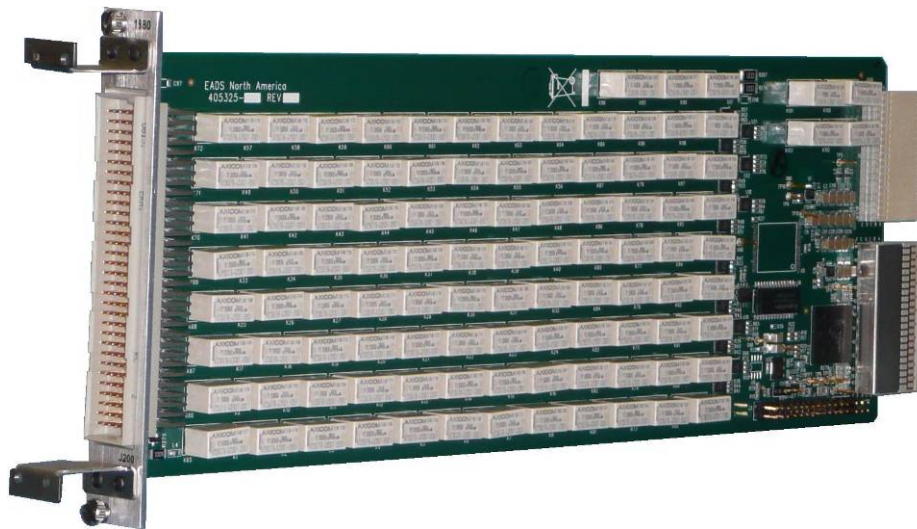


Racal Instruments™

# 1380 64-Channel Scanner/Multiplexer Plug-in Switch Card User Manual

Publication No. 980937-1380 Rev. A



**EADS North America Test and Services,**

a division of EADS North America, Inc.

4 Goodyear, Irvine, CA 92618

Tel: (800) 722-2528, (949) 859-8999; Fax: (949) 859-7139

[info@eads-nadefense.com](mailto:info@eads-nadefense.com)   [sales@eads-nadefense.com](mailto:sales@eads-nadefense.com)  
[helpdesk@eads-nadefense.com](mailto:helpdesk@eads-nadefense.com)   <http://www.eads-nadefense.com>



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2. Product model number
3. Your company and contact information

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# FOR YOUR SAFETY

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Before undertaking any troubleshooting, maintenance or exploratory procedure, read carefully the **WARNINGS** and **CAUTION** notices.



**CAUTION**  
RISK OF ELECTRICAL SHOCK  
DO NOT OPEN



This equipment contains voltage hazardous to human life and safety, and is capable of inflicting personal injury.



If this instrument is to be powered from the AC line (mains) through an autotransformer, ensure the common connector is connected to the neutral (earth pole) of the power supply.



Before operating the unit, ensure the conductor (green wire) is connected to the ground (earth) conductor of the power outlet. Do not use a two-conductor extension cord or a three-prong/two-prong adapter. This will defeat the protective feature of the third conductor in the power cord.



Maintenance and calibration procedures sometimes call for operation of the unit with power applied and protective covers removed. Read the procedures and heed warnings to avoid “live” circuit points.

Before operating this instrument:

1. Ensure the proper fuse is in place for the power source to operate.
2. Ensure all other devices connected to or in proximity to this instrument are properly grounded or connected to the protective third-wire earth ground.

If the instrument:

- fails to operate satisfactorily
- shows visible damage
- has been stored under unfavorable conditions
- has sustained stress

Do not operate until performance is checked by qualified personnel.

# Table of Contents

<b>Chapter 1 Overview and Specifications</b> .....	<b>1-1</b>
Overview.....	1-1
Specifications.....	1-2
Input.....	1-2
DC Performance (1x8, 2-wire).....	1-2
AC Performance (50 $\Omega$ ).....	1-3
Interface Data.....	1-3
Software.....	1-3
Environmental Data.....	1-3
Conformance Testing.....	1-4
Reliability.....	1-4
Mean Time Between Failure (MTBF).....	1-4
Mechanical.....	1-5
Ordering Information.....	1-5
<b>Chapter 2 Installation Instructions</b> .....	<b>2-1</b>
Unpacking and Inspection.....	2-1
Installation.....	2-1
Plug-in Card Shield.....	2-2
Front Panel Connector Pin Assignment.....	2-3
Mating Connectors.....	2-6
Installing Coding Keys on Cards and Connectors.....	2-11
<b>Chapter 3 Operation</b> .....	<b>3-1</b>
Block Diagram.....	3-1
Module Configuration.....	3-3
Configuration Relays.....	3-5
Using Single-Wire Mode.....	3-6
Front Panel Configuration.....	3-6
System Analog Bus (Back Panel) Configuration.....	3-7
Using the Discharge Resistor.....	3-8
Operating the 1380 Switch Card.....	3-9
Command Set.....	3-9
Identifying the 1380 Card in the Chassis.....	3-9
Using the Analog Bus.....	3-10
Analog Bus Safety Interlock Circuit.....	3-11
LXI Web Page Controls.....	3-12
Relay Control Tab.....	3-12
SCPI Commands Tab.....	3-13
Module Overview Tab.....	3-15
Tools Menu.....	3-16

IVI Driver Operation ..... 3-17

IVI Configuration Store ..... 3-19

Visual C++ Example ..... 3-24

Visual C# Example ..... 3-26

ActivATE Operation ..... 3-27

    Main Tab ..... 3-28

    Relay Reference Tab ..... 3-29

    Main Control Tab ..... 3-30

    Configuration Tab ..... 3-31

Commonly Used SCPI Commands ..... 3-31

Channel Descriptors ..... 3-32

PATH Command ..... 3-33

SCAN Command ..... 3-33

**INDEX ..... 1**

# List of Figures

Figure 1-1: 1380 Plug-in Switch Card .....	1-1
Figure 2-1: Inserting a Plug-In Card .....	2-2
Figure 2-2: Installing a Card Shield .....	2-2
Figure 2-3: Front Panel Connector Layout .....	2-3
Figure 2-4: Cable Assembly (P/N 408191) Connector End .....	2-7
Figure 2-5: Coding Key Hardware .....	2-11
Figure 2-6: Installed Keys .....	2-12
Figure 3-1: 1380 Block Diagram .....	3-2
Figure 3-2: Details from Block Diagram .....	3-3
Figure 3-3: Single Multiplexer Example (Channels 50 through 57) .....	3-4
Figure 3-4: 1380 Module Configuration Block Diagram .....	3-5
Figure 3-5: Multiplexer Configuration Block Diagram .....	3-5
Figure 3-6: Front Panel, Single-Wire Configuration .....	3-7
Figure 3-7: Back Plane, Single-Wire Configuration .....	3-8
Figure 3-8: Discharge Resistor .....	3-8
Figure 3-9: Analog Bus .....	3-10
Figure 3-10: Analog Bus Safety Interlock .....	3-11
Figure 3-11: Relay Control Tab .....	3-13
Figure 3-12: SCPI Commands Tab .....	3-14
Figure 3-13: Module Overview Tab .....	3-15
Figure 3-14: Web Page Tools Menu .....	3-16
Figure 3-15: Creating New IVI Driver Session .....	3-20
Figure 3-16: Associating Software Module with IVI Driver Session .....	3-21
Figure 3-17: Creating a Hardware Asset for the IVI Driver Session .....	3-21
Figure 3-18: Modifying the Module Address for the IVI Driver Session .....	3-22
Figure 3-19: Creating a Logical Name for the IVI Driver Session .....	3-23
Figure 3-20: Example Visual C++ Program Using the IVI Driver .....	3-25
Figure 3-21: Example Visual C++ Program Using the IVI Driver .....	3-27
Figure 3-22: Example ActivATE Test Script for the 1380 .....	3-28
Figure 3-23: ActivATE Main Tab .....	3-29
Figure 3-24: ActivATE Relay Reference Tab .....	3-30
Figure 3-25: ActivATE Manual Control Tab .....	3-30
Figure 3-26: ActivATE Configuration Tab .....	3-31

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## List of Tables

Table 2-1: Channel to Connector Pin Assignments and Mapping .....	2-4
Table 2-2: Cable Assembly Pin and Wire Reference .....	2-7
Table 3-1: Command Arguments for Interconnecting the Muxs .....	3-6
Table 3-2: Command Arguments for Connecting to the Analog Bus .....	3-11
Table 3-3: IVI Driver Channel Names .....	3-17

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## EADS North America Test and Services

### CE Declaration of Conformity

We

**EADS North America Test and Services**

4 Goodyear St.  
Irvine, CA 92618

declare under sole responsibility that the

**1830 Source/ Measure switch, P/N 1830-0102YYZZ**

**LXI 1170, 52ch SPDT, P/N 408161**

**LXI 1180, 80ch SPST, P/N 408162**

**LXI 1220, 16A, P/N 408163-001,-002,-003,-004**

**LXI 1380, 2W 8 1x8 Mux, P/N 408164**

**LXI 1450, Matrix, P/N 408175, 408176**

**DMM, 7.5 Digit, 1830, LXI, 408186**

conforms to the following Product Specifications:

**Safety: EN 61010-1:2001**


**EMC: EN61326:2006 CLASS B**

**Supplementary Information:**

The above specifications are met when the product is installed in an EADS North America Test and Services certified enclosure, with faceplates installed over all unused slots, as applicable.

The product herewith complies with the requirements of EN 61010-1:2001 and EN61326:2006 CLASS B

Irvine, CA, July 6, 2009

  
David Johnston, Engineering Manager

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## Document Change History

Revision	Date	Description of Change
A	8/11/09	Document Control release

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# Chapter 1

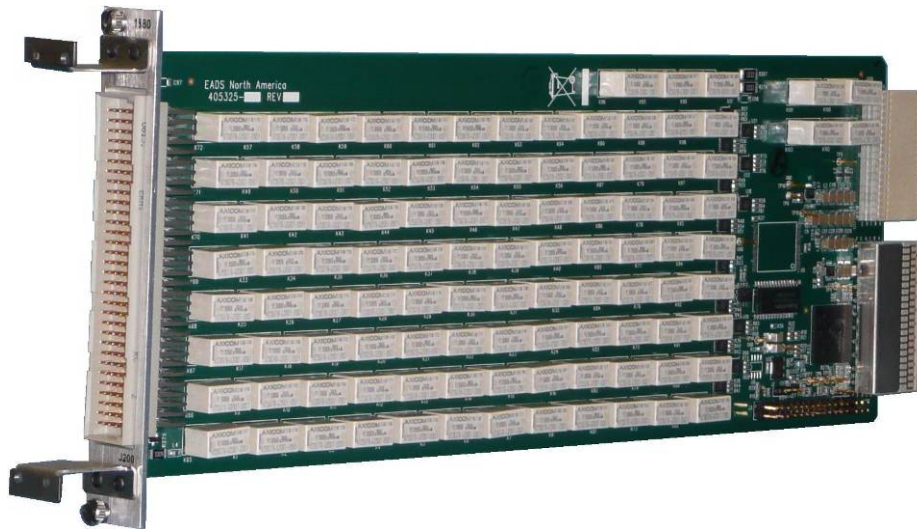
## Overview and Specifications

### Overview

The Racal Instruments™ 1380 is a 64-channel scanner/multiplexer plug-in switch card for the 1800 series Source/Measure Switch platform. The card quickly and easily plugs into a switching system like the Racal Instruments Model 1830 Source/Measure Switch for LXI™/GPIB/USB interfaces and easy expands with the internal Signal Raceway analog bus.

Feature highlights include:

- 64 Channel 2-wire Scanner Multiplexer (128 Channels in 1-wire mode)
- Use as 1x8 multiplexer (mux) at up to 75 MHz
- Switches up to 2 A and 300 VDC/VAC
- Analog bus operability for construction of large multiplexers of up to 1x576 when installed in the Model 1830 Source/Measure Switch System
- Discharge channel with 1 M $\Omega$  resistor for fast measurements



**Figure 1-1: 1380 Plug-in Switch Card**

Each of the eight multiplexers of the 1380 can be used independently or linked together with internal, software controlled configuration relays to form larger dimension scanners/multiplexers. The 1380 is a two-wire, 64-channel multiplexer which can be re-configured in software as a one-wire, 128-

channel multiplexer.

The 1380 64-channel scanner/multiplexer plug-in switch card can be programmed using industry-standard SCPI commands or with an included IVI COM or C driver. If LAN communication is used, the card may be programmed directly using a web-page. If test-executive, data acquisition, and database capabilities are needed, the 1380 can be programmed in the optional ActivATE™ test software platform, which is available as an option at a bundled price when purchased with an 1800-series switching system.

Each plug-in includes provisions for connection of up to four commons to a four-channel, two-wire analog bus on the backplane of the Source/Measure Switch system. The analog bus is easily connected by using software commands of on-board configuration relays.

The 1380 switch card takes advantage of the Signal Raceway analog bus which provides a high-quality route for the connection of instruments to the unit or system under test. The tight integration between the instruments and switching simplifies connectivity and reduces external cabling.

## Specifications

### Input

Maximum Switching Voltage	300 VDC or 300 VAC
Maximum Switching Current	2 A DC/AC
Maximum Switching Power	60 W, 125 VA

### DC Performance (1x8, 2-wire)

Path Resistance	< 750 mΩ (Initial)
Discharge Resistor	1 MΩ
Insulation Resistance	> 10 <sup>9</sup> Ω
Thermal EMF	< 10 μV
Analog Bus	4 channel connection to Differential Bus Thermal EMF + 2 μV Path Resistance + 1 Ω



## AC Performance (50 $\Omega$ )

Bandwidth (-3 dB)	1x8: 75 MHz 1x32: 24 MHz 1x64: 12 MHz
Insertion Loss (1x8)	100 KHz: < 0.1 dB 1 MHz: < 0.1 dB 10 MHz: < 0.2 dB 75 MHz: < 3 dB
Isolation (1x8)	100 KHz: > 90 dB 1 MHz: > 70 dB 10 MHz: > 60 dB 75 MHz: > 30 dB
Crosstalk (1x8)	100 KHz: < -90 dB 1 MHz: < -70 dB 10 MHz: < -60 dB 75 MHz: < -20 dB
Capacitance	Channel-Chassis (1x8): < 250 pF Open Channel (1x8): < 20 pF Hi to Lo (1x8): < 100 pF Hi to Lo (1x64): < 300 pF

## Interface Data

Power Requirements	+5 VDC at 100 mA +3.3 VDC at 1 A +5 VDC at 30 mA per energized relay
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## Software

Native Language	SCPI & SCPI scripting
Driver Support	IVI (C and Com), LabVIEW
Test Executive	ActivATE™ software (optional)
Web Page	LXI control only

## Environmental Data

Temperature	Operating: 0° C to 50° C Storage: -40° C to 71° C
Relative Humidity	80% RH at 40°C

## Conformance Testing

Emissions/Immunity	EN61326: 2006, Class B
Safety	EN61010-1:2001 Pollution degree 1: 300 V Pollution degree 2: 250 V Analog Bus safety interlock Not for connection directly to mains power
Material Handling	RoHS

## Reliability

Switching Time	< 10 ms (includes settling time)
Rated Switch Operations	Mechanical: $1 \times 10^8$ Electrical: 200,000 @ 300 Vrms/.416 A/ 125 VA
Relay Operations Counter	Running total of operations stored in on-board non-volatile memory

## Mean Time Between Failure (MTBF)

The 1380 MTBF is 131,839 hours at 25° C calculated in accordance with MIL-STD-217FN2. Factors affecting relay life expectancy are:

1. Switched voltage
2. Switched current
3. Switched power
4. Maximum switching capacity
5. Maximum rated carrying current
6. Load type (resistive, inductive, capacitive)
7. Switching repetition rate
8. Ambient temperature

The most important factor is the maximum switching capacity, which is an interrelationship of maximum switching power, maximum switching voltage and maximum switching current. When a relay operates at a lower percentage of its maximum switching capacity, its life expectancy is longer. The maximum switching capacity specification is based on a resistive load, and must be further de-rated for inductive and capacitive loads.

## Mechanical

Weight	16 oz. (0.46 kg)
Dimensions	4.26" H x 0.75" W x 11.82" D
Front Panel I/O Interface Connector	160 pin DIN connector

## Ordering Information

Listed below are part numbers for the 1380 switch card and available mating connector accessories. Each 1380 uses a single mating connector.

For additional information regarding the 160-pin cable assembly, see **Chapter 2, Installation Instructions.**

Model/Description	Part No.
Racal Instruments™ 1380 64 Channel, 2A Scanner/Multiplexer	405325
160 pin cable assembly, 6 ft.	408191
160 pin connector kit with back shell and pins	408192
Card shield	408190
Crimp hand tool	991020
Crimp pin-insertion tool	990898
Pin-removal tool	990899

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## Chapter 2

# Installation Instructions

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## Unpacking and Inspection



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### CAUTION

**Use standard ESD precautions including ground straps and static-safe work surfaces whenever handling the 1380 card.**

---

1. Upon receipt, remove the card from its packaging and inspect for damages. If any damage is apparent, inform the carrier immediately. Retain shipping carton and packing material for the carrier's inspection.
2. Verify that the pieces in the package you received contain the correct card. Notify EADS North America Test and Services Customer Support if the card appears damaged in any way.

**Do not attempt to install a damaged card into the Model 1830 Source/Measure Switch System chassis.**

3. The 1380 is shipped in an anti-static bag to prevent electrostatic damage to the card. Do not remove the card from the anti-static bag unless it is in a static-controlled area.

## Installation

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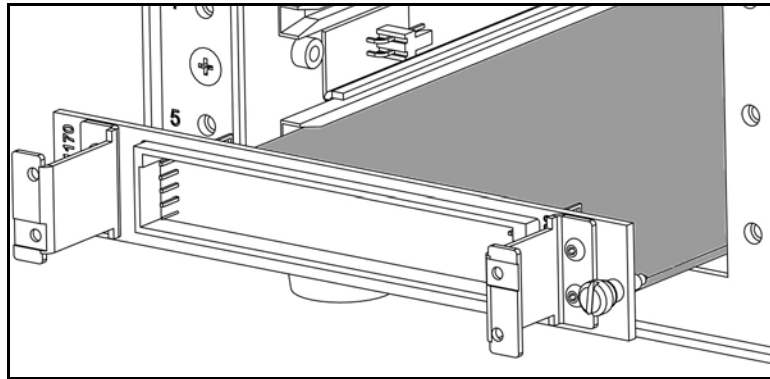
### CAUTION

**Make sure the power to the Model 1830 system is turned OFF before installing or removing any plug-in card. The 1380 card is NOT Hot-Swappable.**

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1. With the system power off, slide the card into the card guides of the 1830 chassis. When inserting the card, place the card edges into the card guides of the 1830. (See Figure 2-1.)
2. Carefully slide the card into the chassis until it stops.
3. Firmly push the card to engage its rear connectors with the 1830 backplane. When the plug-in card is fully seated, its panel is flush with the rear panel of the 1830 chassis.

4. Carefully turn the card retainer screws and tighten securely.

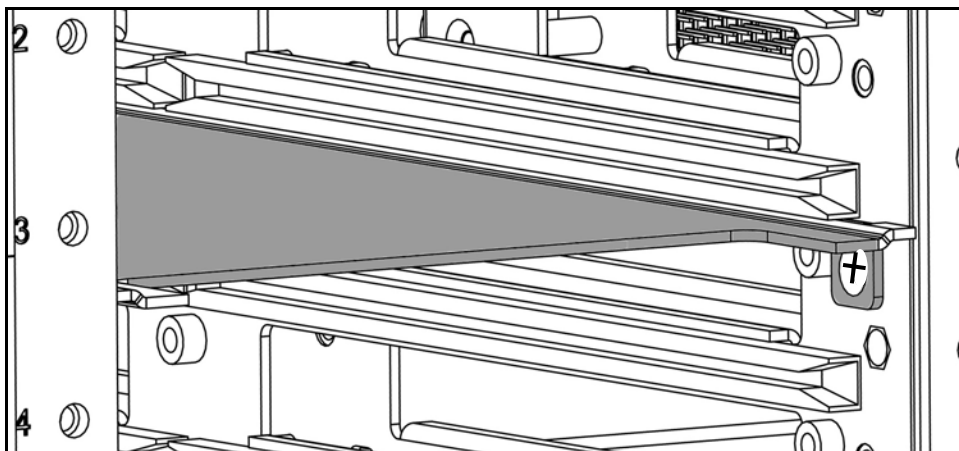


**Figure 2-1: Inserting a Plug-In Card**

## Plug-in Card Shield

If you wish to reduce the electromagnetic interference (EMI) between cards, install an optional card shield (PN 408190) immediately above the cards. Refer to the Figure 2-2.

1. If already installed, remove the plug-in card you wish to cover.
2. Slide the card shield into the slot above the card slot.
3. Use the supplied flat-head screw to attach the shield to the chassis frame.
4. Install the card below the shield.



**Figure 2-2: Installing a Card Shield**

## Front Panel Connector Pin Assignment

The 160-pin connector end of the 1380 card is referred to as the front panel. The connector, labeled J200, is a modified DIN style with 0.025" square posts. See Figure 2-3 for a diagram of the front panel connector pin numbering. See Table 2-1 for pin assignments.

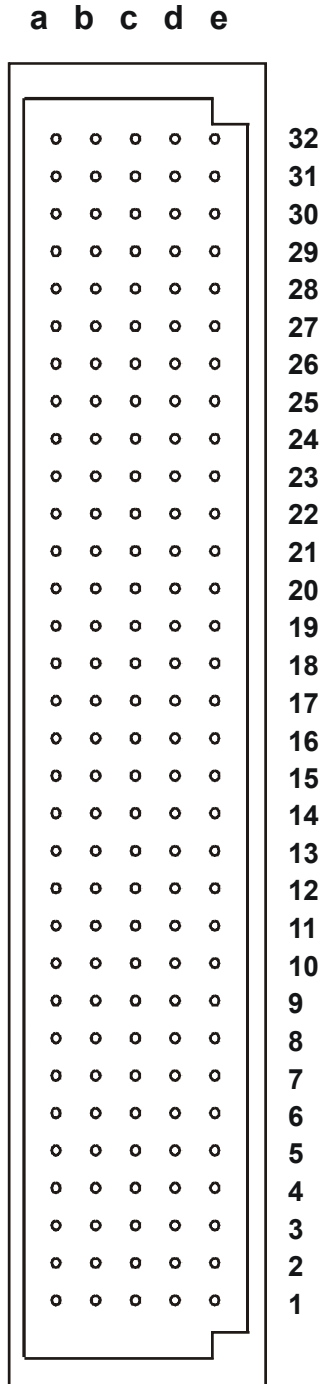


Figure 2-3: Front Panel Connector Layout

Table 2-1: Channel to Connector Pin Assignments and Mapping

Mux	Channel	Pin	
		High	Low
0	COM0 1WIRE	E3	
0	COM0	E2	E1
0	00	A1	B1
0	01	B2	A2
0	02	A3	B3
0	03	B4	A4
0	04	C1	D1
0	05	D2	C2
0	06	C3	D3
0	07	D4	C4
1	COM1 1WIRE	E7	
1	COM1	E6	E5
1	10	A5	B5
1	11	B6	A6
1	12	A7	B7
1	13	B8	A8
1	14	C5	D5
1	15	D6	C6
1	16	C7	D7
1	17	D8	C8
2	COM2 1WIRE	E11	
2	COM2	E10	E9
2	20	A9	B9
2	21	B10	A10
2	22	A11	B11
2	23	B12	A12
2	24	C9	D9
2	25	D10	C10
2	26	C11	D11
2	27	D12	C12
3	COM3 1WIRE	E15	
3	COM3	E14	E13
3	30	A13	B13
3	31	B14	A14
3	32	A15	B15



Mux	Channel	Pin	
		High	Low
3	33	B16	A16
3	34	C13	D13
3	35	D14	C14
3	36	C15	D15
3	37	D16	C16
4	COM4 1WIRE	E19	
4	COM4	E18	E17
4	40	A17	B17
4	41	B18	A18
4	42	A19	B19
4	43	B20	A20
4	44	C17	D17
4	45	D18	C18
4	46	C19	D19
4	47	D20	C20
5	COM5 1WIRE	E23	
5	COM5	E22	E21
5	50	A21	B21
5	51	B22	A22
5	52	A23	B23
5	53	B24	A24
5	54	C21	D21
5	55	D22	C22
5	56	C23	D23
5	57	D24	C24
6	COM6 1WIRE	E27	
6	COM6	E26	E25
6	60	A25	B25
6	61	B26	A26
6	62	A27	B27
6	63	B28	A28
6	64	C25	D25
6	65	D26	C26
6	66	C27	D27
6	67	D28	C28
7	COM7 1WIRE	E31	
7	COM7	E30	E29

Mux	Channel	Pin	
		High	Low
7	70	A29	B29
7	71	B30	A30
7	72	A31	B31
7	73	B32	A32
7	74	C29	D29
7	75	D30	C30
7	76	C31	D31
7	77	D32	C32
	1WIRE REF	E32	
	INTERLOCK	E4	
	DGND	E8	
	SGND	E12	
	SGND	E16	
	SGND	E20	
	SGND	E24	
	SGND	E28	

## Mating Connectors

The following 1380 mating connector accessories are available from your EADS North America Test and Services representative or through our main sales contact numbers.

### **160-Pin Connector Kit with backshell and pins, P/N 408192**

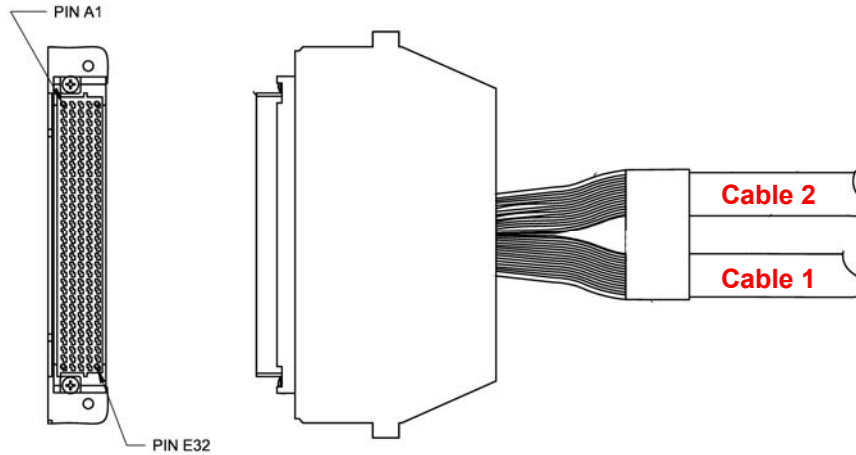
The 160-Pin Connector Kit consists of a connector housing, plastic backshell, and 160 crimp pins. After wire attachment, the pin is inserted into the housing and will snap into place, providing positive retention.

### **160-Pin Cable Assembly, 6 Ft., 24 AWG, P/N 408191**

The 160-Pin Cable Assembly uses 24 AWG cable with crimp pins to mate with the 1380. The other cable end is unterminated. Refer to Table 2-1 for channel-to-pin mapping information. Refer to Figure 2-4 and Table 2-2 for pin and wire reference information. Refer to the figure to identify Cable 1 and Cable 2.

The suggested crimp hand tool is PN991020. The crimp pin-insertion tool is P/N 990898. The corresponding pin-removal tool is P/N 990899.

Included with both the connector and cable assembly is a set of hardware to code your connector to specific plug-in cards. See the section **Installing Coding Keys on Cards and Connectors** later in this chapter for more information.



**Figure 2-4: Cable Assembly (P/N 408191) Connector End**

**Table 2-2: Cable Assembly Pin and Wire Reference**

Wire No.	Pin No.	Cable No.	Wire Color Reference
1	PIN - A32	Cable 1	WHT_BLK_YEL_GRY
2	PIN - A31	Cable 1	WHT_BLK_ORG_VIO
3	PIN - A30	Cable 1	WHT_BLK_RED_VIO
4	PIN - A29	Cable 1	WHT_BLK_BRN_VIO
5	PIN - A28	Cable 1	WHT_BLK_BRN_RED
6	PIN - A27	Cable 1	WHT_GRN_VIO
7	PIN - A26	Cable 1	WHT_YEL_GRN
8	PIN - A25	Cable 1	WHT_ORG_YEL
9	PIN - A24	Cable 1	WHT_RED_YEL
10	PIN - A23	Cable 1	WHT_BRN_GRN
11	PIN - A22	Cable 1	WHT_BLK_VIO
12	PIN - A21	Cable 1	WHT_BLK_RED
13	PIN - A20	Cable 1	WHT_GRN
14	PIN - A19	Cable 1	WHT_BLK
15	PIN - A18	Cable 1	GRN
16	PIN - A17	Cable 1	BLK
17	PIN - A16	Cable 2	WHT_BLK_YEL_GRY
18	PIN - A15	Cable 2	WHT_BLK_ORG_VIO
19	PIN - A14	Cable 2	WHT_BLK_RED_VIO
20	PIN - A13	Cable 2	WHT_BLK_BRN_VIO
21	PIN - A12	Cable 2	WHT_BLK_BRN_RED
22	PIN - A11	Cable 2	WHT_GRN_VIO
23	PIN - A10	Cable 2	WHT_YEL_GRN
24	PIN - A9	Cable 2	WHT_ORG_YEL

Wire No.	Pin No.	Cable No.	Wire Color Reference
25	PIN - A8	Cable 2	WHT_RED_YEL
26	PIN - A7	Cable 2	WHT_BRN_GRN
27	PIN - A6	Cable 2	WHT_BLK_VIO
28	PIN - A5	Cable 2	WHT_BLK_RED
29	PIN - A4	Cable 2	WHT_GRN
30	PIN - A3	Cable 2	WHT_BLK
31	PIN - A2	Cable 2	GRN
32	PIN - A1	Cable 2	BLK
33	PIN - B32	Cable 1	WHT_BLK_GRN_BLU
34	PIN - B31	Cable 1	WHT_BLK_ORG_GRY
35	PIN - B30	Cable 1	WHT_BLK_RED_GRY
36	PIN - B29	Cable 1	WHT_BLK_BRN_GRY
37	PIN - B28	Cable 1	WHT_BLK_BRN_ORG
38	PIN - B27	Cable 1	WHT_GRN_GRY
39	PIN - B26	Cable 1	WHT_YEL_BLU
40	PIN - B25	Cable 1	WHT_ORG_GRN
41	PIN - B24	Cable 1	WHT_RED_GRN
42	PIN - B23	Cable 1	WHT_BRN_BLU
43	PIN - B22	Cable 1	WHT_BLK_GRY
44	PIN - B21	Cable 1	WHT_BLK_ORG
45	PIN - B20	Cable 1	WHT_BLU
46	PIN - B19	Cable 1	WHT_BRN
47	PIN - B18	Cable 1	BLU
48	PIN - B17	Cable 1	BRN
49	PIN - B16	Cable 2	WHT_BLK_GRN_BLU
50	PIN - B15	Cable 2	WHT_BLK_ORG_GRY
51	PIN - B14	Cable 2	WHT_BLK_RED_GRY
52	PIN - B13	Cable 2	WHT_BLK_BRN_GRY
53	PIN - B12	Cable 2	WHT_BLK_BRN_ORG
54	PIN - B11	Cable 2	WHT_GRN_GRY
55	PIN - B10	Cable 2	WHT_YEL_BLU
56	PIN - B9	Cable 2	WHT_ORG_GRN
57	PIN - B8	Cable 2	WHT_RED_GRN
58	PIN - B7	Cable 2	WHT_BRN_BLU
59	PIN - B6	Cable 2	WHT_BLK_GRY
60	PIN - B5	Cable 2	WHT_BLK_ORG
61	PIN - B4	Cable 2	WHT_BLU
62	PIN - B3	Cable 2	WHT_BRN
63	PIN - B2	Cable 2	BLU
64	PIN - B1	Cable 2	BRN
65	PIN - C32	Cable 1	WHT_BLK_GRN_VIO
66	PIN - C31	Cable 1	WHT_BLK_YEL_GRN
67	PIN - C30	Cable 1	WHT_BLK_ORG_YEL

Wire No.	Pin No.	Cable No.	Wire Color Reference
68	PIN - C29	Cable 1	WHT_BLK_RED_YEL
69	PIN - C28	Cable 1	WHT_BLK_BRN_YEL
70	PIN - C27	Cable 1	WHT_BLU_VIO
71	PIN - C26	Cable 1	WHT_YEL_VIO
72	PIN - C25	Cable 1	WHT_ORG_BLU
73	PIN - C24	Cable 1	WHT_RED_BLU
74	PIN - C23	Cable 1	WHT_BRN_VIO
75	PIN - C22	Cable 1	WHT_BRN_RED
76	PIN - C21	Cable 1	WHT_BLK_YEL
77	PIN - C20	Cable 1	WHT_VIO
78	PIN - C19	Cable 1	WHT_RED
79	PIN - C18	Cable 1	VIO
80	PIN - C17	Cable 1	RED
81	PIN - C16	Cable 2	WHT_BLK_GRN_VIO
82	PIN - C15	Cable 2	WHT_BLK_YEL_GRN
83	PIN - C14	Cable 2	WHT_BLK_ORG_YEL
84	PIN - C13	Cable 2	WHT_BLK_RED_YEL
85	PIN - C12	Cable 2	WHT_BLK_BRN_YEL
86	PIN - C11	Cable 2	WHT_BLU_VIO
87	PIN - C10	Cable 2	WHT_YEL_VIO
88	PIN - C9	Cable 2	WHT_ORG_BLU
89	PIN - C8	Cable 2	WHT_RED_BLU
90	PIN - C7	Cable 2	WHT_BRN_VIO
91	PIN - C6	Cable 2	WHT_BRN_RED
92	PIN - C5	Cable 2	WHT_BLK_YEL
93	PIN - C4	Cable 2	WHT_VIO
94	PIN - C3	Cable 2	WHT_RED
95	PIN - C2	Cable 2	VIO
96	PIN - C1	Cable 2	RED
97	PIN - D32	Cable 1	WHT_BLK_GRN_GRY
98	PIN - D31	Cable 1	WHT_BLK_YEL_BLU
99	PIN - D30	Cable 1	WHT_BLK_ORG_GRN
100	PIN - D29	Cable 1	WHT_BLK_RED_GRN
101	PIN - D28	Cable 1	WHT_BLK_BRN_GRN
102	PIN - D27	Cable 1	WHT_BLU_GRY
103	PIN - D26	Cable 1	WHT_YEL_GRY
104	PIN - D25	Cable 1	WHT_ORG_VIO
105	PIN - D24	Cable 1	WHT_RED_VIO
106	PIN - D23	Cable 1	WHT_BRN_GRY
107	PIN - D22	Cable 1	WHT_BRN_ORG
108	PIN - D21	Cable 1	WHT_BLK_GRN
109	PIN - D20	Cable 1	WHT_GRY
110	PIN - D19	Cable 1	WHT_ORG

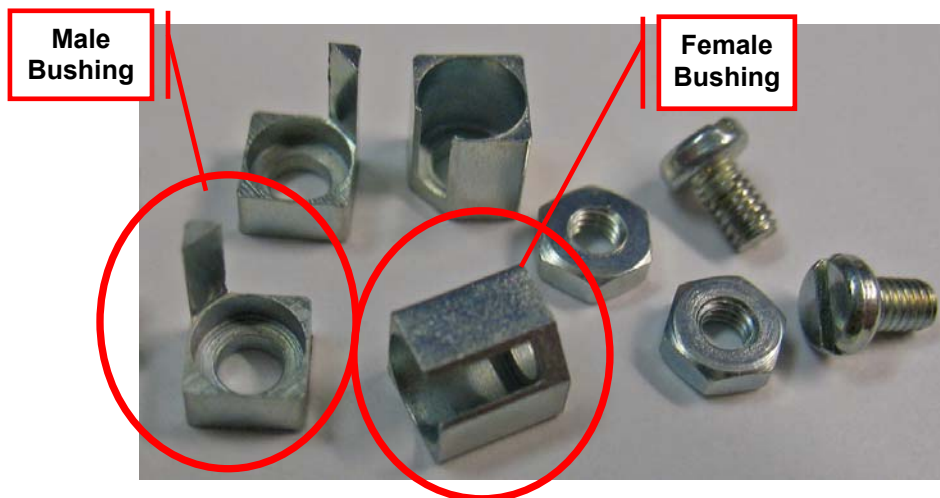
Wire No.	Pin No.	Cable No.	Wire Color Reference
111	PIN - D18	Cable 1	GRY
112	PIN - D17	Cable 1	ORG
113	PIN - D16	Cable 2	WHT_BLK_GRN_GRY
114	PIN - D15	Cable 2	WHT_BLK_YEL_BLU
115	PIN - D14	Cable 2	WHT_BLK_ORG_GRN
116	PIN - D13	Cable 2	WHT_BLK_RED_GRN
117	PIN - D12	Cable 2	WHT_BLK_BRN_GRN
118	PIN - D11	Cable 2	WHT_BLU_GRY
119	PIN - D10	Cable 2	WHT_YEL_GRY
120	PIN - D9	Cable 2	WHT_ORG_VIO
121	PIN - D8	Cable 2	WHT_RED_VIO
122	PIN - D7	Cable 2	WHT_BRN_GRY
123	PIN - D6	Cable 2	WHT_BRN_ORG
124	PIN - D5	Cable 2	WHT_BLK_GRN
125	PIN - D4	Cable 2	WHT_GRY
126	PIN - D3	Cable 2	WHT_ORG
127	PIN - D2	Cable 2	GRY
128	PIN - D1	Cable 2	ORG
129	PIN - E32	Cable 1	WHT_BLK_BLU_VIO
130	PIN - E31	Cable 1	WHT_BLK_YEL_VIO
131	PIN - E30	Cable 1	WHT_BLK_ORG_BLU
132	PIN - E29	Cable 1	WHT_BLK_RED_BLU
133	PIN - E28	Cable 1	WHT_BLK_BRN_BLU
134	PIN - E27	Cable 1	WHT_VIO_GRY
135	PIN - E26	Cable 1	WHT_GRN_BLU
136	PIN - E25	Cable 1	WHT_ORG_GRY
137	PIN - E24	Cable 1	WHT_RED_GRY
138	PIN - E23	Cable 1	WHT_RED_ORG
139	PIN - E22	Cable 1	WHT_BRN_YEL
140	PIN - E21	Cable 1	WHT_BLK_BLU
141	PIN - E20	Cable 1	WHT_BLK_BRN
142	PIN - E19	Cable 1	WHT_YEL
143	PIN - E18	Cable 1	WHT
144	PIN - E17	Cable 1	YEL
145	PIN - E16	Cable 2	WHT_BLK_BLU_VIO
146	PIN - E15	Cable 2	WHT_BLK_YEL_VIO
147	PIN - E14	Cable 2	WHT_BLK_ORG_BLU
148	PIN - E13	Cable 2	WHT_BLK_RED_BLU
149	PIN - E12	Cable 2	WHT_BLK_BRN_BLU
150	PIN - E11	Cable 2	WHT_VIO_GRY
151	PIN - E10	Cable 2	WHT_GRN_BLU
152	PIN - E9	Cable 2	WHT_ORG_GRY
153	PIN - E8	Cable 2	WHT_RED_GRY

Wire No.	Pin No.	Cable No.	Wire Color Reference
154	PIN - E7	Cable 2	WHT_RED_ORG
155	PIN - E6	Cable 2	WHT_BRN_YEL
156	PIN - E5	Cable 2	WHT_BLK_BLU
157	PIN - E4	Cable 2	WHT_BLK_BRN
158	PIN - E3	Cable 2	WHT_YEL
159	PIN - E2	Cable 2	WHT
160	PIN - E1	Cable 2	YEL

## Installing Coding Keys on Cards and Connectors

Included with each connector kit or cable assembly is a set of hardware (Figure 2-5) which you can use to key code your connector to specific plug-in cards to prevent cables from being misconnected to the wrong card. You may want to install the key for specific card types or to match module operating conditions.

The kit comes with two sets of male and female mating bushings along with appropriate mounting hardware. When installed in pairs, you can mount the bushings in up to 16 different coded configurations.



**Figure 2-5: Coding Key Hardware**

Prior to installing the keys, determine the “code” you wish to use and then carefully install the bushings onto the connector and card guide in the proper position so that the prong fits into the open slot when the connector is mated to the card.



**Figure 2-6: Installed Keys**

The left photo in Figure 2-6 shows the male key installed in the connector shell. The right photo shows the female key installed onto the card guide.

Repeat the installation for the both ends of the connector shell and card guide.



## Chapter 3

# Operation

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### Block Diagram

The main block diagram (Figure 3-1) shows the 2-wire connection for 8 1x8 multiplexers (mux). In the diagram, each connection is a 2-wire connection except the front panel 1-wire connections (COMx\_1W). This means each channel number shown in the diagram actually contains one high and low pair. For example, CH00 shown in the MUX0 has two wires CH00\_H and CH00\_L. This also applies to the COM signals. COM0 indicates a pair of COM0\_H and COM0\_L signals.

Between each 1x8 mux, there are 7 interconnection channels CH2000 to Ch2006, which can daisy chain the 1x8 muxs to expand the size of the multiplexer.

Each 1x8 mux has a 1 M $\Omega$  discharge resistor connected to the COM\_H and COM\_L signal, which can be used to discharge the channel between each switching in some applications.

Any channel in a 1380 can be connected to the system analog ABUS through the backplane analog ABUS configuration relays. In the diagram, MUX0, MUX2, MUX4 and MUX6 can be connected to the ABUS1, ABUS2, ABUS3 and ABUS4 through channels 9001-9004 and channels 9901-9904. MUX1, MUX3, MUX5 and MUX7 can be connected to the analog ABUS by using the interconnection channels 2000-2006, which can connect the mux to its adjacent mux and then to the analog BUS.

The 1380 can also be configured in 1-wire mode for all the channels. There are separate configuration channels for the front panel and backplane single wire connections. See the **Using the Single-Wire Mode** section for the detailed operations.

Figure 3-2 shows details of both the front panel single-wire configuration and the back plane/discharge resistor connection. See the **Using the Single-Wire Mode** and the **Using the Discharge Resistor** sections for more information regarding these features.

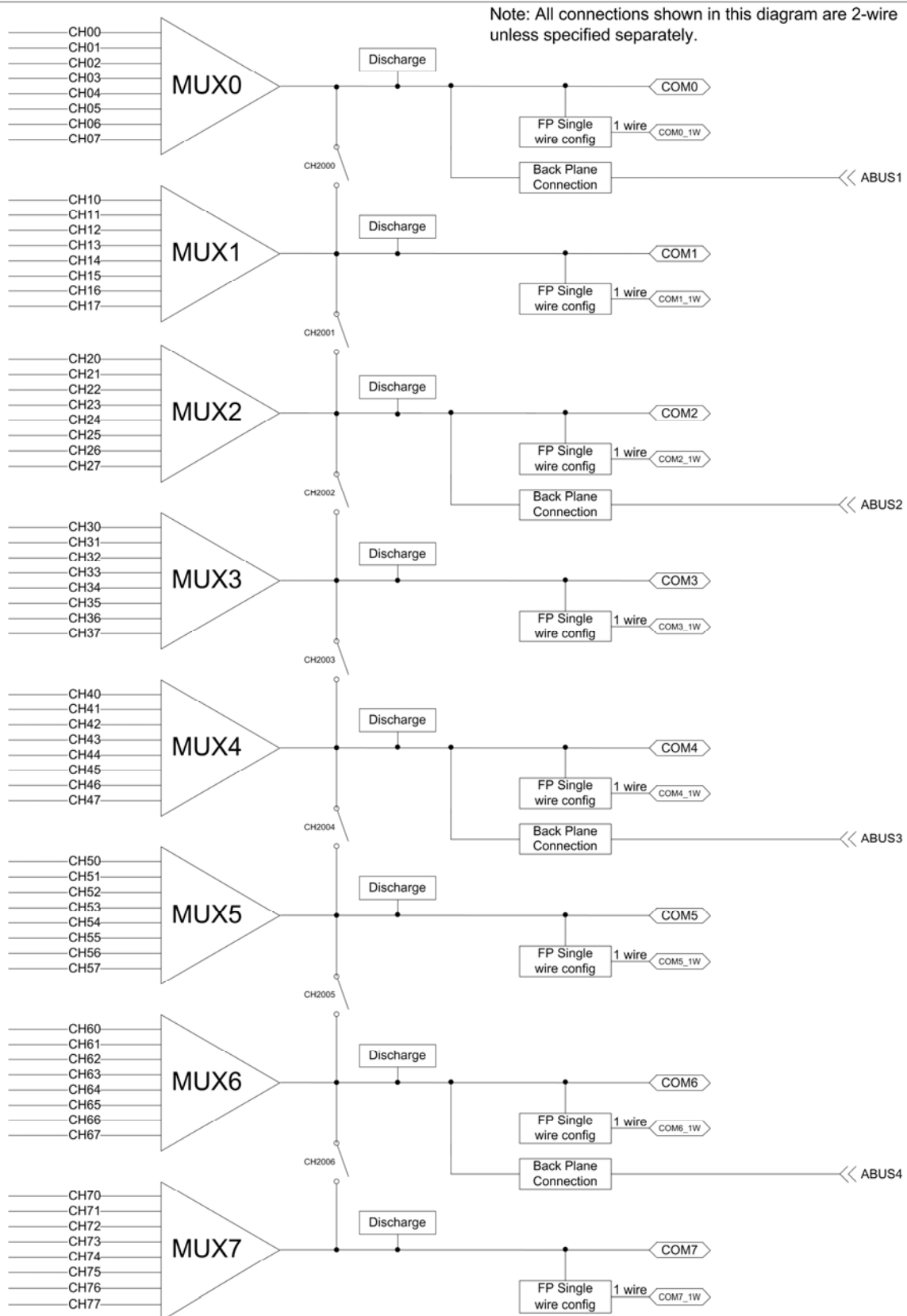


Figure 3-1: 1380 Block Diagram

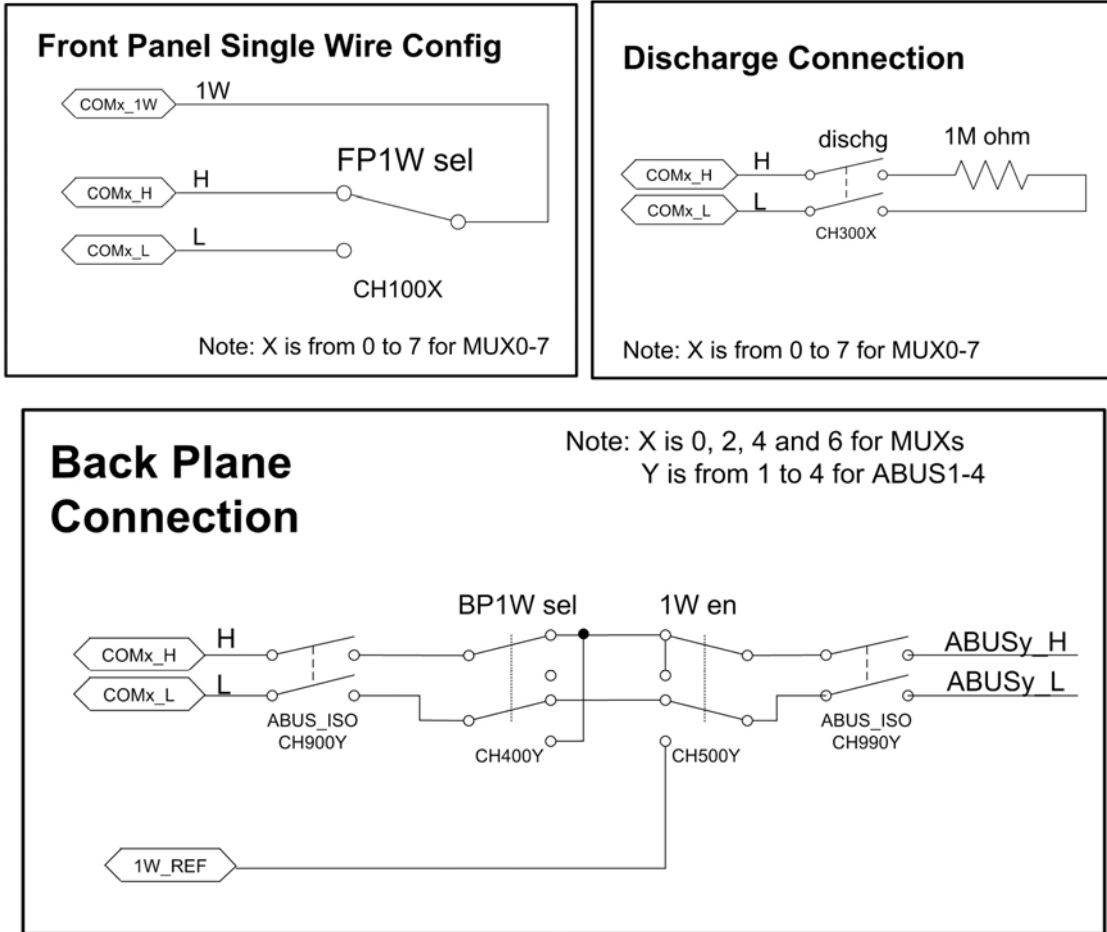
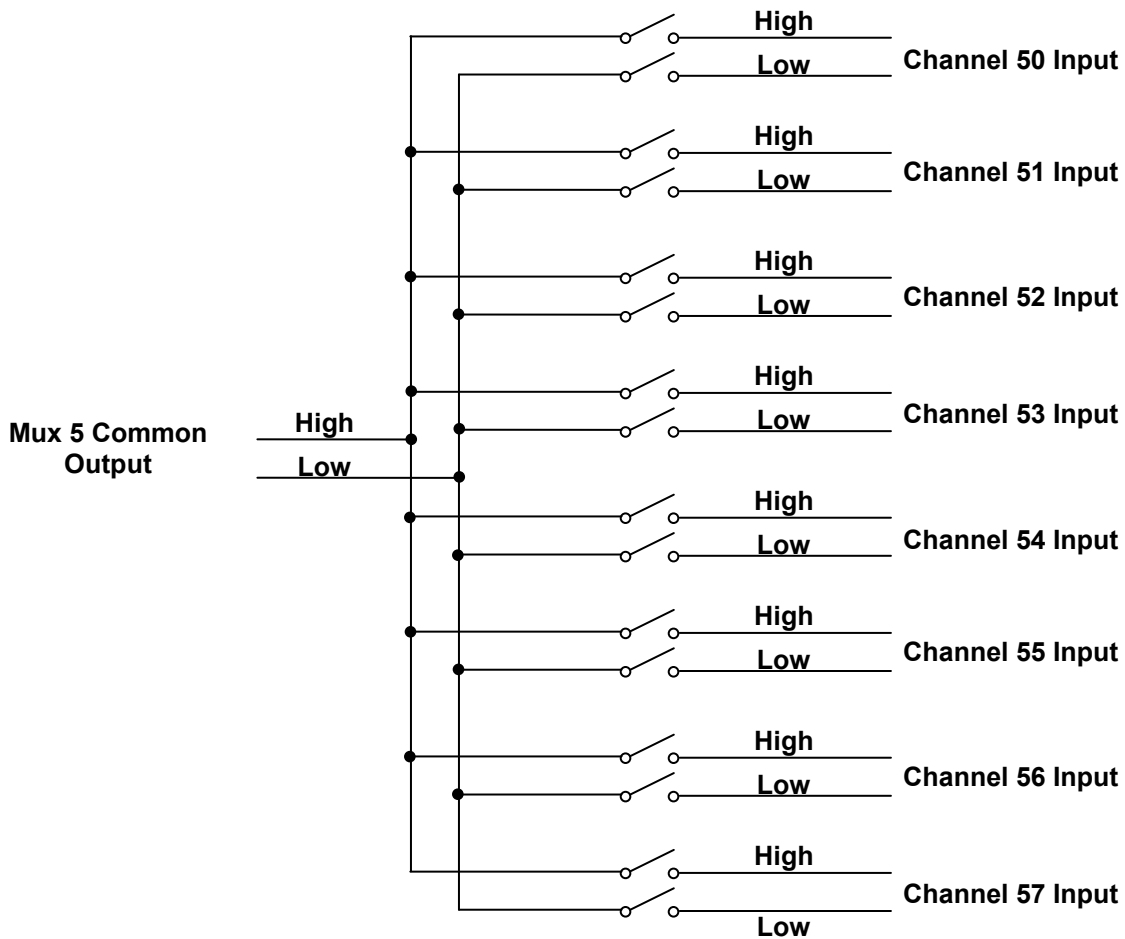


Figure 3-2: Details from Block Diagram

## Module Configuration

The 1380 contains eight 1x8 multiplexers, numbered from 0 through 7. Each multiplexer is made up of eight relays, referred to as channels. Figure 3-3 shows an example of one of these multiplexers (multiplexer 5). In this example, the inputs are channels 50 through 57. The user may close one or more relays to connect the inputs to the common output.



**Figure 3-3: Single Multiplexer Example (Channels 50 through 57)**

*Note: This diagram is simplified for clarity.*

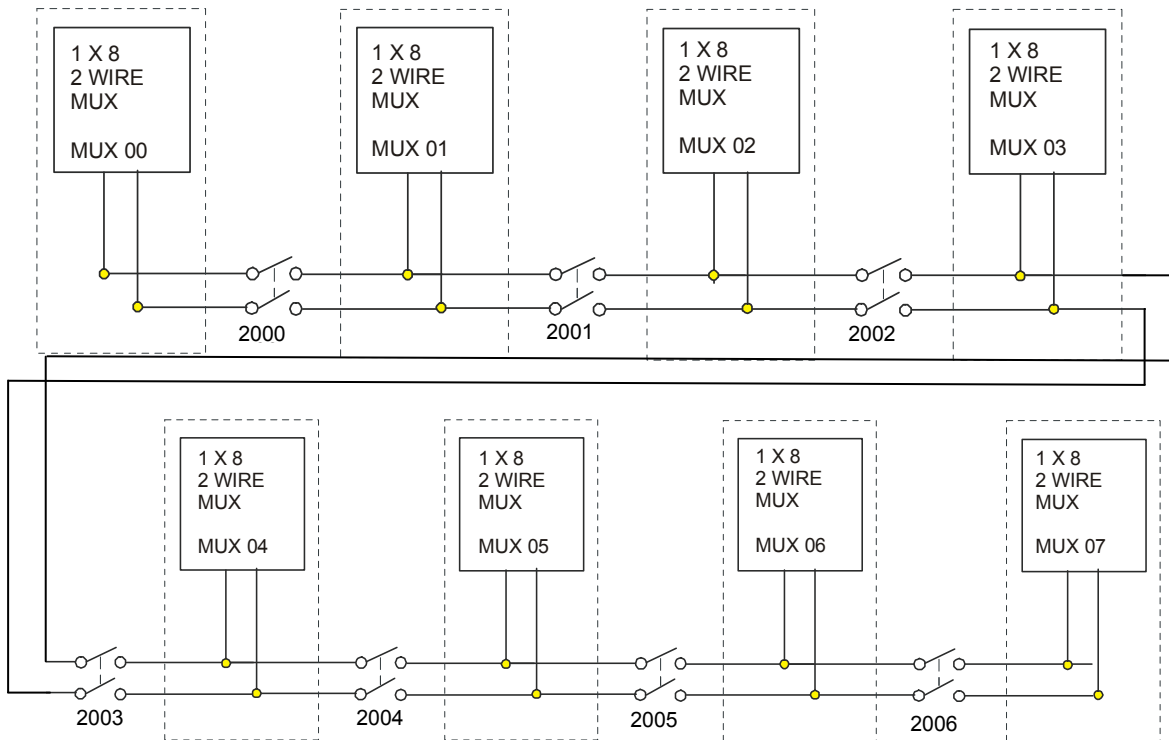
Since each channel is independently controlled, the user can simultaneously connect any combination of mux inputs to the common output of the same multiplexer.

For example, in Figure 3-3, the user may connect the channel 51 and channel 53 inputs to the common output by closing the channel 51 and channel 53 relays at the same time. Taking this concept further, the user could even close the relays for channels 50 through 57 all at the same time, connecting all of this multiplexer's inputs to its common output.

Figure 3-3 also shows just one of the eight multiplexers on the 1380. All eight multiplexers operate independently. For a block diagram of the entire 1380, refer to Figure 3-1. When reviewing this diagram, keep in mind that the 1380 is a two-wire switch product (each relay has two poles). Most applications use one pole to switch the high side of a differential signal, and the other pole to switch the low side.

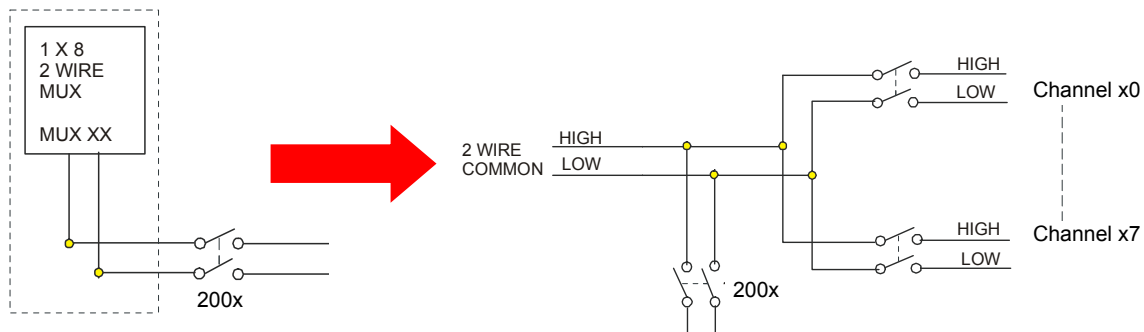
## Configuration Relays

The 1380 is configurable for a variety of applications. Referring to Figure 3-6, there are seven configuration channels, identified by their numbers (2000, 2001, etc.). Figure 3-9 (Analog Bus) shows a more detailed view of the components inside a multiplexer. Table 3-1 shows the command arguments (channel numbers) for connecting mux pairs together.



**Figure 3-4: 1380 Module Configuration Block Diagram**

*Note: This diagram is simplified for clarity.*



**Figure 3-5: Multiplexer Configuration Block Diagram**

*Note: This diagram is simplified for clarity.*

**Table 3-1: Command Arguments for Interconnecting the Muxs**

Mux Interconnection	Command Argument (Channel)	Pin	
		High	Low
0-1	2000	E2	E1
1-2	2001	E6	E5
2-3	2002	E10	E9
3-4	2003	E14	E13
4-5	2004	E18	E17
5-6	2005	E22	E21
6-7	2006	E26	E25

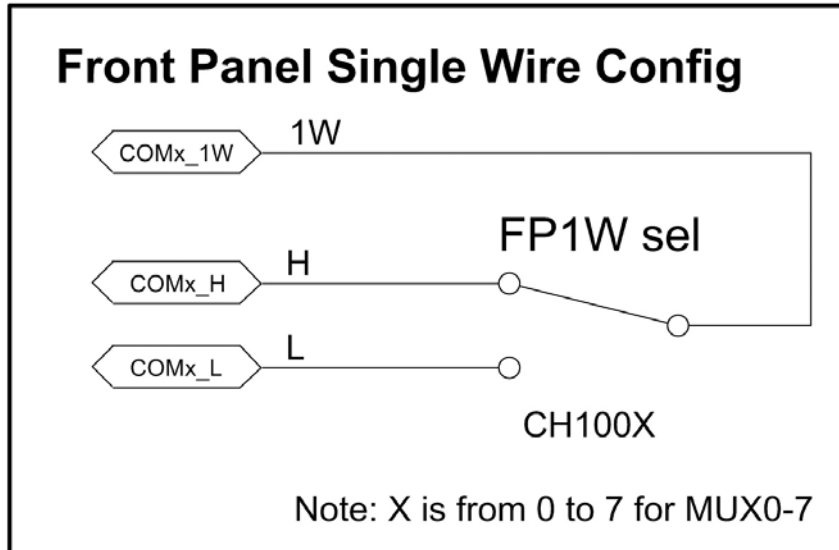
## Using Single-Wire Mode

In single wire mode, the 1380 can be configured to

- 8 independent 1x16 single-ended (1-wire) mux
- 4 independent 1x32 single-ended (1-wire) mux
- 2 independent 1x48 single-ended (1-wire) mux
- 2 independent 1x64 single-ended (1-wire) mux
- 1 1x128 single-ended (1-wire) mux
- Larger size mux by using the system analog BUS

## Front Panel Configuration

For the mux size up to 1x128, neither external wire nor internal wiring through analog ABUS is required. The front panel connection for the one-wire mode is shown in Figure 3-6. Channel 1000 to 1007 can select between high and low common signals from each mux, and bring it to the COMx\_1W pin on the front panel connector. See Figure 3-6 for the detailed connection for each 1x8 mux. The COMx\_1W pin assignment is shown in Table 2-1 in Chapter 2.



**Figure 3-6: Front Panel, Single-Wire Configuration**

## System Analog Bus (Back Panel) Configuration

For larger size of mux (greater than 1x128), the system analog ABUS will be utilized for the interconnection between two or more 1380 cards. The analog ABUS high signals will be dedicated to the 1-wire signal connection though the system analog ABUS, the low signals will be used as the common reference through the bus.

There are two relays to configure. 1W en (CH500Y) takes the front panel 1W\_net signal and routes this as the common signal to ABUS low. The BP1W sel switches either the COM\_H or COM\_L signal to the ABUS H. Refer to Figure 3-7.

The channel 4001 to channel 4004 will select the signals between the COMx\_H and COMx\_L to be connected to the analog ABUS high signal. The channel 5001 to channel 5004 will switch to the 1-wire reference signal which is coming from the front panel connector from the external references when the 1-wire mode is enabled.

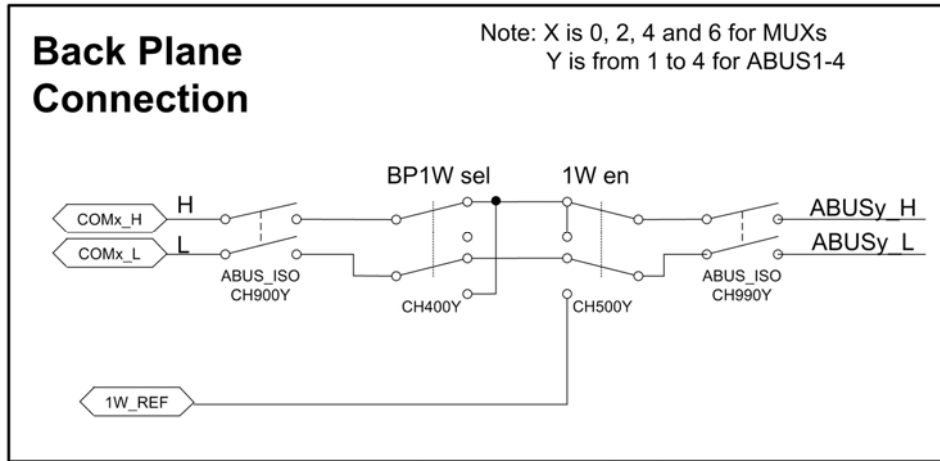


Figure 3-7: Back Plane, Single-Wire Configuration

## Using the Discharge Resistor

The 1380 includes a 1 MΩ discharge resistor for each independent 1x8 mux. This is useful for some applications with switching between high impedance sources. The discharge resistors can be conducted through channel 3000 to channel 3007 for MUX0 to MUX7 separately. The diagram in Figure 3-8 shows the discharge resistor connection for each mux.

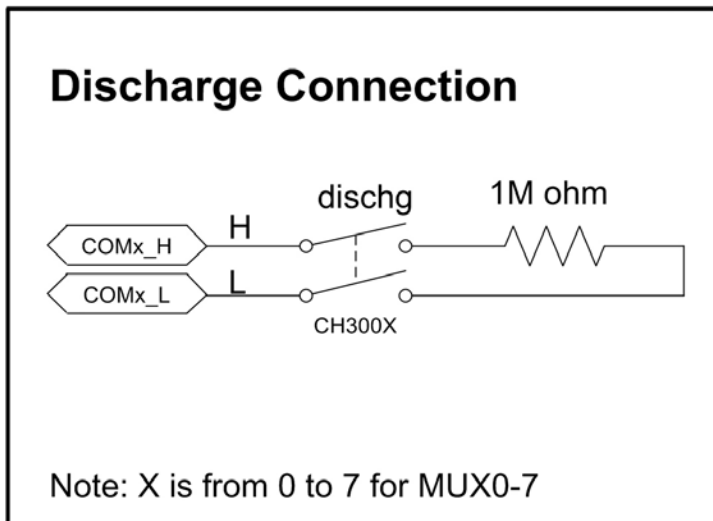


Figure 3-8: Discharge Resistor



## Operating the 1380 Switch Card

The 1380 switch card is controlled by the firmware in the 1800-series Source/Measure Switch platform into which it is installed. There are several ways to operate the 1380 switch card. These include:

- Using the web page to interactively control the relays.
- Using the web page to interactively send SCPI commands to operate the relays.
- Using SCPI commands in a test program to directly communicate with the 1830.
- Using the IVI™ driver to control the relays from any COM-compatible programming language, such as Visual C++, Visual BASIC, .Net languages, LabVIEW™, and so on.
- Using the ActivATE™ driver to control the relays from within an ActivATE test program.
- Using the GUI of the ActivATE driver to control the relays interactively.

The first two methods above communicate exclusively via the Ethernet interface. The remaining methods can use the VISA I/O library to communicate via Ethernet, GPIB, or USB.

## Command Set

The 1800-series platform uses the SCPI command language to provide for set-up and control of all of the instrument functions, including operating the 1380 card.

Commands such as CLOSE, OPEN, SCAN, INCLude, and EXCLude all use channel descriptors to select one or more relays on one or more plug-in modules.

Consult your 1800-series system user manual for a more detailed description of the SCPI command language supported by the platform.

## Identifying the 1380 Card in the Chassis

The main web page is recommended for identifying which cards are located in the system chassis. As an alternative, a SCPI command can be used to read the type of cards installed in the 1800-series platform.

The “SYSTem:CTYPE?” query can be used to read the type of card, the serial number, and the firmware/FPGA/hardware revision of the card in the chassis:

```
SYST:CTYPE? 9
```

Reads the type of card installed in slot 9. The response to this command uses the format:

```
<model code>,<manufacturer>,<serial number>,<revision info>
```

A typical response for the 1380 card is:

```
XI1380,EADS NORTH AMERICA,112508363942,1.0-0.0-2.1
```

If no card is recognized in the slot 9, the reply would be

```
NONE,EADS NORTH AMERICA,0,0.0-0.0-0.0
```

## Using the Analog Bus

For even greater flexibility, the 1380 takes full advantage of the analog bus found in the 1800-Series Switching System. Four analog bus relays (channels 9901 through 9904 in Figure 3-9) connect the output of multiplexer (mux) 0, 2, 4, or 6 to the four analog bus pairs.

Table 3-2 shows the command arguments (channel numbers) for connecting the mux output to the analog bus.

Refer to the next section on the Analog Bus Safety Interlock Circuit for accessing the bus.

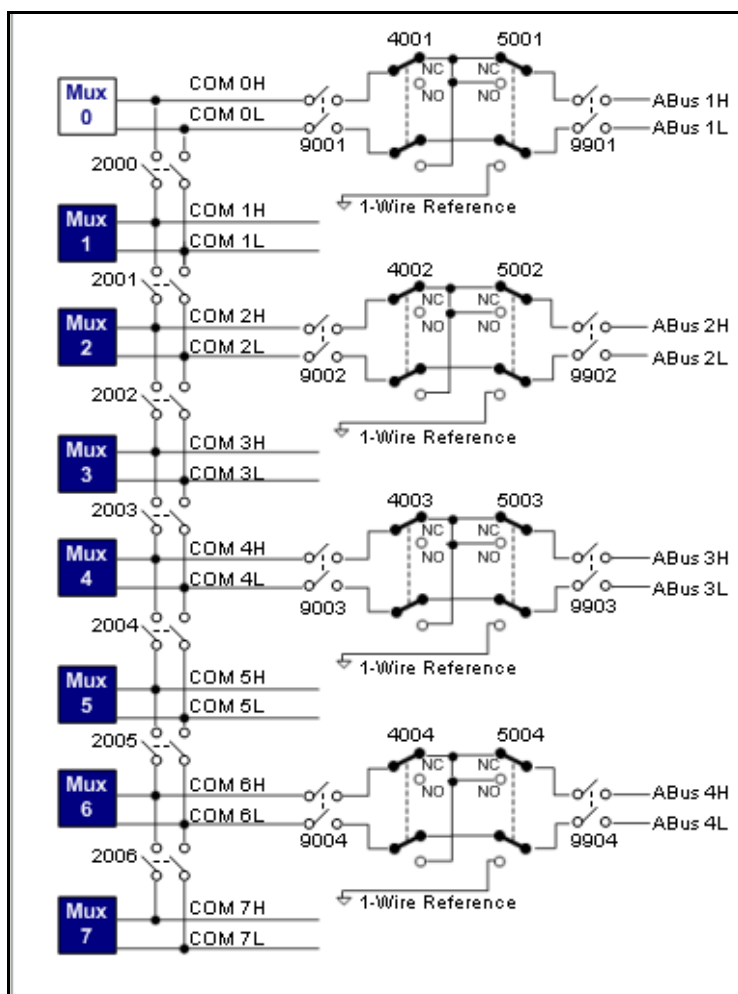


Figure 3-9: Analog Bus

**Table 3-2: Command Arguments for Connecting to the Analog Bus**

Analog Bus	Command Argument (Channel)	Pin	
		High	Low
0	9001/9901	E2	E1
1	9002/9902	E10	E9
2	9003/9903	E18	E17
3	9004/9904	E26	E25

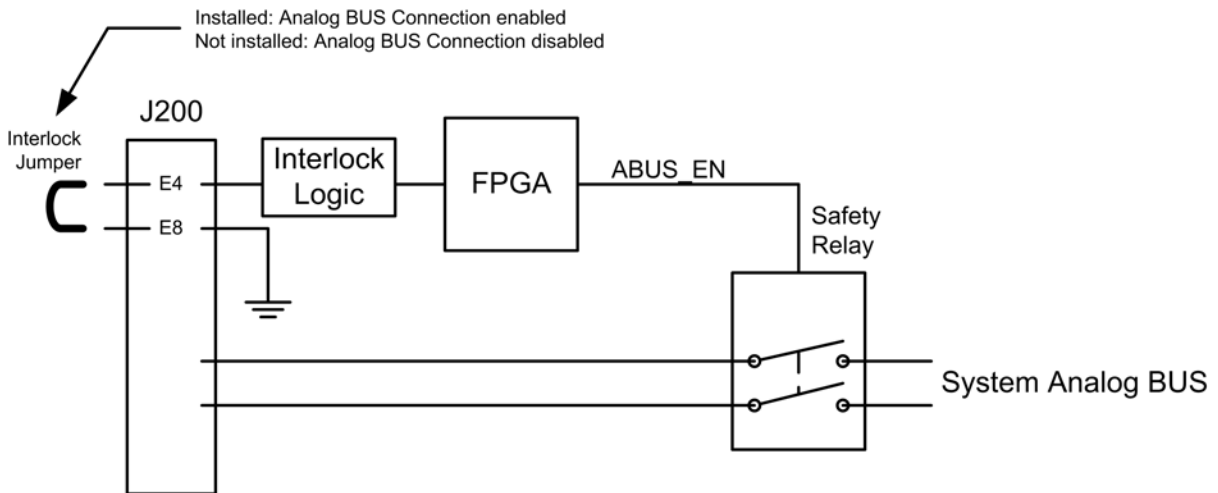
## Analog Bus Safety Interlock Circuit

### CAUTION



The 1830 Analog Bus is rated for 300 VAC/VDC on ABus and 150 VAC/VDC on SABus. Depending on use, the potential exists for high voltages to be present on these internal buses which could be routed to the outside connector.

The 1380 board has a built-in safety interlock circuit which prevents the module connection to the 1830 Analog Bus and potential high voltage exposure on the outside connector **unless external interlock jumpers are installed.**



**Figure 3-10: Analog Bus Safety Interlock**

### CAUTION



When utilizing high voltage or hazardous signals, the cable signals should be insulated from user exposure with a connector shell.

To allow access to the analog bus, you must install a jumper or connecting loop (Figure 3-10) between pins E4 and E8 on the outside connector of the card. This will result in the interlock being “closed” and the analog bus relays available for use. One method of connection would be to wire these pins together at the connector end when you build your cable harness.

A message appears on the **Relay Control** tab of the web page indicating the status of the interlock and your access to the 1830 analog bus. The following illustrations show the message when the interlock is closed (and the relays are enabled for use) or open (the relays are disabled).

Analog Bus Safety Interlock is closed. Analog Bus Relays enabled.

Analog Bus Safety Interlock is open. Analog Bus Relays disabled.

---

## CAUTION

**Pin E8 is referenced through digital ground to earth ground, should only be connected to Pin E4 when required, and must not be used for any other signal connection. Pin E4 is TTL signal compatible only, and must not be used for any purpose other than the safety interlock.**

**DO NOT connect any high voltage signals to these two pins. Non-compliance may cause damage to the instrument or electrical shock hazard.**

---

## LXI Web Page Controls

Figures 3-11 through 3-13 show the LXI web pages that allow you to control the 1380 card through manual setting or through SCPI commands.

## Relay Control Tab

The **Relay Control** tab (Figure 3-11) allows you to change the conditions on the various relays on the 1380 card. Simply click the appropriate relay to change the state of the relay on the card. The relay change is immediate.

Note the message on the top of the screen in the figure regarding the Analog Bus Safety Interlock. When the jumper between connector pins E4 and E8 is installed, the message indicates that the interlock is closed, the bus relays are enabled, and you are connected to the analog bus. Figure 3-11 shows this message.

When the jumper is not connected, the message (shown below) indicates

that the interlock is open, the bus relays are not enabled, and you are not connected to the analog bus.

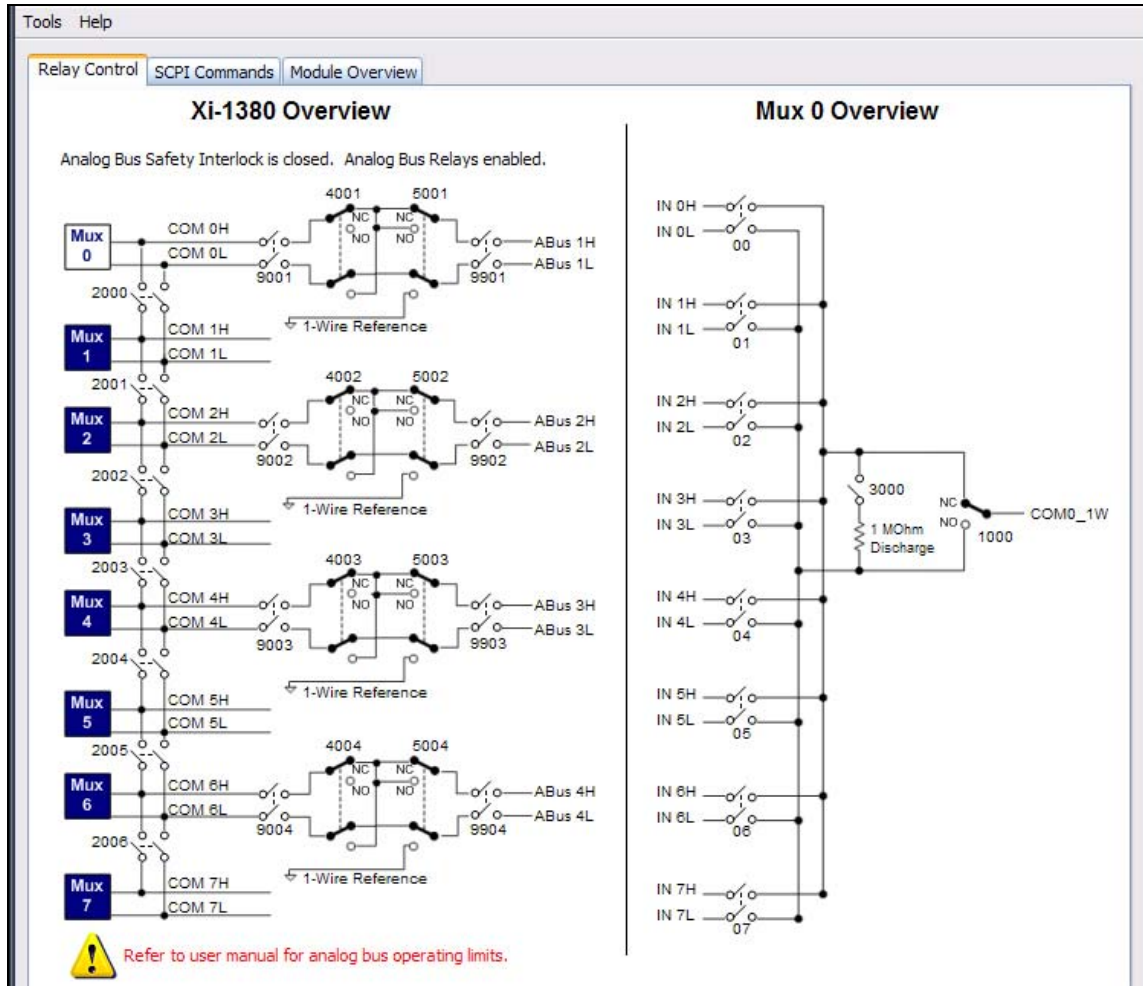


Figure 3-11: Relay Control Tab

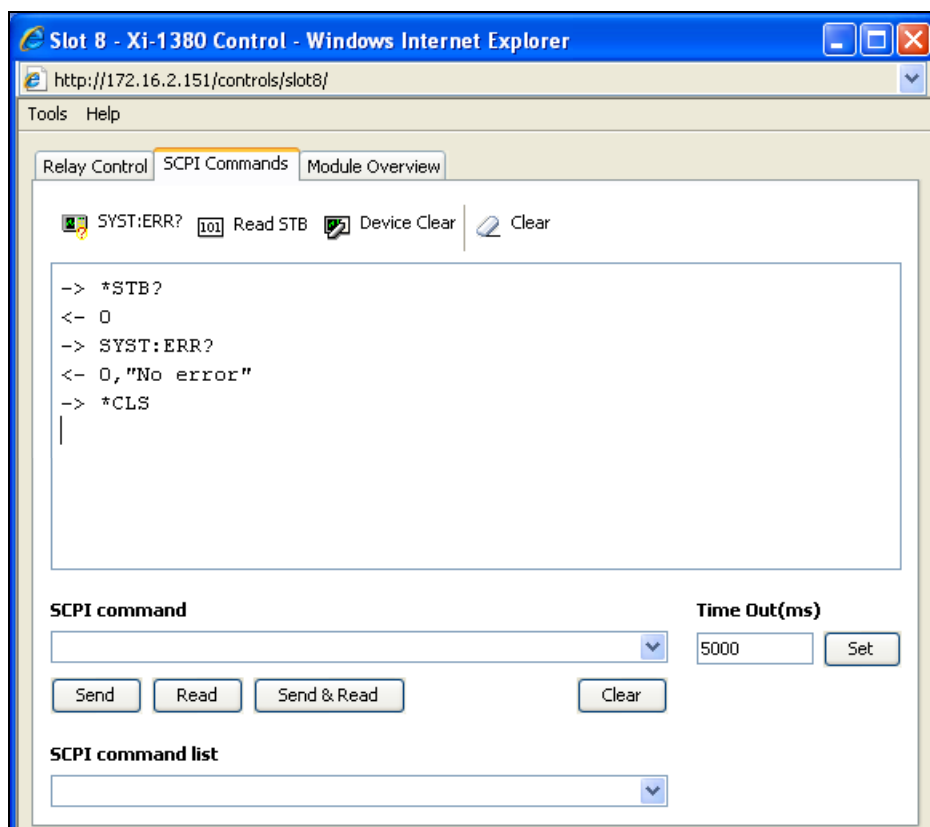
### SCPI Commands Tab

The **SCPI Commands** tab (Figure 3-12) allows you to send SCPI commands to the card. A few common SCPI commands have clickable icons along the top of the tab including:

- **SYST:ERR?:** Checks on and reports if there are any errors
- **Read STB:** Reads the value of the Status Byte Register
- **Device Clear:** Clears error queue and flushes all input and output buffers
- **Clear:** Clears any text in the text message box below the icons

Use the **SCPI Command** input box to enter SCPI commands. The command and any replies will be shown in the text message box.

- Clicking **Send** sends the command.
- Clicking **Read** receives the reply.
- Clicking **Send/Read** both sends and then receives the reply.
- Clicking **Clear** clears the commands history in the **SCPI command** input box



**Figure 3-12: SCPI Commands Tab**

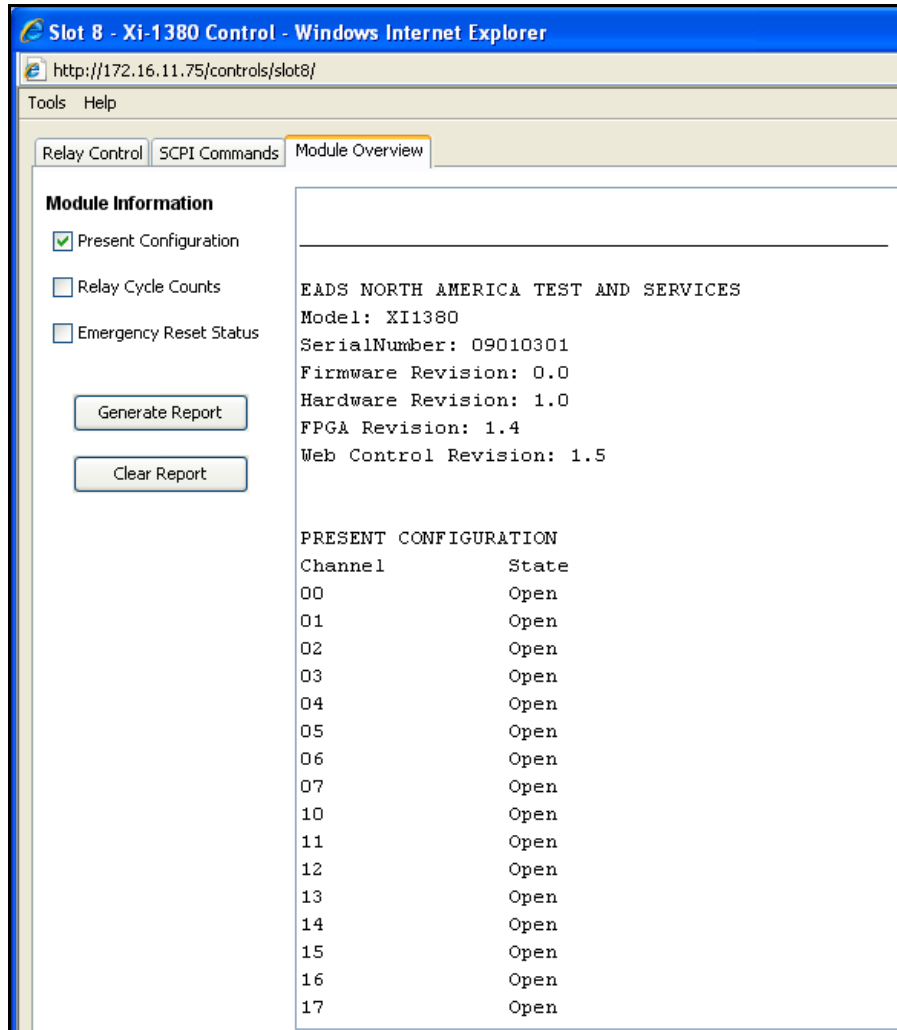
The **Time Out** box allows you to set different values as needed.

The **SCPI command list** drop-down box includes a list of commonly used commands and queries that you can choose to automatically appear in the **SCPI command** input box.

Additional information on and a listing of SCPI commands can be found in the **Model 1830 Source/Measure Switch System User Manual**, part number 980937.

## Module Overview Tab

The **Module Overview** tab (Figure 3-13) allows you to review current card information including model and serial number, revision levels, channel/state configuration, relay cycle counts, and emergency reset status.



**Figure 3-13: Module Overview Tab**

Clicking **Generate Report** generates a status report and shows the results on the information screen to the right of the button. Clicking **Clear Report** removes the information from the screen. Clicking any of the checkboxes on the left side before you click **Generate Report** adds this additional information to the generated report.

## Tools Menu

Each web page has a **Tools** menu (Figure 3-14) with a drop-down menu that expands when you click it.

The selections include:

- **Simulation** – Puts the control into a simulation mode where no commands for this card are sent to the 1830 system
- **Reset Device** – Resets the card to its default state
- **Update Control** – Updates the control to reflect the current state of the card on the 1830
- **Reconnect Control** – Re-establishes communication between the control and the 1830 system. Useful when the 1830 has been power cycled and the control is left open.

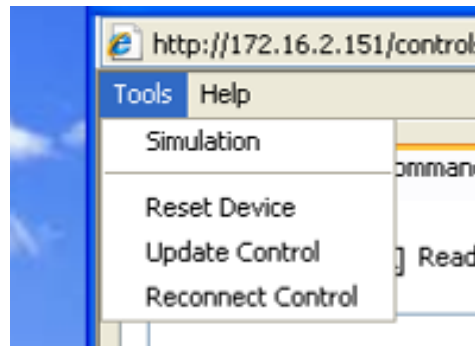


Figure 3-14: Web Page Tools Menu



## IVI Driver Operation

The 1380 card is supplied with an IVI (Interchangeable Virtual Instruments) driver. This driver is IVISwch class compliant. For more information on IVI and IVISwch class drivers, consult the IVI website

<http://www.ivifoundation.org>

Unlike SCPI commands, the IVI driver does not specifically select channel numbers to operate one or more relays. The IVI driver operates on channel names, which identify the two points to connect together.

The IVI driver channel names corresponding to the SCPI channel numbers is shown in Table 3-3 below. Note that in many cases, since a single channel controls both the high and low side of a 2-wire pair, the channel can be closed by specifying either both high or both low channel names. This is true for every channel below EXCEPT those marked with an asterisk (\*). In those cases, the channel is closed by specifying the first pair, and opened by specifying the second channel pair.

**Table 3-3: IVI Driver Channel Names**

Channel	Channel Name 1 (H)	Channel Name 2 (H)	Channel Name 1 (L)	Channel Name 2 (L)
0	COM0_H	CH00_H	COM0_L	CH00_L
1	COM0_H	CH01_H	COM0_L	CH01_L
2	COM0_H	CH02_H	COM0_L	CH02_L
3	COM0_H	CH03_H	COM0_L	CH03_L
4	COM0_H	CH04_H	COM0_L	CH04_L
5	COM0_H	CH05_H	COM0_L	CH06_L
6	COM0_H	CH06_H	COM0_L	CH07_L
7	COM0_H	CH07_H	COM0_L	CH08_L
10	COM1_H	CH10_H	COM1_L	CH10_L
...	...	...		
17	COM1_H	CH17_H	COM1_L	CH17_L
20	COM2_H	CH20_H	COM2_L	CH20_L
...	...	...		
77	COM7_H	CH77_H	COM7_L	CH77_L
1000*	COM0_1W	COM0_H	COM0_1W	COM0_L
1001*	COM1_1W	COM1_H	COM1_1W	COM1_L
1002*	COM2_1W	COM2_H	COM2_1W	COM2_L
1003*	COM3_1W	COM3_H	COM3_1W	COM3_L
1004*	COM4_1W	COM4_H	COM4_1W	COM4_L
1005*	COM5_1W	COM5_H	COM5_1W	COM5_L
1006*	COM6_1W	COM6_H	COM6_1W	COM6_L

Channel	Channel Name 1 (H)	Channel Name 2 (H)	Channel Name 1 (L)	Channel Name 2 (L)
1007*	COM7_1W	COM7_H	COM7_1W	COM7_L
2000	COM0_H	COM1_H	COM0_L	COM1_L
2001	COM1_H	COM2_H	COM1_L	COM2_L
2002	COM2_H	COM3_H	COM2_L	COM3_L
2003	COM3_H	COM4_H	COM3_L	COM4_L
2004	COM4_H	COM5_H	COM4_L	COM5_L
2005	COM5_H	COM6_H	COM5_L	COM6_L
2006	COM6_H	COM7_H	COM6_L	COM7_L
3000	COM0_H	DSCHRG0_H	COM0_L	DSCHRG0_L
3001	COM1_H	DSCHRG1_H	COM1_L	DSCHRG1_L
3002	COM2_H	DSCHRG2_H	COM2_L	DSCHRG2_L
3003	COM3_H	DSCHRG3_H	COM3_L	DSCHRG3_L
3004	COM4_H	DSCHRG4_H	COM4_L	DSCHRG4_L
3005	COM5_H	DSCHRG5_H	COM5_L	DSCHRG5_L
3006	COM6_H	DSCHRG6_H	COM6_L	DSCHRG6_L
3007	COM7_H	DSCHRG7_H	COM7_L	DSCHRG7_L
4001 Open	ABUS1_ISO_H	ABUS1_EN_H	ABUS1_ISO_L	ABUS1_EN_L
4001 Closed	ABUS1_ISO_L	ABUS1_EN_H		
4002 Open	ABUS2_ISO_H	ABUS1_EN_H	ABUS2_ISO_L	ABUS2_EN_L
4002 Closed	ABUS2_ISO_L	ABUS2_EN_H		
4003 Open	ABUS3_ISO_H	ABUS3_EN_H	ABUS3_ISO_L	ABUS3_EN_L
4003 Closed	ABUS3_ISO_L	ABUS3_EN_H		
4004 Open	ABUS4_ISO_H	ABUS4_EN_H	ABUS4_ISO_L	ABUS4_EN_L
4004 Closed	ABUS4_ISO_L	ABUS4_EN_H		
5001	BP_1W_REF	ABUS1_EN_L		
5002	BP_1W_REF	ABUS2_EN_L		
5003	BP_1W_REF	ABUS3_EN_L		
5004	BP_1W_REF	ABUS4_EN_L		
9001	COM0_H	ABUS1_ISO_H	COM0_L	ABUS1_ISO_L
9002	COM2_H	ABUS2_ISO_H	COM2_L	ABUS2_ISO_L
9003	COM4_H	ABUS3_ISO_H	COM4_L	ABUS3_ISO_L

Channel	Channel Name 1 (H)	Channel Name 2 (H)	Channel Name 1 (L)	Channel Name 2 (L)
9004	COM6_H	ABUS4_ISO_H	COM4_L	ABUS4_ISO_L
9901	ABUS1_EN_H	ABUS1_H	ABUS1_EN_L	ABUS1_L
9902	ABUS2_EN_H	ABUS2_H	ABUS2_EN_L	ABUS2_L
9903	ABUS3_EN_H	ABUS3_H	ABUS3_EN_L	ABUS3_L
9904	ABUS4_EN_H	ABUS4_H	ABUS4_EN_L	ABUS4_L

So, to close relay 77, you could use the “Connect” API for **either** the high or the low channel

```
sp_driver->Path->Connect( "COM7_H", "CH77_H" );
```

or

```
sp_driver->Path->Connect( "COM7_L", "CH77_L" );
```

(you could do both, but then you would have to Disconnect() both before the connection would be broken).

Once the channel is closed, it may be opened with the “Disconnect()” method:

```
sp_driver->Path->Disconnect( "COM7_H", " CH77_H" );
```

To disconnect all channels, the DisconnectAll() method may be used:

```
sp_driver->Path->DisconnectAll();
```

In order to install and operate properly, the IVI shared components must first be installed on your computer. To download the IVI shared components, visit the IVI foundation website:

[http://www.ivifoundation.org/shared\\_components/Default.aspx](http://www.ivifoundation.org/shared_components/Default.aspx)

Once the shared components have been installed, the IVI driver for the 1380 may be installed. The IVI driver can be installed from the manual and software installation CD provided with the 1800 series platform. The driver may also be downloaded from EADS’s website:

<http://www.eads-nadefense.com/downloads/1830.dl.htm>

## IVI Configuration Store

Once the driver is installed, the IVI Configuration Store must be edited to create a “session”. The session is used to associate the VISA resource descriptor and the module address (plug-in slot) with the 1380.

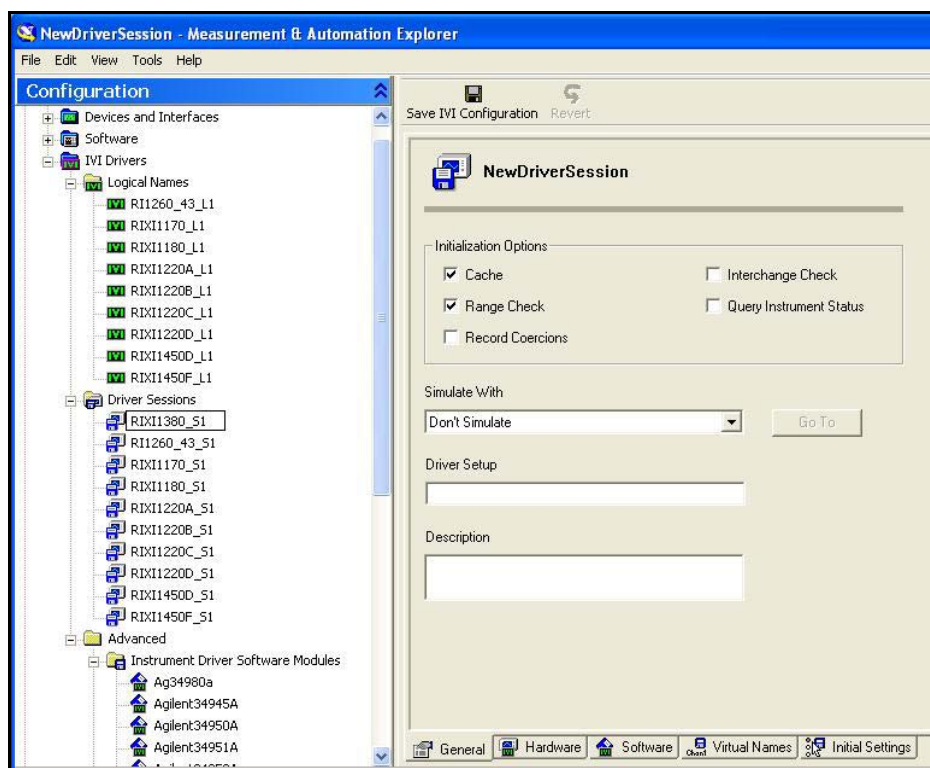
You must create a new session for **each** 1380 you want to control. That is, if there are 3 1380 switch cards plugged into your 1800-series platform, then you will need to create 3 sessions to control them.

The most effective way to edit the IVI configuration store is with an IVI-aware tool, such as National Instruments™ Measurement and Automation Explorer

(NI-MAX). The following example shows how to use this tool to make the entries in the IVI configuration store to allow operation of the IVI driver for the 1380.

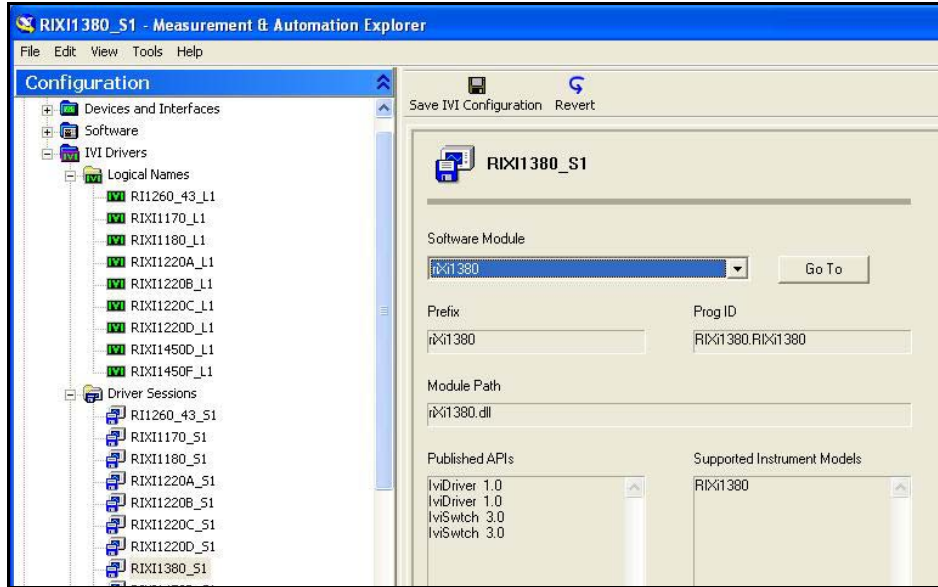
The first step is to create a driver session. This can be done by right-clicking on the **Driver Sessions** element in the IVI Drivers portion of the NI-MAX tool.

In the example shown in Figure 3-15, we have created a new session named “RIXI1380\_S1”.



**Figure 3-15: Creating New IVI Driver Session**

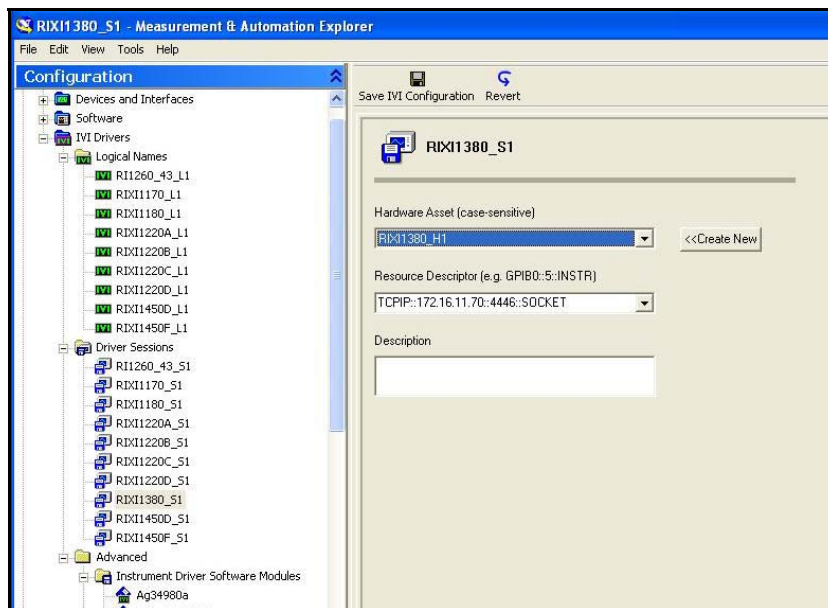
Once the driver session has been created, it must be associated with a software module. To do this, select the **Software** tab of the session. Then select the “riXi1380” software module that was installed with the IVI driver installation. This is shown in Figure 3-16.



**Figure 3-16: Associating Software Module with IVI Driver Session**

The next step in the process is to create a hardware asset to associate with the driver. This is basically a VISA resource descriptor that can be used to communicate with the 1800-series system that contains the 1380 module (in this case via the Ethernet interface). This is shown in Figure 3-17.

Note that the “Resource Descriptor” is the VISA resource descriptor for the 1800 series platform into which the 1380 module is plugged. VISA supports the Ethernet interface (as shown), the USB interface, or the GPIB interface. The main web page for the 1800 series platform displays the Ethernet and USB VISA descriptors, and the GPIB address, for the platform.



**Figure 3-17: Creating a Hardware Asset for the IVI Driver Session**

After the hardware asset has been created, the module address must be updated to match the plug-in slot of the 1380. Select the **Initial Settings** tab and modify the “Module Address” entry to match the plug-in slot of the 1380 card. In the example shown in Figure 3-18, the module address is set to 7.

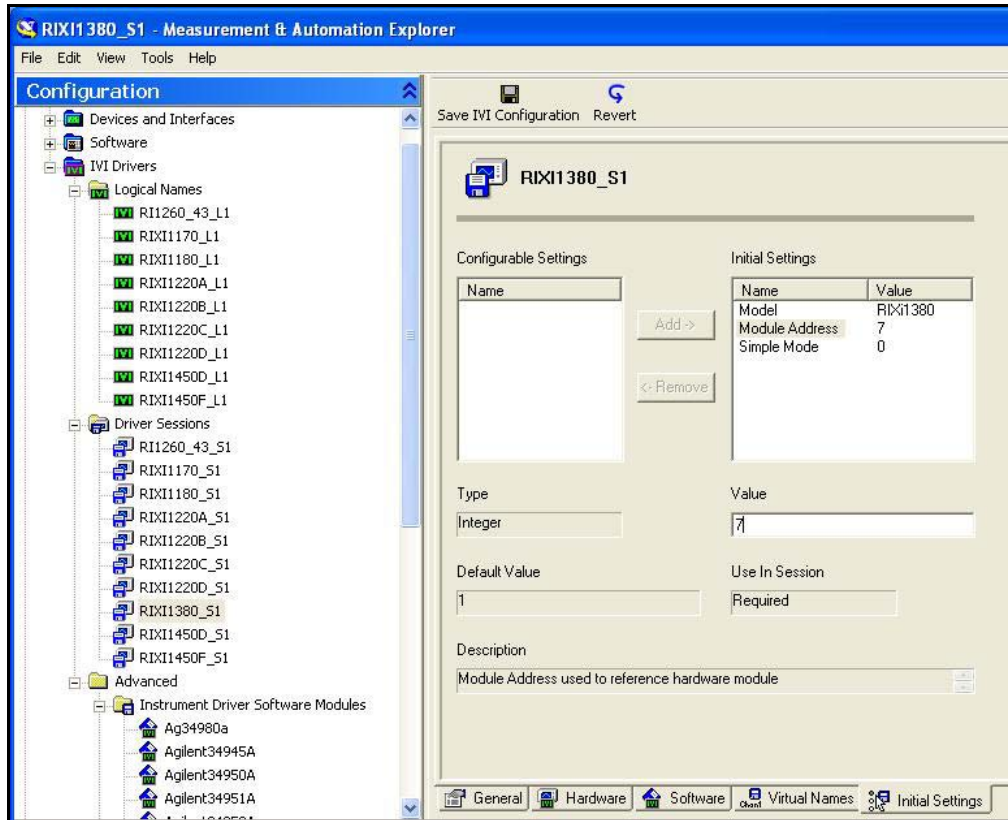
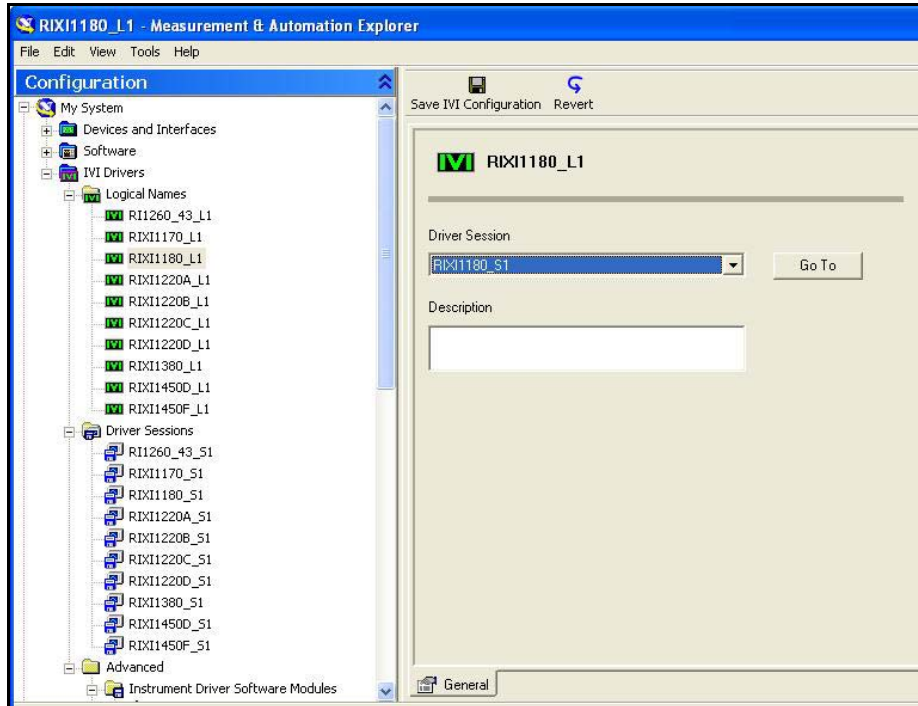


Figure 3-18: Modifying the Module Address for the IVI Driver Session

The final step in the configuration process is to create a logical name. To do this, right mouse click on the **Logical Names** tree element and select the **Create new (case sensitive)** item. Enter the name of the new logical session (shown in Figure 3-19 as “RIXI1380\_L1”) and then select the driver session created previously (“RIXI1380\_S1”).



**Figure 3-19: Creating a Logical Name for the IVI Driver Session**

After all of the editing has completed, click the **Save IVI Configuration** button to save the configuration in the IVI configuration store.

## Visual C++ Example

An example showing how to use the IVI driver with Microsoft Visual C++ is shown in Figure 3-20. This example instantiates an instance of the driver, initiates the driver, and closes two channels (channels 0 and 9901). It then waits for the channel debounce to occur, and finally opens all channels.

```
// Example console test program showing how to use the
// basic methods of the 1380 IVI driver
//

#include "stdafx.h"
#include <atlstr.h>

int _tmain(int argc, _TCHAR* argv[])
{
    ::CoInitialize(NULL);

    try
    {
        IIVIvDriverPtr spDriver(__uuidof(RIXI1380));
        IIVIvSwTchPtr spSwitch;

        try
        {

            // IIVIvDriverIdentity properties
            // Initialize not required
            _bstr_t bstrIdentifier = spDriver->Identity->Identifier;
            wprintf(L"Identifier: %s\n", bstrIdentifier.GetBSTR());

            _bstr_t bstrRevision = spDriver->Identity->Revision;
            wprintf(L"Revision: %s\n", bstrRevision.GetBSTR());

            _bstr_t bstrVendor = spDriver->Identity->Vendor;
            wprintf(L"Vendor: %s\n", bstrVendor.GetBSTR());

            _bstr_t bstrDescription;
            bstrDescription = spDriver->Identity->Description;
            wprintf(L"Description: %s\n", bstrDescription.GetBSTR());

            // Setup resource descriptor.
            // this is the IVI configuration store logical name
            CString strResourceDesc = "RIXI1380_L1";

            // Setup IVI-defined initialization options
            CString strStandardInitOptions =
                "Cache=true, InterchangeCheck=false,
                QueryInstrStatus=true, RangeCheck=true,
                RecordCoercions=false, Simulate=false";

            // Setup driver-specific initialization options
            CString strDriverSetupOptions =
                "DriverSetup= Model=RIXI1380, Trace=false";

            CString strOptions = strStandardInitOptions + "," +
```



```

        strDriverSetupOptions;

    spDriver->Initialize(LPCTSTR(strResourceDesc),
        VARIANT_FALSE, VARIANT_FALSE,
        LPCTSTR(strOptions));

    // cast the specific driver to an
    // IVISwch class compliant one
    spSwitch = spDriver;

    // close channel 0
    _bstr_t channel1 = _bstr_t("COM0_H");
    _bstr_t channel2 = _bstr_t("CH00_H");

    spSwitch->Path->Connect(channel1, channel2);

    channel1 = _bstr_t("ABUS1_EN_H");
    channel2 = _bstr_t("ABUS1_H");

    // close channel 9901
    spSwitch->Path->Connect(channel1, channel2);

    // wait until the channels have settled (up to 10 msec)
    spSwitch->Path->WaitForDebounce( 10 );

    // Disconnect all channels
    spSwitch->Path->DisconnectAll();

}
catch (_com_error& e)
{
    ::MessageBox(NULL, e.Description(), e.ErrorMessage(),
        MB_ICONERROR);
}

if (spSwitch != NULL && spSwitch->Initialized)
{
    // Close driver
    spSwitch->Close();
}
}
catch (_com_error& e)
{
    ::MessageBox(NULL, e.Description(), e.ErrorMessage(),
        MB_ICONERROR);
}

::CoUninitialize();

printf("\nDone - Press Enter to Exit");
getchar();

return 0;
}

```

**Figure 3-20: Example Visual C++ Program Using the IVI Driver**

## Visual C# Example

An example showing how to use the IVI driver with Microsoft Visual C# is shown in Figure 3-21. This example instantiates an instance of the driver, initiates the driver, and closes two channels (channels 0 and 9901). It then waits for the channel debounce to occur, and finally opens all channels.

Note that for the C# program to link, the following interoperability references must be added to the C# project:

```
Ivi.Driver.Interop.dll
Ivi.Swtch.Interop.dll
EADS.RIXI1380.Interop.dll
```

The interoperability DLLs are installed when the IVI shared components are installed (first two items above) and when the 1380 IVI driver is installed. These are typically installed into the following directory, but your system may have a different IVI installation directory:

```
C:\Program Files\IVI\Bin\Primary Interop Assemblies
```

```
using System;

namespace ClientCS
{
    /// <summary>
    /// Example test program to operate the IVI driver using C#.
    /// </summary>
    class ClientCS
    {
        /// <summary>
        /// The main entry point for the application.
        /// </summary>
        [STAThread]
        static void Main(string[] args)
        {
            EADS.RIXI1380.Interop.RIXI1380 riDriver =
                new EADS.RIXI1380.Interop.RIXI1380Class();

            Ivi.Swtch.Interop.IIviSwtch switchDriver;

            // Use resource string from IVI configuration store
            string strResourceDesc = "RIXI1380_L1";

            // Setup IVI-defined initialization options
            string strStandardInitOptions =
                "Cache=true, InterchangeCheck=false,
                QueryInstrStatus=true, RangeCheck=true,
                RecordCoercions=false, Simulate=false";

            // Setup driver-specific initialization options
            string strDriverSetupOptions =
                "DriverSetup= Model=RIXI1380, Trace=false";

            string strOptions = strStandardInitOptions + "," +
                strDriverSetupOptions;
```

```
riDriver.Initialize(strResourceDesc, false, false,
                  strOptions);

// cast the RIXI1380 driver as an IVISwch class driver
switchDriver = riDriver as Ivi.Swch.Interop.IIviSwch;

if (switchDriver != null)
{
    // connect channel 0
    switchDriver.Path.Connect("COM0_H", "CH00_H");

    // connect channel 9901
    switchDriver.Path.Connect("ABUS1_EN_H", "ABUS1_H");

    // wait for debounce (up to 10 msec)
    switchDriver.Path.WaitForDebounce( 10 );

    // disconnect all channels
    switchDriver.Path.DisconnectAll();
}
}
}
```

**Figure 3-21: Example Visual C++ Program Using the IVI Driver**

## ActivATE Operation

The 1380 module may also be used within the ActivATE test platform environment.

Consult the 1800-series manual for a description of how to configure your system for use with the 1800-series plug-in cards. That section will instruct you how you may add the 1800-series driver to the list of devices available to your test program, and also how to configure the 1800-series driver to provide access to the drivers for the various plug-in modules.

Once the ActivATE environment is configured, the driver for the 1380 will be available for your test program. The following methods are the most commonly used to operate the relays on the 1380 module:

- Close() closes a single channel
- CloseList() closes a list of channels
- CloseRange() closes a range of channels
- Open() opens a single channel
- OpenList() opens a list of channels
- OpenRange() opens a range of channels.

The sample function in Figure 3-22 illustrates a series of function calls to operate various channels on the 1380 card. Note that the test program reference “xi1380\_1” has been assigned as the interface to the 1380 card.

```
Function Sample_Test()  
  
    Dim nErr  
  
    'initialize test node as a failure  
    Sample_Test = false  
  
    ' close channel 9901  
    nErr = xi1380_1.Close(9901)  
    if nErr <> 0 then exit function  
  
    'close channels 0, 11, 31, and 50  
    nErr = xi1380_1.CloseList("0,11,31,50")  
    if nErr <> 0 then exit function  
  
    'close channels 21 to 25  
    nErr = xi1380_1.CloseRange(21,25)  
    if nErr <> 0 then exit function  
  
    ' open channel 0  
    nErr = xi1380_1.Open( 0 )  
    if nErr <> 0 then exit function  
  
    'open a channels 0, 21, 27, 77  
    nErr = xi1380_1.OpenList("0, 21, 27, 77")  
    if nErr <> 0 then exit function  
  
    'open channels 0 to 77  
    nErr = xi1380_1.OpenRange(0,77)  
  
    ' indicate test has passed  
    Sample_Test = true  
  
End Function
```

**Figure 3-22: Example ActivATE Test Script for the 1380**

The ActivATE environment also has a graphical user interface (GUI) that can be used both as a control and to display the current status of the 1380. This graphical user interface is “live” in that it remains synced up with the current state of the instrument if it is controlled via the ActivATE driver.

## Main Tab

The **Main** tab of the ActivATE GUI (Figure 3-23) displays the present status for the channels of the 1380. By clicking on any of the relays, the state of the relay can be changed from closed to open or from open to closed. An open check box means that relay is open.

The current status of the channels shows on this tab but if you have a

question about status, click **Update** to confirm.

Click **Reset** to open all the relays. Click **Simulation** to put the screen into simulation mode where no commands for this card are sent to the 1830 system.

The **Main** tab features a message regarding the Analog Bus Safety Interlock. **Analog Bus Safety Interlock is closed** means that a jumper is installed, the analog bus relays are enabled, and the 1380 card is electrically connected to the analog bus. If the message states that the Interlock is open, the relays are disabled and the card is not connected to the analog bus.

Refer to the section **Analog Bus Safety Interlock Circuit** earlier in this chapter for additional information.

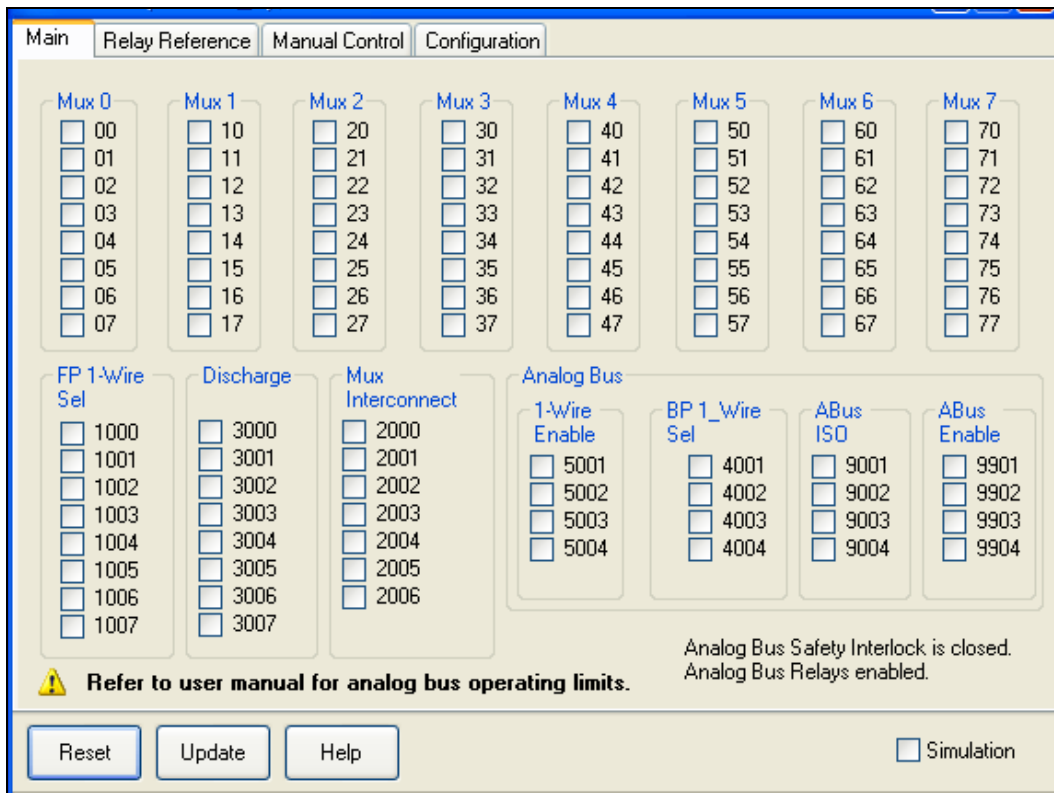


Figure 3-23: ActivATE Main Tab

## Relay Reference Tab

The 1380 card has an extra **Relay Reference** tab (Figure 3-24). This tab shows a graphic representation of the 1380 relay configuration. Unlike the web-page version, this graphic does not allow you to click it and change relay states. The graphic is included to help you visualize the various relay options available to you on the Main tab. The Main tab can change the relay states.

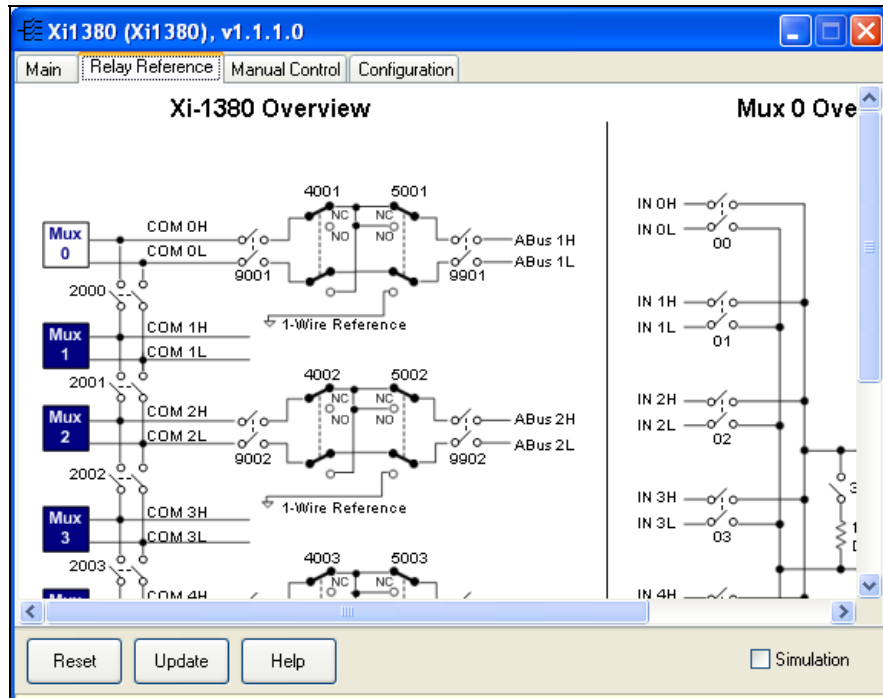


Figure 3-24: ActivATE Relay Reference Tab

### Main Control Tab

The **Manual Control** tab (Figure 3-25) acts very similar to the web page version. It allows you to send SCPI commands to and read replies from the system.

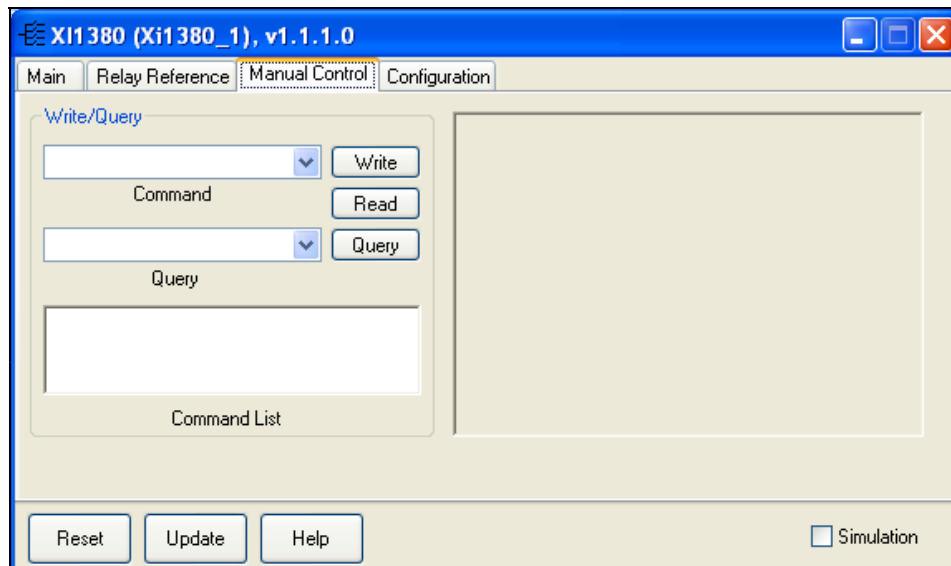


Figure 3-25: ActivATE Manual Control Tab

## Configuration Tab

The **Configuration** tab (Figure 3-26) provides the means to locate and load the XML command file that contains all of the relevant SCPI commands for this card. The tab also allows you to enable a file trace to store all the commands sent to the hardware (through the driver). This is helpful for debugging purposes.

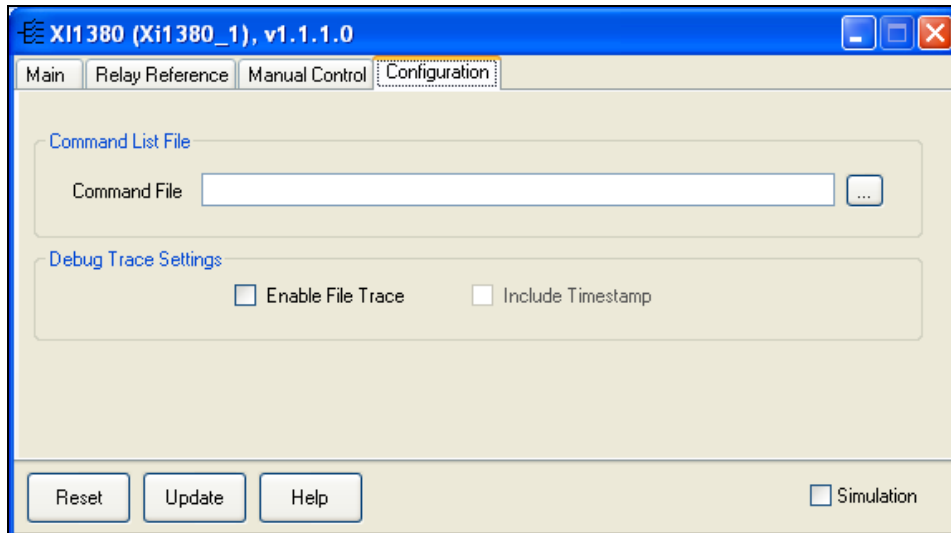


Figure 3-26: ActivATE Configuration Tab

## Commonly Used SCPI Commands

The full command set supported by the 1800-series system is documented in its user manual. This section describes a few of the most commonly used commands that apply specifically to the 1380.

The most commonly used commands used with the 1380 card are:

CLOSE	close one or more channels on one or more cards
OPEN	open one or more channels on one or more cards
SCAN	operate a list of relay channels, closing one and opening the previous one with each trigger received
PATH	define a set of relays to operate and associate a name to them
EXCLude	prevent more than one in a group of relays from being closed simultaneously
INCLude	cause two or more relays to always stay in the same state as the others so that they are all opened or all closed

CHANnel:DElAy      sets the channel close and open settling times for each channel

## Channel Descriptors

Many SCPI commands require one or more relays to be selected. These commands take a *channel descriptor* as one of the command parameters. The most basic form of a channel descriptor uses the form:

```
(@ <module address> ( <channel> ) )
```

Where:

<module address> identifies the slot of the plug-in (1 to 9)  
<channel> identifies the relay channel being controlled.

The valid <channel> numbers for a 1380 card are:

0 to 7	(MUX 0)
10 to 17	(MUX 1)
20 to 27	(MUX 2)
30 to 37	(MUX 3)
40 to 47	(MUX 4)
50 to 57	(MUX 5)
60 to 67	(MUX 6)
70 to 77	(MUX 7)
1000 to 1007	(1-wire relays for each COM)
2000 to 2006	(COM interconnect relays)
3000 to 3007	(Discharge relays for each COM)
4001 to 4004	1-wire connections for analog bus low-to-high
5001 to 5004	Connect backplane 1W reference to each analog bus
9001 to 9004	Connect analog bus isolation relays
9901 to 9904	Connect 1380 to analog bus 1 to 4

For the best display of how the channels operate, view the 1380 web page.

The following would be valid channel descriptors for an 1380 switch card plugged into slot 7:

```
(@7(0))
(@7(23))
(@7(77))
```

In addition to single channels, multiple channels on the same card can be separated by commas. For example:

```
(@7(0,23,77))
```



specifies each channel 0, 23, and 77 on the switch card in slot 9. Also, a range of relays may be specified by using the colon character (':'):

```
(@7(11:15,47:44))
```

specifies that each channel from 11 to 15 and from 44 to 47 should be selected for the command.

Note that the channel descriptors can include channels from multiple modules as well:

```
(@9(16,22),7(14:21),5(0,14))
```

The previous example selects two channels from the plug-in card in slot 9, all channels between 14 and 21 for the plug-in in slot 7, and channels 0 and 14 for the plug-in in slot 5.

## PATH Command

The PATH command can be used to associate a set of relays with a name. The name can then be used in lieu of channel numbers in the commands that support a channel list.

For example, a path named "TURN\_OFF\_POWER" can be associated with several channels on one or more switch cards:

```
PATH:DEFINE TURN_OFF_POWER,(@7(11,22))
```

Now when the command

```
CLOSE (@TURN_OFF_POWER)
```

is received, it will close all of the channels defined for the path named TURN\_OFF\_POWER.

## SCAN Command

The SCAN command is used to instruct the 1800-series system to scan across a set of relay channels. The relay channels can occur in any order, across any number of plug-in modules.

The SCAN list is defined by using the SCAN command:

```
SCAN (@9(0,11:15,23:16,77))
```

This example shows that the scan list will cycle through the following sequence of channels on the plug-in module in slot 9:

```
0,11,12,13,14,15,23,22,21,20,17,16,77
```

After the scan has been initiated (with an "INITiate:IMMediate" command), the 1800 series platform will wait for a trigger to be received, at which point scanning will begin. The trigger source used for scanning is determined by the "TRIGger:SOURce" command.

Once the trigger source has been received, the system will wait for a "scan advance source". The scan advance source is selected by the

“SCAN:ADVance:SOURce” command. For each trigger received on the scan advance source, the system will open the previous switch in the scan list, wait for it to settle, and then close the next switch in the scan list.

At each step of the scan list, a set of SCPI commands can be executed. The set of SCPI commands to execute are defined by the “SEQunce:DEFine” command. For example, if you want to configure a DMM in slot 14 to use the 2-wire resistance function in the 10KOhm range and make 2 readings, you could issue the following commands:

```
SEQUENCE:DEF      READ_2_WIRE
SEQUENCE:STEP     "SENSE:RES 10000,(@14(0))"
SEQUENCE:STEP     "READ? (@14(0))"
SEQUENCE:STEP     "READ? (@14(0))"
SEQUENCE:END
```

Now, the series of 3 SCPI commands can be used by specifying the sequence name “READ\_2\_WIRE”. In order to execute the sequence whenever one of the channels on the scan list is closed, the sequence must be associated with the channel(s) by using the “SEQunce:SELect” command:

```
SEQ:SEL READ_2_WIRE,(@9(0:16))
```

With this association, the scan list will make two 2-wire measurements in the 10K Ohm range after each channel 0 through 16 is closed. Since there is no association for any channel above 16, no action will be taken for those channels when they are closed during the execution of the scan list.

The sequence association can be unique for each channel on the scan list. That is, if the scan list consists of 50 channels, each of those channels could have a unique sequence defined and then associated with it.

For more information on the SCAN and SEQUENCE commands, consult the SCPI section of your 1800-series system user manual.

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# INDEX

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- ABUS
  - IVI driver channel, 3-17
  - voltage limits, 3-11
- ActivATE
  - Configuration tab, 3-31
  - Main Control tab, 3-30
  - Main tab, 3-28
  - operation, 3-27
  - Relay Reference tab, 3-29
  - software, 1-2
  - test script, 3-28
- analog bus, 1-2
  - block diagram, 3-10
  - DC performance, 1-2
  - safety interlock, 3-11
  - Signal Raceway, 1-2
  - using, 3-10
- back plane, single-wire configuration, 3-8
- block diagram
  - 1380 operation, 3-1
  - back plane configuration, 3-8
  - discharge connection, 3-8
  - front panel single-wire configuration, 3-7
  - multiplexer configuration, 3-5
  - relay configuration, 3-5
  - single multiplexer, 3-4
- C driver, 1-2
- cable assembly
  - description, 2-6
  - part number, 1-5
  - pin and wire reference, 2-7
- card shield, 2-2
- channel, 1-1
- channel descriptors, 3-32
- coding keys, 2-11
- connector
  - code key, 2-11
  - kit, 1-5, 2-6
  - layout, 2-3
  - type, 1-5
  - wire reference, 2-7
- crimp
  - hand tool, 2-6
  - pin insertion tool, 2-6
- description, 1-1
- discharge resistor, 3-8
- driver support, 1-3
- ESD procedures, 2-1
- front panel
  - connector, 2-3
  - single-wire configuration, 3-7
- independently, use, 1-1
- installing
  - card shield, 2-2
  - connector code key, 2-11
  - plug-in card, 2-1
- IVI
  - configuration store, 3-19
  - driver operation, 3-17
- IVI COM driver, 1-2
- LabVIEW, 1-3
- LAN communication, 1-2
- linked together, use, 1-1
- mating connector, 2-6
- module configuration, 3-3
- module overview page, 3-15
- MTBF, 1-4
- multiplexer (mux), 1-1, 3-1
- ordering information, 1-5
- part numbers, 1-5
- PATH command, 3-33
- power requirements, 1-3
- relay
  - configuration, 3-5
- relay control page, 3-13
- SABUS

- IVI driver channel, 3-17
  - voltage limits, 3-11
- safety interlock, analog bus, 3-11
- SCAN command, 3-33
- SCPI commands, 1-2, 3-12
  - commonly used, 3-31
- Signal Raceway analog bus, 1-2
- simulation, 3-29
- simulation mode, 3-16
- single-wire mode, 3-6
- specifications
  - AC performance, 1-3
  - conformance testing, 1-4
  - DC performance, 1-2
  - environmental, 1-3
  - input, 1-2
  - interface data, 1-3
  - mechanical, 1-4, 1-5
  - reliability, 1-4
  - software, 1-3
  - switching, 1-2
- supplies, 1-5
- switching specifications, 1-2
- tools menu, 3-16
- two-wire use, 1-2
- Visual C#, 3-26
- Visual C++, 3-24
- web page controls, 3-12
  - tools menu, 3-16
- weight, 1-5