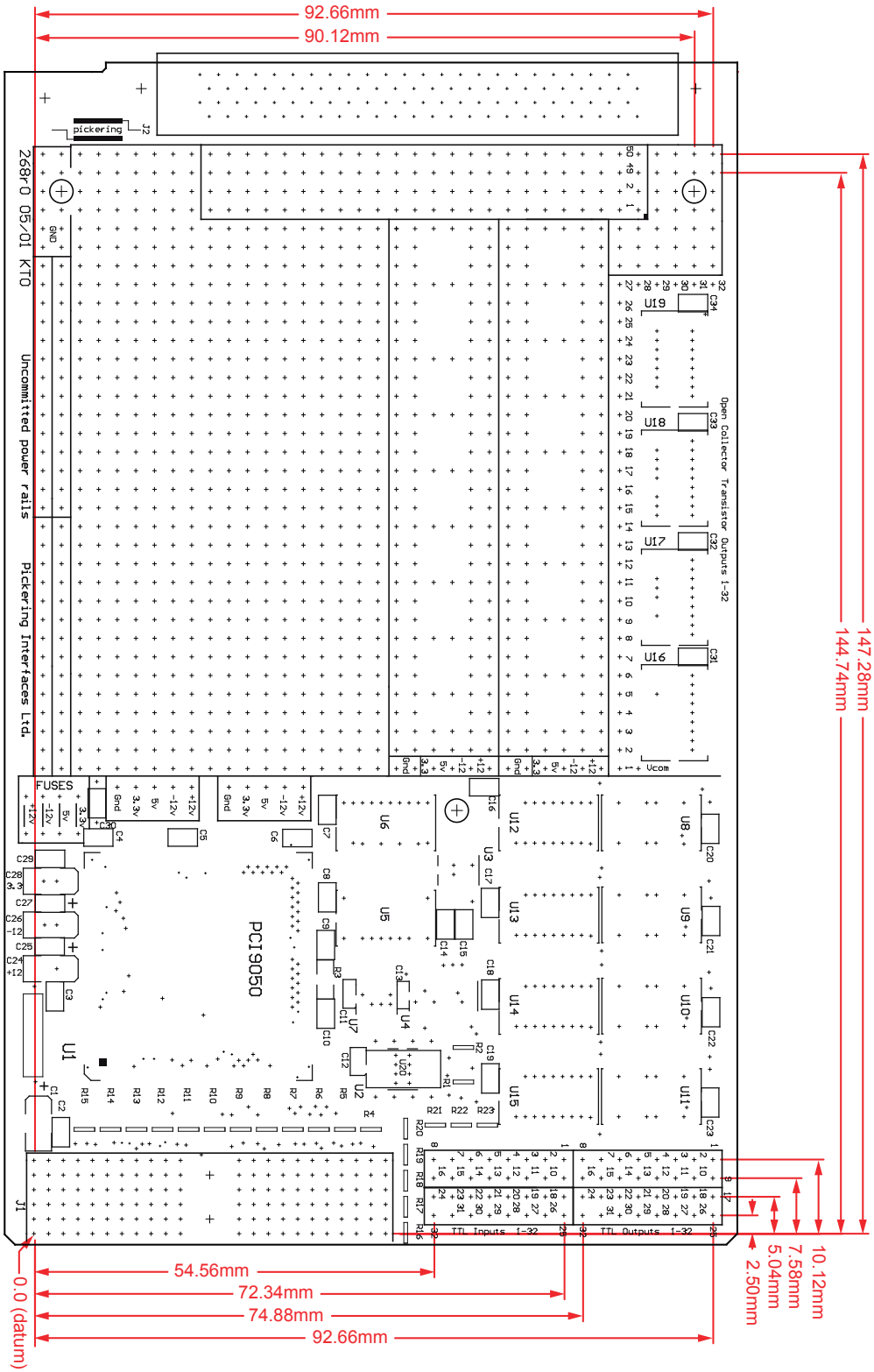


Figure 2.6 - Breadboard/Prototyping Module - Dimensions of Wiring Points

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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.

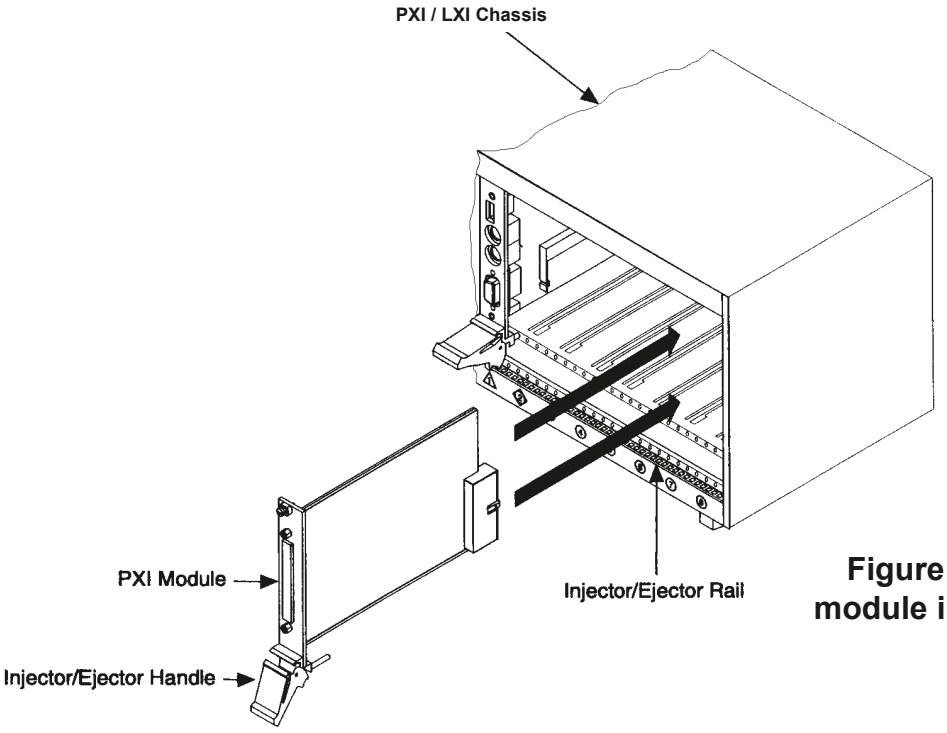


Figure 3.1 - Installing the module into a PXI / cPCI / LXI Chassis

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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.

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SECTION 4 - PROGRAMMING GUIDE

PROGRAMMING OPTIONS FOR PICKERING INTERFACES PXI CARDS

Software drivers are supplied for Microsoft Windows operating systems, with specific support for the following development environments:

- Microsoft Visual Studio (VB, C++, C#)
- Borland C++
- National Instruments LabWindows/CVI
- National Instruments LabVIEW and LabVIEW RT

Windows drivers are supplied in the form of Dynamic Link Libraries, which should also be usable in any other development environment that supports them.

Some recent drivers developed for the LXI platform are capable of addressing both PXI and LXI domains. Such duality may be of help to users considering future migration from PXI based systems to LXI based systems, or indeed systems containing both PXI and LXI components.

Programming for PXI

A number of different Windows drivers are available to meet particular system requirements, and should none of these be suitable there is also the option of register-level programming. Drivers are generally 'universal', handling all models in the System 40, 45 and 50 ranges; however some models that are not compliant with the Ivi Swtch class cannot be used with the pi40iv IVI driver. The pipx40 and Pilpxi drivers are also applicable to certain models in the System 41 (PXI Instruments) range - see these drivers' System 41 support list.

Please note that this documentation is available in its most up-to-date form as HTML help files, fully hyperlinked for easy access - both pipx40 and Pilpxi documents are included in the Pipx40vpp software installation.

IVI Driver for Windows - pi40iv

The pi40iv IVI (Interchangeable Virtual Instrument) driver supports all Pickering Interfaces PXI switch cards that are consistent with the Iviswtch class model - as are the great majority of cards in the System 40/45/50 ranges. It integrates well with LabWindows/CVI and LabVIEW, and is fully compatible with Switch Executive. It is also usable in general-purpose programming environments such as Visual C++ and Visual Basic.

Prior installation of the VISA and IviEngine from National Instruments are required for the correct installation and operation of this driver.

VISA Driver for Windows - pipx40

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

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

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

Direct I/O Driver for Windows - Pilpxi

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

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Register-level Programming

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

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

Programming for LXI

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

IVI Driver for Windows - pi40iv

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

Direct I/O Driver for Windows - Piplx

The piplx driver is based on the PXI Direct I/O driver pilpxi, but with added functionality to deal with the added need to address the chassis using an IP address. It integrates well with LabWindows/CVI and LabVIEW, and is fully compatible with Switch Executive. It is also usable in general-purpose programming environments such as Visual C++ and Visual Basic.

Please note that this driver may also be used in the PXI domain. If the addressed card is in the local computer PCI/PXI system, commands will be passed through to the PXI Direct I/O driver. This mechanism allows the piplx driver to be used for both PXI and LXI cards.

The LXI format offers additional interface options not available in PXI :

.NET

A .NET native driver is also available. Once again this may be used for both LXI and PXI card control.

SOAP

Pickering LXI products include a SOAP interface which is usable from a wide variety of platforms and languages.

SSH

Pickering LXI products include an SSH interface which allows remote command line access to control cards, or, using a suitable package, programmatic control.

The user is advised to visit the Pickering web site for further details of all the above drivers, where documentation, example programs, and further help with driver choice are available.

LabVIEW, LabWindows/CVI and Switch Executive are trademarks of National Instruments Corporation.

General Pickering Card Architecture

With most drivers, before programming a Pickering card it is important to understand the basic architecture of Pickering cards.

The switches on a Pickering card are organized into logical sub-units, each sub-unit containing a set of objects of similar type and use. These objects may be switches, digital outputs, digital inputs, resistors, power supplies etc, depending on the nature of the specific card.

For example a simple matrix card will usually contain a single sub-unit containing the switches arranged in a 2-dimensional array. However a similar card with additional isolating relays connected to the matrix will contain additional sub-units containing those isolation relays.

Low level drivers include functions to allow the programmer to query the card to ascertain the number of sub-units, and the size and type of each sub-unit.

For full details of the driver functions available the programmer should refer to the documentation provided.

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Digital Input-Output Sub Units

This section describes the Input and Output sub-unit of the card and lists the functions that can be used to operate the module.

The card comprises a 32-Bit Input and a 32-Bit Output Sub-unit where each bit represent a channel on the card.

It requires one DWORD each for both Input and Output sub-units.

	Applicable Functions	
	VISA Driver	**Direct Driver**
Input Sub-Unit	**pipx40_setChannelPattern** **pipx40_setChannelState**	**PIL_ReadSub** **PIL_ReadBit**
1: INPUT(32)	Read the channels individually using ReadBit/readInputState OR use ReadSub/readInputPattern function to read the Input pattern as a DWORD where Channel 1 is LSB and Channel 32 is MSB.	

	Applicable Functions	
	VISA Driver	**Direct Driver**
Output Sub-Unit	**pipx40_setChannelState** pipx40_getChannelState **pipx40_setChannelPattern** pipx40_getChannelPattern **pipx40_clearSub** pipx40_setMaskState pipx40_getMaskState pipx40_setMaskPattern pipx40_getMaskPattern pipx40_clearMask	**PIL_OpBit** PIL_ViewBit **PIL_WriteSub** PIL_ViewSub **PIL_ClearSub** PIL_MaskBit PIL_ViewMaskBit PIL_WriteMask PIL_ViewMask PIL_ClearMask
1: DIGITAL(32)	Set the Output Sub-Unit bit by bit using OpBit or setChannelState or set it all 32 Channels at once using WriteSub or setChannelPattern as a DWORD where Channel 1 is LSB and Channel 32 is MSB.	

Note: The functions above shown in bold are the commonly used functions.

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Table 4.1 - 40-220 Input Sub-Unit

TTL Input		Sub-Unit	Bit	Channel
IC	Pin			
U12	2	1	0	1
U12	4	1	1	2
U12	6	1	2	3
U12	8	1	3	4
U12	11	1	4	5
U12	13	1	5	6
U12	15	1	6	7
U12	17	1	7	8
U13	2	1	8	9
U13	4	1	9	10
U13	6	1	10	11
U13	8	1	11	12
U13	11	1	12	13
U13	13	1	13	14
U13	15	1	14	15
U13	17	1	15	16
U14	2	1	16	17
U14	4	1	17	18
U14	6	1	18	19
U14	8	1	19	20
U14	11	1	20	21
U14	13	1	21	22
U14	15	1	22	23
U14	17	1	23	24
U15	2	1	24	25
U15	4	1	25	26
U15	6	1	26	27
U15	8	1	27	28
U15	11	1	28	29
U15	13	1	29	30
U15	15	1	30	31
U15	17	1	31	32

Note: All inputs are fitted with a 10kΩ pull-up resistor to +5V.

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Table 4.2 - 40-220 Output Sub-Unit

TTL Output		Open Collector Transistor		Sub-Unit	Bit	Channel
IC	Pin	IC	Pin			
U8	2	U16	18	1	0	1
U8	5	U16	17	1	1	2
U8	6	U16	16	1	2	3
U8	9	U16	15	1	3	4
U8	12	U16	14	1	4	5
U8	15	U16	13	1	5	6
U8	16	U16	12	1	6	7
U8	19	U16	11	1	7	8
U9	2	U17	18	1	8	9
U9	5	U17	17	1	9	10
U9	6	U17	16	1	10	11
U9	9	U17	15	1	11	12
U9	12	U17	14	1	12	13
U9	15	U17	13	1	13	14
U9	16	U17	12	1	14	15
U9	19	U17	11	1	15	16
U10	2	U18	18	1	16	17
U10	5	U18	17	1	17	18
U10	6	U18	16	1	18	19
U10	9	U18	15	1	19	20
U10	12	U18	14	1	20	21
U10	15	U18	13	1	21	22
U10	16	U18	12	1	22	23
U10	19	U18	11	1	23	24
U11	2	U19	18	1	24	25
U11	5	U19	17	1	25	26
U11	6	U19	16	1	26	27
U11	9	U19	15	1	27	28
U11	12	U19	14	1	28	29
U11	15	U19	13	1	29	30
U11	16	U19	12	1	30	31
U11	19	U19	11	1	31	32

Note: The cathode of each open collector output flyback diode is connected to the **Vcom** wiring point. Apply the relavent power rail to the **Vcom** wiring point to implement the flyback diode feature.

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Using the Direct I/O Driver or VISA Driver to Control the Digital I/O Module

This section provides some code fragments which show how to control the Digital I/O using either the Direct I/O Driver or the VISA Driver.

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

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

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

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

Setting an Output State

Using the Pickering Direct I/O driver:

```
DWORD SubUnit = 1;
PIL_ClearSub(CardNo, SubUnit); //deactivate all Channels
PIL_OpBit(CardNo, SubUnit, 5, 1); //activate Channel 5
PIL_OpBit(CardNo, SubUnit, 5, 0); //deactivate Channel 5
```

Using the VISA driver:

```
ViUInt32 SubUnit = 1;
pipx40_clearSub(vi, SubUnit); //clear all sink driver channels to inactive
pipx40_setChannelState (vi, SubUnit, 5, 1); //activate Channel 5
pipx40_setChannelState (vi, SubUnit, 5, 0); //deactivate Channel 5
```

Reading all 32 Input State

Using the Pickering Direct I/O driver:

```
DWORD SubUnit;
DWORD InputChannelValues[1];

SubUnit = 1; //Read the input channel value
PIL_ReadSub(CardNo, SubUnit, InputChannelValues) //return 32 values, 1 bit per
  channel
```

Using the VISA driver:

```
ViUInt32 SubUnit;
SubUnit = 2; //Read the input channel value
ViUInt32 InputChannelValues[1];
pipx40_readInputPattern(vi, SubUnit, InputChannelValues); //return 32 values, 1
  bit per channel
```


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SECTION 5 - CONNECTOR INFORMATION

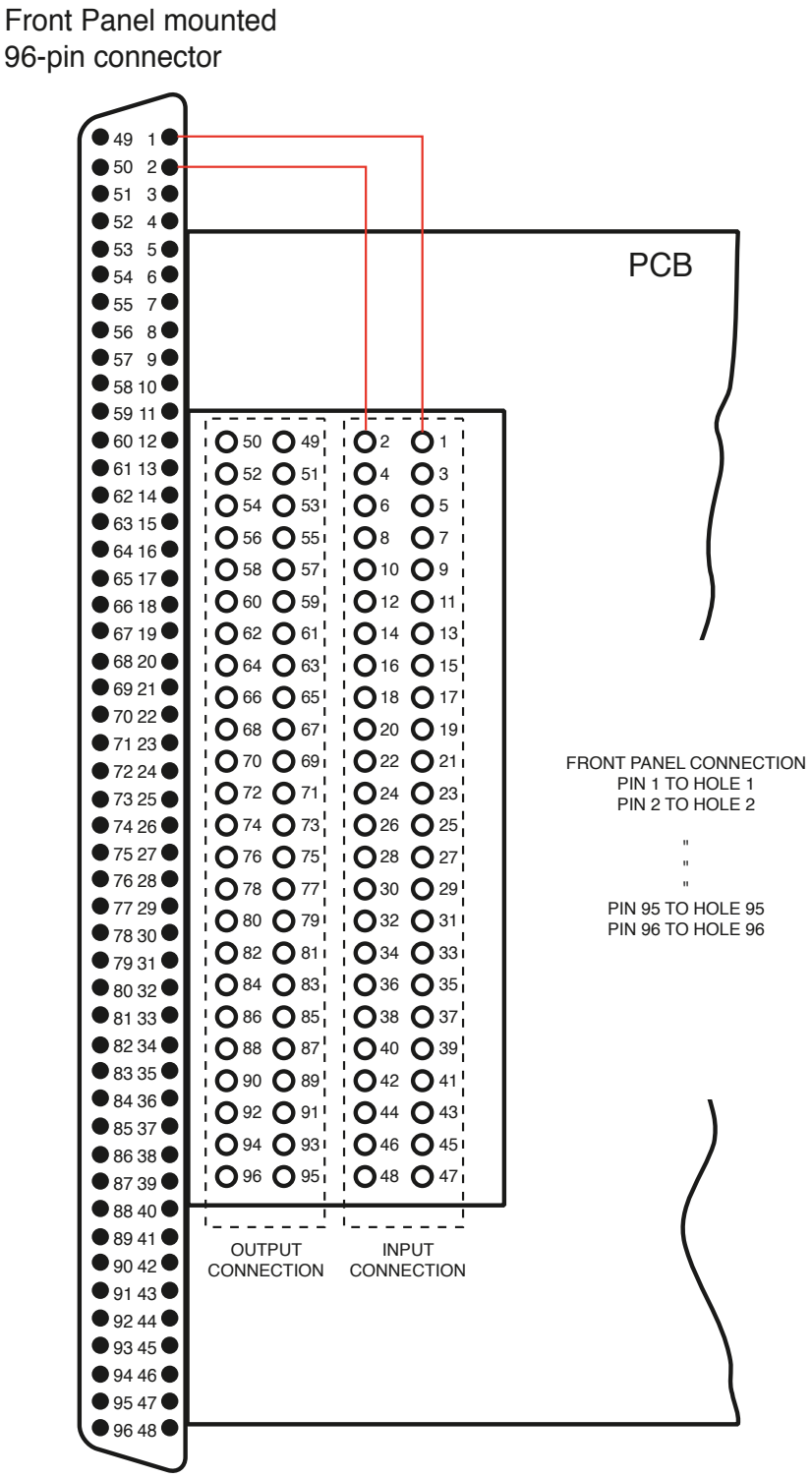


Figure 5.1 - Pinouts: Breadboard Module 40-220-001 & Prototyping Module 40-225-101 (96-pin micro-D male connector)

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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.

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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.

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GENERAL MAINTENANCE

The 40-220 is designed to support user defined circuits. The module guarantee only extends to the interfaces described in this manual, it does not extend to any user circuits that a module may have had added to it.

If the module fails it is recommended that it is returned to Pickering Interfaces to repair. While Pickering Interfaces will do its its best to preserve the user circuits installed on the module we cannot guarantee to repair the modules without impacting the user parts, and we reserve the right to replace the module with a new one which does not contain the user circuits in the event that a fault is impossible to diagnose or uneconomic to repair. In these circumstances the user circuits will have to be replicated. Users are strongly urged to make sure any circuits they add are well documented.

Calibration methods for the added circuits are the responsibility of the user.

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SECTION 8 - WARNINGS AND CAUTIONS

WARNING – HAZARDOUS ENVIRONMENTS

This product is not specifically designed for use in hazardous environments, for example in explosive atmospheres. If the product is to be used in hazardous environments we recommend that the user ensures suitable protective measures are taken.



WARNING - DANGER OF ELECTRIC SHOCK

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 this 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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