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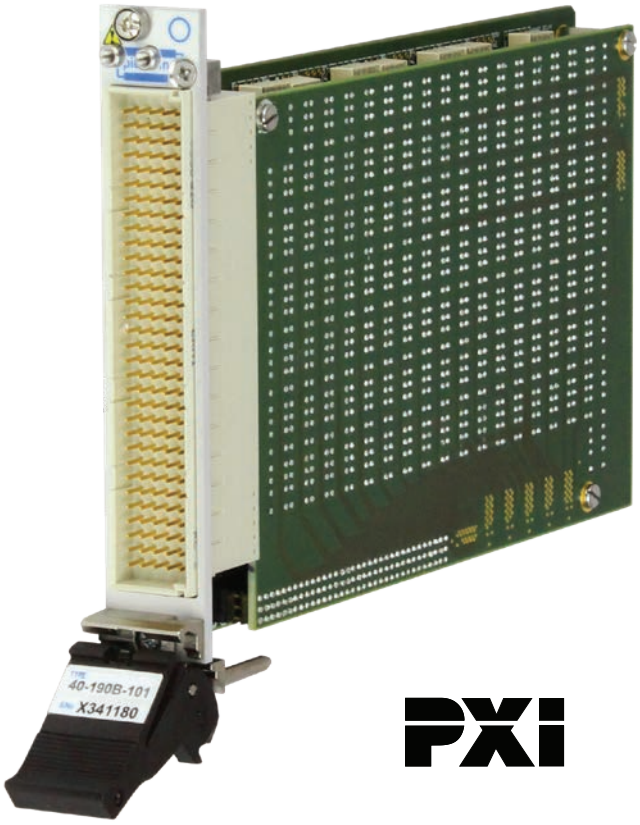
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40-190B User Manual

PXI 2 Amp Fault Insertion Switch



PXI

Issue 6.4 July 2023

pickeringtest.com

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ISO 9001
Reg No. FM38792

TECHNICAL SUPPORT

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

WARRANTY

All products manufactured by Pickering Interfaces are warranted against defective materials and workmanship for a period of three years, excluding programmable power supplies, from the date of delivery to the original purchaser. Any product found to be defective within this period will, at the discretion of Pickering Interfaces be repaired or replaced.

Products serviced and repaired outside of the warranty period are warranted for ninety days.

Extended warranty and service are available. Please contact Pickering Interfaces by phone, the website or via e-mail.

ENVIRONMENTAL POLICY

Pickering Interfaces operates under an environmental management system similar to ISO 14001.

Pickering Interfaces strives to fulfil all relevant environmental laws and regulations and reduce wastes and releases to the environment. Pickering Interfaces aims to design and operate products in a way that protects the environment and the health and safety of its employees, customers and the public. Pickering Interfaces endeavours to develop and manufacture products that can be produced, distributed, used and recycled, or disposed of, in a safe and environmentally friendly manner.

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PRODUCT SAFETY

SAFETY SYMBOLS

The following safety symbols may be used on the product and throughout the product documentation.

MEANING / DESCRIPTION	SYMBOL
PROTECTIVE EARTH (GROUND) To identify any terminal which is intended for connection to an external conductor for protection against electric shock in case of a fault, or the terminal of a protective earth (ground) electrode.	
DANGEROUS VOLTAGE To indicate hazards arising from dangerous voltages.	
WARNING / CAUTION An appropriate safety instruction should be followed or caution to a potential hazard exists. Refer to the relevant instructions detailed within the product manual.	
HEAVY If this product is heavy reference should be made to the safety instructions for provisions of lifting and moving.	
STATIC SENSITIVE To indicate that static sensitive devices are present and handling precautions should be followed.	

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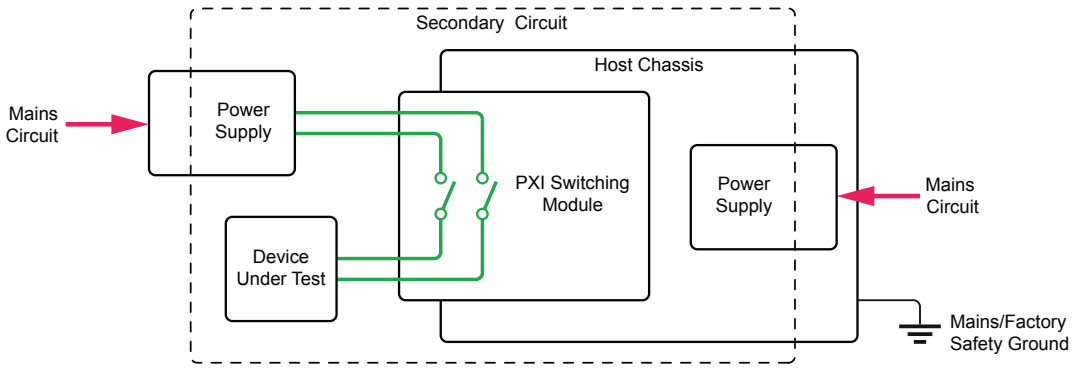
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WARNINGS AND CAUTIONS

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

WARNING - DANGER OF ELECTRIC SHOCK	SYMBOL
This module may contain hazardous voltages. Before removing the module from the rack remove all supplies and disconnect user I/O signals. Unused slots in the host chassis are populated with blanking plates to prevent access to user I/O signals that may be present. Blanking panels are available to order from Pickering in a variety of slot widths. If the product is not used in this manner for example by using an extender card then additional care must be taken to avoid contact with exposed signals. Not to be used in safety critical circuits, refer to the Pickering Interfaces' terms & conditions of sale. This module must not be used for the switching of Mains Circuits. For the switching of voltages up to the module's full specification, Secondary Circuit power supplies and the Device Under Test must be fully isolated from the Mains Circuit and the safety earth. The host chassis must be correctly installed and be connected to mains or factory safety ground, please refer to your chassis installation manual.  **Diagram Showing Separation Between The Mains Circuit and Secondary Circuit / DUT** For the purposes of this document, a Mains Circuit is an installation classified as Overvoltage Category II up to 300V. Separation between the Secondary Circuit and Mains Circuit is achieved by a transformer in which the primary windings are separated from the secondary windings by reinforced insulation, double insulation, or a screen connected to the protective conductor terminal.	

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

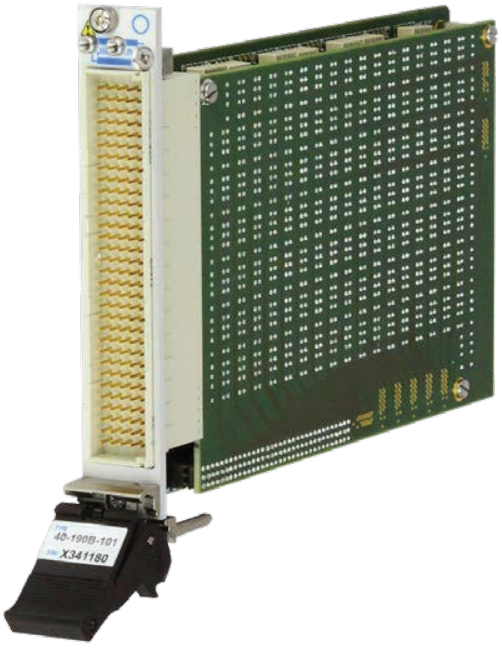
CAUTION - PRODUCT DOCUMENTATION	SYMBOL
Suitably qualified & trained users should ensure that the accompanying documentation is fully read and understood before attempting to install or operate the product.	

SAFETY INSTRUCTIONS

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

SECTION 1 - TECHNICAL SPECIFICATION

- 74, 64 or 32 Fault Insertion Channels
- Choice of Normally Closed or Normally Open Through Relays
- Choice of 1 or 2 Fault Insertion Buses
- Choose From 12 Configurations!
- Suitable for Automotive/Avionics ECU Burn-in/ Endurance Test Applications
- High Density Low Cost Solution
- Simulation of Various Types of Electrical Fault, Enabling Rigorous Fault Testing
- Fault Bus MUX For Selecting External Fault Conditions
- High Simultaneous Relay Drive
- 2A Hot or Cold Switching with 60W Max Power
- Switch up to 165VDC/115VAC (NC Through Relay Versions) or 200VDC/240VAC (NO Through Relay Versions)
- VISA, IVI & Kernel Drivers Supplied for Windows
- Supported by PXI or LXI Chassis
- Supported by *eBIRST*™
- 3 Year Warranty



The 40-190B is a Fault Insertion switch available with 74, 64 or 32 channels. It is primarily designed for the simulation of fault conditions in automotive & avionics applications involving the reliability testing of safety critical controllers.

It has the ablity to insert 3 different fault conditions between the test fixture and the equipment under test:

- Open-Circuit
- Short-Circuit between UUT connections
- Short-Circuit to other signals such as Power, Ignition and Ground via a Fault Insertion Bus

Through relays on each channel enable signals to the UUT to be held open-circuit. Fault Insertion Buses allow any channel to be shorted to any other channel also enabling connection to an external fault condition. The module is available with either 1 or 2 fault buses. A four channel multiplexer on each bus allows an external signal such as Power, Ignition or Ground to be selected as the fault condition. Additionally, switched signal lines (Monitor1 & Monitor2) allow direct monitoring of the fault buses with a DMM.

The modules in the 40-190B range are available in two versions with different default (power off) states:

- **Normally Closed Through Relays** and all fault insertion relays open, giving an un-interrupted path between the test fixture and the equipment under test.
- **Normally Open Through Relays** and all fault insertion relays open with no default path between the test fixture and the equipment under test.

Pickering's Range of PXI Fault Insertion Switches					
Model No.	Signal Channels	Fault Buses	Fault Inputs	Max Voltage	Max Current or Bus Type
40-190B	74, 64 or 32	1 or 2	4 or 8	165V	2A
40-191A	6	2	2	40V	30A
40-192	6	2	2	200V	10A
40-193	7	1 or 2	1 or 2	16V	20A, 1A min
40-194	7	1 or 2	1 or 2	16V	20A, no min
40-195	22 or 11 pairs	—	8 or 4	150V	1A
40-196	10 or 5 pairs	—	10 or 5	110V	5A
40-197A	34 or 16	4	8	300V	2A
40-198	20	1 or 2	3 or 6	250V	5A
40-199	10	1 or 2	2	250V	10A
40-200	4 or 8 differential	4	8	100V	CAN, FlexRay
40-201	4 or 8 differential	2	4	100V	Ethernet/AFDX /BroadR-Reach
40-202	22 or 11 pairs	—	22 or 11	150V	2A

High Simultaneous Drive

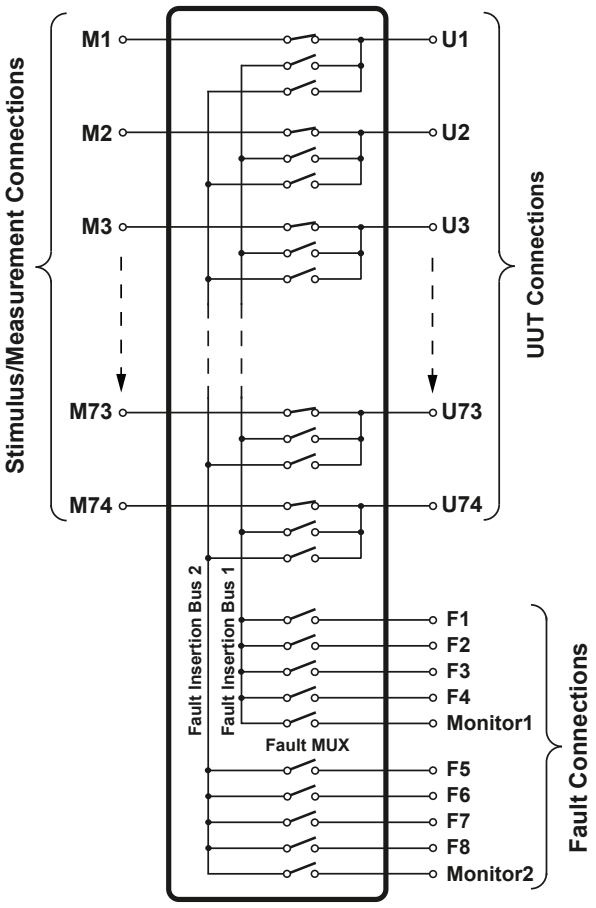
Any combination of relays may be operated (providing the maximum total card switch current is not exceeded), enabling maximum flexibility for fault selection.

Supported by *eBIRST*

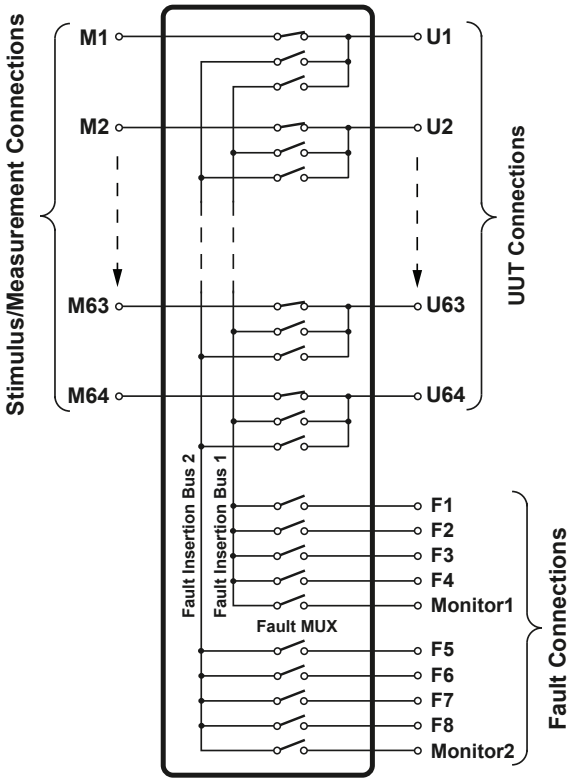
eBIRST switching system test tools simplify switching system fault-finding by quickly testing the system and graphically identifying the faulty relay.

For more information go to: pickeringtest.com/ebirst

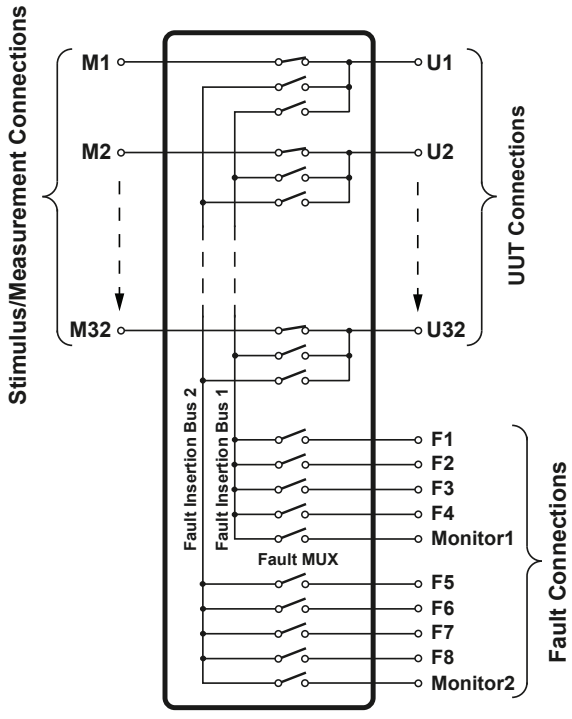
Versions With Normally Closed Through Relays



40-190B-002 Dual Bus, 74-Channel Fault Insertion Switch Schematic (40-190B-001 Has 1 Fault Bus)

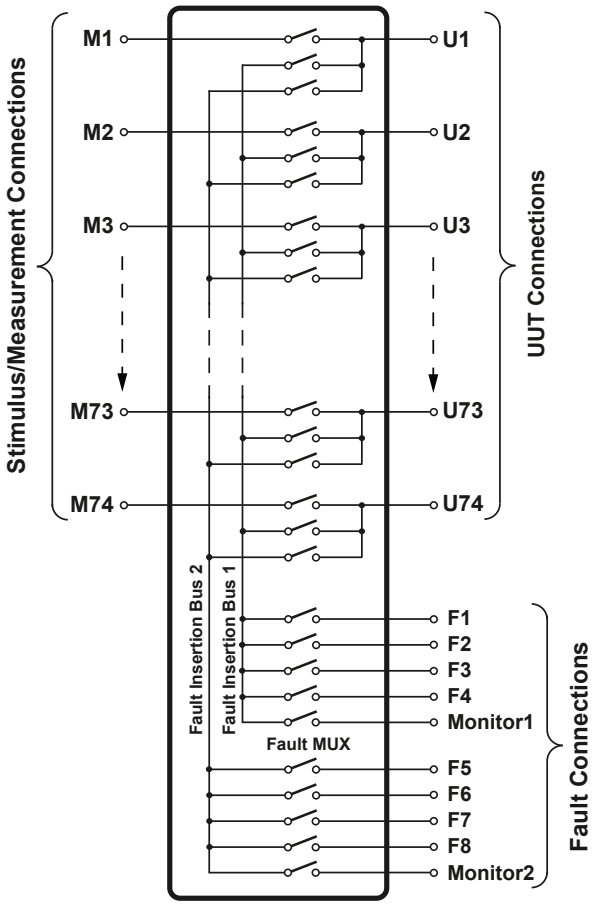


40-190B-102 Dual Bus, 64-Channel Fault Insertion Switch Schematic (40-190B-101 Has 1 Fault Bus)

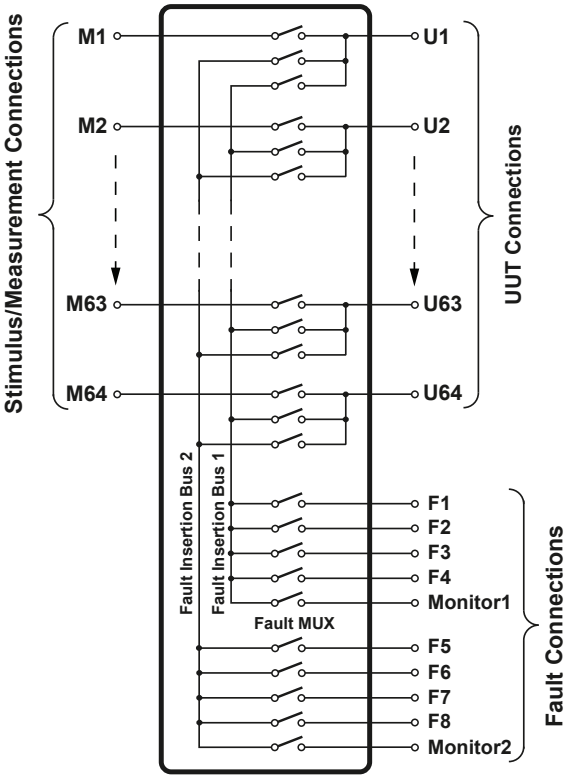


40-190B-202 Dual Bus, 32-Channel Fault Insertion Switch Schematic (40-190B-201 Has 1 Fault Bus)

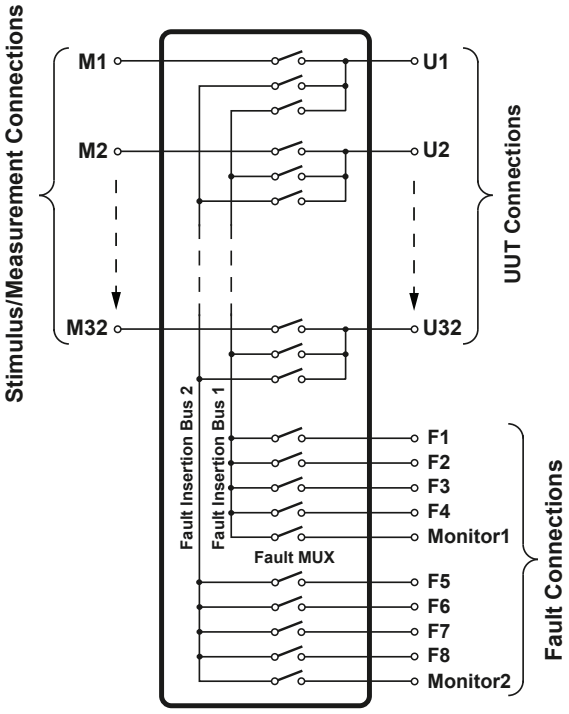
Versions With Normally Open Through Relays



40-190B-302 Dual Bus, 74-Channel Fault Insertion Switch Schematic (40-190B-301 Has 1 Fault Bus)



40-190B-402 Dual Bus, 64-Channel Fault Insertion Switch Schematic (40-190B-401 Has 1 Fault Bus)



40-190B-502 Dual Bus, 32-Channel Fault Insertion Switch Schematic (40-190B-501 Has 1 Fault Bus)

Relay Type

The 40-190B is fitted with high quality electro-mechanical relays with palladium-ruthenium gold covered contacts. A spare relay is built onto the circuit board to allow easy maintenance with minimum downtime.

Switching Specification - Versions With Normally Closed Through Relays

Switch Type	Electro-mechanical
Contact Type:	Palladium-Ruthenium, Gold Covered Bifurcated
Max Switch Voltage:	165VDC/115VAC*
Max Power:	60W
Max Switch Current:	2A
Max Continuous Carry Current:	2A
Max Pulsed Carry Current (for a single switch path):	6A for 100ms (up to 10% duty cycle)
Max Total Card Switch Current:	64A †
Max number of simultaneously operated relays:	No Limit
Initial On Path Resistance:	150mΩ typical
Off Path Resistance:	$>10^9\Omega$
Thermal Offset:	<5µV per relay
Operate Time:	<3ms
Expected Life (operations)	
Very low power signal load:	$>1x10^8$
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)

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

† Applies to PXI chassis installation (please contact sales office for use in alternative platforms).

Bandwidth Specification - Versions With Normally Closed Through Relays

M to U path:	>35MHz typical at 50Ω impedance
Fault path:	>7MHz typical at 50Ω impedance

Switching Specification - Versions With Normally Open Through Relays

Switch Type	Electro-mechanical
Contact Type:	Palladium-Ruthenium, Gold Covered Bifurcated
Max Switch Voltage:	200VDC/240VAC*
Max Power:	60W
Max Switch Current:	2A
Max Continuous Carry Current:	2A
Max Pulsed Carry Current (for a single switch path):	6A for 100ms (up to 10% duty cycle)
Max Total Card Switch Current:	64A †
Max number of simultaneously operated relays:	No Limit
Initial On Path Resistance:	300mΩ typical
Off Path Resistance:	$>10^9\Omega$
Thermal Offset:	<5µV per relay
Operate Time:	<3ms
Expected Life (operations)	
Very low power signal load:	$>1x10^8$
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)

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

† Applies to PXI chassis installation (please contact sales office for use in alternative platforms).

RF Specification - Versions With Normally Open Through Relays

Bandwidth (-3dB):	M to U Path:	20MHz (typical)
	Fault Path:	6MHz (typical)
Bandwidth (VSWR 1.5:1):	M to U Path:	6MHz (typical)
	Fault Path:	1MHz (typical)
Crosstalk (typical):	10kHz:	-80dB
	100kHz:	-60dB
	1MHz:	-40dB
	10MHz:	-20dB
Isolation (typical):	10kHz:	70dB
	100kHz:	65dB
	1MHz:	60dB
	10MHz:	40dB

Note: The 40-190B is suitable for carrying signals such as CAN to 1Mbps & FlexRay to 20Mbps (10Mbps per channel path)

Power Requirements

+3.3V	+5V	+12V	-12V
0	<2A	0	0

Mechanical Characteristics

Single slot 3U PXI (CompactPCI card).
Module weight: 380g (40-190B-002).

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 160-pin male DIN 41612 connector, for pin outs please refer to the operating manual.
We recommend that Pickering mating connectors are used with this module. They are designed to ensure there are no mechanical interference problems when used in a PXI chassis.

Note: The pinout of the 40-190B is not compatible with the pinout of the earlier 40-190 Fault Insertion Switch.

Operating/Storage Conditions

Operating Conditions

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

Storage and Transport Conditions

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

PXI & CompactPCI Compliance

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

Uses a 33MHz 32-bit backplane interface.

Safety & CE Compliance

All modules are fully CE compliant and meet applicable EU directives: Low-voltage safety EN61010-1:2010, EMC Immunity EN61326-1:2013, Emissions EN55011:2009+A1:2010.

Product Order Codes

Fault Insertion Switches With Normally Closed Through Relays

Single Bus 74-Channel 2A:	**40-190B-001**
Dual Bus 74-Channel 2A:	**40-190B-002**
Single Bus 64-Channel 2A:	**40-190B-101**
Dual Bus 64-Channel 2A:	**40-190B-102**
Single Bus 32-Channel 2A:	**40-190B-201**
Dual Bus 32-Channel 2A:	**40-190B-202**

Fault Insertion Switches With Normally Open Through Relays

Single Bus 74-Channel 2A:	**40-190B-301**
Dual Bus 74-Channel 2A:	**40-190B-302**
Single Bus 64-Channel 2A:	**40-190B-401**
Dual Bus 64-Channel 2A:	**40-190B-402**
Single Bus 32-Channel 2A:	**40-190B-501**
Dual Bus 32-Channel 2A:	**40-190B-502**

Product Customization

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

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

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

Support Products

eBIRST Switching System Test Tool

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

Product	Test Tool	Adaptor
40-190B	**93-002-001**	**93-002-410**

Spare Relay Kits

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

Product	Relay Kit
40-190B (All versions)	**91-100-001**

For further assistance, please contact the Pickering sales office.

Mating Connectors & Cabling

For connection accessories for the 40-190B series please refer to the 90-001D 160-pin DIN 41612 Connector Accessories data sheet where a complete list and documentation can be found for accessories, or refer to the Connection Solutions catalog.

Chassis Compatibility

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

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



Chassis Selection Guide

Standard PXI or hybrid PXIe Chassis from any Vendor:

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



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

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

Connectivity Solutions

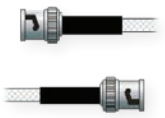
We provide a full range of supporting cable and connector solutions for all our switching products—20 connector families with 1200+ products. We offer everything from simple mating connectors to complex cables assemblies and terminal blocks. All assemblies are manufactured by Pickering and are guaranteed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



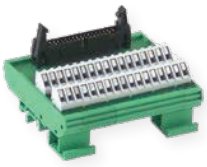
Connectors & Backshells



Multiway Cable Assemblies



RF Cable Assemblies



Connector Blocks

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



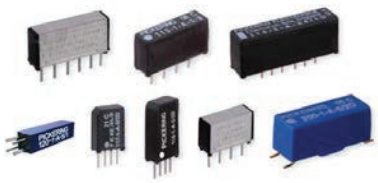
Mass Interconnect

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

Pickering Reed Relays

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

To learn more, please go to: pickeringrelay.com



Programming

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

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

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

Drivers for popular Linux distributions are available, other environments are also supported, please contact Pickering with specific enquiries. We provide Soft Front Panels (SFPs) for our products for familiarity and manual control, as well as comprehensive documentation and example programs to help you develop test routines with ease.
To learn more about software drivers and development environments, please go to: pickeringtest.com/software

Signal Routing Software



Our signal routing software, Switch Path Manager, automatically selects and energizes switch paths through Pickering switching systems. Signal routing is performed by simply defining test system endpoints to be connected together, greatly accelerating Test System software development. To learn more, please go to: pickeringtest.com/spm

Diagnostic Relay Test Tools



eBIRST Switching System Test Tools are designed specifically for our PXI, PCI or LXI products, these tools simplify switching system fault-finding by quickly testing the system and graphically identifying the faulty relay.
To learn more, please go to: pickeringtest.com/ebirst

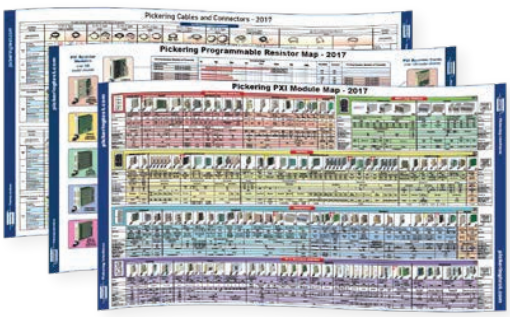
Three Year Warranty & Guaranteed Long-Term Support

All standard products manufactured by Pickering Interfaces are warranted against defective materials and workmanship for a period of three years from the date of delivery to the original purchaser. Extended warranty and service agreements are available for all our modules and systems with various levels to suit your requirements. Although we offer a 3-year warranty as standard, we also include guaranteed long-term support—with a history of supporting our products for typically 15-20 years. To learn more, please go to: pickeringtest.com/support

Available Product Resources

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







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

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SECTION 2 - TECHNICAL DESCRIPTION

FUNCTIONAL DESCRIPTION

A functional block diagram is provided in Figure 2.1. The Fault Insertion Switch is powered by a +5V input via Compact PCI bus connector. The interface to the user test equipment is via the front panel mounted 160-pin DIN 41612 connector. The module comprises a Mother and Daughter PCB combination with the switching functions distributed between the two boards. The Mother PCB is populated with 106 relays with their associated drivers as well as the PCI interface and control logic. The Daughter PCB mounts on the Mother board and contains 126 relays with driver ICs. The relays used are miniature electro-mechanical types with 2A current handling. The relays are energised via control signals from relay drivers on the mother and daughter boards. The relay drivers are addressed by the PCI bridge to output the required signal. The module"s configuration and PCI Bridge configuration data are stored in EEPROMS.

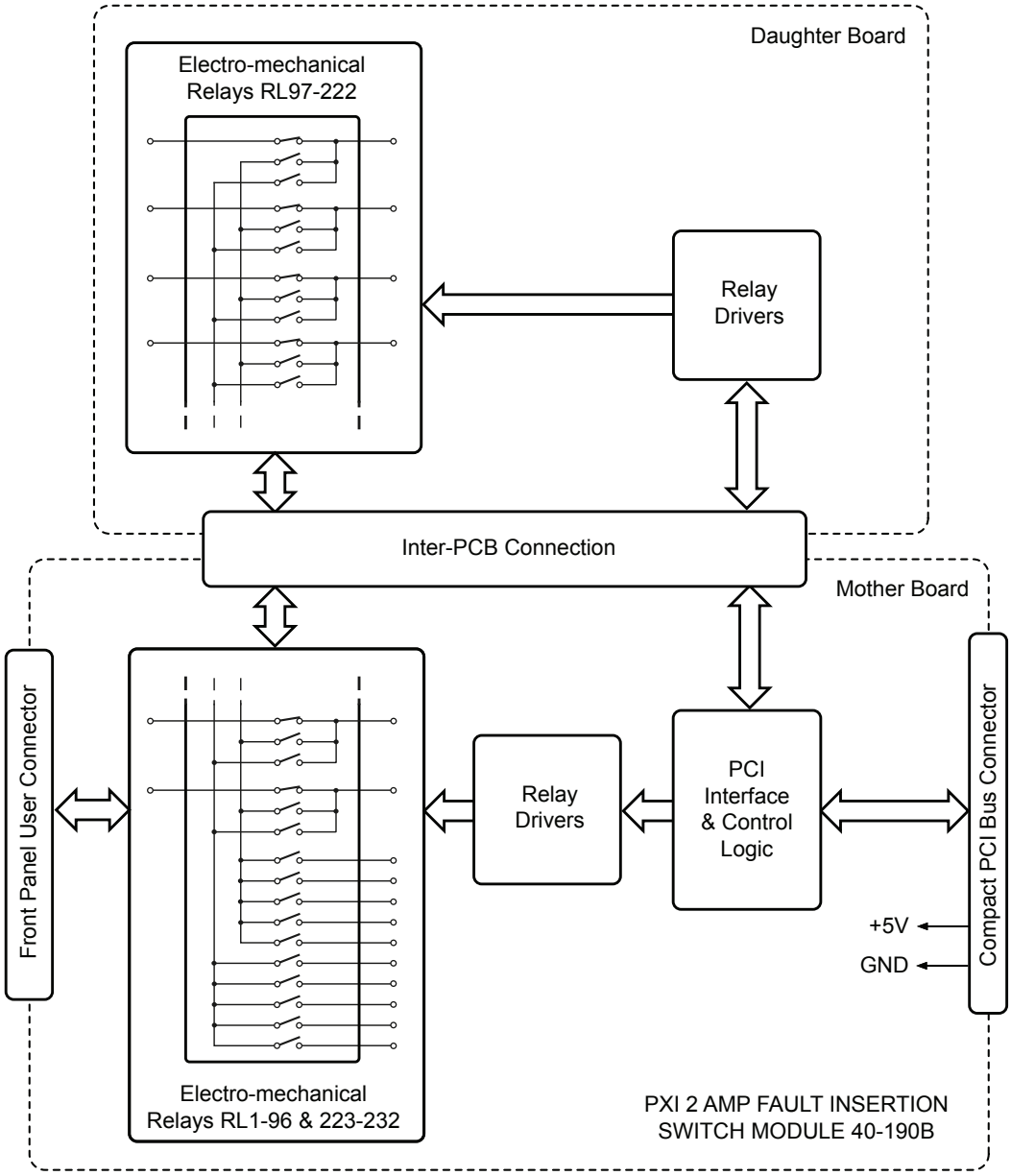


Figure 2.1 - 2A Fault Insertion Switch 40-190B: Functional Block Diagram

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SECTION 3 - INSTALLATION

Refer to the Warnings and Cautions at the front of this manual

Modular products require installation in a suitable PXI/LXI chassis. The module is designed for indoor use only.

PREOPERATION CHECKS (UNPACKING)

1. Check the module for transport damage and report any damage immediately to Pickering Interfaces. Do not attempt to install the product if any damage is evident.
2. Position the chassis relative to any other equipment the module(s) will connect with. Ensure the chassis is not connected to the electrical supply.
3. Ensure that the designated area for the chassis containing the module is of flat and solid construction to withstand and support the combined weight of the module(s) and chassis.

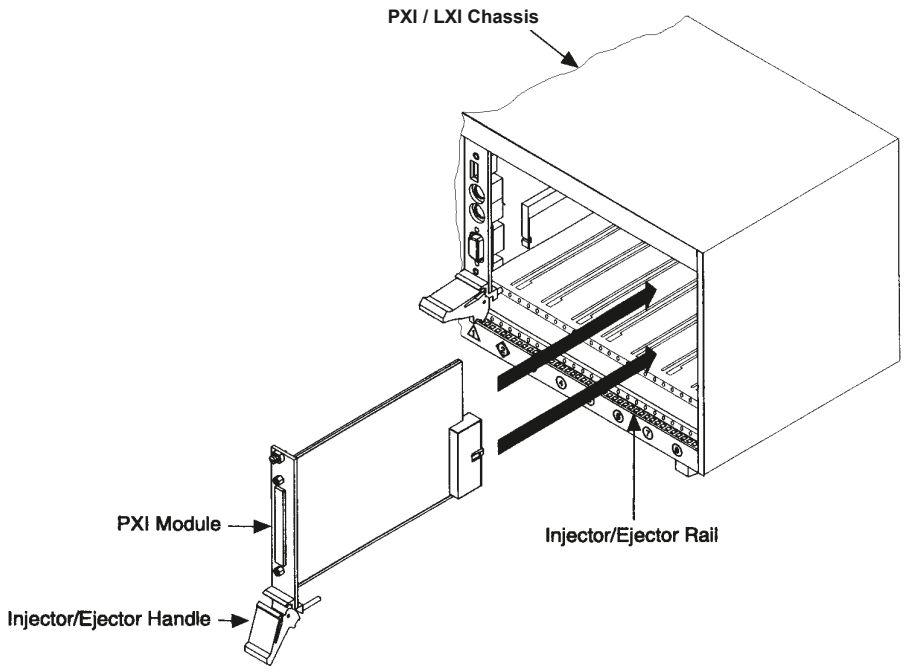


Figure 3.1 - Installing the Module into a PXI/cPCI/LXI Chassis

HARDWARE INSTALLATION
ELECTRICAL CONNECTION (CHASSIS)

1. The chassis must be electrically installed in accordance with local regional electrical codes by a qualified engineer.
2. The chassis must be grounded.

Electrostatic discharge can damage the components on the module. To avoid such damage in handling the board refer to page VII.

Ensure that there is adequate ventilation.

The module should be installed in accordance with the following procedure:

1. Ensure that the system is turned OFF but still connected to mains so that it remains grounded.
2. Choose an appropriate slot in the rack.
3. Remove the blanking plate for the chosen slot.
4. Ensure that the injector/ejector handle is in its downward position. Align the module with the card guides on the top and bottom of the slot.

   Do not raise the injector/ejector handle whilst inserting the module as the module will not insert properly.
5. Hold the handle whilst slowly sliding the module into the card guides until the handle catches on the injector/ejector rail (refer to Figure 3.1).
6. Raise the injector/ejector handle until the module firmly seats into the backplane. The front panel of the module should be flush with the front panel of the chassis.
7. Secure the front panel of the module using both screws to the chassis front panel mounting rails.
8. In a system employing a remote control interface to connect an external controller to a PXI chassis or to link multiple chassis, power-up the system as follows:
   a. For a system comprising an external controller and one chassis, power up the chassis before powering up the external controller.
   b. For a system comprising more than one chassis, turn ON the last chassis in the system followed by the penultimate, etc, and finally turn ON the external controller or chassis containing the system controller.
9. For Pickering Interfaces modular LXI installation there is no requirement to use any particular power up sequence.

SOFTWARE INSTALLATION

First install the appropriate Pickering PXI switch card drivers by running the installer program Setup.exe (provided in a compressed zip file), either from the CD-ROM supplied, or by downloading the latest version from our website **pickeringtest.com** - the recommended method. Setup is accompanied by a ReadMe file containing additional installation information. A single installation covers all cards in the System 40, System 45 and System 50 ranges.

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

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

TESTING OPERATION

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



Figure 3.2 - General Soft Front Panel Icon

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

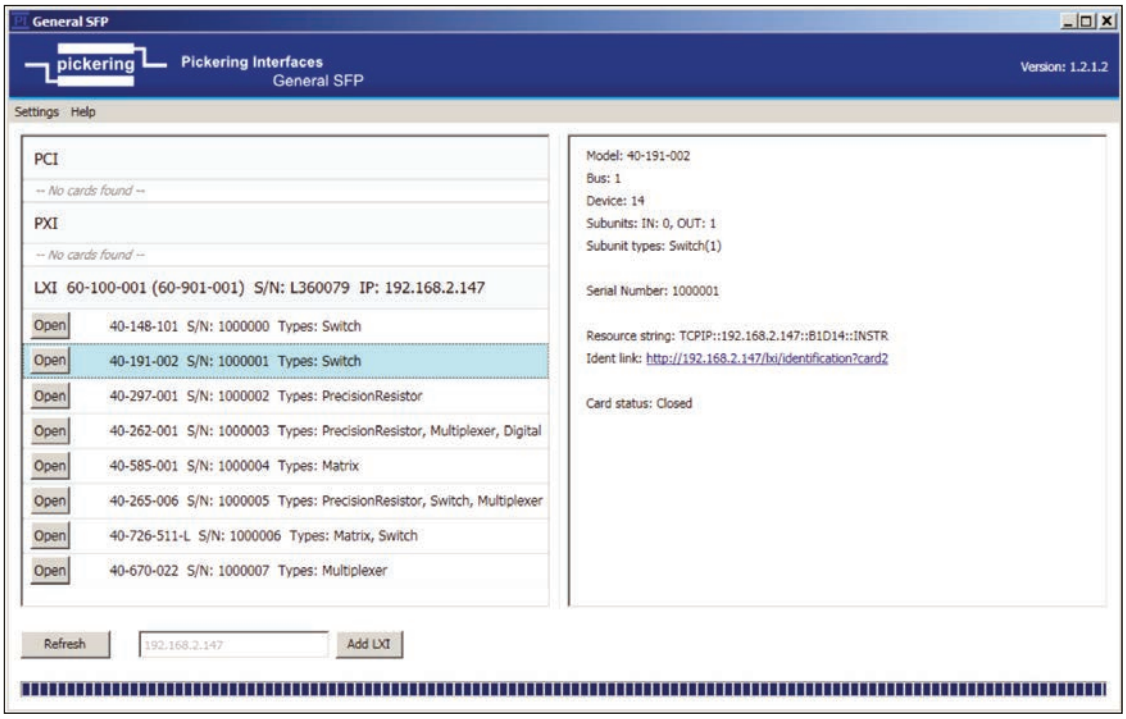


Figure 3.3 - General Soft Front Panel Selector

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

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SECTION 4 - PROGRAMMING GUIDE

PROGRAMMING OPTIONS FOR PICKERING INTERFACES PXI MODULES

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

This is available as a download from:
https://www.pickeringtest.com/support/software-drivers-and-downloads

Also, it can be accessed from the DVD supplied with the product:
<DVD_DRIVE>\downloads\Documentation\Software-Manual.pdf

MODULE ARCHITECTURE

The Pickering 40-190B Fault Insertion Switch is available with 74, 64 or 32 channels and with one or two fault buses. Each version is also available with normally closed or normally open through relays. The architecture is outlined in the following diagrams:

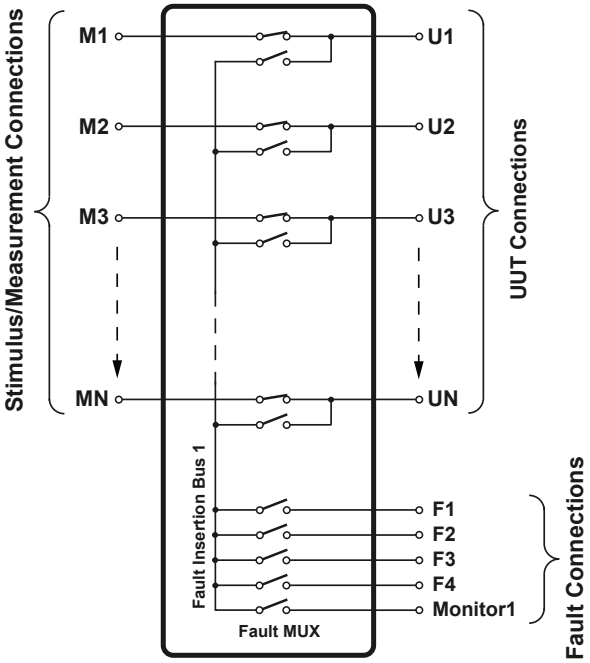


Figure 4.1 - Fault Insertion Switch with one fault bus and normally closed through relays. The maximum channel count "N" is 74 (40-190B-001), 64 (40-190B-101) or 32 (40-190B-201).

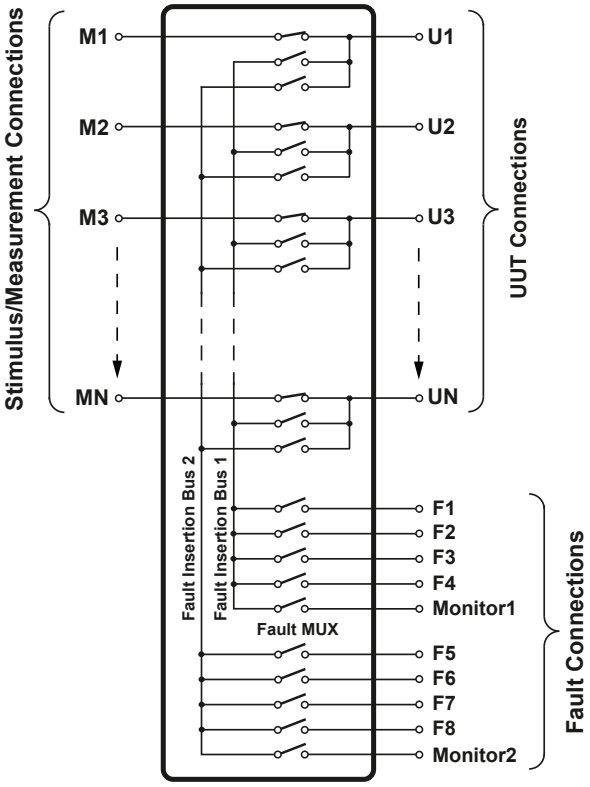


Figure 4.2 - Fault Insertion Switch with two fault buses and normally closed through relays. The maximum channel count "N" is 74 (40-190B-002), 64 (40-190B-102) or 32 (40-190B-202).

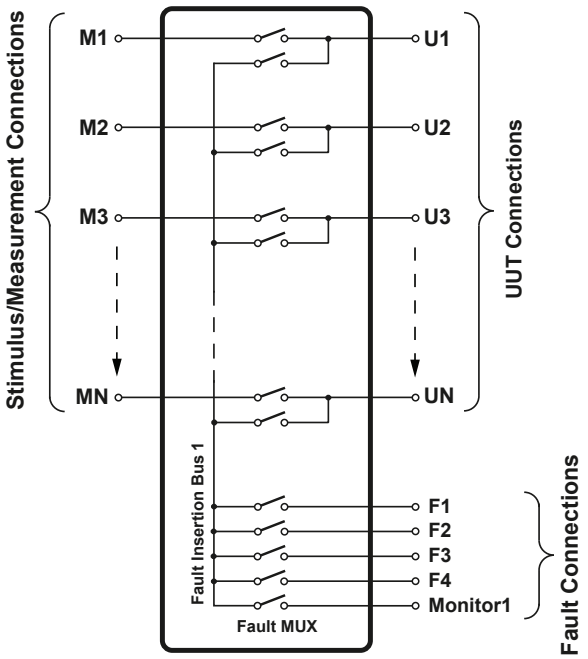


Figure 4.3 - Fault Insertion Switch with one fault bus and normally open through relays. The maximum channel count "N" is 74 (40-190B-301), 64 (40-190B-401) or 32 (40-190B-501).

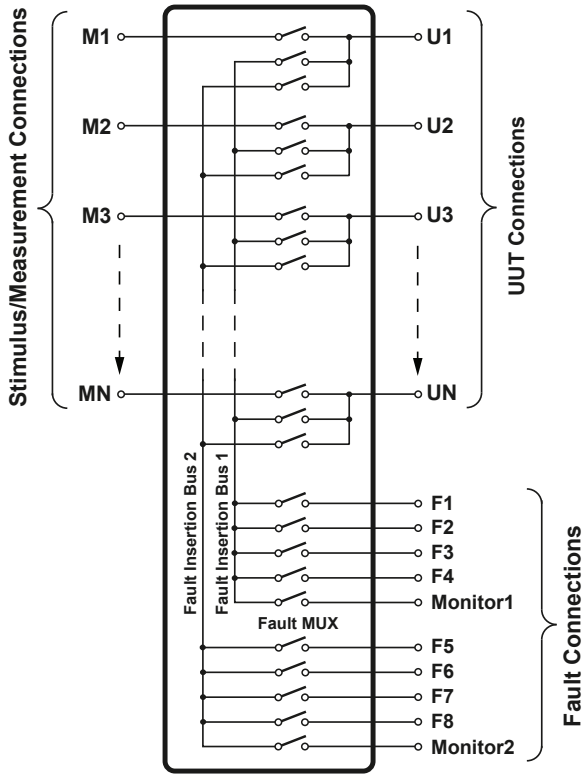


Figure 4.4 - Fault Insertion Switch with two fault buses and normally open through relays. The maximum channel count "N" is 74 (40-190B-302), 64 (40-190B-402) or 32 (40-190B-502).

The 40-190B modules contain multiple sub-units and two different ways to control the UUT connection switches for each channel and the fault line conditions. However, the first Sub-unit comprises all the channels, fault buses and MUX connections.

Please Note: The tables below apply to the first Sub-Unit only.

UUT Connections

Use the table below to determine the address (bit offset) of each channel's UUT connection switches for sub-models -001, -101 and -201:

Connections	Bit Offset	Function
Mn/Un (n = channel)	(n – 1) * 2 + 1	Break
	(n – 1) * 2 + 2	Fault1

Use the table below to determine the address (bit offset) of each channel's UUT connection switches for sub-models -002, -102 and -202:

Connections	Bit Offset	Function
Mn/Un (n = channel)	(n – 1) * 3 + 1	Break
	(n – 1) * 3 + 2	Fault1
	(n – 1) * 3 + 3	Fault2

Fault MUX/Line Connections

Use the table below to determine the address (bit offset) of each fault condition switch for sub-models -001, -101 and -201:

Connections	Bit Offset	Function
Fault and monitor (N = number of channels) (m = Fault connection)	(N * 2) + m	Fault Connection m
	(N * 2) + 5	Monitor 1

Use the table below to determine the address (bit offset) of each fault condition switch for sub-models -002, -102 and -202:

Connections	Bit Offset	Function
Fault and monitor (N = number of channels) (m = Fault connection)	(N * 3) + m	Fault Connection m
	(N * 3) + 9	Monitor 1
	(N * 3) + 10	Monitor 2

Example - the address of the Monitor 1 on a 40-190B-102 will be (64 * 3) + 9 or 201

40-190B-201 Sub-Unit Allocation

The 40-190B is available with single or dual fault insertion buses and is controlled with 5 sub-units or 7 sub-units respectively. There are 2 modes of operation embedded within the card. Mode A allows the user to control all switches within one sub-unit and Mode B partitions the switches into different sub-units with respect to their function.

Mode A comprises Sub-Unit 1 which enables the user to control all the switches within one sub-unit resulting in switching with less commands but it's up to the user to locate the switch functions within the sub-unit.

SUB-UNIT 1: consists of Break relays and Fault buses for each channel, plus (tagged on the end) the fault MUX and monitor connection.

WARNING: Fault and monitor MUX connection switches should not have multiple connections. Multiple connections can short the MUX circuitry resulting in possible card failure. It is recommended to customers to use Mode B as it ensures that the Fault MUX has only a single connection operating at any one time.

Mode B (Single Fault Bus Versions) comprises sub-units with a separate switch function. For all single fault bus versions (-001, -101 and -201), Sub-units 2, 3, 4 and 5 partition the card according to switch functionality.

SUB-UNIT 2: consists of Break Relays for each channel.

SUB-UNIT 3: consists of Fault insertion Bus 1 for each channel.

SUB-UNIT 4: consists of the Fault MUX connection.

SUB-UNIT 5: consists of the Monitor connection.

Please Note: Only one Mode can be operated at a time.

Mode B (Dual Fault Bus Versions) comprises sub-units with a separate switch function. For all dual fault bus versions (-002, -102 and -202), Sub-units 2, 3, 4, 5, 6 and 7 partition the card according to switch functionality.

SUB-UNIT 2: consists of Break Relays for each channel.

SUB-UNIT 3: consists of Fault insertion Bus 1 for each channel.

SUB-UNIT 4: consists of Fault insertion Bus 2 for each channel.

SUB-UNIT 5: consists of the Fault MUX 1 connection.

SUB-UNIT 6: consists of the Fault MUX 2 connection.

SUB-UNIT 7: consists of the Monitor connections 1 and 2.

Please Note: Only one Mode can be operated at a time.

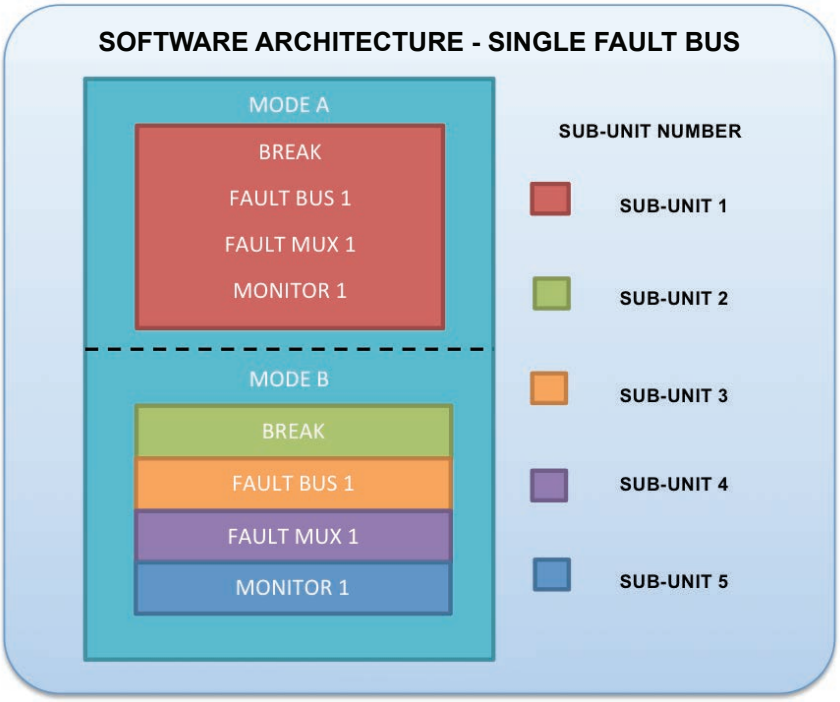


Figure 4.5 - Fault Insertion Switch 40-190B Sub-Unit Allocation - Single Fault Bus

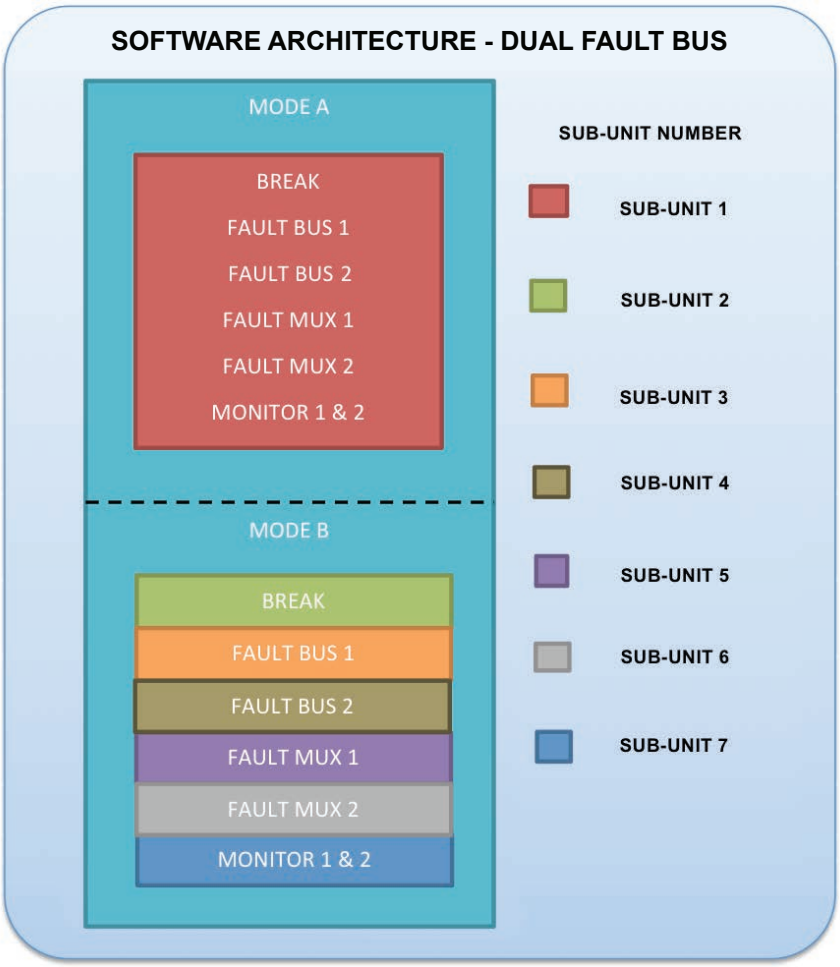


Figure 4.6 - Fault Insertion Switch 40-190B Sub-Unit Allocation - Dual Fault Bus

PROGRAMMING THE MODULE

Programming The 40-190B Single and Dual Fault Bus Versions Using a Single Sub-Unit (Mode A)

Here are examples of using drivers with the 40-190B using sub-unit 1. The examples shown are for the 40-190B-002 (74-channel, dual bus), other versions operate in the same way but with different numbers of bits in the sub-unit. Refer to Tables 4.1 to 4.6 for the bit usage within the sub-unit.

Using PILPXI

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

OpBit

```
DWORD sub_unit = 1;
PIL_OpBit( card_num, sub_unit, 1, 1);   // Operates the channel 1 Break relay
PIL_OpBit( card_num, sub_unit, 1, 0);   // Releases the channel 1 Break relay
PIL_OpBit( card_num, sub_unit, 6, 1);   // Operates the channel 2, Fault Bus 2 relay
PIL_OpBit( card_num, sub_unit, 228, 1); // Connects input F6 to Fault Bus 2
PIL_OpBit( card_num, sub_unit, 232, 1); // Connects Monitor 2 to Fault Bus 2
```

WriteSub

```
// Sub-unit is 232 bits wide, so 8 DWORDS are needed to hold the entire pattern
DWORD data[8];
data[0] = 1;            // Sets lowest bit to 1, channel 1 Break relay
data[1] = 0;
data[2] = 0;
data[3] = 0;
data[4] = 0;
data[5] = 0;
data[6] = 0;            // Disconnect all fault and monitor connections
data[7] = 0;            // from the fault buses
PIL_WriteSub( card_num, sub_unit, data);
data[0] = 0x20;         // Sets 6th bit, channel 2, Fault Bus 2 relay
data[1] = 0;
data[2] = 0;
data[3] = 0;
data[4] = 0;
data[5] = 0;
data[6] = 0;
data[7] = 0x88;         // Connect F6 and Monitor 2 to Fault Bus 2
PIL_WriteSub( card_num, sub_unit, data);
```

Using PIPX40

setChannelState

```
ViUInt32 sub_unit = 1;
pipx40_setChannelState(vi, sub_unit, 1, VI_ON);     // Operates the channel 1 Break relay
pipx40_setChannelState(vi, sub_unit, 1, VI_OFF);    // Releases the channel 1 Break relay
pipx40_setChannelState(vi, sub_unit, 6, VI_ON);// Operates the channel 2 Fault Bus 2 relay
pipx40_setChannelState(vi, sub_unit, 228, VI_ON);   // Connects input F6 to Fault Bus 2
pipx40_setChannelState(vi, sub_unit, 232, VI_ON);   // Connects Monitor 2 to Fault Bus 2
```

setChannelPattern

```
// Sub-unit is 223 bits wide, so 8 ViUInt32 values are needed to hold the entire pattern
ViUInt32 data[7];
data[0] = 1;            // Sets lowest bit to 1, channel 1 Break relay
data[1] = 0;
data[2] = 0;
data[3] = 0;
data[4] = 0;
data[5] = 0;
data[6] = 0;            // Disconnect all fault and monitor connections
data[7] = 0;            // from the fault buses
pipx40_setChannelPattern( vi, sub_unit, data);
data[0] = 0x20;         // Sets 6th bit, channel 2, Fault Bus 2 relay
data[1] = 0;
data[2] = 0;
data[3] = 0;
data[4] = 0;
data[5] = 0;
data[6] = 0;
data[7] = 0x88;         // Connect F6 and Monitor 2 to Fault Bus 2
pipx40_setChannelPattern( vi, sub_unit, data);
```

Using pi40iv

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

```
pi40iv_Connect(vi, comA1, chA1);        // Operates the channel 1 Break relay
pi40iv_Disconnect(vi, comA1, chA1);     // Releases the channel 1 Break relay
pi40iv_Connect(vi, comA6, chA6);        // Operates the channel 2, Fault Bus 2 relay
pi40iv_Connect(vi, comA228, chA228);    // Connects input F6 to Fault Bus 2
pi40iv_Connect(vi, comA232, chA232);    // Connects Monitor 2 to Fault Bus 2
```

The IVI Swtch driver specification contains no bulk setting capabilities.

Programming The 40-190B Dual Fault Bus Versions Using Multiple Sub-Units (Mode B)

Here are examples of using drivers with the dual fault bus versions of the 40-190B using sub-units 2-7. The examples shown are for the 40-190B-002 (74-channel, dual bus), other dual bus versions operate in the same way but with different numbers of bits in the sub-units. Refer to Tables 4.10, 4.11 and 4.12 for the bit usage within each sub-unit.

Using PILPXI

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

OpBit

```
DWORD sub_unit = 2; // Break Relays
PIL_OpBit( card_num, sub_unit, 1, 1); // Operates the channel 1 Break relay
PIL_OpBit( card_num, sub_unit, 1, 0); // Releases the channel 1 Break relay


sub_unit = 4;       // Fault Bus 2
PIL_OpBit( card_num, sub_unit, 2, 1); // Operates the channel 2, Fault Bus 2 relay


sub_unit = 6;       // Fault MUX 2
PIL_OpBit( card_num, sub_unit, 1, 1); // Connects input F5 to Fault Bus 2


sub_unit = 7;       // Fault Monitor 1 & 2
PIL_OpBit( card_num, sub_unit, 2, 1); // Connects Monitor 2 to Fault Bus 2
```

WriteSub

```
// Sub-unit 2, 3 & 4 are each 74 bits wide and therefore require 3 DWORDs for each
sub-unit to hold the entire pattern whereas sub units 5, 6 and 7 require 1 DWORD
each to hold the pattern
DWORD data[0];
DWORD sub_unit;
sub_unit = 2;   // Break Relays
data[0] = 1;    // Connects channel 1 break relay
data[0] = 0;    // Resets Break Relay Sub-unit
PIL_WriteSub( card_num, sub_unit, data);

sub_unit = 4;   // Fault Bus 2
data[0] = 2;    // Operates the channel 2, Fault Bus 2 relay
data[0] = 0;    // Disconnects Fault Bus 2
PIL_WriteSub( card_num, sub_unit, data);

sub_unit = 6;   // Fault MUX 2
data[0] = 1;    // Connects input F5 to Fault Bus 2
data[0] = 0;    // Disconnects Fault MUX 2
PIL_WriteSub( card_num, sub_unit, data);

sub_unit = 7;   // Fault Monitor 1 & 2
data[0] = 2;    // Connects Monitor 2 to Fault Bus 2
data[0] = 0;    // Disconnects Monitor 2 from Fault Bus 2
PIL_WriteSub( card_num, sub_unit, data);
```

Using PIPX40

setChannelState

```
ViUInt32 sub_unit = 2;    // Break Relays
pipx40_setChannelState(vi, sub_unit, 1, VI_ON);     // Operates the channel 1 Break relay
pipx40_setChannelState(vi, sub_unit, 1, VI_OFF);    // Releases the channel 1 Break relay

sub_unit = 4;             // Fault Bus 2
pipx40_setChannelState(vi, sub_unit, 2, VI_ON);// Operates the channel 2 Fault Bus 2 relay

sub_unit = 6;             // Fault MUX 2
pipx40_setChannelState(vi, sub_unit, 1, VI_ON);     // Connects input F5 to Fault Bus 2

sub_unit = 7;             // Fault Monitor 1 & 2
pipx40_setChannelState(vi, sub_unit, 2, VI_ON);     // Connects Monitor 2 to Fault Bus 2
```

setChannelPattern

```
// Sub-unit 2, 3 & 4 are each 74 bits wide and therefore require 3 ViUInt32 for each
sub-unit to hold the entire pattern whereas sub units 5, 6 and 7 require 1 ViUInt32
each to hold the pattern

ViUInt32 data[0];
ViUInt32 sub_unit;
sub_unit = 2;    // Break Relays
data[0] = 1;     // Connects channel 1 Break relay
data[0] = 0;     // Resets Break Relay Sub-unit
PIL_WriteSub( vi, sub_unit, data);

sub_unit = 4;    // Fault Bus 2
data[0] = 2;     // Operates the channel 2, Fault Bus 2 relay
data[0] = 0;     // Disconnects fault 1 Bus
PIL_WriteSub( vi, sub_unit, data);

sub_unit = 6;    // Fault MUX 2
data[0] = 1;     // Connects input F5 to Fault Bus 2
data[0] = 0;     // Disconnects Fault MUX 2
PIL_WriteSub( vi, sub_unit, data);

sub_unit = 7;    // Fault Monitor 1 & 2
data[0] = 2;     // Connects Monitor 2 to Fault Bus 2
data[0] = 0;     // Disconnects Monitor 2 from Fault Bus 2
PIL_WriteSub( vi, sub_unit, data);
```

Using pi40iv

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

```
pi40iv_Connect(vi, comB1, chB1);    // Operates the channel 1 Break relay
pi40iv_Disconnect(vi, comB1, chB1); // Releases the channel 1 Break relay
pi40iv_Connect(vi, comD2, chD2);    // Operates the channel 2, Fault Bus 2 relay
pi40iv_Connect(vi, comF, chF1);     // Connects input F5 to Fault Bus 2
pi40iv_Connect(vi, comG, chG2);     // Connects Monitor 2 to Fault Bus 2
```

The IVI Swtch driver specification contains no bulk setting capabilities.

Programming The 40-190B Single Fault Bus Versions Using Multiple Sub-Units (Mode B)

Here are examples of using drivers with the single fault bus versions of the 40-190B using sub-units 2-5. The examples shown are for the 40-190B-201 (32-channel, single bus), other single bus versions operate in the same way but with different numbers of bits in the sub-units. Refer to Tables 4.7, 4.8 and 4.9 for the bit usage within each sub-unit.

Using PILPXI

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

OpBit

```
DWORD sub_unit = 2; // Break Relays
PIL_OpBit( card_num, sub_unit, 1, 1); // Operates the channel 1 Break relay
PIL_OpBit( card_num, sub_unit, 1, 0); // Releases the channel 1 Break relay


sub_unit = 3;       // Fault Bus 1
PIL_OpBit( card_num, sub_unit, 2, 1); // Operates the channel 2, Fault Bus 1 relay


sub_unit = 4;       // Fault MUX
PIL_OpBit( card_num, sub_unit, 1, 1); // Connects input F1 to Fault Bus 1


sub_unit = 5;       // Fault Monitor 1
PIL_OpBit( card_num, sub_unit, 1, 1); // Connects Monitor 1 to Fault Bus 1
```

WriteSub

```
// Sub-unit 2-5 are each 32 bits wide and hence required 1 DWORD is needed for each
sub-unit to hold the entire pattern
DWORD data[0];
DWORD sub_unit;
sub_unit = 2;   // Break Relays
data[0] = 1;    // Connects channel 1 break relay
data[0] = 0;    // Resets Break Relay Sub-unit
PIL_WriteSub( card_num, sub_unit, data);


sub_unit = 3;   // Fault Bus
data[0] = 2;    // Operates the channel 2, Fault Bus 1 relay
data[0] = 0;    // Disconnects fault 1 Bus
PIL_WriteSub( card_num, sub_unit, data);


sub_unit = 4;   // Fault MUX
data[0] = 1;    // Connects input F1 to Fault Bus 1
data[0] = 0;    // Disconnects Fault MUX 1
PIL_WriteSub( card_num, sub_unit, data);


sub_unit = 5;   // Fault Monitor 1
data[0] = 1;    // Connects input Monitor to Fault Bus 1
data[0] = 0;    // Disconnects input Monitor 1 to Fault Bus 1
PIL_WriteSub( card_num, sub_unit, data);
```

Using PIPX40

setChannelState

```
ViUInt32 sub_unit = 2;    // Break Relays
pipx40_setChannelState(vi, sub_unit, 1, VI_ON);     // Operates the channel 1 Break relay
pipx40_setChannelState(vi, sub_unit, 1, VI_OFF);    // Releases the channel 1 Break relay

sub_unit = 3;             // Fault Bus 1
pipx40_setChannelState(vi, sub_unit, 2, VI_ON);// Operates the channel 2 Fault Bus 1 relay

sub_unit = 4;             // Fault MUX 1
pipx40_setChannelState(vi, sub_unit, 1, VI_ON);     // Connects input F1 to Fault Bus 1

sub_unit = 5;             // Fault Monitor 1
pipx40_setChannelState(vi, sub_unit, 1, VI_ON);     // Connects Monitor 1 to Fault Bus 1
```

setChannelPattern

```
// Sub-unit 2-5 are each 32 bits wide and hence required 1 ViUInt32 is needed for each
sub-unit to hold the entire pattern

ViUInt32 data[0];
ViUInt32 sub_unit;
sub_unit = 2;    // Break Relays
data[0] = 1;     // Connects channel 1 Break relay
data[0] = 0;     // Resets Break Relay Sub-unit
PIL_WriteSub( vi, sub_unit, data);

sub_unit = 3;    // Fault Bus
data[0] = 2;     // Operates the channel 2, Fault Bus 1 relay
data[0] = 0;     // Disconnects fault 1 Bus
PIL_WriteSub( vi, sub_unit, data);

sub_unit = 4;    // Fault MUX
data[0] = 1;     // Connects input F1 to Fault Bus 1
data[0] = 0;     // Disconnects Fault MUX 1
PIL_WriteSub( vi, sub_unit, data);

sub_unit = 5;    // Fault Monitor 1
data[0] = 1;     // Connects input Monitor to Fault Bus 1
data[0] = 0;     // Disconnects input Monitor 1 to Fault Bus 1
PIL_WriteSub( vi, sub_unit, data);
```

Using pi40iv

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

```
pi40iv_Connect(vi, comB1, chB1);    // Operates the channel 1 Break relay
pi40iv_Disconnect(vi, comB1, chB1); // Releases the channel 1 Break relay
pi40iv_Connect(vi, comC2, chC2);    // Operates the channel 2, Fault Bus 1 relay
pi40iv_Connect(vi, comD, chD1);     // Connects input F1 to Fault Bus 1
pi40iv_Connect(vi, comE, chE1);     // Connects Monitor 1 to Fault Bus 1
```

The IVI Swtch driver specification contains no bulk setting capabilities.

USING PICKERING DRIVERS IN LabVIEW

Most Pickering drivers include a LabVIEW wrapper to permit full operation of the Pickering product from the LabVIEW environment. These wrappers are normally installed to the current LabVIEW folder system during installation of the Pickering driver.

The process of controlling a Pickering product normally consists of the following steps:

1. Open a control session on the product
2. Use functions in the library to operate the product
3. Close the control session

Following is a simple example of the use of the most common Pickering drivers:

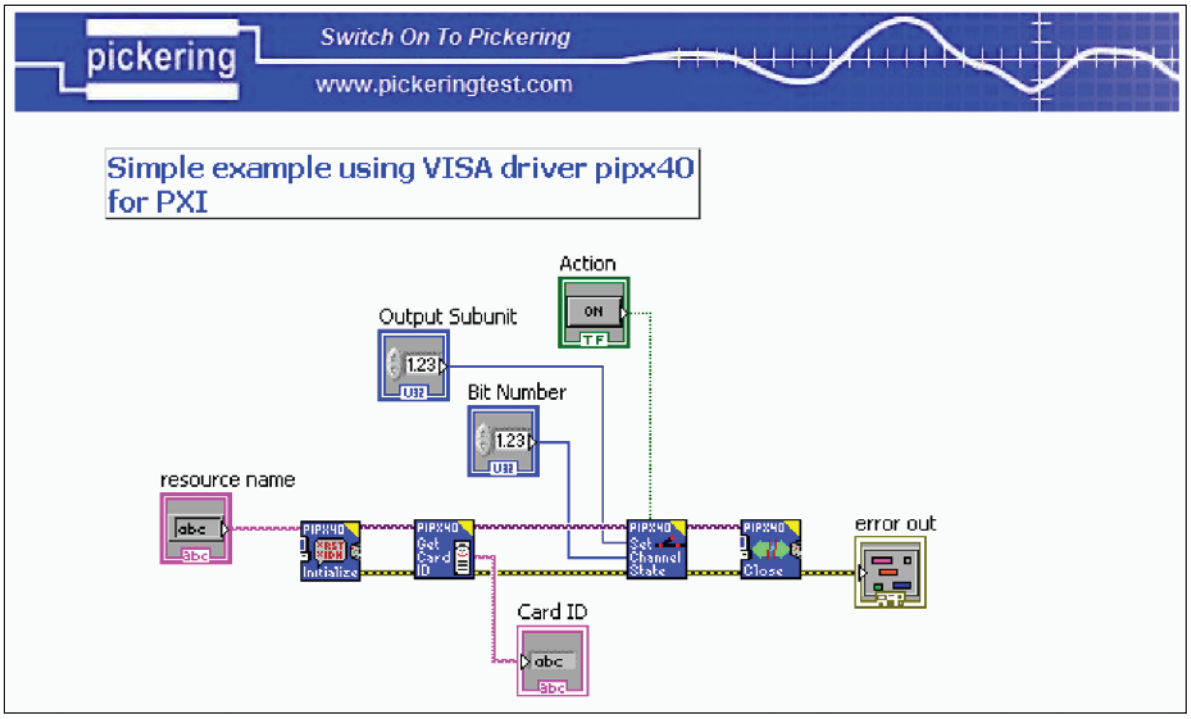


Figure 4.7 - Example Use of Pickering Drivers in LabVIEW

To download LabVIEW examples, please go to:

http://wiki.pickeringtest.net/Using+Pickering+Drivers+in+LabView

RELAY/BIT LOOK-UP TABLES - SINGLE SUB-UNIT CONTROL

Table 4.1 - Relay/Bit Table for 40-190B-001 & 40-190B-301 (74-channel, single bus versions) for Sub-Unit 1 Including IVI Channel Names

BIT TO RELAY FUNCTION CROSS REFERENCE TABLE (40-190B-001/301)														
Sub-Unit	Bit	Function	IVI Channel Names		Sub-Unit	Bit	Function	IVI Channel Names		Sub-Unit	Bit	Function	IVI Channel Names	
1	1	CH1 Break	comA1	chA1	1	52	CH26 Fault1	comA52	chA52	1	103	CH52 Break	comA103	chA103
1	2	CH1 Fault1	comA2	chA2	1	53	CH27 Break	comA53	chA53	1	104	CH52 Fault1	comA104	chA104
1	3	CH2 Break	comA3	chA3	1	54	CH27 Fault1	comA54	chA54	1	105	CH53 Break	comA105	chA105
1	4	CH2 Fault1	comA4	chA4	1	55	CH28 Break	comA55	chA55	1	106	CH53 Fault1	comA106	chA106
1	5	CH3 Break	comA5	chA5	1	56	CH28 Fault1	comA56	chA56	1	107	CH54 Break	comA107	chA107
1	6	CH3 Fault1	comA6	chA6	1	57	CH29 Break	comA57	chA57	1	108	CH54 Fault1	comA108	chA108
1	7	CH4 Break	comA7	chA7	1	58	CH29 Fault1	comA58	chA58	1	109	CH55 Break	comA109	chA109
1	8	CH4 Fault1	comA8	chA8	1	59	CH30 Break	comA59	chA59	1	110	CH55 Fault1	comA110	chA110
1	9	CH5 Break	comA9	chA9	1	60	CH30 Fault1	comA60	chA60	1	111	CH56 Break	comA111	chA111
1	10	CH5 Fault1	comA10	chA10	1	61	CH31 Break	comA61	chA61	1	112	CH56 Fault1	comA112	chA112
1	11	CH6 Break	comA11	chA11	1	62	CH31 Fault1	comA62	chA62	1	113	CH57 Break	comA113	chA113
1	12	CH6 Fault1	comA12	chA12	1	63	CH32 Break	comA63	chA63	1	114	CH57 Fault1	comA114	chA114
1	13	CH7 Break	comA13	chA13	1	64	CH32 Fault1	comA64	chA64	1	115	CH58 Break	comA115	chA115
1	14	CH7 Fault1	comA14	chA14	1	65	CH33 Break	comA65	chA65	1	116	CH58 Fault1	comA116	chA116
1	15	CH8 Break	comA15	chA15	1	66	CH33 Fault1	comA66	chA66	1	117	CH59 Break	comA117	chA117
1	16	CH8 Fault1	comA16	chA16	1	67	CH34 Break	comA67	chA67	1	118	CH59 Fault1	comA118	chA118
1	17	CH9 Break	comA17	chA17	1	68	CH34 Fault1	comA68	chA68	1	119	CH60 Break	comA119	chA119
1	18	CH9 Fault1	comA18	chA18	1	69	CH35 Break	comA69	chA69	1	120	CH60 Fault1	comA120	chA120
1	19	CH10 Break	comA19	chA19	1	70	CH35 Fault1	comA70	chA70	1	121	CH61 Break	comA121	chA121
1	20	CH10 Fault1	comA20	chA20	1	71	CH36 Break	comA71	chA71	1	122	CH61 Fault1	comA122	chA122
1	21	CH11 Break	comA21	chA21	1	72	CH36 Fault1	comA72	chA72	1	123	CH62 Break	comA123	chA123
1	22	CH11 Fault1	comA22	chA22	1	73	CH37 Break	comA73	chA73	1	124	CH62 Fault1	comA124	chA124
1	23	CH12 Break	comA23	chA23	1	74	CH37 Fault1	comA74	chA74	1	125	CH63 Break	comA125	chA125
1	24	CH12 Fault1	comA24	chA24	1	75	CH38 Break	comA75	chA75	1	126	CH63 Fault1	comA126	chA126
1	25	CH13 Break	comA25	chA25	1	76	CH38 Fault1	comA76	chA76	1	127	CH64 Break	comA127	chA127
1	26	CH13 Fault1	comA26	chA26	1	77	CH39 Break	comA77	chA77	1	128	CH64 Fault1	comA128	chA128
1	27	CH14 Break	comA27	chA27	1	78	CH39 Fault1	comA78	chA78	1	129	CH65 Break	comA129	chA129
1	28	CH14 Fault1	comA28	chA28	1	79	CH40 Break	comA79	chA79	1	130	CH65 Fault1	comA130	chA130
1	29	CH15 Break	comA29	chA29	1	80	CH40 Fault1	comA80	chA80	1	131	CH66 Break	comA131	chA131
1	30	CH15 Fault1	comA30	chA30	1	81	CH41 Break	comA81	chA81	1	132	CH66 Fault1	comA132	chA132
1	31	CH16 Break	comA31	chA31	1	82	CH41 Fault1	comA82	chA82	1	133	CH67 Break	comA133	chA133
1	32	CH16 Fault1	comA32	chA32	1	83	CH42 Break	comA83	chA83	1	134	CH67 Fault1	comA134	chA134
1	33	CH17 Break	comA33	chA33	1	84	CH42 Fault1	comA84	chA84	1	135	CH68 Break	comA135	chA135
1	34	CH17 Fault1	comA34	chA34	1	85	CH43 Break	comA85	chA85	1	136	CH68 Fault1	comA136	chA136
1	35	CH18 Break	comA35	chA35	1	86	CH43 Fault1	comA86	chA86	1	137	CH69 Break	comA137	chA137
1	36	CH18 Fault1	comA36	chA36	1	87	CH44 Break	comA87	chA87	1	138	CH69 Fault1	comA138	chA138
1	37	CH19 Break	comA37	chA37	1	88	CH44 Fault1	comA88	chA88	1	139	CH70 Break	comA139	chA139
1	38	CH19 Fault1	comA38	chA38	1	89	CH45 Break	comA89	chA89	1	140	CH70 Fault1	comA140	chA140
1	39	CH20 Break	comA39	chA39	1	90	CH45 Fault1	comA90	chA90	1	141	CH71 Break	comA141	chA141
1	40	CH20 Fault1	comA40	chA40	1	91	CH46 Break	comA91	chA91	1	142	CH71 Fault1	comA142	chA142
1	41	CH21 Break	comA41	chA41	1	92	CH46 Fault1	comA92	chA92	1	143	CH72 Break	comA143	chA143
1	42	CH21 Fault1	comA42	chA42	1	93	CH47 Break	comA93	chA93	1	144	CH72 Fault1	comA144	chA144
1	43	CH22 Break	comA43	chA43	1	94	CH47 Fault1	comA94	chA94	1	145	CH73 Break	comA145	chA145
1	44	CH22 Fault1	comA44	chA44	1	95	CH48 Break	comA95	chA95	1	146	CH73 Fault1	comA146	chA146
1	45	CH23 Break	comA45	chA45	1	96	CH48 Fault1	comA96	chA96	1	147	CH74 Break	comA147	chA147
1	46	CH23 Fault1	comA46	chA46	1	97	CH49 Break	comA97	chA97	1	148	CH74 Fault1	comA148	chA148
1	47	CH24 Break	comA47	chA47	1	98	CH49 Fault1	comA98	chA98	1	149	Fault Select 1	comA149	chA149
1	48	CH24 Fault1	comA48	chA48	1	99	CH50 Break	comA99	chA99	1	150	Fault Select 2	comA150	chA150
1	49	CH25 Break	comA49	chA49	1	100	CH50 Fault1	comA100	chA100	1	151	Fault Select 3	comA151	chA151
1	50	CH25 Fault1	comA50	chA50	1	101	CH51 Break	comA101	chA101	1	152	Fault Select 4	comA152	chA152
1	51	CH26 Break	comA51	chA51	1	102	CH51 Fault1	comA102	chA102	1	153	Monitor 1	comA153	chA153

Table 4.2 - Relay/Bit Table for 40-190B-101 & 40-190B-401 (64-channel, single bus versions) for Sub-Unit 1 Including IVI Channel Names

BIT TO RELAY FUNCTION CROSS REFERENCE TABLE (40-190B-101/401)														
Sub-Unit	Bit	Function	IVI Channel Names		Sub-Unit	Bit	Function	IVI Channel Names		Sub-Unit	Bit	Function	IVI Channel Names	
1	1	CH1 Break	comA1	chA1	1	45	CH23 Break	comA45	chA45	1	89	CH45 Break	comA89	chA89
1	2	CH1 Fault1	comA2	chA2	1	46	CH23 Fault1	comA46	chA46	1	90	CH45 Fault1	comA90	chA90
1	3	CH2 Break	comA3	chA3	1	47	CH24 Break	comA47	chA47	1	91	CH46 Break	comA91	chA91
1	4	CH2 Fault1	comA4	chA4	1	48	CH24 Fault1	comA48	chA48	1	92	CH46 Fault1	comA92	chA92
1	5	CH3 Break	comA5	chA5	1	49	CH25 Break	comA49	chA49	1	93	CH47 Break	comA93	chA93
1	6	CH3 Fault1	comA6	chA6	1	50	CH25 Fault1	comA50	chA50	1	94	CH47 Fault1	comA94	chA94
1	7	CH4 Break	comA7	chA7	1	51	CH26 Break	comA51	chA51	1	95	CH48 Break	comA95	chA95
1	8	CH4 Fault1	comA8	chA8	1	52	CH26 Fault1	comA52	chA52	1	96	CH48 Fault1	comA96	chA96
1	9	CH5 Break	comA9	chA9	1	53	CH27 Break	comA53	chA53	1	97	CH49 Break	comA97	chA97
1	10	CH5 Fault1	comA10	chA10	1	54	CH27 Fault1	comA54	chA54	1	98	CH49 Fault1	comA98	chA98
1	11	CH6 Break	comA11	chA11	1	55	CH28 Break	comA55	chA55	1	99	CH50 Break	comA99	chA99
1	12	CH6 Fault1	comA12	chA12	1	56	CH28 Fault1	comA56	chA56	1	100	CH50 Fault1	comA100	chA100
1	13	CH7 Break	comA13	chA13	1	57	CH29 Break	comA57	chA57	1	101	CH51 Break	comA101	chA101
1	14	CH7 Fault1	comA14	chA14	1	58	CH29 Fault1	comA58	chA58	1	102	CH51 Fault1	comA102	chA102
1	15	CH8 Break	comA15	chA15	1	59	CH30 Break	comA59	chA59	1	103	CH52 Break	comA103	chA103
1	16	CH8 Fault1	comA16	chA16	1	60	CH30 Fault1	comA60	chA60	1	104	CH52 Fault1	comA104	chA104
1	17	CH9 Break	comA17	chA17	1	61	CH31 Break	comA61	chA61	1	105	CH53 Break	comA105	chA105
1	18	CH9 Fault1	comA18	chA18	1	62	CH31 Fault1	comA62	chA62	1	106	CH53 Fault1	comA106	chA106
1	19	CH10 Break	comA19	chA19	1	63	CH32 Break	comA63	chA63	1	107	CH54 Break	comA107	chA107
1	20	CH10 Fault1	comA20	chA20	1	64	CH32 Fault1	comA64	chA64	1	108	CH54 Fault1	comA108	chA108
1	21	CH11 Break	comA21	chA21	1	65	CH33 Break	comA65	chA65	1	109	CH55 Break	comA109	chA109
1	22	CH11 Fault1	comA22	chA22	1	66	CH33 Fault1	comA66	chA66	1	110	CH55 Fault1	comA110	chA110
1	23	CH12 Break	comA23	chA23	1	67	CH34 Break	comA67	chA67	1	111	CH56 Break	comA111	chA111
1	24	CH12 Fault1	comA24	chA24	1	68	CH34 Fault1	comA68	chA68	1	112	CH56 Fault1	comA112	chA112
1	25	CH13 Break	comA25	chA25	1	69	CH35 Break	comA69	chA69	1	113	CH57 Break	comA113	chA113
1	26	CH13 Fault1	comA26	chA26	1	70	CH35 Fault1	comA70	chA70	1	114	CH57 Fault1	comA114	chA114
1	27	CH14 Break	comA27	chA27	1	71	CH36 Break	comA71	chA71	1	115	CH58 Break	comA115	chA115
1	28	CH14 Fault1	comA28	chA28	1	72	CH36 Fault1	comA72	chA72	1	116	CH58 Fault1	comA116	chA116
1	29	CH15 Break	comA29	chA29	1	73	CH37 Break	comA73	chA73	1	117	CH59 Break	comA117	chA117
1	30	CH15 Fault1	comA30	chA30	1	74	CH37 Fault1	comA74	chA74	1	118	CH59 Fault1	comA118	chA118
1	31	CH16 Break	comA31	chA31	1	75	CH38 Break	comA75	chA75	1	119	CH60 Break	comA119	chA119
1	32	CH16 Fault1	comA32	chA32	1	76	CH38 Fault1	comA76	chA76	1	120	CH60 Fault1	comA120	chA120
1	33	CH17 Break	comA33	chA33	1	77	CH39 Break	comA77	chA77	1	121	CH61 Break	comA121	chA121
1	34	CH17 Fault1	comA34	chA34	1	78	CH39 Fault1	comA78	chA78	1	122	CH61 Fault1	comA122	chA122
1	35	CH18 Break	comA35	chA35	1	79	CH40 Break	comA79	chA79	1	123	CH62 Break	comA123	chA123
1	36	CH18 Fault1	comA36	chA36	1	80	CH40 Fault1	comA80	chA80	1	124	CH62 Fault1	comA124	chA124
1	37	CH19 Break	comA37	chA37	1	81	CH41 Break	comA81	chA81	1	125	CH63 Break	comA125	chA125
1	38	CH19 Fault1	comA38	chA38	1	82	CH41 Fault1	comA82	chA82	1	126	CH63 Fault1	comA126	chA126
1	39	CH20 Break	comA39	chA39	1	83	CH42 Break	comA83	chA83	1	127	CH64 Break	comA127	chA127
1	40	CH20 Fault1	comA40	chA40	1	84	CH42 Fault1	comA84	chA84	1	128	CH64 Fault1	comA128	chA128
1	41	CH21 Break	comA41	chA41	1	85	CH43 Break	comA85	chA85	1	129	Fault Select 1	comA129	chA129
1	42	CH21 Fault1	comA42	chA42	1	86	CH43 Fault1	comA86	chA86	1	130	Fault Select 2	comA130	chA130
1	43	CH22 Break	comA43	chA43	1	87	CH44 Break	comA87	chA87	1	131	Fault Select 3	comA131	chA131
1	44	CH22 Fault1	comA44	chA44	1	88	CH44 Fault1	comA88	chA88	1	132	Fault Select 4	comA132	chA132
										1	133	Monitor 1	comA133	chA133

Table 4.3 - Relay/Bit Table for 40-190B-201 & 40-190B-501 (32-channel, single bus versions) for Sub-Unit 1 Including IVI Channel Names

BIT TO RELAY FUNCTION CROSS REFERENCE TABLE (40-190B-201/501)									
Sub-Unit	Bit	Function	IVI Channel Names		Sub-Unit	Bit	Function	IVI Channel Names	
1	1	CH1 Break	comA1	chA1	1	35	CH18 Break	comA35	chA35
1	2	CH1 Fault1	comA2	chA2	1	36	CH18 Fault1	comA36	chA36
1	3	CH2 Break	comA3	chA3	1	37	CH19 Break	comA37	chA37
1	4	CH2 Fault1	comA4	chA4	1	38	CH19 Fault1	comA38	chA38
1	5	CH3 Break	comA5	chA5	1	39	CH20 Break	comA39	chA39
1	6	CH3 Fault1	comA6	chA6	1	40	CH20 Fault1	comA40	chA40
1	7	CH4 Break	comA7	chA7	1	41	CH21 Break	comA41	chA41
1	8	CH4 Fault1	comA8	chA8	1	42	CH21 Fault1	comA42	chA42
1	9	CH5 Break	comA9	chA9	1	43	CH22 Break	comA43	chA43
1	10	CH5 Fault1	comA10	chA10	1	44	CH22 Fault1	comA44	chA44
1	11	CH6 Break	comA11	chA11	1	45	CH23 Break	comA45	chA45
1	12	CH6 Fault1	comA12	chA12	1	46	CH23 Fault1	comA46	chA46
1	13	CH7 Break	comA13	chA13	1	47	CH24 Break	comA47	chA47
1	14	CH7 Fault1	comA14	chA14	1	48	CH24 Fault1	comA48	chA48
1	15	CH8 Break	comA15	chA15	1	49	CH25 Break	comA49	chA49
1	16	CH8 Fault1	comA16	chA16	1	50	CH25 Fault1	comA50	chA50
1	17	CH9 Break	comA17	chA17	1	51	CH26 Break	comA51	chA51
1	18	CH9 Fault1	comA18	chA18	1	52	CH26 Fault1	comA52	chA52
1	19	CH10 Break	comA19	chA19	1	53	CH27 Break	comA53	chA53
1	20	CH10 Fault1	comA20	chA20	1	54	CH27 Fault1	comA54	chA54
1	21	CH11 Break	comA21	chA21	1	55	CH28 Break	comA55	chA55
1	22	CH11 Fault1	comA22	chA22	1	56	CH28 Fault1	comA56	chA56
1	23	CH12 Break	comA23	chA23	1	57	CH29 Break	comA57	chA57
1	24	CH12 Fault1	comA24	chA24	1	58	CH29 Fault1	comA58	chA58
1	25	CH13 Break	comA25	chA25	1	59	CH30 Break	comA59	chA59
1	26	CH13 Fault1	comA26	chA26	1	60	CH30 Fault1	comA60	chA60
1	27	CH14 Break	comA27	chA27	1	61	CH31 Break	comA61	chA61
1	28	CH14 Fault1	comA28	chA28	1	62	CH31 Fault1	comA62	chA62
1	29	CH15 Break	comA29	chA29	1	63	CH32 Break	comA63	chA63
1	30	CH15 Fault1	comA30	chA30	1	64	CH32 Fault1	comA64	chA64
1	31	CH16 Break	comA31	chA31	1	65	Fault Sel. 1	comA65	chA65
1	32	CH16 Fault1	comA32	chA32	1	66	Fault Sel. 2	comA66	chA66
1	33	CH17 Break	comA33	chA33	1	67	Fault Sel. 3	comA67	chA67
1	34	CH17 Fault1	comA34	chA34	1	68	Fault Sel. 4	comA68	chA68
					1	69	Monitor 1	comA69	chA69

Table 4.4 - Relay/Bit Table for 40-190B-002 & 40-190B-302 (74-channel, dual bus versions) for Sub-Unit 1 Including IVI Channel Names

BIT TO RELAY FUNCTION CROSS REFERENCE TABLE (40-190B-002/302)									
Sub-Unit	Bit	Function	IVI Channel Names		Sub-Unit	Bit	Function	IVI Channel Names	
1	1	CH1 Break	comA1	chA1	1	59	CH20 Fault1	comA59	chA59
1	2	CH1 Fault1	comA2	chA2	1	60	CH20 Fault2	comA60	chA60
1	3	CH1 Fault2	comA3	chA3	1	61	CH21 Break	comA61	chA61
1	4	CH2 Break	comA4	chA4	1	62	CH21 Fault1	comA62	chA62
1	5	CH2 Fault1	comA5	chA5	1	63	CH21 Fault2	comA63	chA63
1	6	CH2 Fault2	comA6	chA6	1	64	CH22 Break	comA64	chA64
1	7	CH3 Break	comA7	chA7	1	65	CH22 Fault1	comA65	chA65
1	8	CH3 Fault1	comA8	chA8	1	66	CH22 Fault2	comA66	chA66
1	9	CH3 Fault2	comA9	chA9	1	67	CH23 Break	comA67	chA67
1	10	CH4 Break	comA10	chA10	1	68	CH23 Fault1	comA68	chA68
1	11	CH4 Fault1	comA11	chA11	1	69	CH23 Fault2	comA69	chA69
1	12	CH4 Fault2	comA12	chA12	1	70	CH24 Break	comA70	chA70
1	13	CH5 Break	comA13	chA13	1	71	CH24 Fault1	comA71	chA71
1	14	CH5 Fault1	comA14	chA14	1	72	CH24 Fault2	comA72	chA72
1	15	CH5 Fault2	comA15	chA15	1	73	CH25 Break	comA73	chA73
1	16	CH6 Break	comA16	chA16	1	74	CH25 Fault1	comA74	chA74
1	17	CH6 Fault1	comA17	chA17	1	75	CH25 Fault2	comA75	chA75
1	18	CH6 Fault2	comA18	chA18	1	76	CH26 Break	comA76	chA76
1	19	CH7 Break	comA19	chA19	1	77	CH26 Fault1	comA77	chA77
1	20	CH7 Fault1	comA20	chA20	1	78	CH26 Fault2	comA78	chA78
1	21	CH7 Fault2	comA21	chA21	1	79	CH27 Break	comA79	chA79
1	22	CH8 Break	comA22	chA22	1	80	CH27 Fault1	comA80	chA80
1	23	CH8 Fault1	comA23	chA23	1	81	CH27 Fault2	comA81	chA81
1	24	CH8 Fault2	comA24	chA24	1	82	CH28 Break	comA82	chA82
1	25	CH9 Break	comA25	chA25	1	83	CH28 Fault1	comA83	chA83
1	26	CH9 Fault1	comA26	chA26	1	84	CH28 Fault2	comA84	chA84
1	27	CH9 Fault2	comA27	chA27	1	85	CH29 Break	comA85	chA85
1	28	CH10 Break	comA28	chA28	1	86	CH29 Fault1	comA86	chA86
1	29	CH10 Fault1	comA29	chA29	1	87	CH29 Fault2	comA87	chA87
1	30	CH10 Fault2	comA30	chA30	1	88	CH30 Break	comA88	chA88
1	31	CH11 Break	comA31	chA31	1	89	CH30 Fault1	comA89	chA89
1	32	CH11 Fault1	comA32	chA32	1	90	CH30 Fault2	comA90	chA90
1	33	CH11 Fault2	comA33	chA33	1	91	CH31 Break	comA91	chA91
1	34	CH12 Break	comA34	chA34	1	92	CH31 Fault1	comA92	chA92
1	35	CH12 Fault1	comA35	chA35	1	93	CH31 Fault2	comA93	chA93
1	36	CH12 Fault2	comA36	chA36	1	94	CH32 Break	comA94	chA94
1	37	CH13 Break	comA37	chA37	1	95	CH32 Fault1	comA95	chA95
1	38	CH13 Fault1	comA38	chA38	1	96	CH32 Fault2	comA96	chA96
1	39	CH13 Fault2	comA39	chA39	1	97	CH33 Break	comA97	chA97
1	40	CH14 Break	comA40	chA40	1	98	CH33 Fault1	comA98	chA98
1	41	CH14 Fault1	comA41	chA41	1	99	CH33 Fault2	comA99	chA99
1	42	CH14 Fault2	comA42	chA42	1	100	CH34 Break	comA100	chA100
1	43	CH15 Break	comA43	chA43	1	101	CH34 Fault1	comA101	chA101
1	44	CH15 Fault1	comA44	chA44	1	102	CH34 Fault2	comA102	chA102
1	45	CH15 Fault2	comA45	chA45	1	103	CH35 Break	comA103	chA103
1	46	CH16 Break	comA46	chA46	1	104	CH35 Fault1	comA104	chA104
1	47	CH16 Fault1	comA47	chA47	1	105	CH35 Fault2	comA105	chA105
1	48	CH16 Fault2	comA48	chA48	1	106	CH36 Break	comA106	chA106
1	49	CH17 Break	comA49	chA49	1	107	CH36 Fault1	comA107	chA107
1	50	CH17 Fault1	comA50	chA50	1	108	CH36 Fault2	comA108	chA108
1	51	CH17 Fault2	comA51	chA51	1	109	CH37 Break	comA109	chA109
1	52	CH18 Break	comA52	chA52	1	110	CH37 Fault1	comA110	chA110
1	53	CH18 Fault1	comA53	chA53	1	111	CH37 Fault2	comA111	chA111
1	54	CH18 Fault2	comA54	chA54	1	112	CH38 Break	comA112	chA112
1	55	CH19 Break	comA55	chA55	1	113	CH38 Fault1	comA113	chA113
1	56	CH19 Fault1	comA56	chA56	1	114	CH38 Fault2	comA114	chA114
1	57	CH19 Fault2	comA57	chA57	1	115	CH39 Break	comA115	chA115
1	58	CH20 Break	comA58	chA58	1	116	CH39 Fault1	comA116	chA116

Table 4.4 Continued - Relay/Bit Table for 40-190B-002 & 40-190B-302 (74-channel, dual bus versions) for Sub-Unit 1 Including IVI Channel Names

BIT TO RELAY FUNCTION CROSS REFERENCE TABLE (40-190B-002/302)										
Sub-Unit	Bit	Function	IVI Channel Names		Sub-Unit	Bit	Function	IVI Channel Names	
1	117	CH39 Fault2	comA117	chA117	1	175	CH59 Break	comA175	chA175
1	118	CH40 Break	comA118	chA118	1	176	CH59 Fault1	comA176	chA176
1	119	CH40 Fault1	comA119	chA119	1	177	CH59 Fault2	comA177	chA177
1	120	CH40 Fault2	comA120	chA120	1	178	CH60 Break	comA178	chA178
1	121	CH41 Break	comA121	chA121	1	179	CH60 Fault1	comA179	chA179
1	122	CH41 Fault1	comA122	chA122	1	180	CH60 Fault2	comA180	chA180
1	123	CH41 Fault2	comA123	chA123	1	181	CH61 Break	comA181	chA181
1	124	CH42 Break	comA124	chA124	1	182	CH61 Fault1	comA182	chA182
1	125	CH42 Fault1	comA125	chA125	1	183	CH61 Fault2	comA183	chA183
1	126	CH42 Fault2	comA126	chA126	1	184	CH62 Break	comA184	chA184
1	127	CH43 Break	comA127	chA127	1	185	CH62 Fault1	comA185	chA185
1	128	CH43 Fault1	comA128	chA128	1	186	CH62 Fault2	comA186	chA186
1	129	CH43 Fault2	comA129	chA129	1	187	CH63 Break	comA187	chA187
1	130	CH44 Break	comA130	chA130	1	188	CH63 Fault1	comA188	chA188
1	131	CH44 Fault1	comA131	chA131	1	189	CH63 Fault2	comA189	chA189
1	132	CH44 Fault2	comA132	chA132	1	190	CH64 Break	comA190	chA190
1	133	CH45 Break	comA133	chA133	1	191	CH64 Fault1	comA191	chA191
1	134	CH45 Fault1	comA134	chA134	1	192	CH64 Fault2	comA192	chA192
1	135	CH45 Fault2	comA135	chA135	1	193	CH65 Break	comA193	chA193
1	136	CH46 Break	comA136	chA136	1	194	CH65 Fault1	comA194	chA194
1	137	CH46 Fault1	comA137	chA137	1	195	CH65 Fault2	comA195	chA195
1	138	CH46 Fault2	comA138	chA138	1	196	CH66 Break	comA196	chA196
1	139	CH47 Break	comA139	chA139	1	197	CH66 Fault1	comA197	chA197
1	140	CH47 Fault1	comA140	chA140	1	198	CH66 Fault2	comA198	chA198
1	141	CH47 Fault2	comA141	chA141	1	199	CH67 Break	comA199	chA199
1	142	CH48 Break	comA142	chA142	1	200	CH67 Fault1	comA200	chA200
1	143	CH48 Fault1	comA143	chA143	1	201	CH67 Fault2	comA201	chA201
1	144	CH48 Fault2	comA144	chA144	1	202	CH68 Break	comA202	chA202
1	145	CH49 Break	comA145	chA145	1	203	CH68 Fault1	comA203	chA203
1	146	CH49 Fault1	comA146	chA146	1	204	CH68 Fault2	comA204	chA204
1	147	CH49 Fault2	comA147	chA147	1	205	CH69 Break	comA205	chA205
1	148	CH50 Break	comA148	chA148	1	206	CH69 Fault1	comA206	chA206
1	149	CH50 Fault1	comA149	chA149	1	207	CH69 Fault2	comA207	chA207
1	150	CH50 Fault2	comA150	chA150	1	208	CH70 Break	comA208	chA208
1	151	CH51 Break	comA151	chA151	1	209	CH70 Fault1	comA209	chA209
1	152	CH51 Fault1	comA152	chA152	1	210	CH70 Fault2	comA210	chA210
1	153	CH51 Fault2	comA153	chA153	1	211	CH71 Break	comA211	chA211
1	154	CH52 Break	comA154	chA154	1	212	CH71 Fault1	comA212	chA212
1	155	CH52 Fault1	comA155	chA155	1	231	CH71 Fault2	comA213	chA213
1	156	CH52 Fault2	comA156	chA156	1	214	CH72 Break	comA214	chA214
1	157	CH53 Break	comA157	chA157	1	215	CH72 Fault1	comA215	chA215
1	158	CH53 Fault1	comA158	chA158	1	216	CH72 Fault2	comA216	chA216
1	159	CH53 Fault2	comA159	chA159	1	217	CH73 Break	comA217	chA217
1	160	CH54 Break	comA160	chA160	1	218	CH73 Fault1	comA218	chA218
1	161	CH54 Fault1	comA161	chA161	1	219	CH73 Fault2	comA219	chA219
1	162	CH54 Fault2	comA162	chA162	1	220	CH74 Break	comA220	chA220
1	163	CH55 Break	comA163	chA163	1	221	CH74 Fault1	comA221	chA221
1	164	CH55 Fault1	comA164	chA164	1	222	CH74 Fault2	comA222	chA222
1	165	CH55 Fault2	comA165	chA165	1	223	Fault Select 1	comA223	chA223
1	166	CH56 Break	comA166	chA166	1	224	Fault Select 2	comA224	chA224
1	167	CH56 Fault1	comA167	chA167	1	225	Fault Select 3	comA225	chA225
1	168	CH56 Fault2	comA168	chA168	1	226	Fault Select 4	comA226	chA226
1	169	CH57 Break	comA168	chA169	1	227	Fault Select 5	comA227	chA227
1	170	CH57 Fault1	comA170	chA170	1	228	Fault Select 6	comA228	chA228
1	171	CH57 Fault2	comA171	chA171	1	229	Fault Select 7	comA229	chA229
1	172	CH58 Break	comA172	chA172	1	230	Fault Select 8	comA230	chA230
1	173	CH58 Fault1	comA173	chA173	1	231	Monitor 1	comA231	chA231
1	174	CH58 Fault2	comA174	chA174	1	232	Monitor 2	comA232	chA232

Table 4.5 - Relay/Bit Table for 40-190B-102 & 40-190B-302 (64-channel, dual bus versions) for Sub-Unit 1 Including IVI Channel Names

BIT TO RELAY FUNCTION CROSS REFERENCE TABLE (40-190B-102/402)									
Sub-Unit	Bit	Function	IVI Channel Names		Sub-Unit	Bit	Function	IVI Channel Names	
1	1	CH1 Break	comA1	chA1	1	51	CH17 Fault2	comA51	chA51
1	2	CH1 Fault1	comA2	chA2	1	52	CH18 Break	comA52	chA52
1	3	CH1 Fault2	comA3	chA3	1	53	CH18 Fault1	comA53	chA53
1	4	CH2 Break	comA4	chA4	1	54	CH18 Fault2	comA54	chA54
1	5	CH2 Fault1	comA5	chA5	1	55	CH19 Break	comA55	chA55
1	6	CH2 Fault2	comA6	chA6	1	56	CH19 Fault1	comA56	chA56
1	7	CH3 Break	comA7	chA7	1	57	CH19 Fault2	comA57	chA57
1	8	CH3 Fault1	comA8	chA8	1	58	CH20 Break	comA58	chA58
1	9	CH3 Fault2	comA9	chA9	1	59	CH20 Fault1	comA59	chA59
1	10	CH4 Break	comA10	chA10	1	60	CH20 Fault2	comA60	chA60
1	11	CH4 Fault1	comA11	chA11	1	61	CH21 Break	comA61	chA61
1	12	CH4 Fault2	comA12	chA12	1	62	CH21 Fault1	comA62	chA62
1	13	CH5 Break	comA13	chA13	1	63	CH21 Fault2	comA63	chA63
1	14	CH5 Fault1	comA14	chA14	1	64	CH22 Break	comA64	chA64
1	15	CH5 Fault2	comA15	chA15	1	65	CH22 Fault1	comA65	chA65
1	16	CH6 Break	comA16	chA16	1	66	CH22 Fault2	comA66	chA66
1	17	CH6 Fault1	comA17	chA17	1	67	CH23 Break	comA67	chA67
1	18	CH6 Fault2	comA18	chA18	1	68	CH23 Fault1	comA68	chA68
1	19	CH7 Break	comA19	chA19	1	69	CH23 Fault2	comA69	chA69
1	20	CH7 Fault1	comA20	chA20	1	70	CH24 Break	comA70	chA70
1	21	CH7 Fault2	comA21	chA21	1	71	CH24 Fault1	comA71	chA71
1	22	CH8 Break	comA22	chA22	1	72	CH24 Fault2	comA72	chA72
1	23	CH8 Fault1	comA23	chA23	1	73	CH25 Break	comA73	chA73
1	24	CH8 Fault2	comA24	chA24	1	74	CH25 Fault1	comA74	chA74
1	25	CH9 Break	comA25	chA25	1	75	CH25 Fault2	comA75	chA75
1	26	CH9 Fault1	comA26	chA26	1	76	CH26 Break	comA76	chA76
1	27	CH9 Fault2	comA27	chA27	1	77	CH26 Fault1	comA77	chA77
1	28	CH10 Break	comA28	chA28	1	78	CH26 Fault2	comA78	chA78
1	29	CH10 Fault1	comA29	chA29	1	79	CH27 Break	comA79	chA79
1	30	CH10 Fault2	comA30	chA30	1	80	CH27 Fault1	comA80	chA80
1	31	CH11 Break	comA31	chA31	1	81	CH27 Fault2	comA81	chA81
1	32	CH11 Fault1	comA32	chA32	1	82	CH28 Break	comA82	chA82
1	33	CH11 Fault2	comA33	chA33	1	83	CH28 Fault1	comA83	chA83
1	34	CH12 Break	comA34	chA34	1	84	CH28 Fault2	comA84	chA84
1	35	CH12 Fault1	comA35	chA35	1	85	CH29 Break	comA85	chA85
1	36	CH12 Fault2	comA36	chA36	1	86	CH29 Fault1	comA86	chA86
1	37	CH13 Break	comA37	chA37	1	87	CH29 Fault2	comA87	chA87
1	38	CH13 Fault1	comA38	chA38	1	88	CH30 Break	comA88	chA88
1	39	CH13 Fault2	comA39	chA39	1	89	CH30 Fault1	comA89	chA89
1	40	CH14 Break	comA40	chA40	1	90	CH30 Fault2	comA90	chA90
1	41	CH14 Fault1	comA41	chA41	1	91	CH31 Break	comA91	chA91
1	42	CH14 Fault2	comA42	chA42	1	92	CH31 Fault1	comA92	chA92
1	43	CH15 Break	comA43	chA43	1	93	CH31 Fault2	comA93	chA93
1	44	CH15 Fault1	comA44	chA44	1	94	CH32 Break	comA94	chA94
1	45	CH15 Fault2	comA45	chA45	1	95	CH32 Fault1	comA95	chA95
1	46	CH16 Break	comA46	chA46	1	96	CH32 Fault2	comA96	chA96
1	47	CH16 Fault1	comA47	chA47	1	97	CH33 Break	comA97	chA97
1	48	CH16 Fault2	comA48	chA48	1	98	CH33 Fault1	comA98	chA98
1	49	CH17 Break	comA49	chA49	1	99	CH33 Fault2	comA99	chA99
1	50	CH17 Fault1	comA50	chA50	1	100	CH34 Break	comA100	chA100

Table 4.5 Continued - Relay/Bit Table for 40-190B-102 & 40-190B-402 (64-channel, dual bus versions) for Sub-Unit 1 Including IVI Channel Names

BIT TO RELAY FUNCTION CROSS REFERENCE TABLE (40-190B-102/402)										
Sub-Unit	Bit	Function	IVI Channel Names		Sub-Unit	Bit	Function	IVI Channel Names	
1	101	CH34 Fault1	comA101	chA101	1	152	CH51 Fault1	comA152	chA152
1	102	CH34 Fault2	comA102	chA102	1	153	CH51 Fault2	comA153	chA153
1	103	CH35 Break	comA103	chA103	1	154	CH52 Break	comA154	chA154
1	104	CH35 Fault1	comA104	chA104	1	155	CH52 Fault1	comA155	chA155
1	105	CH35 Fault2	comA105	chA105	1	156	CH52 Fault2	comA156	chA156
1	106	CH36 Break	comA106	chA106	1	157	CH53 Break	comA157	chA157
1	107	CH36 Fault1	comA107	chA107	1	158	CH53 Fault1	comA158	chA158
1	108	CH36 Fault2	comA108	chA108	1	159	CH53 Fault2	comA159	chA159
1	109	CH37 Break	comA109	chA109	1	160	CH54 Break	comA160	chA160
1	110	CH37 Fault1	comA110	chA110	1	161	CH54 Fault1	comA161	chA161
1	111	CH37 Fault2	comA111	chA111	1	162	CH54 Fault2	comA162	chA162
1	112	CH38 Break	comA112	chA112	1	163	CH55 Break	comA163	chA163
1	113	CH38 Fault1	comA113	chA113	1	164	CH55 Fault1	comA164	chA164
1	114	CH38 Fault2	comA114	chA114	1	165	CH55 Fault2	comA165	chA165
1	115	CH39 Break	comA115	chA115	1	166	CH56 Break	comA166	chA166
1	116	CH39 Fault1	comA116	chA116	1	167	CH56 Fault1	comA167	chA167
1	117	CH39 Fault2	comA117	chA117	1	168	CH56 Fault2	comA168	chA168
1	118	CH40 Break	comA118	chA118	1	169	CH57 Break	comA168	chA169
1	119	CH40 Fault1	comA119	chA119	1	170	CH57 Fault1	comA170	chA170
1	120	CH40 Fault2	comA120	chA120	1	171	CH57 Fault2	comA171	chA171
1	121	CH41 Break	comA121	chA121	1	172	CH58 Break	comA172	chA172
1	122	CH41 Fault1	comA122	chA122	1	173	CH58 Fault1	comA173	chA173
1	123	CH41 Fault2	comA123	chA123	1	174	CH58 Fault2	comA174	chA174
1	124	CH42 Break	comA124	chA124	1	175	CH59 Break	comA175	chA175
1	125	CH42 Fault1	comA125	chA125	1	176	CH59 Fault1	comA176	chA176
1	126	CH42 Fault2	comA126	chA126	1	177	CH59 Fault2	comA177	chA177
1	127	CH43 Break	comA127	chA127	1	178	CH60 Break	comA178	chA178
1	128	CH43 Fault1	comA128	chA128	1	179	CH60 Fault1	comA179	chA179
1	129	CH43 Fault2	comA129	chA129	1	180	CH60 Fault2	comA180	chA180
1	130	CH44 Break	comA130	chA130	1	181	CH61 Break	comA181	chA181
1	131	CH44 Fault1	comA131	chA131	1	182	CH61 Fault1	comA182	chA182
1	132	CH44 Fault2	comA132	chA132	1	183	CH61 Fault2	comA183	chA183
1	133	CH45 Break	comA133	chA133	1	184	CH62 Break	comA184	chA184
1	134	CH45 Fault1	comA134	chA134	1	185	CH62 Fault1	comA185	chA185
1	135	CH45 Fault2	comA135	chA135	1	186	CH62 Fault2	comA186	chA186
1	136	CH46 Break	comA136	chA136	1	187	CH63 Break	comA187	chA187
1	137	CH46 Fault1	comA137	chA137	1	188	CH63 Fault1	comA188	chA188
1	138	CH46 Fault2	comA138	chA138	1	189	CH63 Fault2	comA189	chA189
1	139	CH47 Break	comA139	chA139	1	190	CH64 Break	comA190	chA190
1	140	CH47 Fault1	comA140	chA140	1	191	CH64 Fault1	comA191	chA191
1	141	CH47 Fault2	comA141	chA141	1	192	CH64 Fault2	comA192	chA192
1	142	CH48 Break	comA142	chA142	1	193	Fault Select 1	comA193	chA193
1	143	CH48 Fault1	comA143	chA143	1	194	Fault Select 2	comA194	chA194
1	144	CH48 Fault2	comA144	chA144	1	195	Fault Select 3	comA195	chA195
1	145	CH49 Break	comA145	chA145	1	196	Fault Select 4	comA196	chA196
1	146	CH49 Fault1	comA146	chA146	1	197	Fault Select 5	comA197	chA197
1	147	CH49 Fault2	comA147	chA147	1	198	Fault Select 6	comA198	chA198
1	148	CH50 Break	comA148	chA148	1	199	Fault Select 7	comA199	chA199
1	149	CH50 Fault1	comA149	chA149	1	200	Fault Select 8	comA200	chA200
1	150	CH50 Fault2	comA150	chA150	1	201	Monitor 1	comA201	chA201
1	151	CH51 Break	comA151	chA151	1	202	Monitor 2	comA202	chA202

Table 4.6 - Relay/Bit Table for 40-190B-202 & 40-190B-502 (32-channel, dual bus versions) for Sub-Unit 1 Including IVI Channel Names

BIT TO RELAY FUNCTION CROSS REFERENCE TABLE (40-190B-202/502)									
Sub-Unit	Bit	Function	IVI Channel Names		Sub-Unit	Bit	Function	IVI Channel Names	
1	1	CH1 Break	comA1	chA1	1	54	CH18 Fault2	comA54	chA54
1	2	CH1 Fault1	comA2	chA2	1	55	CH19 Break	comA55	chA55
1	3	CH1 Fault2	comA3	chA3	1	56	CH19 Fault1	comA56	chA56
1	4	CH2 Break	comA4	chA4	1	57	CH19 Fault2	comA57	chA57
1	5	CH2 Fault1	comA5	chA5	1	58	CH20 Break	comA58	chA58
1	6	CH2 Fault2	comA6	chA6	1	59	CH20 Fault1	comA59	chA59
1	7	CH3 Break	comA7	chA7	1	60	CH20 Fault2	comA60	chA60
1	8	CH3 Fault1	comA8	chA8	1	61	CH21 Break	comA61	chA61
1	9	CH3 Fault2	comA9	chA9	1	62	CH21 Fault1	comA62	chA62
1	10	CH4 Break	comA10	chA10	1	63	CH21 Fault2	comA63	chA63
1	11	CH4 Fault1	comA11	chA11	1	64	CH22 Break	comA64	chA64
1	12	CH4 Fault2	comA12	chA12	1	65	CH22 Fault1	comA65	chA65
1	13	CH5 Break	comA13	chA13	1	66	CH22 Fault2	comA66	chA66
1	14	CH5 Fault1	comA14	chA14	1	67	CH23 Break	comA67	chA67
1	15	CH5 Fault2	comA15	chA15	1	68	CH23 Fault1	comA68	chA68
1	16	CH6 Break	comA16	chA16	1	69	CH23 Fault2	comA69	chA69
1	17	CH6 Fault1	comA17	chA17	1	70	CH24 Break	comA70	chA70
1	18	CH6 Fault2	comA18	chA18	1	71	CH24 Fault1	comA71	chA71
1	19	CH7 Break	comA19	chA19	1	72	CH24 Fault2	comA72	chA72
1	20	CH7 Fault1	comA20	chA20	1	73	CH25 Break	comA73	chA73
1	21	CH7 Fault2	comA21	chA21	1	74	CH25 Fault1	comA74	chA74
1	22	CH8 Break	comA22	chA22	1	75	CH25 Fault2	comA75	chA75
1	23	CH8 Fault1	comA23	chA23	1	76	CH26 Break	comA76	chA76
1	24	CH8 Fault2	comA24	chA24	1	77	CH26 Fault1	comA77	chA77
1	25	CH9 Break	comA25	chA25	1	78	CH26 Fault2	comA78	chA78
1	26	CH9 Fault1	comA26	chA26	1	79	CH27 Break	comA79	chA79
1	27	CH9 Fault2	comA27	chA27	1	80	CH27 Fault1	comA80	chA80
1	28	CH10 Break	comA28	chA28	1	81	CH27 Fault2	comA81	chA81
1	29	CH10 Fault1	comA29	chA29	1	82	CH28 Break	comA82	chA82
1	30	CH10 Fault2	comA30	chA30	1	83	CH28 Fault1	comA83	chA83
1	31	CH11 Break	comA31	chA31	1	84	CH28 Fault2	comA84	chA84
1	32	CH11 Fault1	comA32	chA32	1	85	CH29 Break	comA85	chA85
1	33	CH11 Fault2	comA33	chA33	1	86	CH29 Fault1	comA86	chA86
1	34	CH12 Break	comA34	chA34	1	87	CH29 Fault2	comA87	chA87
1	35	CH12 Fault1	comA35	chA35	1	88	CH30 Break	comA88	chA88
1	36	CH12 Fault2	comA36	chA36	1	89	CH30 Fault1	comA89	chA89
1	37	CH13 Break	comA37	chA37	1	90	CH30 Fault2	comA90	chA90
1	38	CH13 Fault1	comA38	chA38	1	91	CH31 Break	comA91	chA91
1	39	CH13 Fault2	comA39	chA39	1	92	CH31 Fault1	comA92	chA92
1	40	CH14 Break	comA40	chA40	1	93	CH31 Fault2	comA93	chA93
1	41	CH14 Fault1	comA41	chA41	1	94	CH32 Break	comA94	chA94
1	42	CH14 Fault2	comA42	chA42	1	95	CH32 Fault1	comA95	chA95
1	43	CH15 Break	comA43	chA43	1	96	CH32 Fault2	comA96	chA96
1	44	CH15 Fault1	comA44	chA44	1	97	Fault Select 1	comA97	chA97
1	45	CH15 Fault2	comA45	chA45	1	98	Fault Select 2	comA98	chA98
1	46	CH16 Break	comA46	chA46	1	99	Fault Select 3	comA99	chA99
1	47	CH16 Fault1	comA47	chA47	1	100	Fault Select 4	comA100	chA100
1	48	CH16 Fault2	comA48	chA48	1	101	Fault Select 5	comA101	chA101
1	49	CH17 Break	comA49	chA49	1	102	Fault Select 6	comA102	chA102
1	50	CH17 Fault1	comA50	chA50	1	103	Fault Select 7	comA103	chA103
1	51	CH17 Fault2	comA51	chA51	1	104	Fault Select 8	comA104	chA104
1	52	CH18 Break	comA52	chA52	1	105	Monitor 1	comA105	chA105
1	53	CH18 Fault1	comA53	chA53	1	106	Monitor 2	comA106	chA106

RELAY/BIT LOOK-UP TABLES - MULTIPLE SUB-UNIT CONTROL

Table 4.7 - Relay/Bit Table for 40-190B-001 & 40-190B-301 (74-channel, single bus versions) for Sub-Units 2 to 5 Including IVI Channel Names

BIT TO RELAY FUNCTION CROSS REFERENCE TABLE (40-190B-001/301)														
Sub-Unit	Bit	Function	IVI Channel Names		Sub-Unit	Bit	Function	IVI Channel Names		Sub-Unit	Bit	Function	IVI Channel Names	
2	1	CH1 Break	comB1	chB1	2	52	CH52 Break	comB52	chB52	3	29	CH29 Fault1	comC29	chC29
2	2	CH2 Break	comB2	chB2	2	53	CH53 Break	comB53	chB53	3	30	CH30 Fault1	comC30	chC30
2	3	CH3 Break	comB3	chB3	2	54	CH54 Break	comB54	chB54	3	31	CH31 Fault1	comC31	chC31
2	4	CH4 Break	comB4	chB4	2	55	CH55 Break	comB55	chB55	3	32	CH32 Fault1	comC32	chC32
2	5	CH5 Break	comB5	chB5	2	56	CH56 Break	comB56	chB56	3	33	CH33 Fault1	comC33	chC33
2	6	CH6 Break	comB6	chB6	2	57	CH57 Break	comB57	chB57	3	34	CH34 Fault1	comC34	chC34
2	7	CH7 Break	comB7	chB7	2	58	CH58 Break	comB58	chB58	3	35	CH35 Fault1	comC35	chC35
2	8	CH8 Break	comB8	chB8	2	59	CH59 Break	comB59	chB59	3	36	CH36 Fault1	comC36	chC36
2	9	CH9 Break	comB9	chB9	2	60	CH60 Break	comB60	chB60	3	37	CH37 Fault1	comC37	chC37
2	10	CH10 Break	comB10	chB10	2	61	CH61 Break	comB61	chB61	3	38	CH38 Fault1	comC38	chC38
2	11	CH11 Break	comB11	chB11	2	62	CH62 Break	comB62	chB62	3	39	CH39 Fault1	comC39	chC39
2	12	CH12 Break	comB12	chB12	2	63	CH63 Break	comB63	chB63	3	40	CH40 Fault1	comC40	chC40
2	13	CH13 Break	comB13	chB13	2	64	CH64 Break	comB64	chB64	3	41	CH41 Fault1	comC41	chC41
2	14	CH14 Break	comB14	chB14	2	65	CH65 Break	comB65	chB65	3	42	CH42 Fault1	comC42	chC42
2	15	CH15 Break	comB15	chB15	2	66	CH66 Break	comB66	chB66	3	43	CH43 Fault1	comC43	chC43
2	16	CH16 Break	comB16	chB16	2	67	CH67 Break	comB67	chB67	3	44	CH44 Fault1	comC44	chC44
2	17	CH17 Break	comB17	chB17	2	68	CH68 Break	comB68	chB68	3	45	CH45 Fault1	comC45	chC45
2	18	CH18 Break	comB18	chB18	2	69	CH69 Break	comB69	chB69	3	46	CH46 Fault1	comC46	chC46
2	19	CH19 Break	comB19	chB19	2	70	CH70 Break	comB70	chB70	3	47	CH47 Fault1	comC47	chC47
2	20	CH20 Break	comB20	chB20	2	71	CH71 Break	comB71	chB71	3	48	CH48 Fault1	comC48	chC48
2	21	CH21 Break	comB21	chB21	2	72	CH72 Break	comB72	chB72	3	49	CH49 Fault1	comC49	chC49
2	22	CH22 Break	comB22	chB22	2	73	CH73 Break	comB73	chB73	3	50	CH50 Fault1	comC50	chC50
2	23	CH23 Break	comB23	chB23	2	74	CH74 Break	comB74	chB74	3	51	CH51 Fault1	comC51	chC51
2	24	CH24 Break	comB24	chB24	3	1	CH1 Fault1	comC1	chC1	3	52	CH52 Fault1	comC52	chC52
2	25	CH25 Break	comB25	chB25	3	2	CH2 Fault1	comC2	chC2	3	53	CH53 Fault1	comC53	chC53
2	26	CH26 Break	comB26	chB26	3	3	CH3 Fault1	comC3	chC3	3	54	CH54 Fault1	comC54	chC54
2	27	CH27 Break	comB27	chB27	3	4	CH4 Fault1	comC4	chC4	3	55	CH55 Fault1	comC55	chC55
2	28	CH28 Break	comB28	chB28	3	5	CH5 Fault1	comC5	chC5	3	56	CH56 Fault1	comC56	chC56
2	29	CH29 Break	comB29	chB29	3	6	CH6 Fault1	comC6	chC6	3	57	CH57 Fault1	comC57	chC57
2	30	CH30 Break	comB30	chB30	3	7	CH7 Fault1	comC7	chC7	3	58	CH58 Fault1	comC58	chC58
2	31	CH31 Break	comB31	chB31	3	8	CH8 Fault1	comC8	chC8	3	59	CH59 Fault1	comC59	chC59
2	32	CH32 Break	comB32	chB32	3	9	CH9 Fault1	comC9	chC9	3	60	CH60 Fault1	comC60	chC60
2	33	CH33 Break	comB33	chB33	3	10	CH10 Fault1	comC10	chC10	3	61	CH61 Fault1	comC61	chC61
2	34	CH34 Break	comB34	chB34	3	11	CH11 Fault1	comC11	chC11	3	62	CH62 Fault1	comC62	chC62
2	35	CH35 Break	comB35	chB35	3	12	CH12 Fault1	comC12	chC12	3	63	CH63 Fault1	comC63	chC63
2	36	CH36 Break	comB36	chB36	3	13	CH13 Fault1	comC13	chC13	3	64	CH64 Fault1	comC64	chC64
2	37	CH37 Break	comB37	chB37	3	14	CH14 Fault1	comC14	chC14	3	65	CH65 Fault1	comC65	chC65
2	38	CH38 Break	comB38	chB38	3	15	CH15 Fault1	comC15	chC15	3	66	CH66 Fault1	comC66	chC66
2	39	CH39 Break	comB39	chB39	3	16	CH16 Fault1	comC16	chC16	3	67	CH67 Fault1	comC67	chC67
2	40	CH40 Break	comB40	chB40	3	17	CH17 Fault1	comC17	chC17	3	68	CH68 Fault1	comC68	chC68
2	41	CH41 Break	comB41	chB41	3	18	CH18 Fault1	comC18	chC18	3	69	CH69 Fault1	comC69	chC69
2	42	CH42 Break	comB42	chB42	3	19	CH19 Fault1	comC19	chC19	3	70	CH70 Fault1	comC70	chC70
2	43	CH43 Break	comB43	chB43	3	20	CH20 Fault1	comC20	chC20	3	71	CH71 Fault1	comC71	chC71
2	44	CH44 Break	comB44	chB44	3	21	CH21 Fault1	comC21	chC21	3	72	CH72 Fault1	comC72	chC72
2	45	CH45 Break	comB45	chB45	3	22	CH22 Fault1	comC22	chC22	3	73	CH73 Fault1	comC73	chC73
2	46	CH46 Break	comB46	chB46	3	23	CH23 Fault1	comC23	chC23	3	74	CH74 Fault1	comC74	chC74
2	47	CH47 Break	comB47	chB47	3	24	CH24 Fault1	comC24	chC24	4	1	Fault Select 1	comD	chD1
2	48	CH48 Break	comB48	chB48	3	25	CH25 Fault1	comC25	chC25	4	2	Fault Select 2	comD	chD2
2	49	CH49 Break	comB49	chB49	3	26	CH26 Fault1	comC26	chC26	4	3	Fault Select 3	comD	chD3
2	50	CH50 Break	comB50	chB50	3	27	CH27 Fault1	comC27	chC27	4	4	Fault Select 4	comD	chD4
2	51	CH51 Break	comB51	chB51	3	28	CH28 Fault1	comC28	chC28	5	1	Monitor 1	comE	chE1

Table 4.8 - Relay/Bit Table for 40-190B-101 & 40-190B-401 (64-channel, single bus versions) for Sub-Unit 2 to 5 Including IVI Channel Names

BIT TO RELAY FUNCTION CROSS REFERENCE TABLE (40-190B-101/401)														
Sub-Unit	Bit	Function	IVI Channel Names		Sub-Unit	Bit	Function	IVI Channel Names		Sub-Unit	Bit	Function	IVI Channel Names	
2	1	CH1 Break	comB1	chB1	2	45	CH45 Break	comB45	chB45	3	25	CH25 Fault1	comC25	chC25
2	2	CH2 Break	comB2	chB2	2	46	CH46 Break	comB46	chB46	3	26	CH26 Fault1	comC26	chC26
2	3	CH3 Break	comB3	chB3	2	47	CH47 Break	comB47	chB47	3	27	CH27 Fault1	comC27	chC27
2	4	CH4 Break	comB4	chB4	2	48	CH48 Break	comB48	chB48	3	28	CH28 Fault1	comC28	chC28
2	5	CH5 Break	comB5	chB5	2	49	CH49 Break	comB49	chB49	3	29	CH29 Fault1	comC29	chC29
2	6	CH6 Break	comB6	chB6	2	50	CH50 Break	comB50	chB50	3	30	CH30 Fault1	comC30	chC30
2	7	CH7 Break	comB7	chB7	2	51	CH51 Break	comB51	chB51	3	31	CH31 Fault1	comC31	chC31
2	8	CH8 Break	comB8	chB8	2	52	CH52 Break	comB52	chB52	3	32	CH32 Fault1	comC32	chC32
2	9	CH9 Break	comB9	chB9	2	53	CH53 Break	comB53	chB53	3	33	CH33 Fault1	comC33	chC33
2	10	CH10 Break	comB10	chB10	2	54	CH54 Break	comB54	chB54	3	34	CH34 Fault1	comC34	chC34
2	11	CH11 Break	comB11	chB11	2	55	CH55 Break	comB55	chB55	3	35	CH35 Fault1	comC35	chC35
2	12	CH12 Break	comB12	chB12	2	56	CH56 Break	comB56	chB56	3	36	CH36 Fault1	comC36	chC36
2	13	CH13 Break	comB13	chB13	2	57	CH57 Break	comB57	chB57	3	37	CH37 Fault1	comC37	chC37
2	14	CH14 Break	comB14	chB14	2	58	CH58 Break	comB58	chB58	3	38	CH38 Fault1	comC38	chC38
2	15	CH15 Break	comB15	chB15	2	59	CH59 Break	comB59	chB59	3	39	CH39 Fault1	comC39	chC39
2	16	CH16 Break	comB16	chB16	2	60	CH60 Break	comB60	chB60	3	40	CH40 Fault1	comC40	chC40
2	17	CH17 Break	comB17	chB17	2	61	CH61 Break	comB61	chB61	3	41	CH41 Fault1	comC41	chC41
2	18	CH18 Break	comB18	chB18	2	62	CH62 Break	comB62	chB62	3	42	CH42 Fault1	comC42	chC42
2	19	CH19 Break	comB19	chB19	2	63	CH63 Break	comB63	chB63	3	43	CH43 Fault1	comC43	chC43
2	20	CH20 Break	comB20	chB20	2	64	CH64 Break	comB64	chB64	3	44	CH44 Fault1	comC44	chC44
2	21	CH21 Break	comB21	chB21	3	1	CH1 Fault1	comC1	chC1	3	45	CH45 Fault1	comC45	chC45
2	22	CH22 Break	comB22	chB22	3	2	CH2 Fault1	comC2	chC2	3	46	CH46 Fault1	comC46	chC46
2	23	CH23 Break	comB23	chB23	3	3	CH3 Fault1	comC3	chC3	3	47	CH47 Fault1	comC47	chC47
2	24	CH24 Break	comB24	chB24	3	4	CH4 Fault1	comC4	chC4	3	48	CH48 Fault1	comC48	chC48
2	25	CH25 Break	comB25	chB25	3	5	CH5 Fault1	comC5	chC5	3	49	CH49 Fault1	comC49	chC49
2	26	CH26 Break	comB26	chB26	3	6	CH6 Fault1	comC6	chC6	3	50	CH50 Fault1	comC50	chC50
2	27	CH27 Break	comB27	chB27	3	7	CH7 Fault1	comC7	chC7	3	51	CH51 Fault1	comC51	chC51
2	28	CH28 Break	comB28	chB28	3	8	CH8 Fault1	comC8	chC8	3	52	CH52 Fault1	comC52	chC52
2	29	CH29 Break	comB29	chB29	3	9	CH9 Fault1	comC9	chC9	3	53	CH53 Fault1	comC53	chC53
2	30	CH30 Break	comB30	chB30	3	10	CH10 Fault1	comC10	chC10	3	54	CH54 Fault1	comC54	chC54
2	31	CH31 Break	comB31	chB31	3	11	CH11 Fault1	comC11	chC11	3	55	CH55 Fault1	comC55	chC55
2	32	CH32 Break	comB32	chB32	3	12	CH12 Fault1	comC12	chC12	3	56	CH56 Fault1	comC56	chC56
2	33	CH33 Break	comB33	chB33	3	13	CH13 Fault1	comC13	chC13	3	57	CH57 Fault1	comC57	chC57
2	34	CH34 Break	comB34	chB34	3	14	CH14 Fault1	comC14	chC14	3	58	CH58 Fault1	comC58	chC58
2	35	CH35 Break	comB35	chB35	3	15	CH15 Fault1	comC15	chC15	3	59	CH59 Fault1	comC59	chC59
2	36	CH36 Break	comB36	chB36	3	16	CH16 Fault1	comC16	chC16	3	60	CH60 Fault1	comC60	chC60
2	37	CH37 Break	comB37	chB37	3	17	CH17 Fault1	comC17	chC17	3	61	CH61 Fault1	comC61	chC61
2	38	CH38 Break	comB38	chB38	3	18	CH18 Fault1	comC18	chC18	3	62	CH62 Fault1	comC62	chC62
2	39	CH39 Break	comB39	chB39	3	19	CH19 Fault1	comC19	chC19	3	63	CH63 Fault1	comC63	chC63
2	40	CH40 Break	comB40	chB40	3	20	CH20 Fault1	comC20	chC20	3	64	CH64 Fault1	comC64	chC64
2	41	CH41 Break	comB41	chB41	3	21	CH21 Fault1	comC21	chC21	4	1	Fault Select 1	comD	chD1
2	42	CH42 Break	comB42	chB42	3	22	CH22 Fault1	comC22	chC22	4	2	Fault Select 2	comD	chD2
2	43	CH43 Break	comB43	chB43	3	23	CH23 Fault1	comC23	chC23	4	3	Fault Select 3	comD	chD3
2	44	CH44 Break	comB44	chB44	3	24	CH24 Fault1	comC24	chC24	4	4	Fault Select 4	comD	chD4
										5	1	Monitor 1	comE	chE1

Table 4.9 - Relay/Bit Table for 40-190B-201 & 40-190B-501 (32-channel, single bus versions) for Sub-Units 2 to 5 Including IVI Channel Names

BIT TO RELAY FUNCTION CROSS REFERENCE TABLE (40-190B-201/501)									
Sub-Unit	Bit	Function	IVI Channel Names		Sub-Unit	Bit	Function	IVI Channel Names	
2	1	CH1 Break	comB1	chB1	3	1	CH1 Fault1	comC1	chC1
2	2	CH2 Break	comB2	chB2	3	2	CH2 Fault1	comC2	chC2
2	3	CH3 Break	comB3	chB3	3	3	CH3 Fault1	comC3	chC3
2	4	CH4 Break	comB4	chB4	3	4	CH4 Fault1	comC4	chC4
2	5	CH5 Break	comB5	chB5	3	5	CH5 Fault1	comC5	chC5
2	6	CH6 Break	comB6	chB6	3	6	CH6 Fault1	comC6	chC6
2	7	CH7 Break	comB7	chB7	3	7	CH7 Fault1	comC7	chC7
2	8	CH8 Break	comB8	chB8	3	8	CH8 Fault1	comC8	chC8
2	9	CH9 Break	comB9	chB9	3	9	CH9 Fault1	comC9	chC9
2	10	CH10 Break	comB10	chB10	3	10	CH10 Fault1	comC10	chC10
2	11	CH11 Break	comB11	chB11	3	11	CH11 Fault1	comC11	chC11
2	12	CH12 Break	comB12	chB12	3	12	CH12 Fault1	comC12	chC12
2	13	CH13 Break	comB13	chB13	3	13	CH13 Fault1	comC13	chC13
2	14	CH14 Break	comB14	chB14	3	14	CH14 Fault1	comC14	chC14
2	15	CH15 Break	comB15	chB15	3	15	CH15 Fault1	comC15	chC15
2	16	CH16 Break	comB16	chB16	3	16	CH16 Fault1	comC16	chC16
2	17	CH17 Break	comB17	chB17	3	17	CH17 Fault1	comC17	chC17
2	18	CH18 Break	comB18	chB18	3	18	CH18 Fault1	comC18	chC18
2	19	CH19 Break	comB19	chB19	3	19	CH19 Fault1	comC19	chC19
2	20	CH20 Break	comB20	chB20	3	20	CH20 Fault1	comC20	chC20
2	21	CH21 Break	comB21	chB21	3	21	CH21 Fault1	comC21	chC21
2	22	CH22 Break	comB22	chB22	3	22	CH22 Fault1	comC22	chC22
2	23	CH23 Break	comB23	chB23	3	23	CH23 Fault1	comC23	chC23
2	24	CH24 Break	comB24	chB24	3	24	CH24 Fault1	comC24	chC24
2	25	CH25 Break	comB25	chB25	3	25	CH25 Fault1	comC25	chC25
2	26	CH26 Break	comB26	chB26	3	26	CH26 Fault1	comC26	chC26
2	27	CH27 Break	comB27	chB27	3	27	CH27 Fault1	comC27	chC27
2	28	CH28 Break	comB28	chB28	3	28	CH28 Fault1	comC28	chC28
2	29	CH29 Break	comB29	chB29	3	29	CH29 Fault1	comC29	chC29
2	30	CH30 Break	comB30	chB30	3	30	CH30 Fault1	comC30	chC30
2	31	CH31 Break	comB31	chB31	3	31	CH31 Fault1	comC31	chC31
2	32	CH32 Break	comB32	chB32	3	32	CH32 Fault1	comC32	chC32
					4	1	Fault Sel. 1	comD	chD1
					4	2	Fault Sel. 2	comD	chD2
					4	3	Fault Sel. 3	comD	chD3
					4	4	Fault Sel. 4	comD	chD4
					5	1	Monitor 1	comE	chE1

Table 4.10 - Relay/Bit Table for 40-190B-002 & 40-190B-302 (74-channel, dual bus versions) for Sub-Units 2 to 7 Including IVI Channel Names

BIT TO RELAY FUNCTION CROSS REFERENCE TABLE (40-190B-002/302)										
Sub-Unit	Bit	Function	IVI Channel Names		Sub-Unit	Bit	Function	IVI Channel Names	
2	1	CH1 Break	comB1	chB1	2	59	CH59 Break	comB59	chB59
2	2	CH2 Break	comB2	chB2	2	60	CH60 Break	comB60	chB60
2	3	CH3 Break	comB3	chB3	2	61	CH61 Break	comB61	chB61
2	4	CH4 Break	comB4	chB4	2	62	CH62 Break	comB62	chB62
2	5	CH5 Break	comB5	chB5	2	63	CH63 Break	comB63	chB63
2	6	CH6 Break	comB6	chB6	2	64	CH64 Break	comB64	chB64
2	7	CH7 Break	comB7	chB7	2	65	CH65 Break	comB65	chB65
2	8	CH8 Break	comB8	chB8	2	66	CH66 Break	comB66	chB66
2	9	CH9 Break	comB9	chB9	2	67	CH67 Break	comB67	chB67
2	10	CH10 Break	comB10	chB10	2	68	CH68 Break	comB68	chB68
2	11	CH11 Break	comB11	chB11	2	69	CH69 Break	comB69	chB69
2	12	CH12 Break	comB12	chB12	2	70	CH70 Break	comB70	chB70
2	13	CH13 Break	comB13	chB13	2	71	CH71 Break	comB71	chB71
2	14	CH14 Break	comB14	chB14	2	72	CH72 Break	comB72	chB72
2	15	CH15 Break	comB15	chB15	2	73	CH73 Break	comB73	chB73
2	16	CH16 Break	comB16	chB16	2	74	CH74 Break	comB74	chB74
2	17	CH17 Break	comB17	chB17	3	1	CH1 Fault1	comC1	chC1
2	18	CH18 Break	comB18	chB18	3	2	CH2 Fault1	comC2	chC2
2	19	CH19 Break	comB19	chB19	3	3	CH3 Fault1	comC3	chC3
2	20	CH20 Break	comB20	chB20	3	4	CH4 Fault1	comC4	chC4
2	21	CH21 Break	comB21	chB21	3	5	CH5 Fault1	comC5	chC5
2	22	CH22 Break	comB22	chB22	3	6	CH6 Fault1	comC6	chC6
2	23	CH23 Break	comB23	chB23	3	7	CH7 Fault1	comC7	chC7
2	24	CH24 Break	comB24	chB24	3	8	CH8 Fault1	comC8	chC8
2	25	CH25 Break	comB25	chB25	3	9	CH9 Fault1	comC9	chC9
2	26	CH26 Break	comB26	chB26	3	10	CH10 Fault1	comC10	chC10
2	27	CH27 Break	comB27	chB27	3	11	CH11 Fault1	comC11	chC11
2	28	CH28 Break	comB28	chB28	3	12	CH12 Fault1	comC12	chC12
2	29	CH29 Break	comB29	chB29	3	13	CH13 Fault1	comC13	chC13
2	30	CH30 Break	comB30	chB30	3	14	CH14 Fault1	comC14	chC14
2	31	CH31 Break	comB31	chB31	3	15	CH15 Fault1	comC15	chC15
2	32	CH32 Break	comB32	chB32	3	16	CH16 Fault1	comC16	chC16
2	33	CH33 Break	comB33	chB33	3	17	CH17 Fault1	comC17	chC17
2	34	CH34 Break	comB34	chB34	3	18	CH18 Fault1	comC18	chC18
2	35	CH35 Break	comB35	chB35	3	19	CH19 Fault1	comC19	chC19
2	36	CH36 Break	comB36	chB36	3	20	CH20 Fault1	comC20	chC20
2	37	CH37 Break	comB37	chB37	3	21	CH21 Fault1	comC21	chC21
2	38	CH38 Break	comB38	chB38	3	22	CH22 Fault1	comC22	chC22
2	39	CH39 Break	comB39	chB39	3	23	CH23 Fault1	comC23	chC23
2	40	CH40 Break	comB40	chB40	3	24	CH24 Fault1	comC24	chC24
2	41	CH41 Break	comB41	chB41	3	25	CH25 Fault1	comC25	chC25
2	42	CH42 Break	comB42	chB42	3	26	CH26 Fault1	comC26	chC26
2	43	CH43 Break	comB43	chB43	3	27	CH27 Fault1	comC27	chC27
2	44	CH44 Break	comB44	chB44	3	28	CH28 Fault1	comC28	chC28
2	45	CH45 Break	comB45	chB45	3	29	CH29 Fault1	comC29	chC29
2	46	CH46 Break	comB46	chB46	3	30	CH30 Fault1	comC30	chC30
2	47	CH47 Break	comB47	chB47	3	31	CH31 Fault1	comC31	chC31
2	48	CH48 Break	comB48	chB48	3	32	CH32 Fault1	comC32	chC32
2	49	CH49 Break	comB49	chB49	3	33	CH33 Fault1	comC33	chC33
2	50	CH50 Break	comB50	chB50	3	34	CH34 Fault1	comC34	chC34
2	51	CH51 Break	comB51	chB51	3	35	CH35 Fault1	comC35	chC35
2	52	CH52 Break	comB52	chB52	3	36	CH36 Fault1	comC36	chC36
2	53	CH53 Break	comB53	chB53	3	37	CH37 Fault1	comC37	chC37
2	54	CH54 Break	comB54	chB54	3	38	CH38 Fault1	comC38	chC38
2	55	CH55 Break	comB55	chB55	3	39	CH39 Fault1	comC39	chC39
2	56	CH56 Break	comB56	chB56	3	40	CH40 Fault1	comC40	chC40
2	57	CH57 Break	comB57	chB57	3	41	CH41 Fault1	comC41	chC41
2	58	CH58 Break	comB58	chB58	3	42	CH42 Fault1	comC42	chC42

Table 4.10 Continued - Relay/Bit Table for 40-190B-002 & 40-190B-302 (74-channel, dual bus versions) for Sub-Units 2 to 7 Including IVI Channel Names

BIT TO RELAY FUNCTION CROSS REFERENCE TABLE (40-190B-002/302)										
Sub-Unit	Bit	Function	IVI Channel Names		Sub-Unit	Bit	Function	IVI Channel Names	
3	43	CH43 Fault1	comC43	chC43	4	27	CH27 Fault2	comD27	chD27
3	44	CH44 Fault1	comC44	chC44	4	28	CH28 Fault2	comD28	chD28
3	45	CH45 Fault1	comC45	chC45	4	29	CH29 Fault2	comD29	chD29
3	46	CH46 Fault1	comC46	chC46	4	30	CH30 Fault2	comD30	chD30
3	47	CH47 Fault1	comC47	chC47	4	31	CH31 Fault2	comD31	chD31
3	48	CH48 Fault1	comC48	chC48	4	32	CH32 Fault2	comD32	chD32
3	49	CH49 Fault1	comC49	chC49	4	33	CH33 Fault2	comD33	chD33
3	50	CH50 Fault1	comC50	chC50	4	34	CH34 Fault2	comD34	chD34
3	51	CH51 Fault1	comC51	chC51	4	35	CH35 Fault2	comD35	chD35
3	52	CH52 Fault1	comC52	chC52	4	36	CH36 Fault2	comD36	chD36
3	53	CH53 Fault1	comC53	chC53	4	37	CH37 Fault2	comD37	chD37
3	54	CH54 Fault1	comC54	chC54	4	38	CH38 Fault2	comD38	chD38
3	55	CH55 Fault1	comC55	chC55	4	39	CH39 Fault2	comD39	chD39
3	56	CH56 Fault1	comC56	chC56	4	40	CH40 Fault2	comD40	chD40
3	57	CH57 Fault1	comC57	chC57	4	41	CH41 Fault2	comD41	chD41
3	58	CH58 Fault1	comC58	chC58	4	42	CH42 Fault2	comD42	chD42
3	59	CH59 Fault1	comC59	chC59	4	43	CH43 Fault2	comD43	chD43
3	60	CH60 Fault1	comC60	chC60	4	44	CH44 Fault2	comD44	chD44
3	61	CH61 Fault1	comC61	chC61	4	45	CH45 Fault2	comD45	chD45
3	62	CH62 Fault1	comC62	chC62	4	46	CH46 Fault2	comD46	chD46
3	63	CH63 Fault1	comC63	chC63	4	47	CH47 Fault2	comD47	chD47
3	64	CH64 Fault1	comC64	chC64	4	48	CH48 Fault2	comD48	chD48
3	65	CH65 Fault1	comC65	chC65	4	49	CH49 Fault2	comD49	chD49
3	66	CH66 Fault1	comC66	chC66	4	50	CH50 Fault2	comD50	chD50
3	67	CH67 Fault1	comC67	chC67	4	51	CH51 Fault2	comD51	chD51
3	68	CH68 Fault1	comC68	chC68	4	52	CH52 Fault2	comD52	chD52
3	69	CH69 Fault1	comC69	chC69	4	53	CH53 Fault2	comD53	chD53
3	70	CH70 Fault1	comC70	chC70	4	54	CH54 Fault2	comD54	chD54
3	71	CH71 Fault1	comC71	chC71	4	55	CH55 Fault2	comD55	chD55
3	72	CH72 Fault1	comC72	chC72	4	56	CH56 Fault2	comD56	chD56
3	73	CH73 Fault1	comC73	chC73	4	57	CH57 Fault2	comD57	chD57
3	74	CH74 Fault1	comC74	chC74	4	58	CH58 Fault2	comD58	chD58
4	1	CH1 Fault2	comD1	chD1	4	59	CH59 Fault2	comD59	chD59
4	2	CH2 Fault2	comD2	chD2	4	60	CH60 Fault2	comD60	chD60
4	3	CH3 Fault2	comD3	chD3	4	61	CH61 Fault2	comD61	chD61
4	4	CH4 Fault2	comD4	chD4	4	62	CH62 Fault2	comD62	chD62
4	5	CH5 Fault2	comD5	chD5	4	63	CH63 Fault2	comD63	chD63
4	6	CH6 Fault2	comD6	chD6	4	64	CH64 Fault2	comD64	chD64
4	7	CH7 Fault2	comD7	chD7	4	65	CH65 Fault2	comD65	chD65
4	8	CH8 Fault2	comD8	chD8	4	66	CH66 Fault2	comD66	chD66
4	9	CH9 Fault2	comD9	chD9	4	67	CH67 Fault2	comD67	chD67
4	10	CH10 Fault2	comD10	chD10	4	68	CH68 Fault2	comD68	chD68
4	11	CH11 Fault2	comD11	chD11	4	69	CH69 Fault2	comD69	chD69
4	12	CH12 Fault2	comD12	chD12	4	70	CH70 Fault2	comD70	chD70
4	13	CH13 Fault2	comD13	chD13	4	71	CH71 Fault2	comD71	chD71
4	14	CH14 Fault2	comD14	chD14	4	72	CH72 Fault2	comD72	chD72
4	15	CH15 Fault2	comD15	chD15	4	73	CH73 Fault2	comD73	chD73
4	16	CH16 Fault2	comD16	chD16	4	74	CH74 Fault2	comD74	chD74
4	17	CH17 Fault2	comD17	chD17	5	1	Fault Select 1	comE	chE1
4	18	CH18 Fault2	comD18	chD18	5	2	Fault Select 2	comE	chE2
4	19	CH19 Fault2	comD19	chD19	5	3	Fault Select 3	comE	chE3
4	20	CH20 Fault2	comD20	chD20	5	4	Fault Select 4	comE	chE4
4	21	CH21 Fault2	comD21	chD21	6	1	Fault Select 5	comF	chF1
4	22	CH22 Fault2	comD22	chD22	6	2	Fault Select 6	comF	chF2
4	23	CH23 Fault2	comD23	chD23	6	3	Fault Select 7	comF	chF3
4	24	CH24 Fault2	comD24	chD24	6	4	Fault Select 8	comF	chF4
4	25	CH25 Fault2	comD25	chD25	7	1	Monitor 1	comG1	chG1
4	26	CH26 Fault2	comD26	chD26	7	2	Monitor 2	comG2	chG2

Table 4.11 - Relay/Bit Table for 40-190B-102 & 40-190B-402 (64-channel, dual bus versions) for Sub-Units 2 to 7 Including IVI Channel Names

BIT TO RELAY FUNCTION CROSS REFERENCE TABLE (40-190B-102/402)									
Sub-Unit	Bit	Function	IVI Channel Names		Sub-Unit	Bit	Function	IVI Channel Names	
2	1	CH1 Break	comB1	chB1	2	51	CH51 Break	comB51	chB51
2	2	CH2 Break	comB2	chB2	2	52	CH52 Break	comB52	chB52
2	3	CH3 Break	comB3	chB3	2	53	CH53 Break	comB53	chB53
2	4	CH4 Break	comB4	chB4	2	54	CH54 Break	comB54	chB54
2	5	CH5 Break	comB5	chB5	2	55	CH55 Break	comB55	chB55
2	6	CH6 Break	comB6	chB6	2	56	CH56 Break	comB56	chB56
2	7	CH7 Break	comB7	chB7	2	57	CH57 Break	comB57	chB57
2	8	CH8 Break	comB8	chB8	2	58	CH58 Break	comB58	chB58
2	9	CH9 Break	comB9	chB9	2	59	CH59 Break	comB59	chB59
2	10	CH10 Break	comB10	chB10	2	60	CH60 Break	comB60	chB60
2	11	CH11 Break	comB11	chB11	2	61	CH61 Break	comB61	chB61
2	12	CH12 Break	comB12	chB12	2	62	CH62 Break	comB62	chB62
2	13	CH13 Break	comB13	chB13	2	63	CH63 Break	comB63	chB63
2	14	CH14 Break	comB14	chB14	2	64	CH64 Break	comB64	chB64
2	15	CH15 Break	comB15	chB15	3	1	CH1 Fault1	comC1	chC1
2	16	CH16 Break	comB16	chB16	3	2	CH2 Fault1	comC2	chC2
2	17	CH17 Break	comB17	chB17	3	3	CH3 Fault1	comC3	chC3
2	18	CH18 Break	comB18	chB18	3	4	CH4 Fault1	comC4	chC4
2	19	CH19 Break	comB19	chB19	3	5	CH5 Fault1	comC5	chC5
2	20	CH20 Break	comB20	chB20	3	6	CH6 Fault1	comC6	chC6
2	21	CH21 Break	comB21	chB21	3	7	CH7 Fault1	comC7	chC7
2	22	CH22 Break	comB22	chB22	3	8	CH8 Fault1	comC8	chC8
2	23	CH23 Break	comB23	chB23	3	9	CH9 Fault1	comC9	chC9
2	24	CH24 Break	comB24	chB24	3	10	CH10 Fault1	comC10	chC10
2	25	CH25 Break	comB25	chB25	3	11	CH11 Fault1	comC11	chC11
2	26	CH26 Break	comB26	chB26	3	12	CH12 Fault1	comC12	chC12
2	27	CH27 Break	comB27	chB27	3	13	CH13 Fault1	comC13	chC13
2	28	CH28 Break	comB28	chB28	3	14	CH14 Fault1	comC14	chC14
2	29	CH29 Break	comB29	chB29	3	15	CH15 Fault1	comC15	chC15
2	30	CH30 Break	comB30	chB30	3	16	CH16 Fault1	comC16	chC16
2	31	CH31 Break	comB31	chB31	3	17	CH17 Fault1	comC17	chC17
2	32	CH32 Break	comB32	chB32	3	18	CH18 Fault1	comC18	chC18
2	33	CH33 Break	comB33	chB33	3	19	CH19 Fault1	comC19	chC19
2	34	CH34 Break	comB34	chB34	3	20	CH20 Fault1	comC20	chC20
2	35	CH35 Break	comB35	chB35	3	21	CH21 Fault1	comC21	chC21
2	36	CH36 Break	comB36	chB36	3	22	CH22 Fault1	comC22	chC22
2	37	CH37 Break	comB37	chB37	3	23	CH23 Fault1	comC23	chC23
2	38	CH38 Break	comB38	chB38	3	24	CH24 Fault1	comC24	chC24
2	39	CH39 Break	comB39	chB39	3	25	CH25 Fault1	comC25	chC25
2	40	CH40 Break	comB40	chB40	3	26	CH26 Fault1	comC26	chC26
2	41	CH41 Break	comB41	chB41	3	27	CH27 Fault1	comC27	chC27
2	42	CH42 Break	comB42	chB42	3	28	CH28 Fault1	comC28	chC28
2	43	CH43 Break	comB43	chB43	3	29	CH29 Fault1	comC29	chC29
2	44	CH44 Break	comB44	chB44	3	30	CH30 Fault1	comC30	chC30
2	45	CH45 Break	comB45	chB45	3	31	CH31 Fault1	comC31	chC31
2	46	CH46 Break	comB46	chB46	3	32	CH32 Fault1	comC32	chC32
2	47	CH47 Break	comB47	chB47	3	33	CH33 Fault1	comC33	chC33
2	48	CH48 Break	comB48	chB48	3	34	CH34 Fault1	comC34	chC34
2	49	CH49 Break	comB49	chB49	3	35	CH35 Fault1	comC35	chC35
2	50	CH50 Break	comB50	chB50	3	36	CH36 Fault1	comC36	chC36

Table 4.11 Continued - Relay/Bit Table for 40-190B-102 & 40-190B-402 (64-channel, dual bus versions) for Sub-Units 2 to 7 Including IVI Channel Names

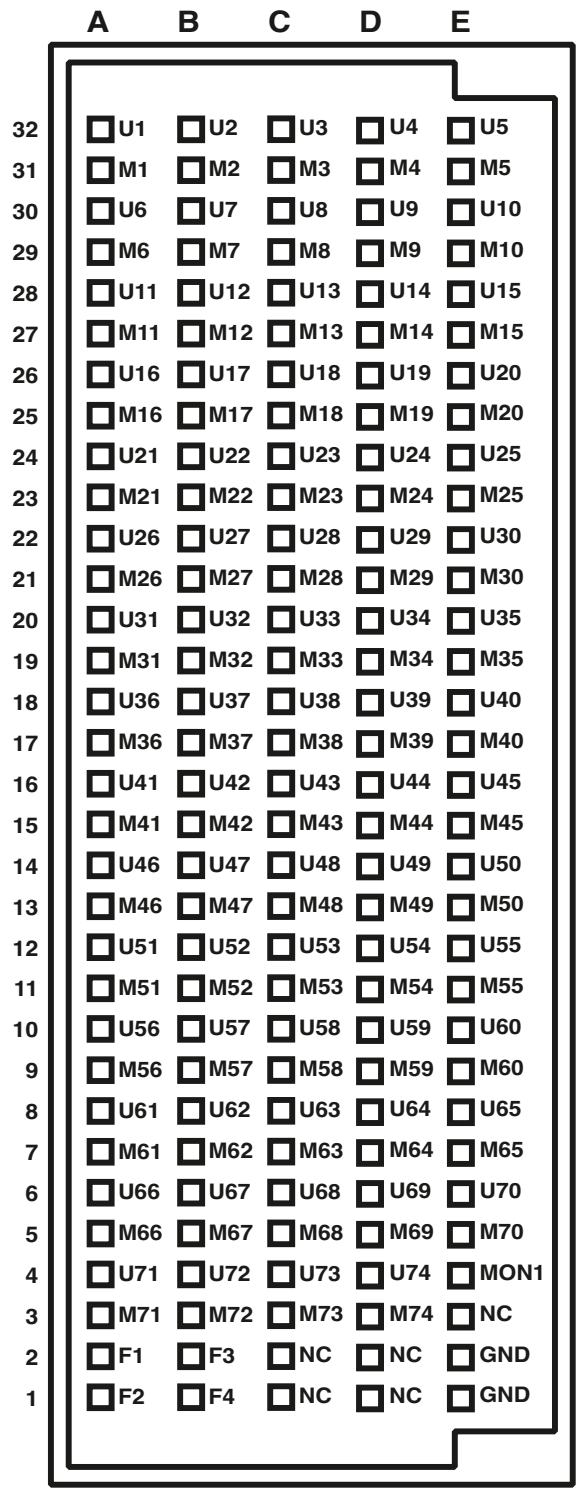
BIT TO RELAY FUNCTION CROSS REFERENCE TABLE (40-190B-102/402)										
Sub-Unit	Bit	Function	IVI Channel Names		Sub-Unit	Bit	Function	IVI Channel Names	
3	37	CH37 Fault1	comC37	chC37	4	24	CH24 Fault2	comD24	chD24
3	38	CH38 Fault1	comC38	chC38	4	25	CH25 Fault2	comD25	chD25
3	39	CH39 Fault1	comC39	chC39	4	26	CH26 Fault2	comD26	chD26
3	40	CH40 Fault1	comC40	chC40	4	27	CH27 Fault2	comD27	chD27
3	41	CH41 Fault1	comC41	chC41	4	28	CH28 Fault2	comD28	chD28
3	42	CH42 Fault1	comC42	chC42	4	29	CH29 Fault2	comD29	chD29
3	43	CH43 Fault1	comC43	chC43	4	30	CH30 Fault2	comD30	chD30
3	44	CH44 Fault1	comC44	chC44	4	31	CH31 Fault2	comD31	chD31
3	45	CH45 Fault1	comC45	chC45	4	32	CH32 Fault2	comD32	chD32
3	46	CH46 Fault1	comC46	chC46	4	33	CH33 Fault2	comD33	chD33
3	47	CH47 Fault1	comC47	chC47	4	34	CH34 Fault2	comD34	chD34
3	48	CH48 Fault1	comC48	chC48	4	35	CH35 Fault2	comD35	chD35
3	49	CH49 Fault1	comC49	chC49	4	36	CH36 Fault2	comD36	chD36
3	50	CH50 Fault1	comC50	chC50	4	37	CH37 Fault2	comD37	chD37
3	51	CH51 Fault1	comC51	chC51	4	38	CH38 Fault2	comD38	chD38
3	52	CH52 Fault1	comC52	chC52	4	39	CH39 Fault2	comD39	chD39
3	53	CH53 Fault1	comC53	chC53	4	40	CH40 Fault2	comD40	chD40
3	54	CH54 Fault1	comC54	chC54	4	41	CH41 Fault2	comD41	chD41
3	55	CH55 Fault1	comC55	chC55	4	42	CH42 Fault2	comD42	chD42
3	56	CH56 Fault1	comC56	chC56	4	43	CH43 Fault2	comD43	chD43
3	57	CH57 Fault1	comC57	chC57	4	44	CH44 Fault2	comD44	chD44
3	58	CH58 Fault1	comC58	chC58	4	45	CH45 Fault2	comD45	chD45
3	59	CH59 Fault1	comC59	chC59	4	46	CH46 Fault2	comD46	chD46
3	60	CH60 Fault1	comC60	chC60	4	47	CH47 Fault2	comD47	chD47
3	61	CH61 Fault1	comC61	chC61	4	48	CH48 Fault2	comD48	chD48
3	62	CH62 Fault1	comC62	chC62	4	49	CH49 Fault2	comD49	chD49
3	63	CH63 Fault1	comC63	chC63	4	50	CH50 Fault2	comD50	chD50
3	64	CH64 Fault1	comC64	chC64	4	51	CH51 Fault2	comD51	chD51
4	1	CH1 Fault2	comD1	chD1	4	52	CH52 Fault2	comD52	chD52
4	2	CH2 Fault2	comD2	chD2	4	53	CH53 Fault2	comD53	chD53
4	3	CH3 Fault2	comD3	chD3	4	54	CH54 Fault2	comD54	chD54
4	4	CH4 Fault2	comD4	chD4	4	55	CH55 Fault2	comD55	chD55
4	5	CH5 Fault2	comD5	chD5	4	56	CH56 Fault2	comD56	chD56
4	6	CH6 Fault2	comD6	chD6	4	57	CH57 Fault2	comD57	chD57
4	7	CH7 Fault2	comD7	chD7	4	58	CH58 Fault2	comD58	chD58
4	8	CH8 Fault2	comD8	chD8	4	59	CH59 Fault2	comD59	chD59
4	9	CH9 Fault2	comD9	chD9	4	60	CH60 Fault2	comD60	chD60
4	10	CH10 Fault2	comD10	chD10	4	61	CH61 Fault2	comD61	chD61
4	11	CH11 Fault2	comD11	chD11	4	62	CH62 Fault2	comD62	chD62
4	12	CH12 Fault2	comD12	chD12	4	63	CH63 Fault2	comD63	chD63
4	13	CH13 Fault2	comD13	chD13	4	64	CH64 Fault2	comD64	chD64
4	14	CH14 Fault2	comD14	chD14	5	1	Fault Select 1	comE	chE1
4	15	CH15 Fault2	comD15	chD15	5	2	Fault Select 2	comE	chE2
4	16	CH16 Fault2	comD16	chD16	5	3	Fault Select 3	comE	chE3
4	17	CH17 Fault2	comD17	chD17	5	4	Fault Select 4	comE	chE4
4	18	CH18 Fault2	comD18	chD18	6	1	Fault Select 5	comF	chF1
4	19	CH19 Fault2	comD19	chD19	6	2	Fault Select 6	comF	chF2
4	20	CH20 Fault2	comD20	chD20	6	3	Fault Select 7	comF	chF3
4	21	CH21 Fault2	comD21	chD21	6	4	Fault Select 8	comF	chF4
4	22	CH22 Fault2	comD22	chD22	7	1	Monitor 1	comG1	chG1
4	23	CH23 Fault2	comD23	chD23	7	2	Monitor 2	comG2	chG2

Table 4.12 - Relay/Bit Table for 40-190B-202 & 40-190B-502 (32-channel, dual bus versions) for Sub-Units 2 to 7 Including IVI Channel Names

BIT TO RELAY FUNCTION CROSS REFERENCE TABLE (40-190B-202/502)									
Sub-Unit	Bit	Function	IVI Channel Names		Sub-Unit	Bit	Function	IVI Channel Names	
2	1	CH1 Break	comB1	chB1	3	22	CH22 Fault1	comC22	chC22
2	2	CH2 Break	comB2	chB2	3	23	CH23 Fault1	comC23	chC23
2	3	CH3 Break	comB3	chB3	3	24	CH24 Fault1	comC24	chC24
2	4	CH4 Break	comB4	chB4	3	25	CH25 Fault1	comC25	chC25
2	5	CH5 Break	comB5	chB5	3	26	CH26 Fault1	comC26	chC26
2	6	CH6 Break	comB6	chB6	3	27	CH27 Fault1	comC27	chC27
2	7	CH7 Break	comB7	chB7	3	28	CH28 Fault1	comC28	chC28
2	8	CH8 Break	comB8	chB8	3	29	CH29 Fault1	comC29	chC29
2	9	CH9 Break	comB9	chB9	3	30	CH30 Fault1	comC30	chC30
2	10	CH10 Break	comB10	chB10	3	31	CH31 Fault1	comC31	chC31
2	11	CH11 Break	comB11	chB11	3	32	CH32 Fault1	comC32	chC32
2	12	CH12 Break	comB12	chB12	4	1	CH1 Fault2	comD1	chD1
2	13	CH13 Break	comB13	chB13	4	2	CH2 Fault2	comD2	chD2
2	14	CH14 Break	comB14	chB14	4	3	CH3 Fault2	comD3	chD3
2	15	CH15 Break	comB15	chB15	4	4	CH4 Fault2	comD4	chD4
2	16	CH16 Break	comB16	chB16	4	5	CH5 Fault2	comD5	chD5
2	17	CH17 Break	comB17	chB17	4	6	CH6 Fault2	comD6	chD6
2	18	CH18 Break	comB18	chB18	4	7	CH7 Fault2	comD7	chD7
2	19	CH19 Break	comB19	chB19	4	8	CH8 Fault2	comD8	chD8
2	20	CH20 Break	comB20	chB20	4	9	CH9 Fault2	comD9	chD9
2	21	CH21 Break	comB21	chB21	4	10	CH10 Fault2	comD10	chD10
2	22	CH22 Break	comB22	chB22	4	11	CH11 Fault2	comD11	chD11
2	23	CH23 Break	comB23	chB23	4	12	CH12 Fault2	comD12	chD12
2	24	CH24 Break	comB24	chB24	4	13	CH13 Fault2	comD13	chD13
2	25	CH25 Break	comB25	chB25	4	14	CH14 Fault2	comD14	chD14
2	26	CH26 Break	comB26	chB26	4	15	CH15 Fault2	comD15	chD15
2	27	CH27 Break	comB27	chB27	4	16	CH16 Fault2	comD16	chD16
2	28	CH28 Break	comB28	chB28	4	17	CH17 Fault2	comD17	chD17
2	29	CH29 Break	comB29	chB29	4	18	CH18 Fault2	comD18	chD18
2	30	CH30 Break	comB30	chB30	4	19	CH19 Fault2	comD19	chD19
2	31	CH31 Break	comB31	chB31	4	20	CH20 Fault2	comD20	chD20
2	32	CH32 Break	comB32	chB32	4	21	CH21 Fault2	comD21	chD21
3	1	CH1 Fault1	comC1	chC1	4	22	CH22 Fault2	comD22	chD22
3	2	CH2 Fault1	comC2	chC2	4	23	CH23 Fault2	comD23	chD23
3	3	CH3 Fault1	comC3	chC3	4	24	CH24 Fault2	comD24	chD24
3	4	CH4 Fault1	comC4	chC4	4	25	CH25 Fault2	comD25	chD25
3	5	CH5 Fault1	comC5	chC5	4	26	CH26 Fault2	comD26	chD26
3	6	CH6 Fault1	comC6	chC6	4	27	CH27 Fault2	comD27	chD27
3	7	CH7 Fault1	comC7	chC7	4	28	CH28 Fault2	comD28	chD28
3	8	CH8 Fault1	comC8	chC8	4	29	CH29 Fault2	comD29	chD29
3	9	CH9 Fault1	comC9	chC9	4	30	CH30 Fault2	comD30	chD30
3	10	CH10 Fault1	comC10	chC10	4	31	CH31 Fault2	comD31	chD31
3	11	CH11 Fault1	comC11	chC11	4	32	CH32 Fault2	comD32	chD32
3	12	CH12 Fault1	comC12	chC12	5	1	Fault Select 1	comE	chE1
3	13	CH13 Fault1	comC13	chC13	5	2	Fault Select 2	comE	chE2
3	14	CH14 Fault1	comC14	chC14	5	3	Fault Select 3	comE	chE3
3	15	CH15 Fault1	comC15	chC15	5	4	Fault Select 4	comE	chE4
3	16	CH16 Fault1	comC16	chC16	6	1	Fault Select 5	comF	chF1
3	17	CH17 Fault1	comC17	chC17	6	2	Fault Select 6	comF	chF2
3	18	CH18 Fault1	comC18	chC18	6	3	Fault Select 7	comF	chF3
3	19	CH19 Fault1	comC19	chC19	6	4	Fault Select 8	comF	chF4
3	20	CH20 Fault1	comC20	chC20	7	1	Monitor 1	comG1	chG1
3	21	CH21 Fault1	comC21	chC21	7	2	Monitor 2	comG2	chG2

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SECTION 5 - CONNECTOR INFORMATION



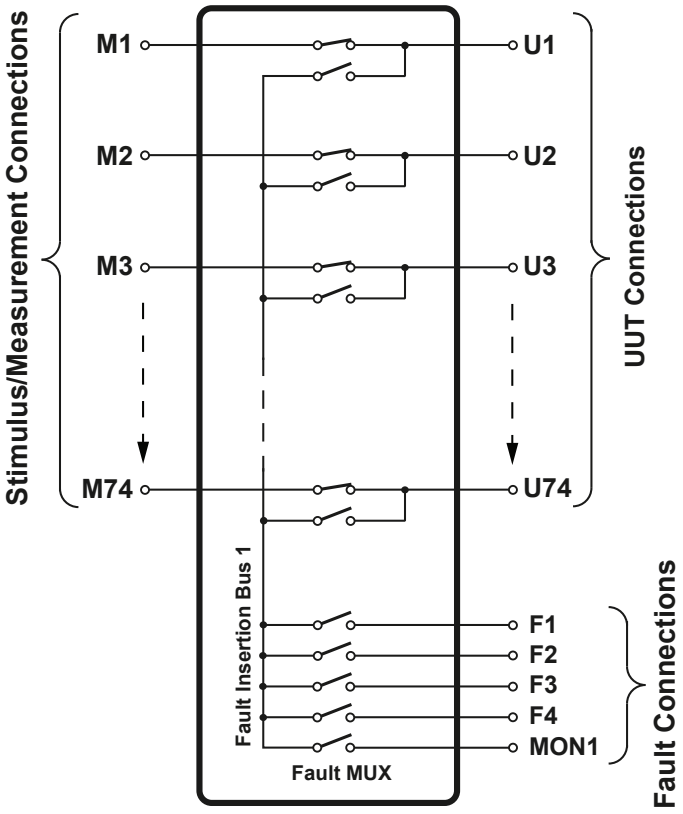
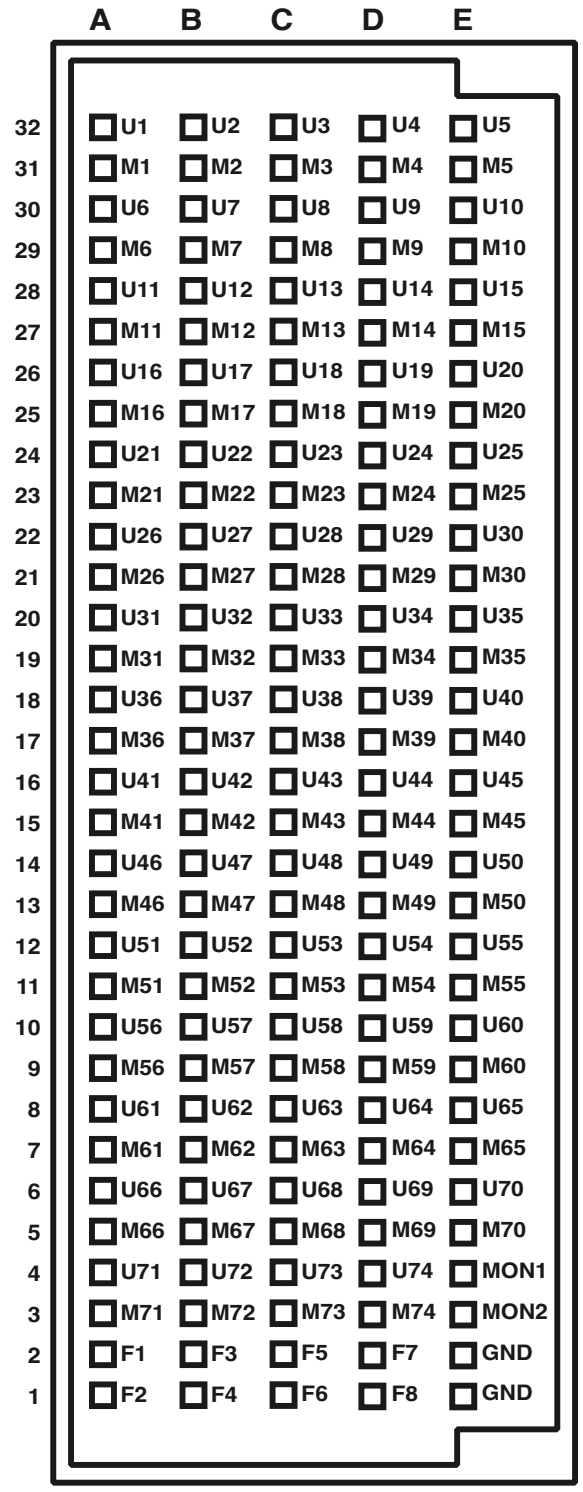


Figure 5.1 - Pinouts: 2A Fault Insertion Module 40-190B-001
(74-channel, single bus version with normally closed through relays)
160-pin male DIN 41612 connector viewed from front of module.



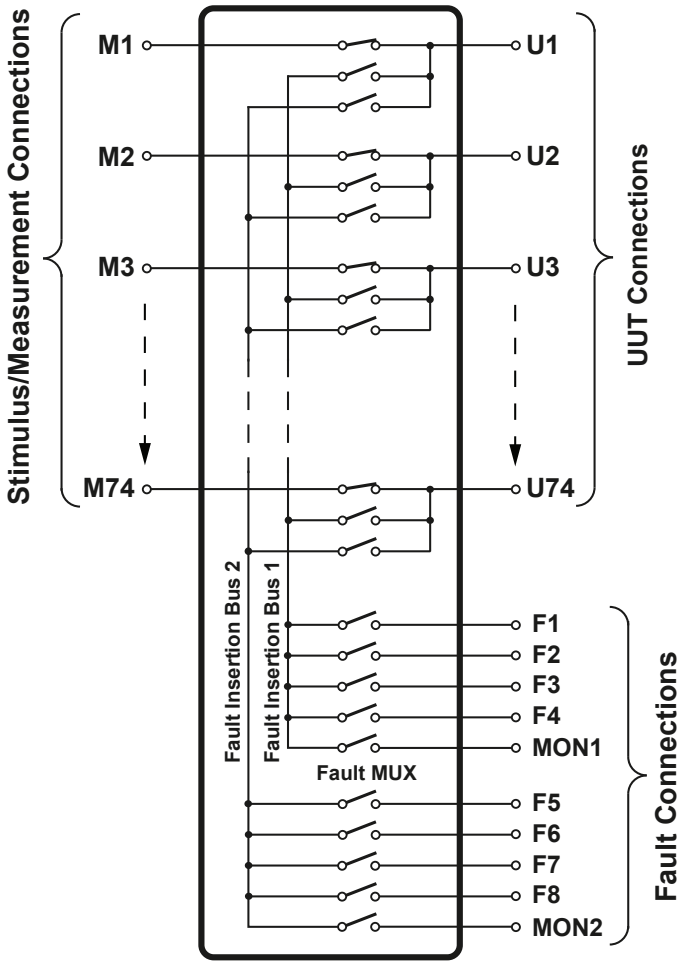
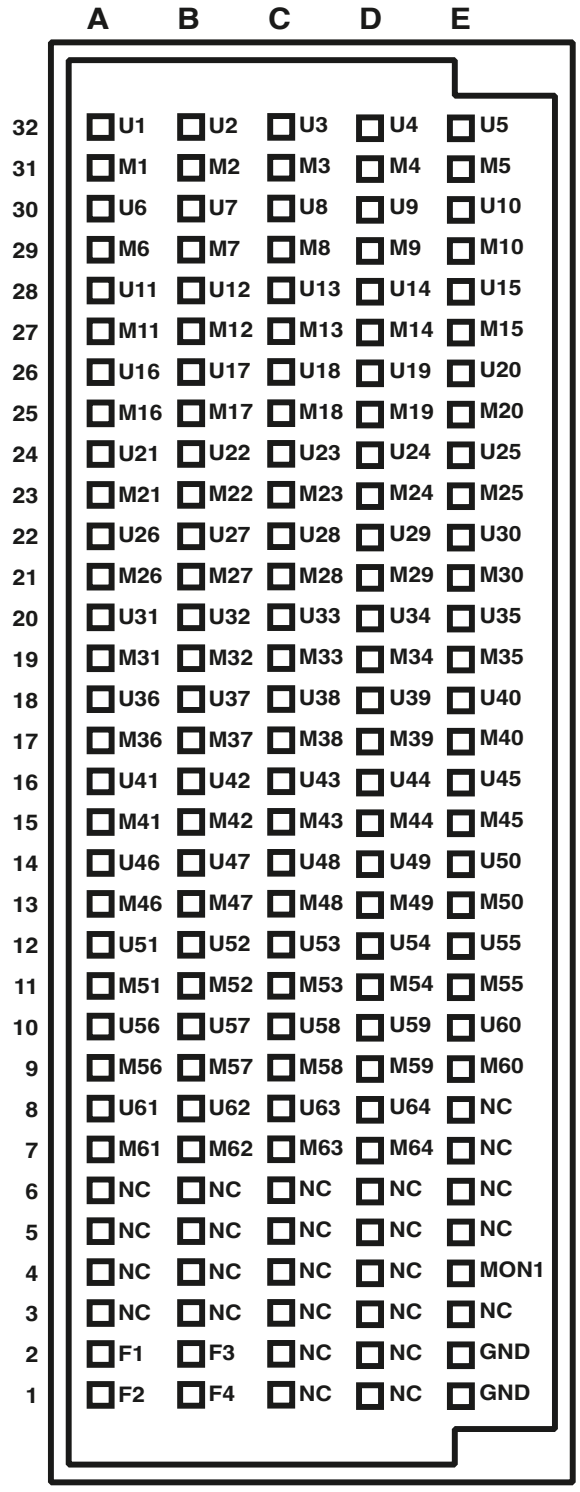


Figure 5.2 - Pinouts: 2A Fault Insertion Module 40-190B-002
(74-channel, dual bus version with normally closed through relays)
160-pin male DIN 41612 connector viewed from front of module.



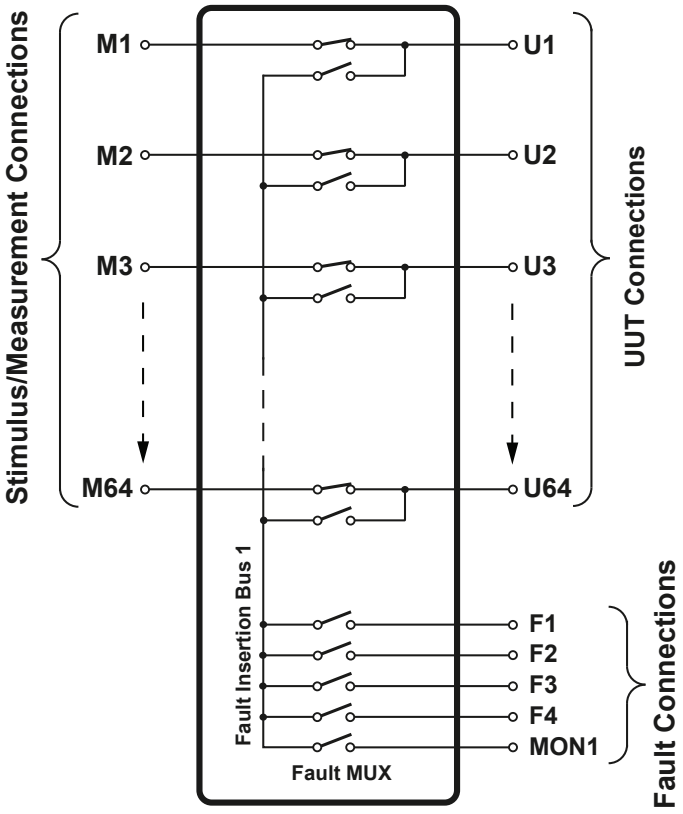
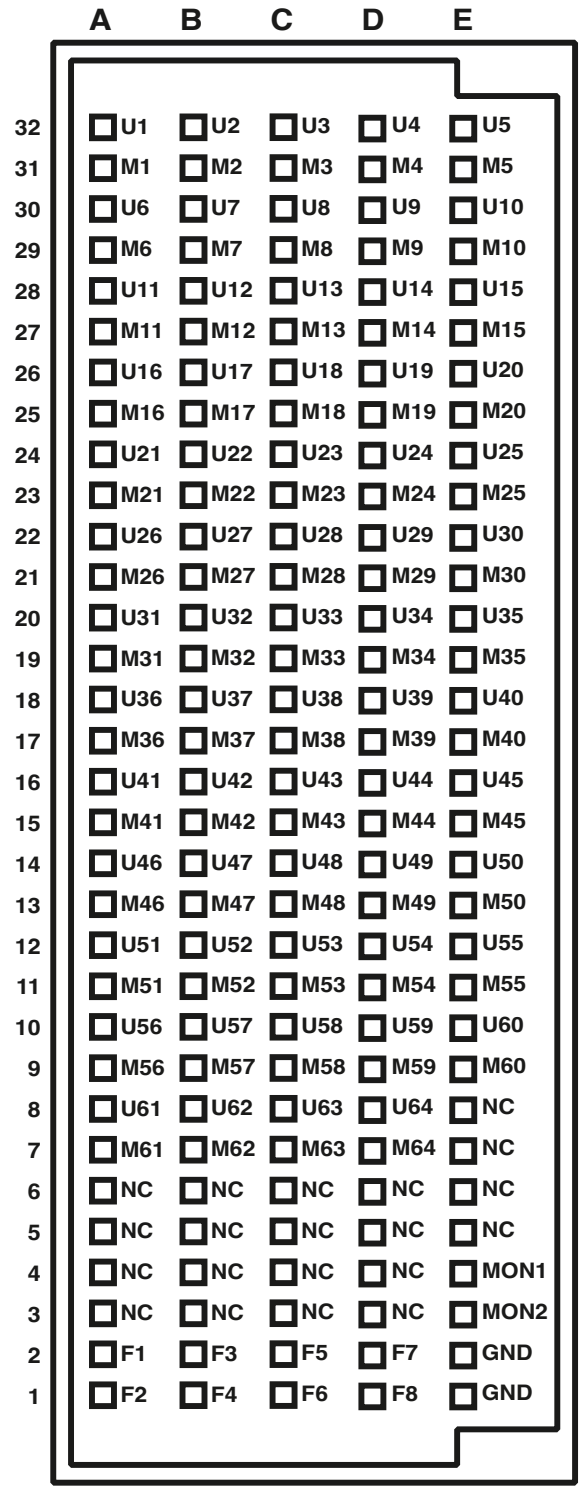


Figure 5.3 - Pinouts: 2A Fault Insertion Module 40-190B-101
(64-channel, single bus version with normally closed through relays)
160-pin male DIN 41612 connector viewed from front of module.



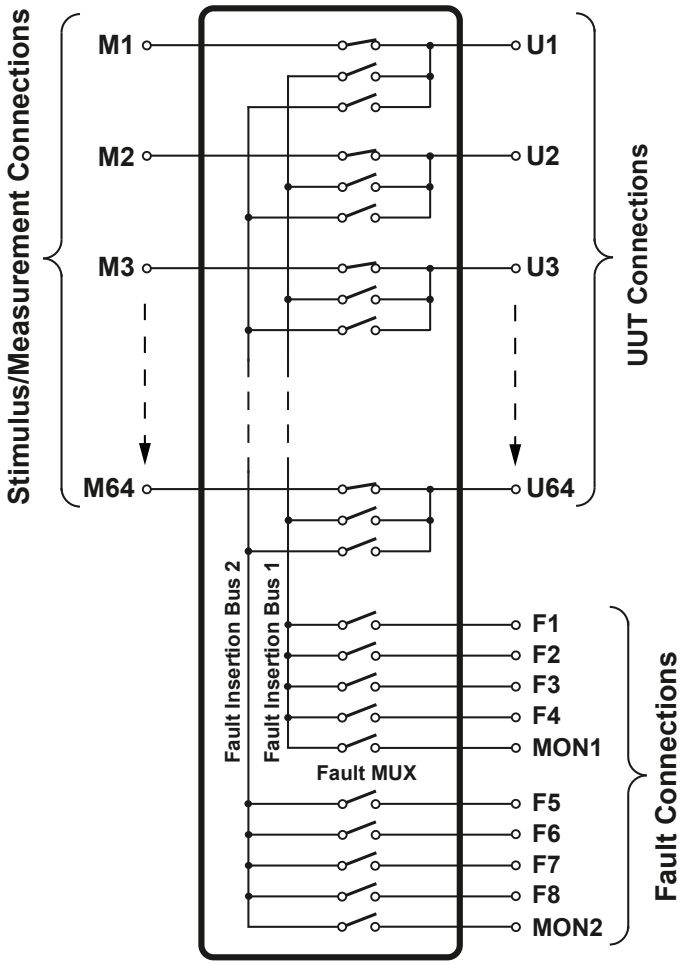
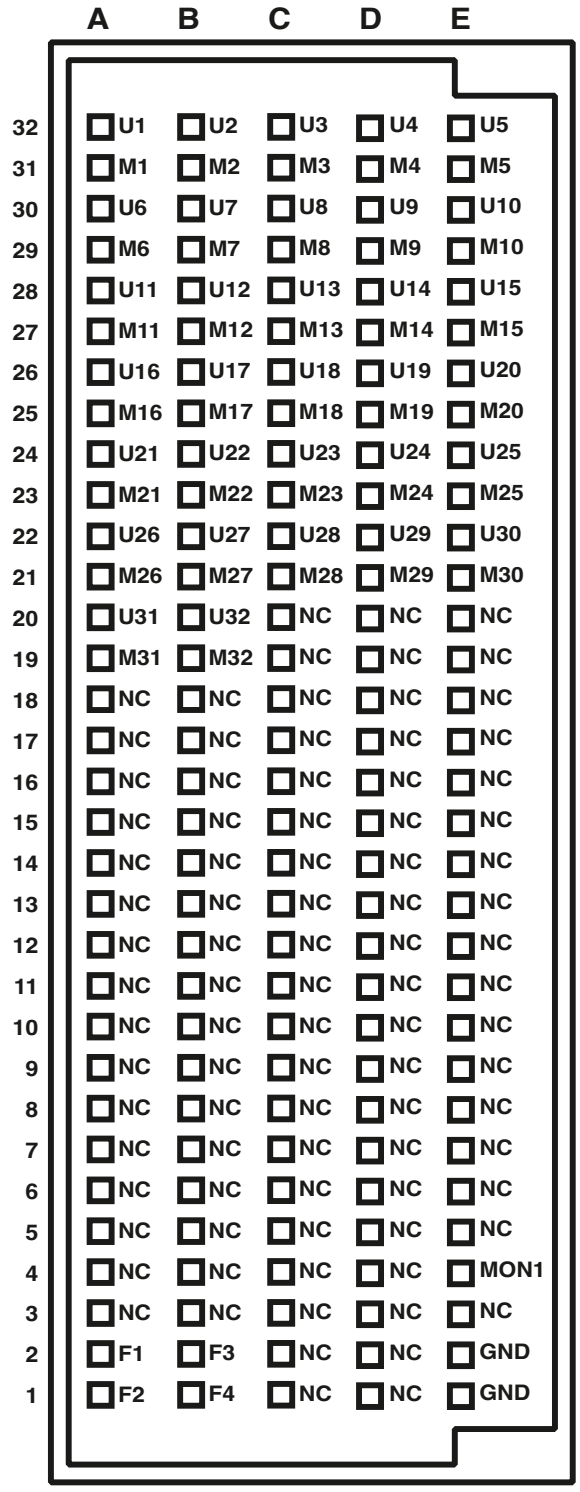


Figure 5.4 - Pinouts: 2A Fault Insertion Module 40-190B-102
(64-channel, dual bus version with normally closed through relays)
160-pin male DIN 41612 connector viewed from front of module.



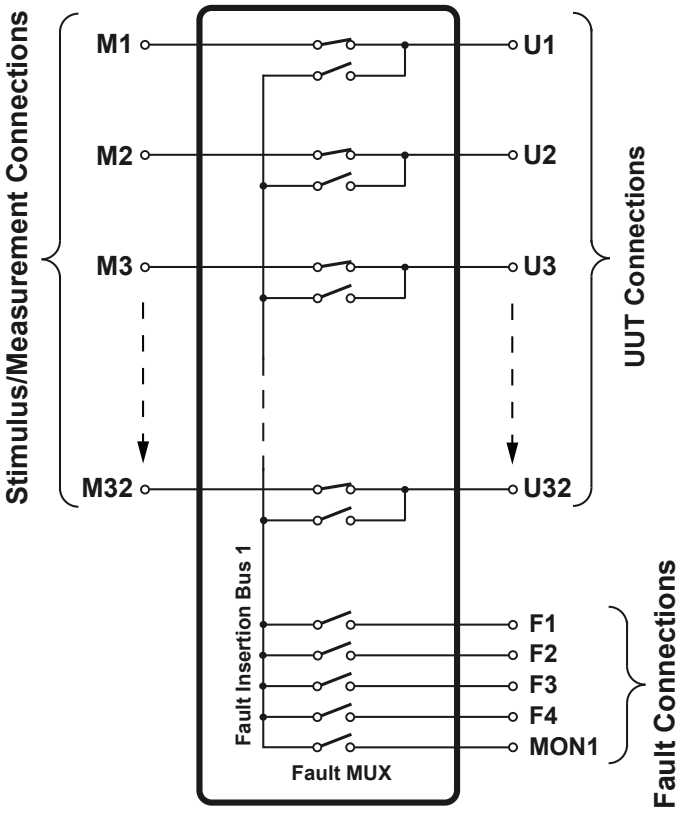
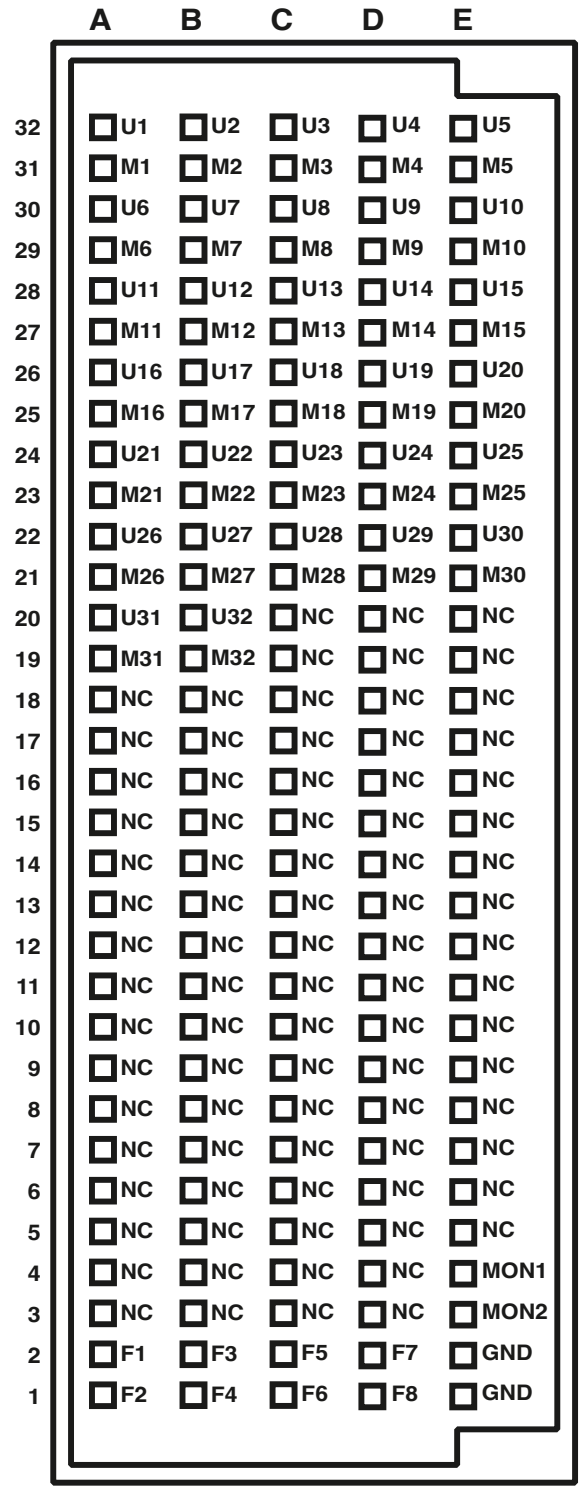


Figure 5.5 - Pinouts: 2A Fault Insertion Module 40-190B-201
(32-channel, single bus version with normally closed through relays)
160-pin male DIN 41612 connector viewed from front of module.



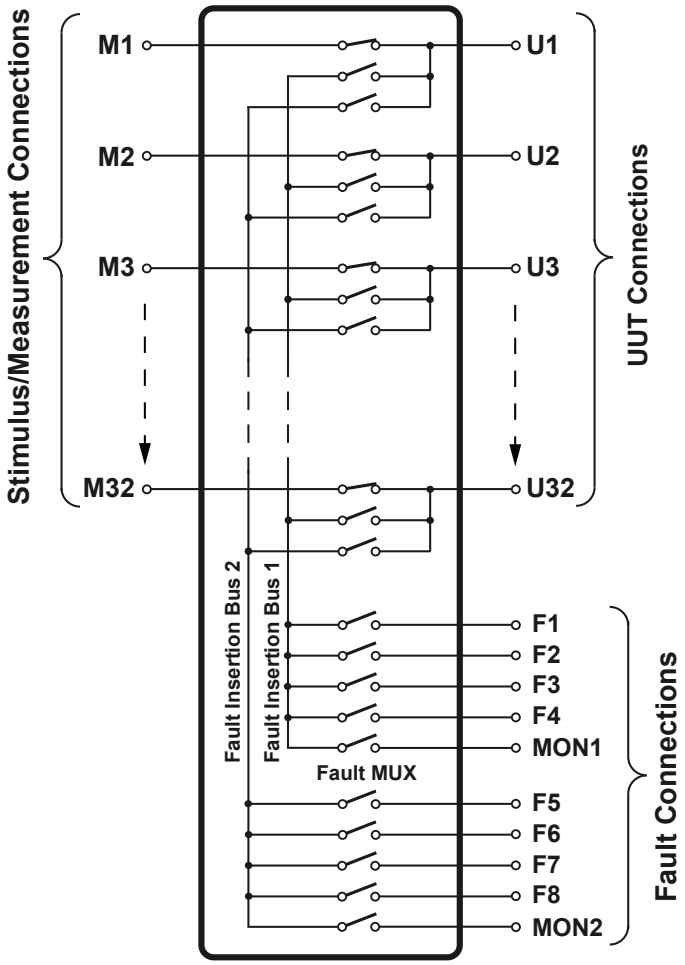
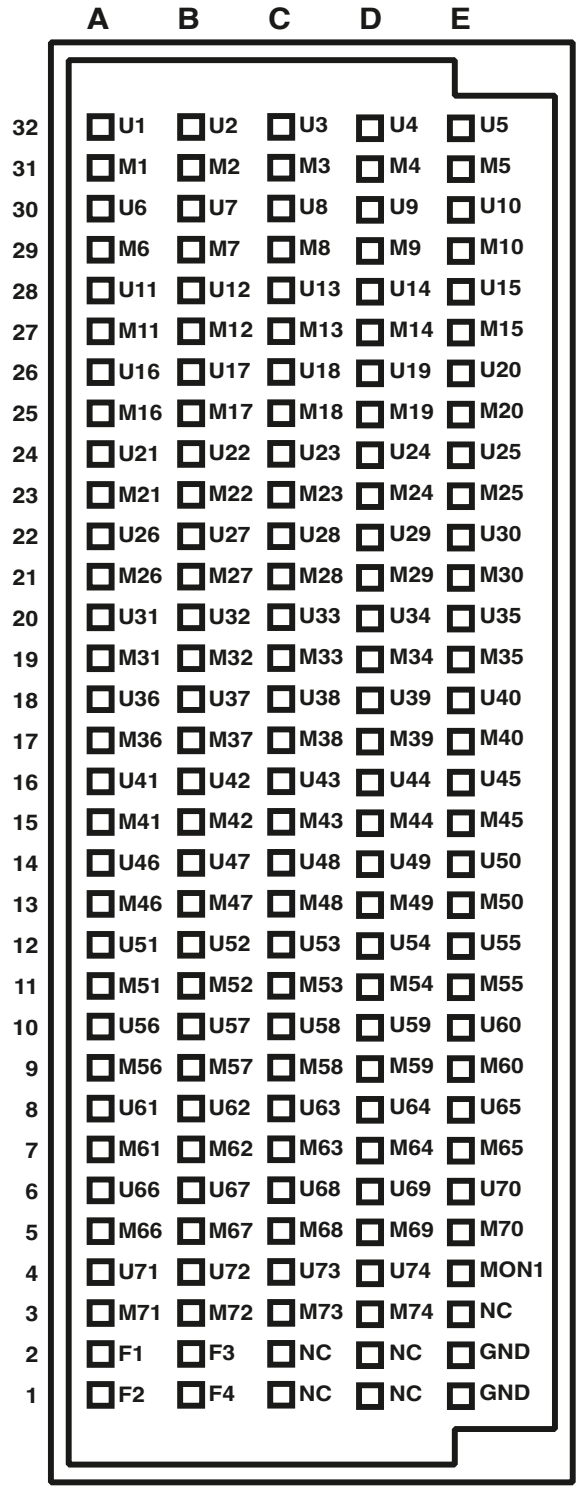


Figure 5.6 - Pinouts: 2A Fault Insertion Module 40-190B-202 (32-channel, dual bus version with normally closed through relays) 160-pin male DIN 41612 connector viewed from front of module.



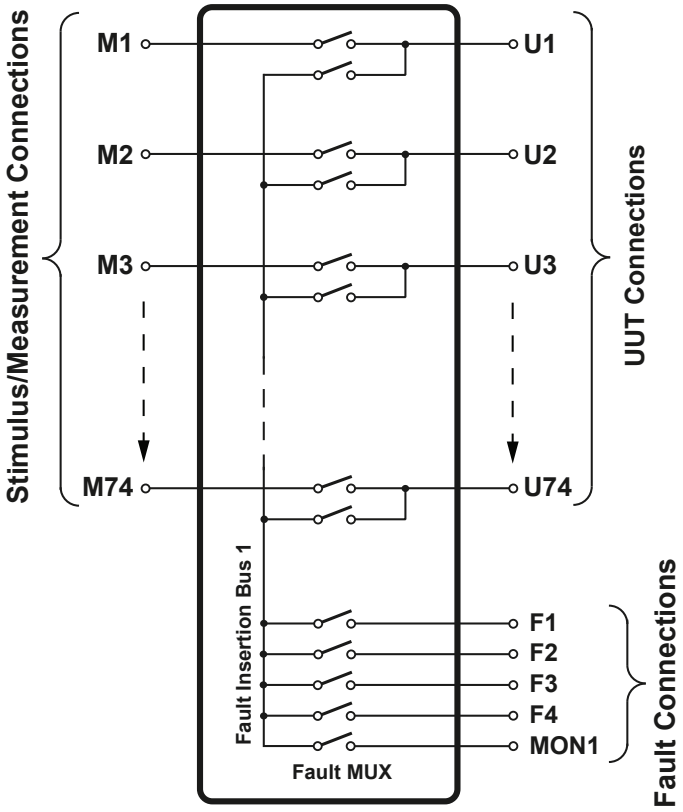
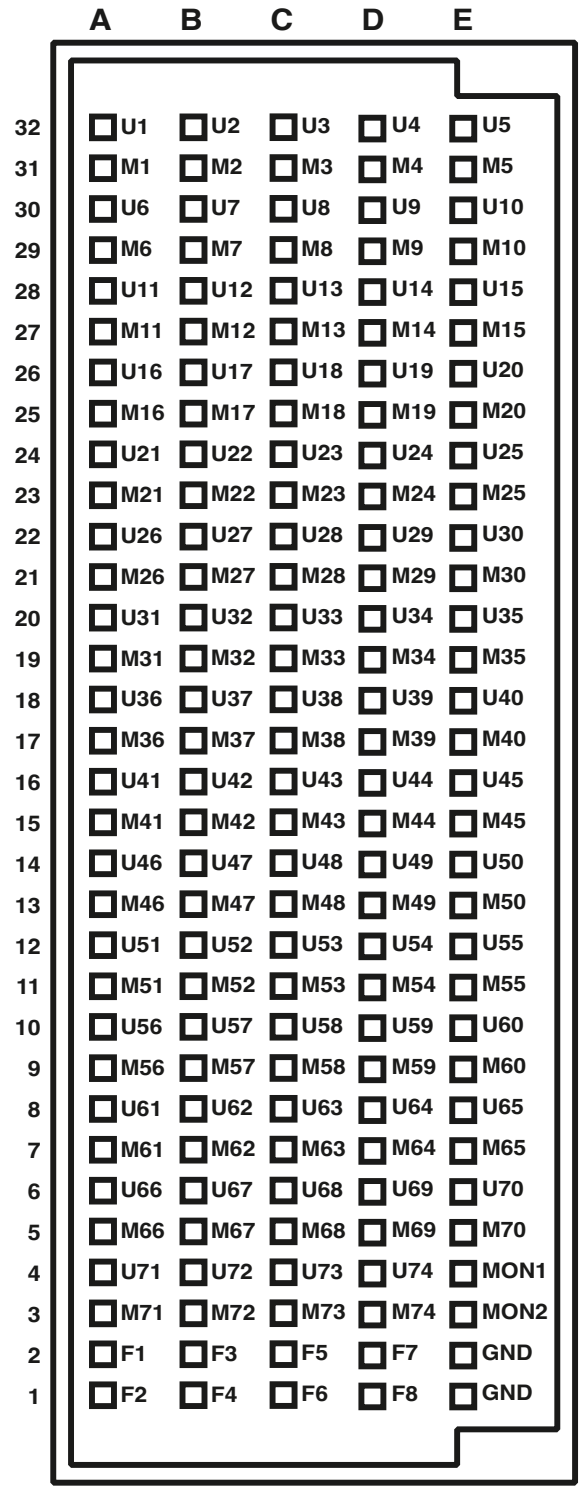


Figure 5.7 - Pinouts: 2A Fault Insertion Module 40-190B-301
(74-channel, single bus version with normally open through relays)
160-pin male DIN 41612 connector viewed from front of module.



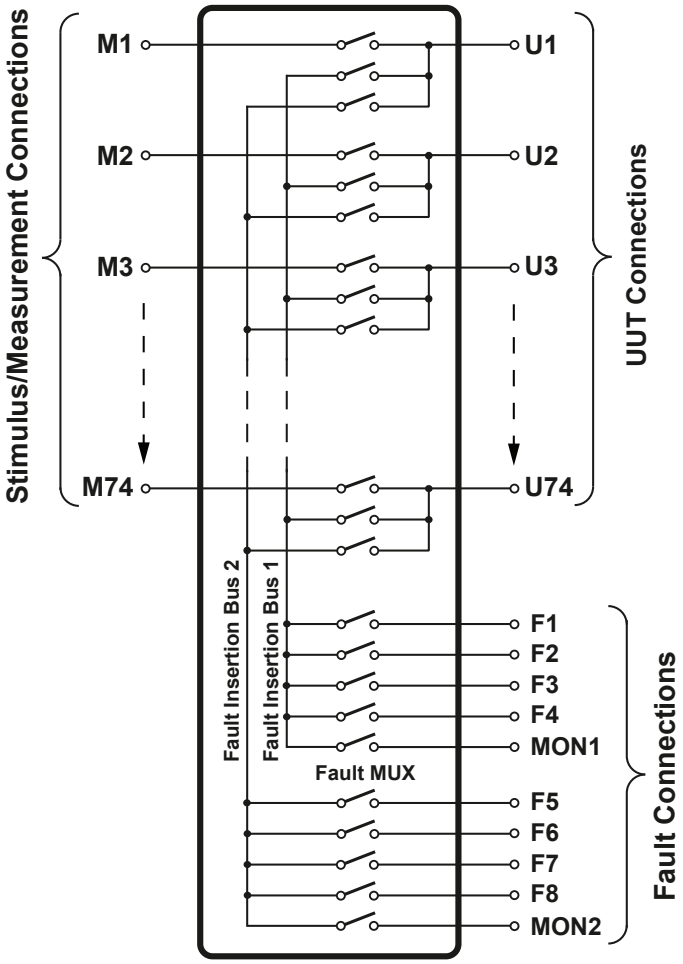
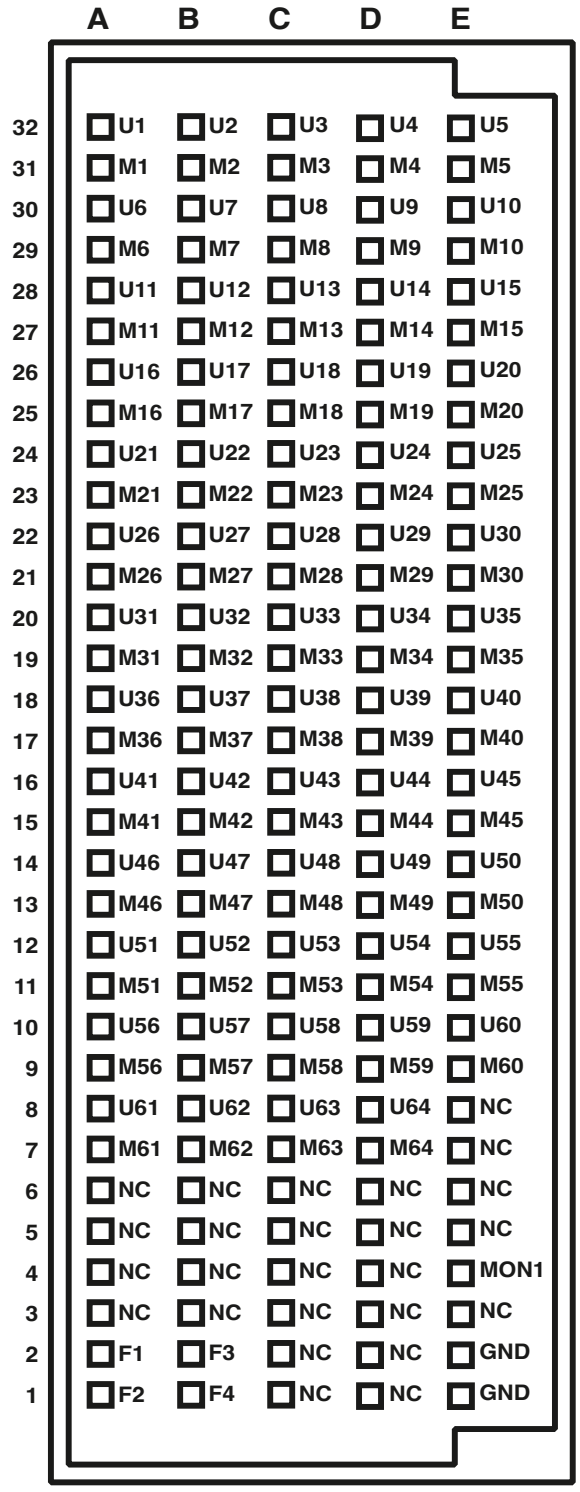


Figure 5.8 - Pinouts: 2A Fault Insertion Module 40-190B-302 (74-channel, dual bus version with normally open through relays) 160-pin male DIN 41612 connector viewed from front of module.



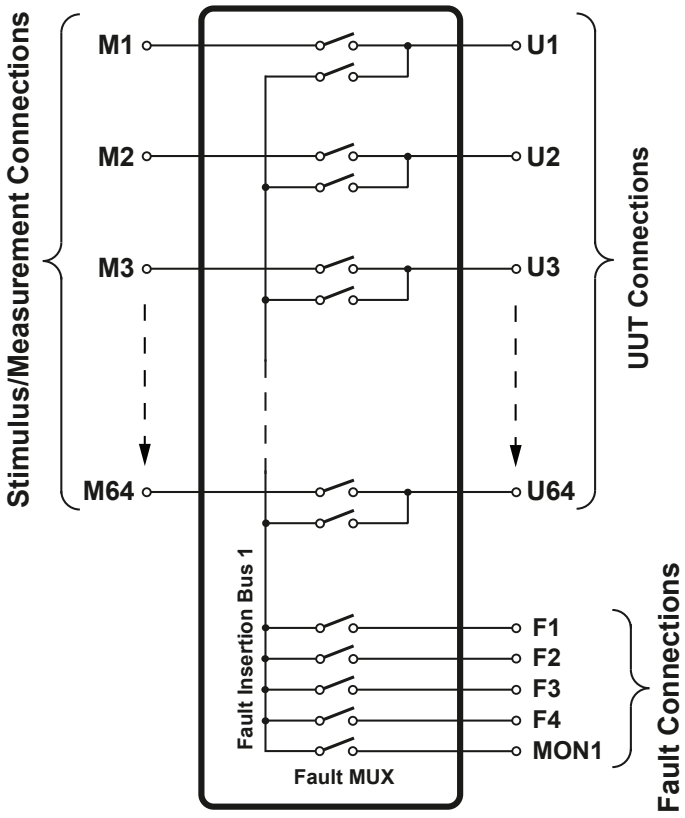
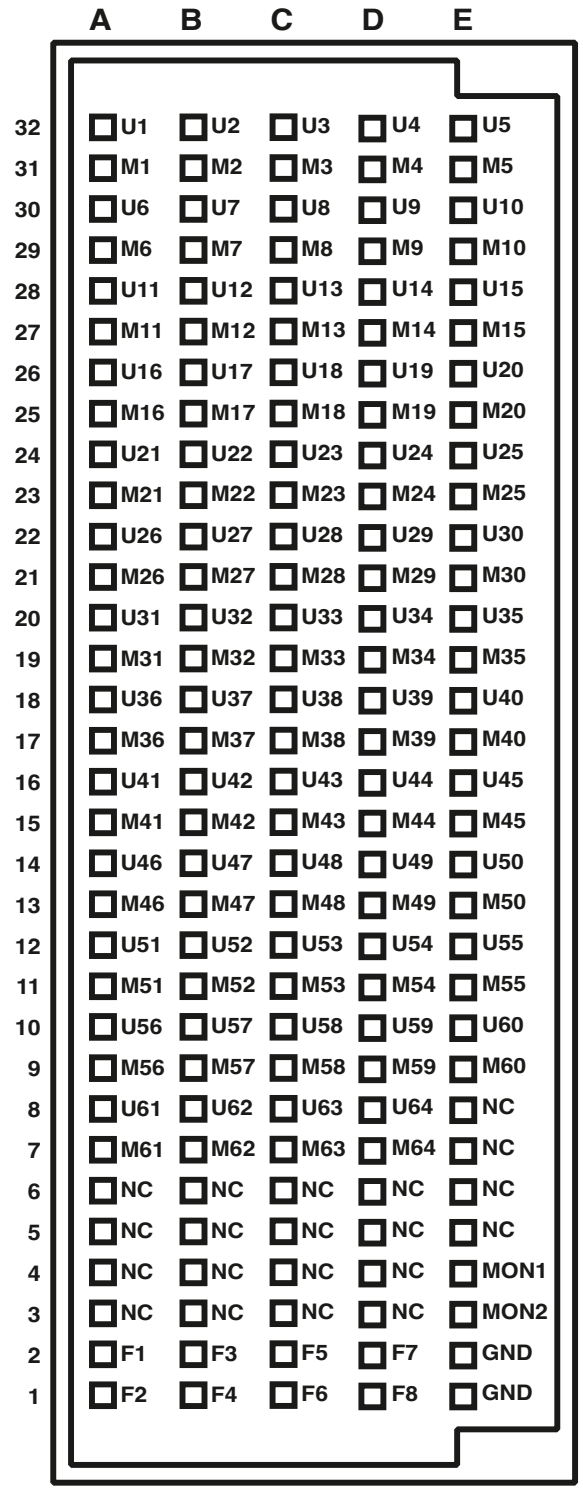


Figure 5.9 - Pinouts: 2A Fault Insertion Module 40-190B-401 (64-channel, single bus version with normally open through relays) 160-pin male DIN 41612 connector viewed from front of module.



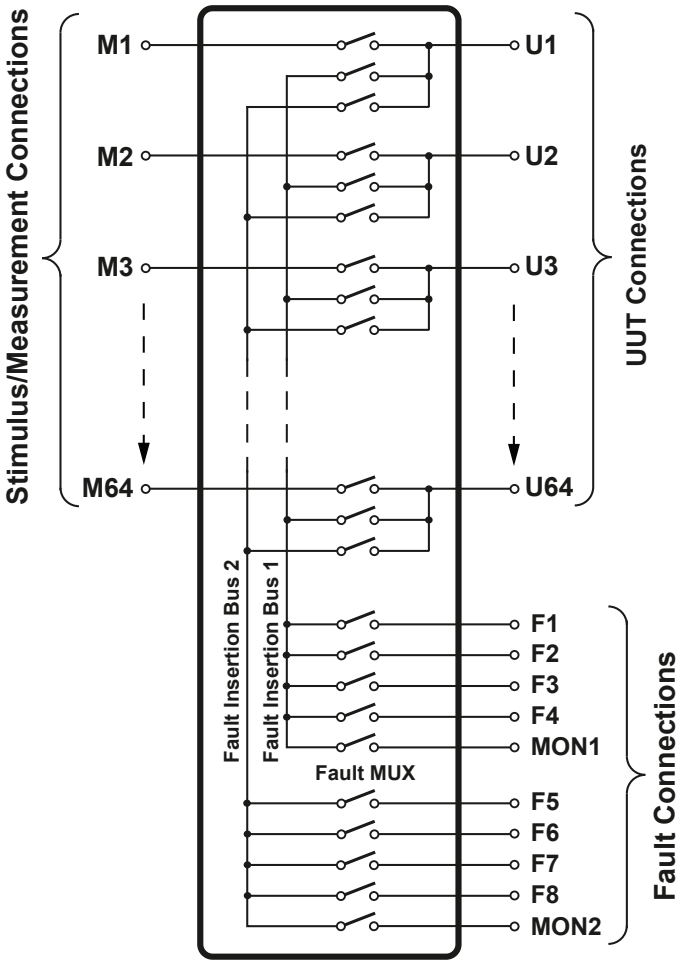
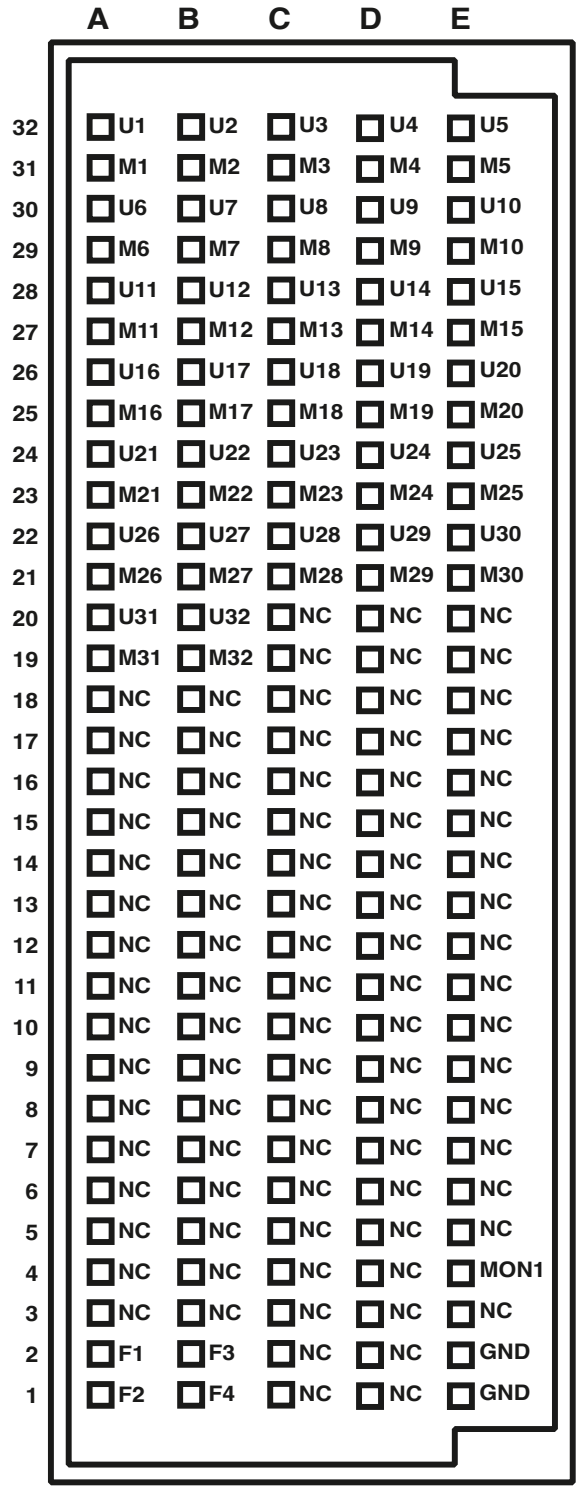


Figure 5.10 - Pinouts: 2A Fault Insertion Module 40-190B-402 (64-channel, dual bus version with normally open through relays) 160-pin male DIN 41612 connector viewed from front of module.



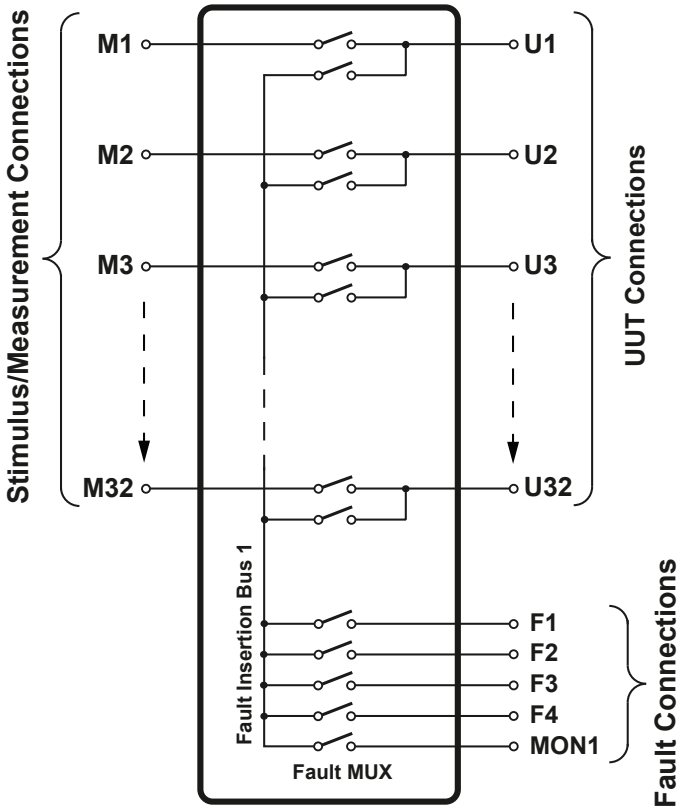
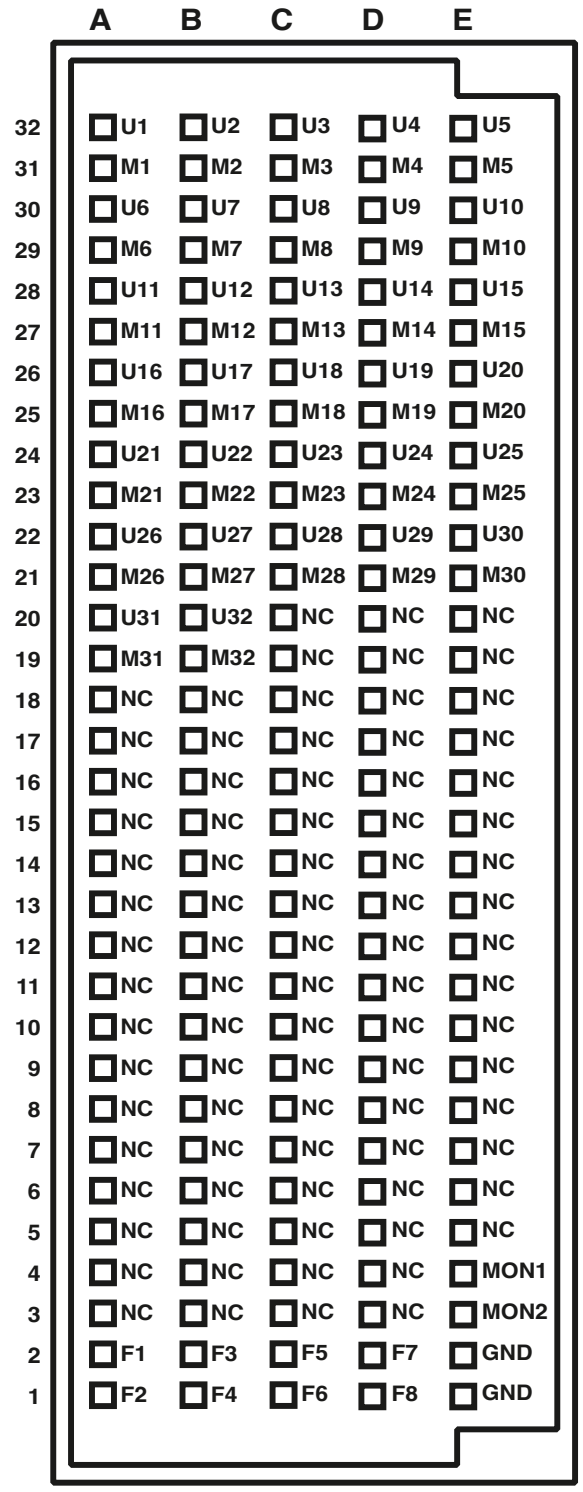


Figure 5.11 - Pinouts: 2A Fault Insertion Module 40-190B-501 (32-channel, single bus version with normally open through relays) 160-pin male DIN 41612 connector viewed from front of module.



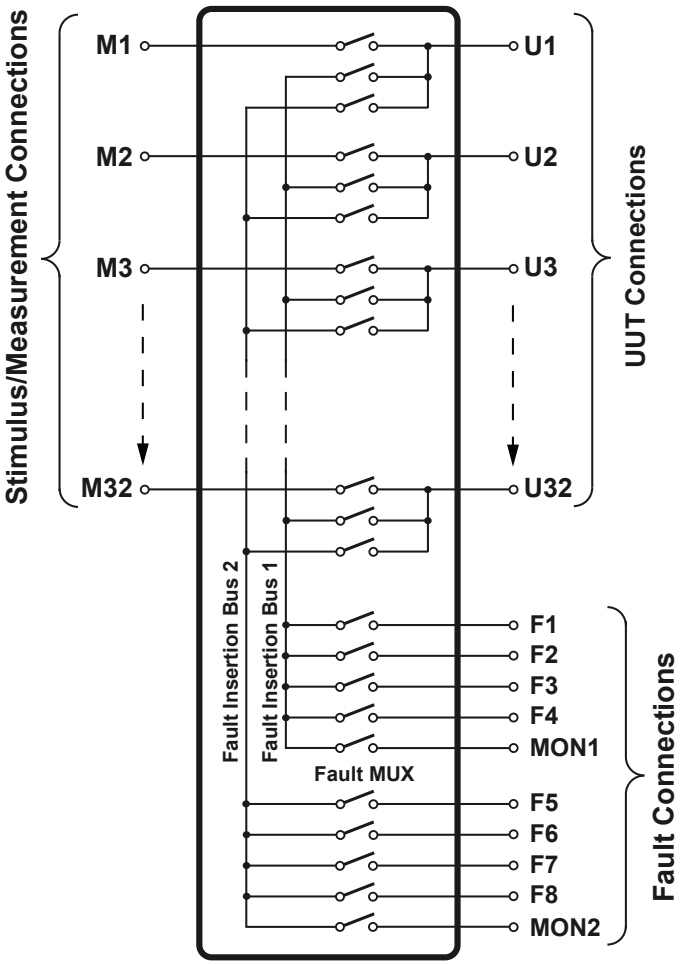


Figure 5.12 - Pinouts: 2A Fault Insertion Module 40-190B-502 (32-channel, dual bus version with normally open through relays) 160-pin male DIN 41612 connector viewed from front of module.

SECTION 6 - TROUBLE SHOOTING

Refer to the Warnings and Cautions at the front of this manual 

INSTALLATION PROBLEMS

The Plug & Play functionality of Pickering switch cards generally ensures trouble-free installation.

If you do experience any installation problems you should first ensure that all cards are properly seated in their slots. Improperly mated cards may go undetected by the operating system, or may be detected as a card of an unknown type. They can also cause the computer to freeze at various stages in the boot sequence.

If your system employs a remote control interface you should check the integrity of all remote control interface links. When the system is powered up, and during Windows start-up, you should expect to see periodic activity on the remote control interface RX/TX (yellow) indicators, clearing to leave only the PWR/LNK (green) LEDs illuminated. The RX/TX indicators should show activity when you attempt to access a card.

DIAGNOSTIC UTILITY

The Pickering Diagnostic Utility (accessible through the Programs>>Pickering>>PXI Utilities menu) generates a diagnostic report of the system's PCI configuration, highlighting any potential configuration problems. Specific details of all installed Pickering switch cards are included. All the installed Pickering switch cards should be listed in the "Pilpxi information" section - if one or more cards is missing it may be possible to determine the reason by referring to the PCI configuration dump contained in the report, but interpretation of this information is far from straightforward, and the best course is to contact Pickering support: support@pickeringtest.com, if possible including a copy of the diagnostic report.

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

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

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

SWITCHING SYSTEM TEST TOOLS

Please refer to Section 7 - Maintenance Information.

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SECTION 7 - MAINTENANCE INFORMATION

Refer to the Warnings and Cautions at the front of this manual 

PERIODIC MAINTENANCE

This product and its corresponding chassis do not require any periodic maintenance.

GENERAL CLEANING

- Isolate the electrical power from the chassis and ensure that no user I/O signals are being applied.
- Wipe the product & chassis surfaces with a clean dry anti-static cloth only.

SOFTWARE UPDATE

For PXI modules operating in a PXI chassis, no module software updates are required. For the latest version of the driver please refer to our web site **pickeringtest.com** where links to our Software Download page will provide the latest version of the driver software for the various programming environments encountered.

For PXI modules which are supported in one of Pickering Interfaces' Modular LXI Chassis (such as the 60-102B and 60-103B) no module software update is required. If the module was introduced after the LXI chassis was manufactured the module may not be recognized, in this case the chassis firmware may need upgrading. This is a simple process which is described in the manual for the Modular LXI Chassis.

SWITCHING SYSTEM TEST TOOLS

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

RELAY LOOK-UP TABLES

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

RELAY LOOK-UP TABLE - 40-190B MOTHERBOARD																			
Relay	Function	-001	-301	-002	-302	-101	-401	-102	-402	-201	-501	-202	-502	Relay	Function	-001	-301	-002	-302	-101	-401	-102	-402	-201	-501	-202	-502
RL1	CH1 Break	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	RL37	CH13 Break	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
RL2	CH1 Fault1	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	RL38	CH13 Fault1	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
RL3	CH1 Fault2			✔	✔		✔		✔		✔		✔	RL39	CH13 Fault2			✔	✔		✔		✔		✔		✔
RL4	CH2 Break	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	RL40	CH14 Break	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
RL5	CH2 Fault1	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	RL41	CH14 Fault1	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
RL6	CH2 Fault2			✔	✔		✔		✔		✔		✔	RL42	CH14 Fault2			✔	✔		✔		✔		✔		✔
RL7	CH3 Break	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	RL43	CH15 Break	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
RL8	CH3 Fault1	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	RL44	CH15 Fault1	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
RL9	CH3 Fault2			✔	✔		✔		✔		✔		✔	RL45	CH15 Fault2			✔	✔		✔		✔		✔		✔
RL10	CH4 Break	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	RL46	CH16 Break	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
RL11	CH4 Fault1	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	RL47	CH16 Fault1	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
RL12	CH4 Fault2			✔	✔		✔		✔		✔		✔	RL48	CH16 Fault2			✔	✔		✔		✔		✔		✔
RL13	CH5 Break	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	RL49	CH17 Break	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
RL14	CH5 Fault1	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	RL50	CH17 Fault1	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
RL15	CH5 Fault2			✔	✔		✔		✔		✔		✔	RL51	CH17 Fault2			✔	✔		✔		✔		✔		✔
RL16	CH6 Break	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	RL52	CH18 Break	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
RL17	CH6 Fault1	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	RL53	CH18 Fault1	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
RL18	CH6 Fault2			✔	✔		✔		✔		✔		✔	RL54	CH18 Fault2			✔	✔		✔		✔		✔		✔
RL19	CH7 Break	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	RL55	CH19 Break	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
RL20	CH7 Fault1	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	RL56	CH19 Fault1	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
RL21	CH7 Fault2			✔	✔		✔		✔		✔		✔	RL57	CH19 Fault2			✔	✔		✔		✔		✔		✔
RL22	CH8 Break	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	RL58	CH20 Break	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
RL23	CH8 Fault1	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	RL59	CH20 Fault1	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
RL24	CH8 Fault2			✔	✔		✔		✔		✔		✔	RL60	CH20 Fault2			✔	✔		✔		✔		✔		✔
RL25	CH9 Break	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	RL61	CH21 Break	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
RL26	CH9 Fault1	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	RL62	CH21 Fault1	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
RL27	CH9 Fault2			✔	✔		✔		✔		✔		✔	RL63	CH21 Fault2			✔	✔		✔		✔		✔		✔
RL28	CH10 Break	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	RL64	CH22 Break	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
RL29	CH10 Fault1	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	RL65	CH22 Fault1	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
RL30	CH10 Fault2			✔	✔		✔		✔		✔		✔	RL66	CH22 Fault2			✔	✔		✔		✔		✔		✔
RL31	CH11 Break	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	RL67	CH23 Break	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
RL32	CH11 Fault1	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	RL68	CH23 Fault1	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
RL33	CH11 Fault2			✔	✔		✔		✔		✔		✔	RL69	CH23 Fault2			✔	✔		✔		✔		✔		✔
RL34	CH12 Break	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	RL70	CH24 Break	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
RL35	CH12 Fault1	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	RL71	CH24 Fault1	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
RL36	CH12 Fault2			✔	✔		✔		✔		✔		✔	RL72	CH24 Fault2			✔	✔		✔		✔		✔		✔

RELAY LOOK-UP TABLE - 40-190B MOTHERBOARD - CONTINUED																	
Relay	Function	-001 -301	-002 -302	-101 -401	-102 -402	-201 -501	-202 -502	Relay	Function	-001 -301	-002 -302	-101 -401	-102 -402	-201 -501	-202 -502
RL73	CH25 Break	✔	✔	✔	✔	✔	✔	RL90	CH30 Fault2		✔		✔		✔
RL74	CH25 Fault1	✔	✔	✔	✔	✔	✔	RL91	CH31 Break	✔	✔	✔	✔	✔	✔
RL75	CH25 Fault2		✔		✔		✔	RL92	CH31 Fault1	✔	✔	✔	✔	✔	✔
RL76	CH26 Break	✔	✔	✔	✔	✔	✔	RL93	CH31 Fault2		✔		✔		✔
RL77	CH26 Fault1	✔	✔	✔	✔	✔	✔	RL94	CH32 Break	✔	✔	✔	✔	✔	✔
RL78	CH26 Fault2		✔		✔		✔	RL95	CH32 Fault1	✔	✔	✔	✔	✔	✔
RL79	CH27 Break	✔	✔	✔	✔	✔	✔	RL96	CH32 Fault2		✔		✔		✔
RL80	CH27 Fault1	✔	✔	✔	✔	✔	✔	RL223	Fault Select 1	✔	✔	✔	✔	✔	✔
RL81	CH27 Fault2		✔		✔		✔	RL224	Fault Select 2	✔	✔	✔	✔	✔	✔
RL82	CH28 Break	✔	✔	✔	✔	✔	✔	RL225	Fault Select 3	✔	✔	✔	✔	✔	✔
RL83	CH28 Fault1	✔	✔	✔	✔	✔	✔	RL226	Fault Select 4	✔	✔	✔	✔	✔	✔
RL84	CH28 Fault2		✔		✔		✔	RL227	Fault Select 6		✔		✔		✔
RL85	CH29 Break	✔	✔	✔	✔	✔	✔	RL228	Fault Select 8		✔		✔		✔
RL86	CH29 Fault1	✔	✔	✔	✔	✔	✔	RL229	Fault Select 5		✔		✔		✔
RL87	CH29 Fault2		✔		✔		✔	RL230	Fault Select 7		✔		✔		✔
RL88	CH30 Break	✔	✔	✔	✔	✔	✔	RL231	Monitor 1	✔	✔	✔	✔	✔	✔
RL89	CH30 Fault1	✔	✔	✔	✔	✔	✔	RL232	Monitor 2		✔		✔		✔

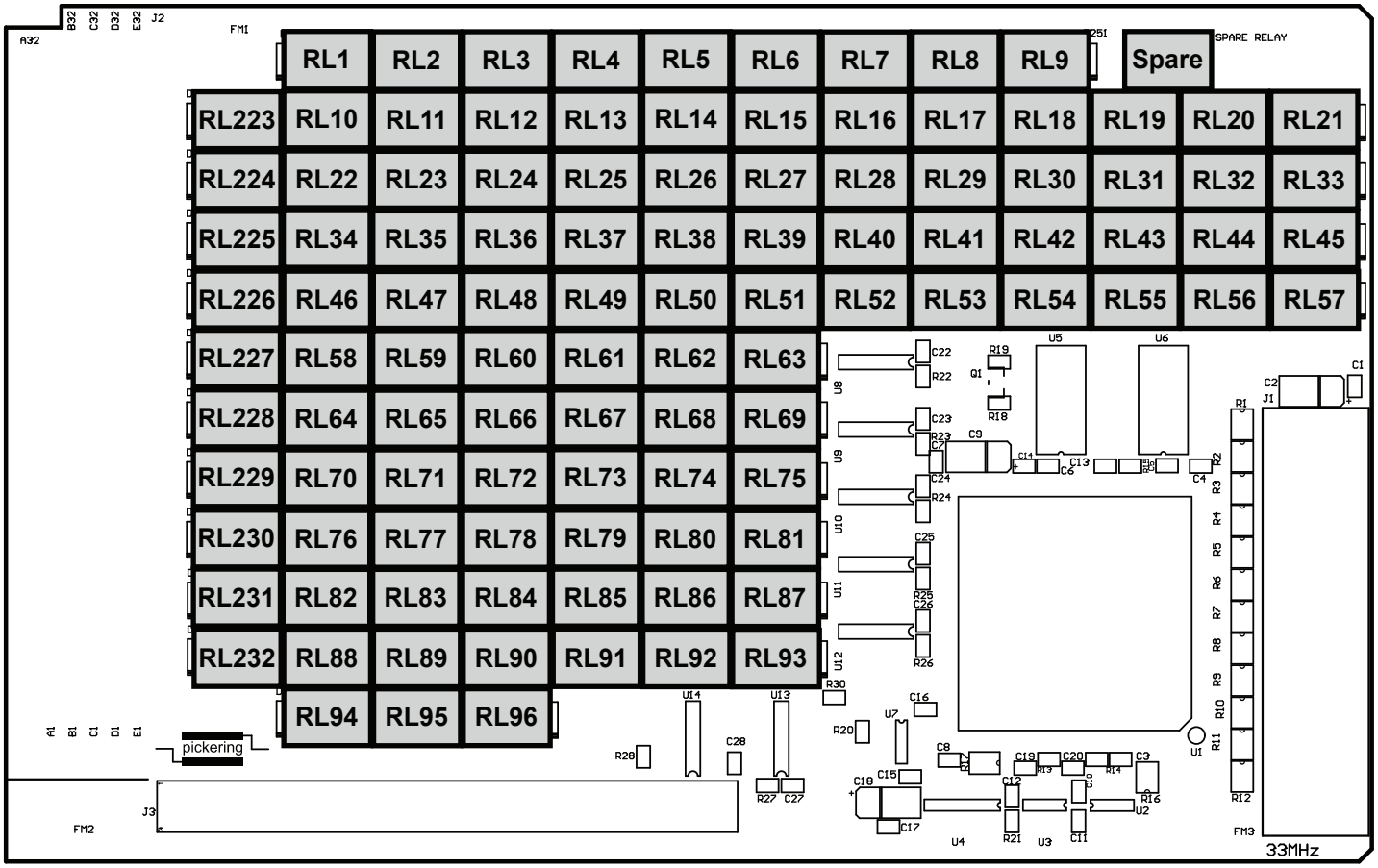


Figure 7.1 - 40-190B Motherboard Component Layout

RELAY LOOK-UP TABLE - 40-190B DAUGHTERBOARD																			
Relay	Function	-001	-301	-002	-302	-101	-401	-102	-402	-201	-501	-202	-502	Relay	Function	-001	-301	-002	-302	-101	-401	-102	-402	-201	-501	-202	-502
RL97	CH33 Break	✔	✔	✔	✔	✔	✔							RL142	CH48 Break	✔	✔	✔	✔	✔	✔						
RL98	CH33 Fault1	✔	✔	✔	✔	✔	✔							RL143	CH48 Fault1	✔	✔	✔	✔	✔	✔						
RL99	CH33 Fault2			✔	✔		✔							RL144	CH48 Fault2			✔	✔		✔						
RL100	CH34 Break	✔	✔	✔	✔	✔	✔							RL145	CH49 Break	✔	✔	✔	✔	✔	✔						
RL101	CH34 Fault1	✔	✔	✔	✔	✔	✔							RL146	CH49 Fault1	✔	✔	✔	✔	✔	✔						
RL102	CH34 Fault2			✔	✔		✔							RL147	CH49 Fault2			✔	✔		✔						
RL103	CH35 Break	✔	✔	✔	✔	✔	✔							RL148	CH50 Break	✔	✔	✔	✔	✔	✔						
RL104	CH35 Fault1	✔	✔	✔	✔	✔	✔							RL149	CH50 Fault1	✔	✔	✔	✔	✔	✔						
RL105	CH35 Fault2			✔	✔		✔							RL150	CH50 Fault2			✔	✔		✔						
RL106	CH36 Break	✔	✔	✔	✔	✔	✔							RL151	CH51 Break	✔	✔	✔	✔	✔	✔						
RL107	CH36 Fault1	✔	✔	✔	✔	✔	✔							RL152	CH51 Fault1	✔	✔	✔	✔	✔	✔						
RL108	CH36 Fault2			✔	✔		✔							RL153	CH51 Fault2			✔	✔		✔						
RL109	CH37 Break	✔	✔	✔	✔	✔	✔							RL154	CH52 Break	✔	✔	✔	✔	✔	✔						
RL110	CH37 Fault1	✔	✔	✔	✔	✔	✔							RL155	CH52 Fault1	✔	✔	✔	✔	✔	✔						
RL111	CH37 Fault2			✔	✔		✔							RL156	CH52 Fault2			✔	✔		✔						
RL112	CH38 Break	✔	✔	✔	✔	✔	✔							RL157	CH53 Break	✔	✔	✔	✔	✔	✔						
RL113	CH38 Fault1	✔	✔	✔	✔	✔	✔							RL158	CH53 Fault1	✔	✔	✔	✔	✔	✔						
RL114	CH38 Fault2			✔	✔		✔							RL159	CH53 Fault2			✔	✔		✔						
RL115	CH39 Break	✔	✔	✔	✔	✔	✔							RL160	CH54 Break	✔	✔	✔	✔	✔	✔						
RL116	CH39 Fault1	✔	✔	✔	✔	✔	✔							RL161	CH54 Fault1	✔	✔	✔	✔	✔	✔						
RL117	CH39 Fault2			✔	✔		✔							RL162	CH54 Fault2			✔	✔		✔						
RL118	CH40 Break	✔	✔	✔	✔	✔	✔							RL163	CH55 Break	✔	✔	✔	✔	✔	✔						
RL119	CH40 Fault1	✔	✔	✔	✔	✔	✔							RL164	CH55 Fault1	✔	✔	✔	✔	✔	✔						
RL120	CH40 Fault2			✔	✔		✔							RL165	CH55 Fault2			✔	✔		✔						
RL121	CH41 Break	✔	✔	✔	✔	✔	✔							RL166	CH56 Break	✔	✔	✔	✔	✔	✔						
RL122	CH41 Fault1	✔	✔	✔	✔	✔	✔							RL167	CH56 Fault1	✔	✔	✔	✔	✔	✔						
RL123	CH41 Fault2			✔	✔		✔							RL168	CH56 Fault2			✔	✔		✔						
RL124	CH42 Break	✔	✔	✔	✔	✔	✔							RL169	CH57 Break	✔	✔	✔	✔	✔	✔						
RL125	CH42 Fault1	✔	✔	✔	✔	✔	✔							RL170	CH57 Fault1	✔	✔	✔	✔	✔	✔						
RL126	CH42 Fault2			✔	✔		✔							RL171	CH57 Fault2			✔	✔		✔						
RL127	CH43 Break	✔	✔	✔	✔	✔	✔							RL172	CH58 Break	✔	✔	✔	✔	✔	✔						
RL128	CH43 Fault1	✔	✔	✔	✔	✔	✔							RL173	CH58 Fault1	✔	✔	✔	✔	✔	✔						
RL129	CH43 Fault2			✔	✔		✔							RL174	CH58 Fault2			✔	✔		✔						
RL130	CH44 Break	✔	✔	✔	✔	✔	✔							RL175	CH59 Break	✔	✔	✔	✔	✔	✔						
RL131	CH44 Fault1	✔	✔	✔	✔	✔	✔							RL176	CH59 Fault1	✔	✔	✔	✔	✔	✔						
RL132	CH44 Fault2			✔	✔		✔							RL177	CH59 Fault2			✔	✔		✔						
RL133	CH45 Break	✔	✔	✔	✔	✔	✔							RL178	CH60 Break	✔	✔	✔	✔	✔	✔						
RL134	CH45 Fault1	✔	✔	✔	✔	✔	✔							RL179	CH60 Fault1	✔	✔	✔	✔	✔	✔						
RL135	CH45 Fault2			✔	✔		✔							RL180	CH60 Fault2			✔	✔		✔						
RL136	CH46 Break	✔	✔	✔	✔	✔	✔							RL181	CH61 Break	✔	✔	✔	✔	✔	✔						
RL137	CH46 Fault1	✔	✔	✔	✔	✔	✔							RL182	CH61 Fault1	✔	✔	✔	✔	✔	✔						
RL138	CH46 Fault2			✔	✔		✔							RL183	CH61 Fault2			✔	✔		✔						
RL139	CH47 Break	✔	✔	✔	✔	✔	✔							RL184	CH62 Break	✔	✔	✔	✔	✔	✔						
RL140	CH47 Fault1	✔	✔	✔	✔	✔	✔							RL185	CH62 Fault1	✔	✔	✔	✔	✔	✔						
RL141	CH47 Fault2			✔	✔		✔							RL186	CH62 Fault2			✔	✔		✔						

RELAY LOOK-UP TABLE - 40-190B DAUGHTERBOARD - CONTINUED																			
Relay	Function	-001	-301	-002	-302	-101	-401	-102	-402	-201	-501	-202	-502	Relay	Function	-001	-301	-002	-302	-101	-401	-102	-402	-201	-501	-202	-502
RL187	CH63 Break	✔		✔		✔		✔						RL205	CH69 Break	✔		✔									
RL188	CH63 Fault1	✔		✔		✔		✔						RL206	CH69 Fault1	✔		✔									
RL189	CH63 Fault2			✔				✔						RL207	CH69 Fault2			✔									
RL190	CH64 Break	✔		✔		✔		✔						RL208	CH70 Break	✔		✔									
RL191	CH64 Fault1	✔		✔		✔		✔						RL209	CH70 Fault1	✔		✔									
RL192	CH64 Fault2			✔				✔						RL210	CH70 Fault2			✔									
RL193	CH65 Break	✔		✔										RL211	CH71 Break	✔		✔									
RL194	CH65 Fault1	✔		✔										RL212	CH71 Fault1	✔		✔									
RL195	CH65 Fault2			✔										RL213	CH71 Fault2			✔									
RL196	CH66 Break	✔		✔										RL214	CH72 Break	✔		✔									
RL197	CH66 Fault1	✔		✔										RL215	CH72 Fault1	✔		✔									
RL198	CH66 Fault2			✔										RL216	CH72 Fault2			✔									
RL199	CH67 Break	✔		✔										RL217	CH73 Break	✔		✔									
RL200	CH67 Fault1	✔		✔										RL218	CH73 Fault1	✔		✔									
RL201	CH67 Fault2			✔										RL219	CH73 Fault2			✔									
RL202	CH68 Break	✔		✔										RL220	CH74 Break	✔		✔									
RL203	CH68 Fault1	✔		✔										RL221	CH74 Fault1	✔		✔									
RL204	CH68 Fault2			✔										RL222	CH74 Fault2			✔									

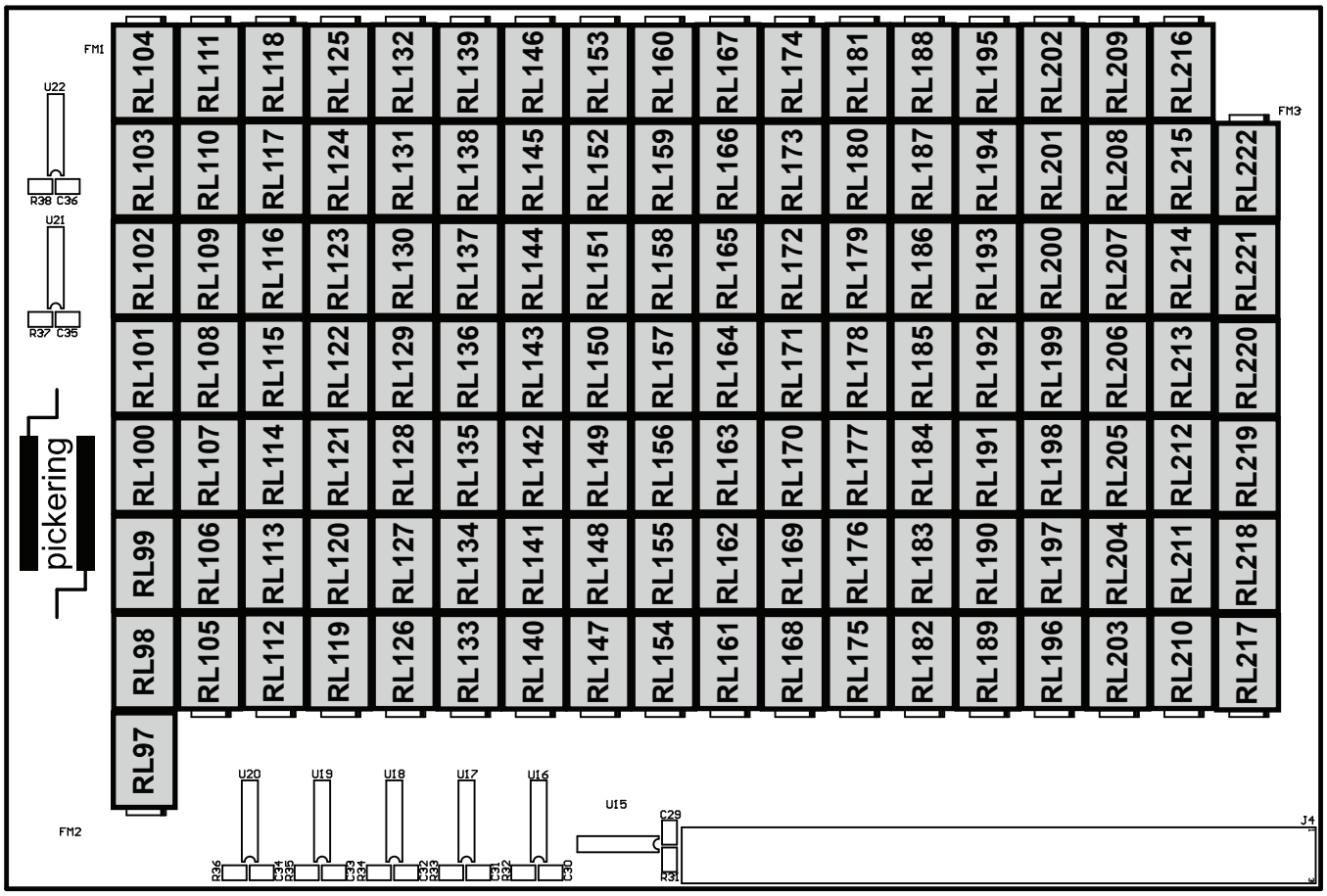


Figure 7.2 - 40-190B-002 Daughterboard Component Layout

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