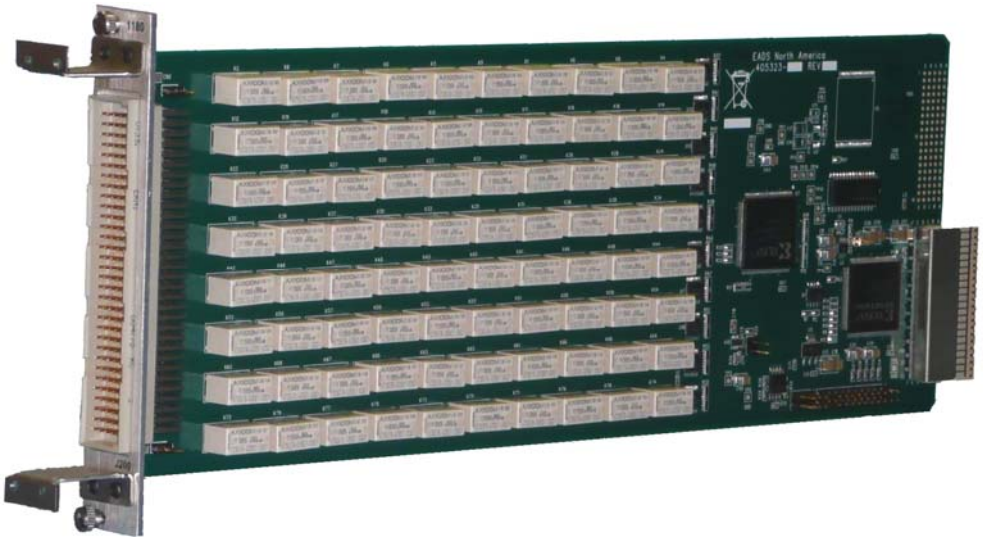
Racal Instruments™

1180 80-Channel 2 Amp, SPST Plug-in Switch Card

User Manual

Publication No. 980937-1180 Rev. B



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FOR YOUR SAFETY

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

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.

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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	4/6/09	Document Control release
B	8/7/09	Revised per EO 29763. Revised DC and AC performance; revised channel to connector pin mapping table; updated web page and ActivATE screen shots; added icon to ESD caution; updated CE declaration with current version; updated insertion loss, switch operations, and safety conformance specifications; and added optional shield ground plane and coding key information.

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Chapter 1
Overview and Specifications

Overview

The Racal Instruments™ 1180 is an 80-channel, SPST (Form A) plug-in switch card for the 1800 series Source/Measure Switch platform. It quickly and easily plugs into a switching system like the Model 1830 Source/Measure Switch System for LXI™/GPIB/USB interfaces.

Feature highlights include:

- 80 channels of SPST switching
- Ideal for general purpose switching to 40 MHz
- Switches up to 2 Amps
- Easily configured to meet user-defined network requirements

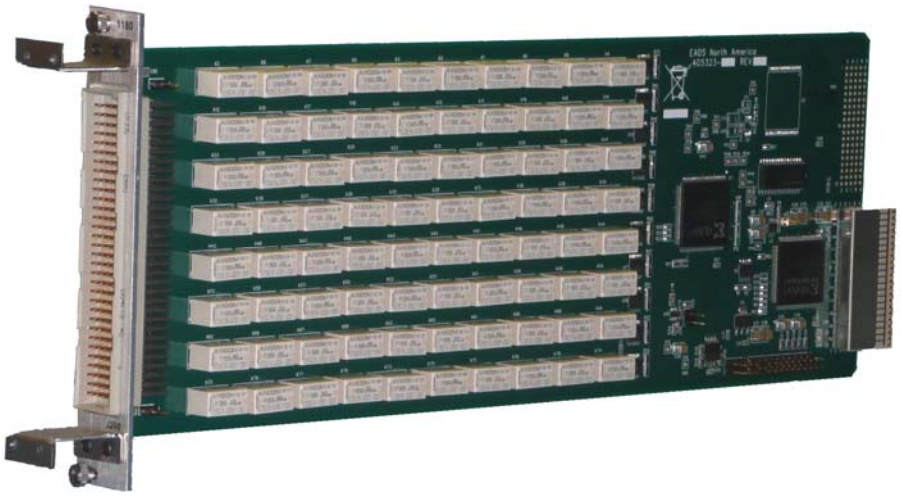


Figure 1-1: 1180 Plug-in Switch Card

Each channel of the 1180 can be used independently or linked in software to form custom switching groups or paths. The large number of channels allows a significant portion of a switching configuration to be realized in a single switch slot, saving valuable slots for data acquisition or other purposes.

Interface connectors are not provided with the 1180 SPST switch card and must be ordered separately. However, a six-foot unterminated cable assembly is available as a standard option.

The 1180 80-channel SPST 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 1180 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.

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

Path Resistance	< 400 mΩ (Initial)
Insulation Resistance	> 10^9 Ω
Thermal EMF	< 10 µV (< 3 µV typical)

AC Performance (into 50 Ω)

Bandwidth (-3 dB)	40 MHz
Insertion Loss	100 KHz: < 0.1 dB 1 MHz: < 0.1 dB 10 MHz: < 0.2 dB 40 MHz < 3 dB
Isolation	100 KHz: > 70 dB 1 MHz: > 50 dB 10 MHz: > 35 dB 40 MHz > 20 db
Crosstalk	100 KHz: < -75 dB 1 MHz: < -55 dB 10 MHz: < -40 dB 40 MHz < -25 dB
Capacitance	Channel-Chassis: < 120 pF Open Channel: < 10 pF

Interface Data

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

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 X 10^8 Electrical: 200,000 @ 300 Vrms/0.416 A/125 VA
Relay Operations Counter	Running total of operations stored in on-board non-volatile memory

Mean Time Between Failure (MTBF)

The 1180 MTBF is 200,744 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	13.6 oz. (0.39 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 1180 switch card and available mating connector accessories. Each 1180 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™ 1180 80-Channel SPST, 2A Switch Card	405323
160-pin cable assembly, 6 ft	408191
160-pin connector kit with backshell and pins	408192
Crimp hand tool	991020
Crimp pin-insertion tool	990898
Pin-removal tool	990899

Chapter 2
Installation Instructions

Unpacking and Inspection

CAUTION

Use standard ESD procedures including ground straps and static-safe work surfaces whenever handling the 1180 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 your received contain the correct card. Notify EADS North America Test and Services Product 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 1180 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

CAUTION

Make sure the power to the Model 1830 system is turned OFF before installing or removing any plug-in card. The 1180 card is NOT Hot-Swappable.

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.

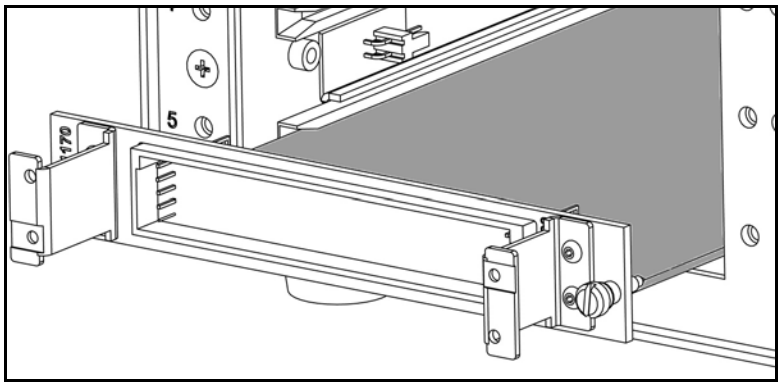


Figure 2-1: Inserting a Plug-In Card

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.

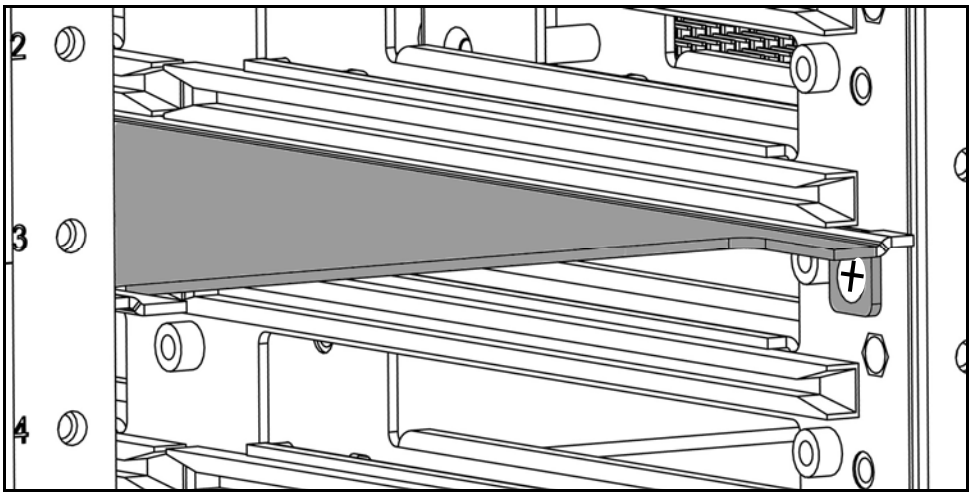


Figure 2-2: Installing a Card Shield

Front Panel Connector Pin Assignment

The 160-pin connector end of the 1180 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.

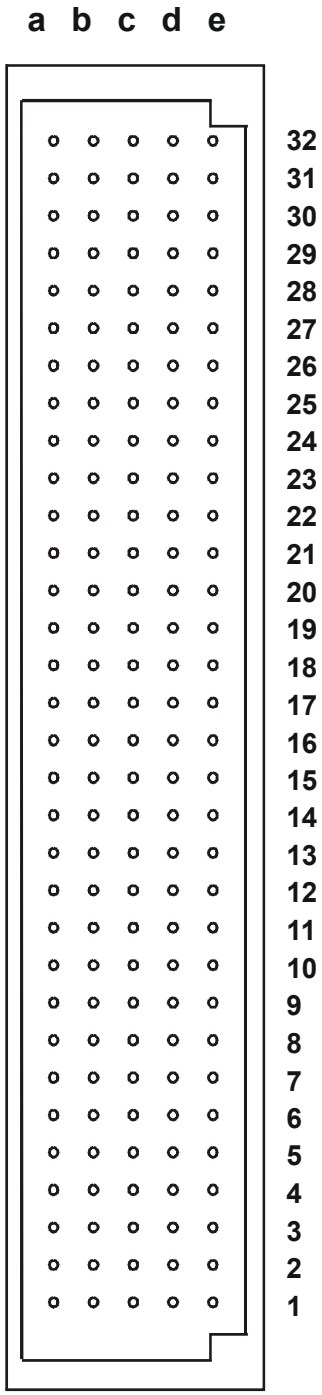


Figure 2-3: Front Panel Connector Layout

Optional Shield Ground Plane

In order to improve signal integrity and shielding, the 1180 module has the option to utilize up to two switching I/O channels as shield ground connections.

Install a jumper on the 1180 card at J5 if you would like to use pin C32 as an optional common shield ground. Install a jumper at J4 if you would like to use pin C01 as an optional shield ground.

However, if you install jumpers for either pin, do not use the matching channel (D32 or B04) for switching. Refer to Figure 2-4 for J4 and J5 locations.

Figure 2-4: Jumper J4 and J5 Locations

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

Relay	Channel Number	Common	Normally Open
K0	00	E32	E31
K1	01	A30	B31
K2	02	A31	B30
K3	03	A32	B29
K4	04	D32	C32 *
K5	05	D29	C31
K6	06	E29	E30
K7	07	D30	C30
K8	08	B32	C29
K9	09	D31	A29
K10	10	E28	E27
K11	11	A26	B27
K12	12	A27	B26

Relay	Channel Number	Common	Normally Open
K13	13	A28	B25
K14	14	D28	C28
K15	15	D25	C27
K16	16	E25	E26
K17	17	D26	C26
K18	18	B28	C25
K19	19	D27	A25
K20	20	E24	E23
K21	21	A22	B23
K22	22	A23	B22
K23	23	A24	B21
K24	24	D24	C24
K25	25	D21	C23
K26	26	E21	E22
K27	27	D22	C22
K28	28	B24	C21
K29	29	D23	A21
K30	30	E20	E19
K31	31	A18	B19
K32	32	A19	B18
K33	33	A20	B17
K34	34	D20	C20
K35	35	D17	C19
K36	36	E17	E18
K37	37	D18	C18
K38	38	B20	C17
K39	39	D19	A17
K40	40	E16	E15
K41	41	A14	B15
K42	42	A15	B14
K43	43	A16	B13
K44	44	D16	C16
K45	45	D13	C15
K46	46	E13	E14
K47	47	D14	C14
K48	48	B16	C13
K49	49	D15	A13
K50	50	E12	E11
K51	51	A10	B11
K52	52	A11	B10
K53	53	A12	B09

Relay	Channel Number	Common	Normally Open
K54	54	D12	C12
K55	55	D09	C11
K56	56	E09	E10
K57	57	D10	C10
K58	58	B12	C09
K59	59	D11	A09
K60	60	E08	E07
K61	61	A06	B07
K62	62	A07	B06
K63	63	A08	B05
K64	64	D08	C08
K65	65	D05	C07
K66	66	E05	E06
K67	67	D06	C06
K68	68	B08	C05
K69	69	D07	A05
K70	70	E04	E03
K71	71	A02	B03
K72	72	A03	B02
K73	73	A04	B01
K74	74	D04	C04
K75	75	D01	C03
K76	76	E01	E02
K77	77	D02	C02
K78	78	B04	C01 *
K79	79	D03	A01

* See **Optional Shield Ground Plane** section if pin is used for optional common ground.

Mating Connectors

The following 1180 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, aluminum 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 1180. The other cable end is unterminated. Refer to Table 2-1 for

channel-to-pin mapping information. Refer to Figure 2-5 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.

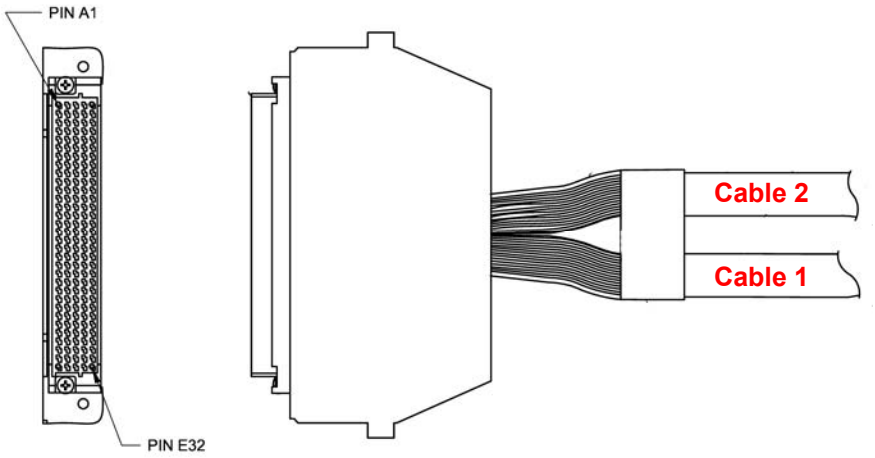


Figure 2-5: Cable Assembly (P/N 408191) Connector End

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

Wire No.	Pin No.	Cable No.	Wire Color Reference
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
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

Wire No.	Pin No.	Cable No.	Wire Color Reference
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
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

Wire No.	Pin No.	Cable No.	Wire Color Reference
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
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

Wire No.	Pin No.	Cable No.	Wire Color Reference
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
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 2-6) 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.

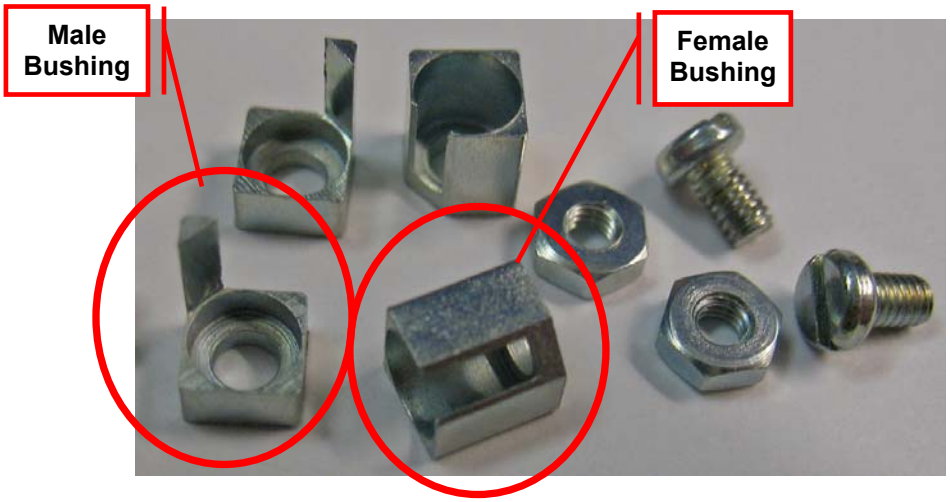


Figure 2-6: Coding Key Hardware

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 2-7: Installed Keys

The left photo in Figure 2-7 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

Block Diagram

Figure 3-1 shows the relay block diagram of the 1180 card.

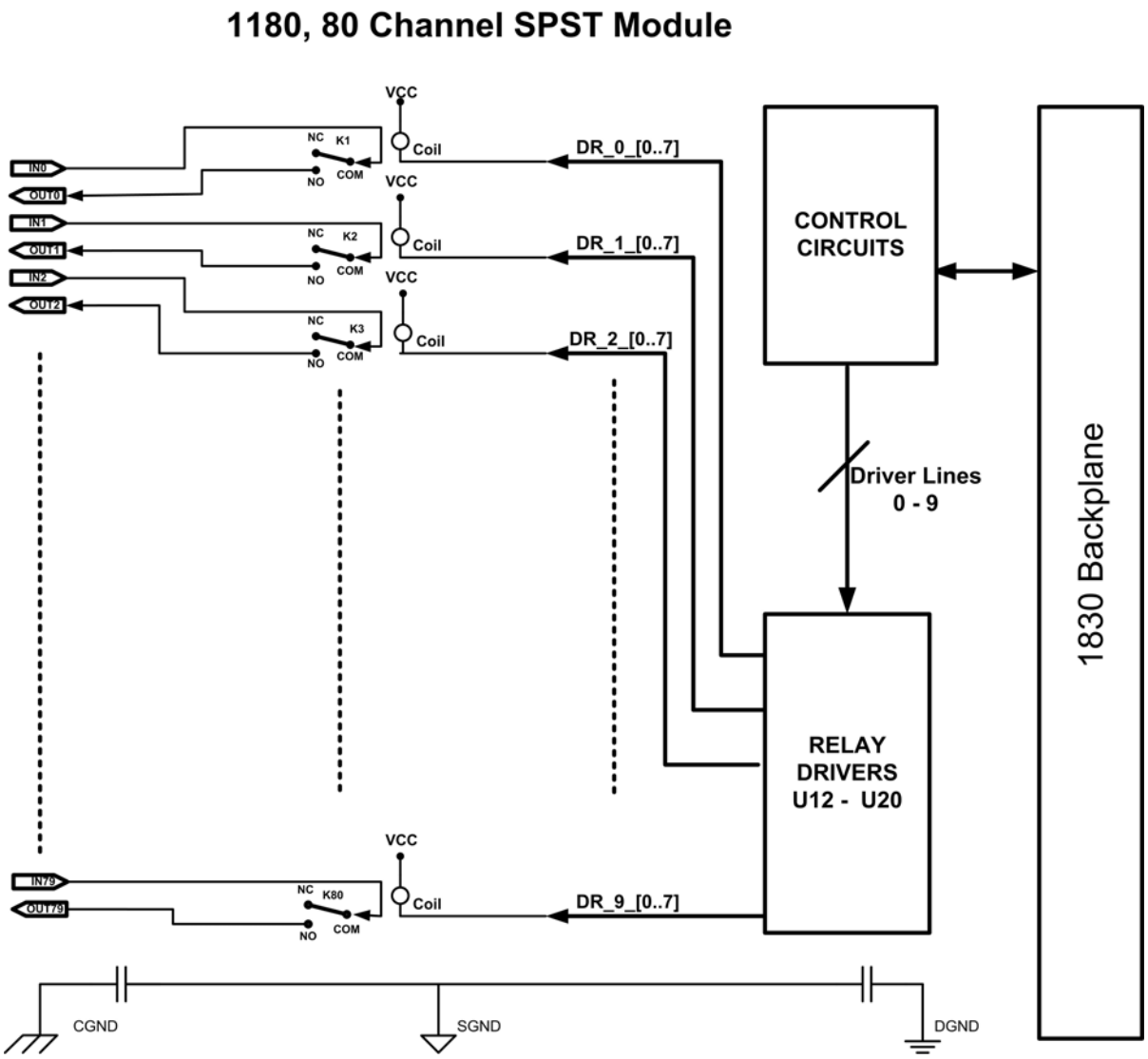
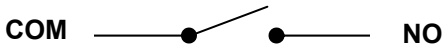


Figure 3-1: Relay Block Diagram

Module Configuration

The 1180 is an 80-channel, SPST plug-in card for the 1800-series system. Figure 3-2 shows a typical block diagram of a single switch.



One channel shown

Figure 3-2: 1180 Single Switch Block Diagram

Operating the 1180 Switch Card

The 1180 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 1180 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.

SCPI 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 1180 switch 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 1180 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 1180 card is:

```
XI1180,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
```

LXI Web Page Controls

Figures 3-3 through 3-5 show the LXI web pages that allow you to control the 1180 card through manual setting or through SCPI commands.

Relay Control Tab

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

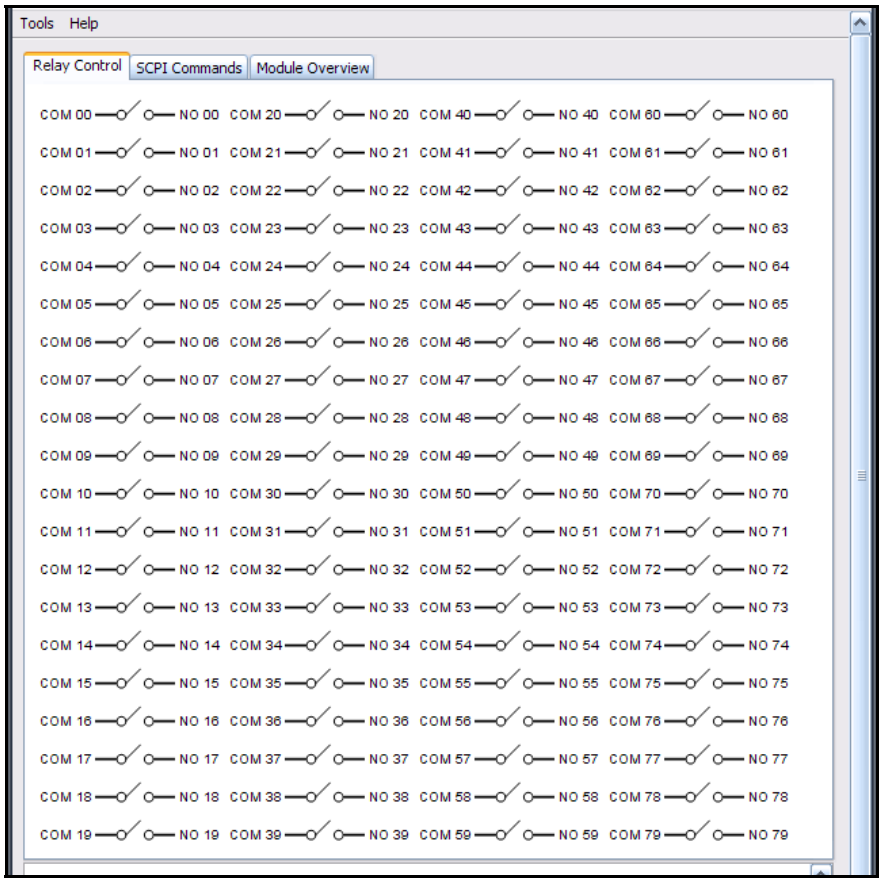


Figure 3-3: Relay Control Tab

SCPI Commands Tab

The **SCPI Commands** tab (Figure 3-4) 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

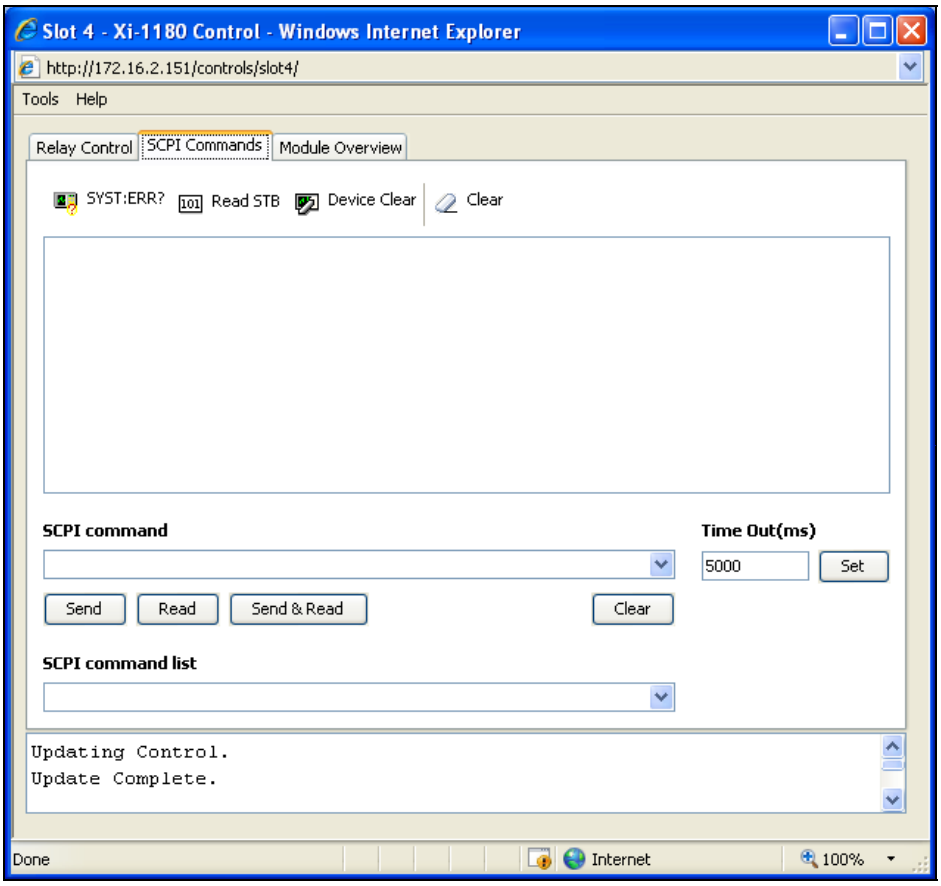


Figure 3-4: SCPI Commands Tab

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 3-5) allows you to review current card information including model and serial number, revision levels, channel/state configuration, relay cycle counts, and emergency reset status.

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.

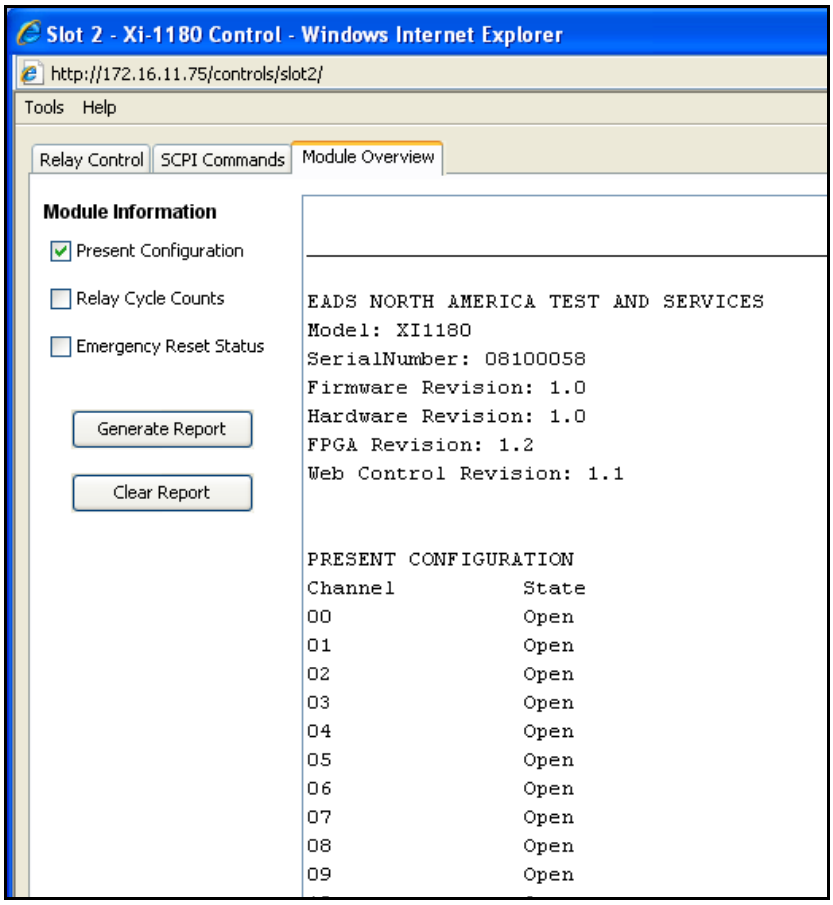


Figure 3-5: Module Overview Tab

Tools Menu

Each web page has a **Tools** menu (Figure 3-6) 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.

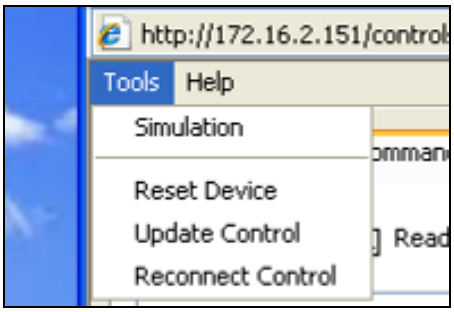


Figure 3-6: Web Page Tools Menu

IVI Driver Operation

The 1180 card is supplied with an IVI (Interchangeable Virtual Instruments) driver. This driver is IVISwtch class compliant. For more information on IVI and IVISwtch 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 3-1.

Table 3-1: IVI Driver Channel Names

Channel	Channel Name 1	Channel Name 2
0	COM 0	NO 0
1	COM 1	NO 1
2	COM 2	NO 2
…	…	…
79	COM 79	NO 79

So, to close relay 79, you would use the “Connect” API as follows

```
sp_driver->Path->Connect(“COM 79”,”NO 79”);
```

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

```
sp_driver->Path->Disconnect(“COM 79”,”NO 79”);
```

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

Once the shared components have been installed, the IVI driver for the 1180 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 1180.

You must create a new session for **each** 1180 you want to control. That is, if there are 3 1180 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 1180.

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 3-7, we have created a new session named "RIXI1180_S1".

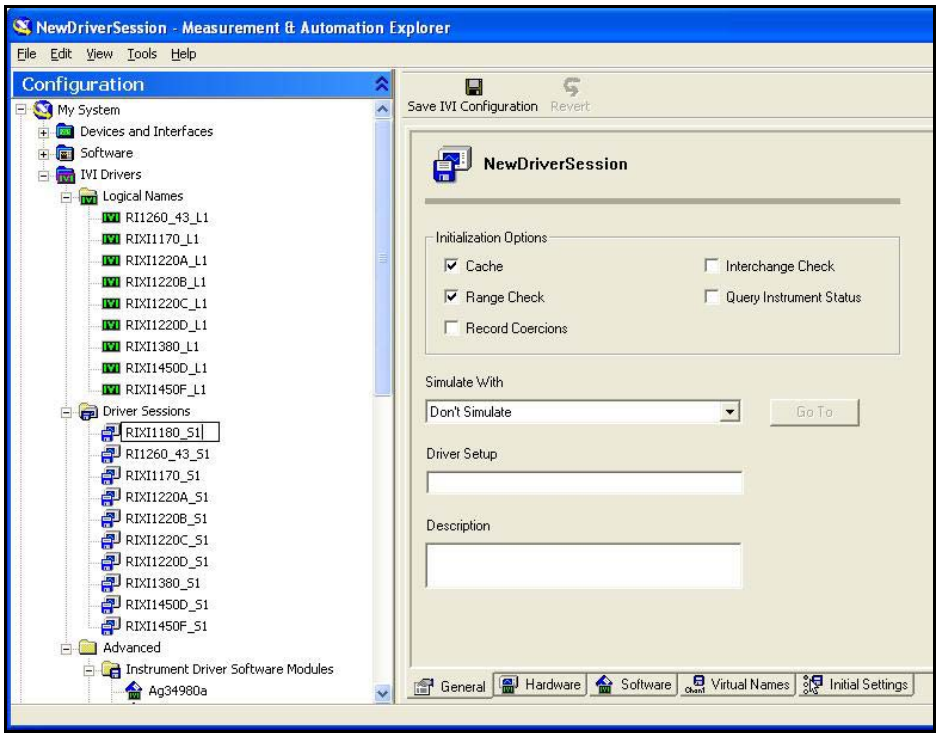


Figure 3-7: Creating New IVI Driver Session

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 "riXi1180" software module that was installed with the IVI driver installation. This is shown in Figure 3-8.

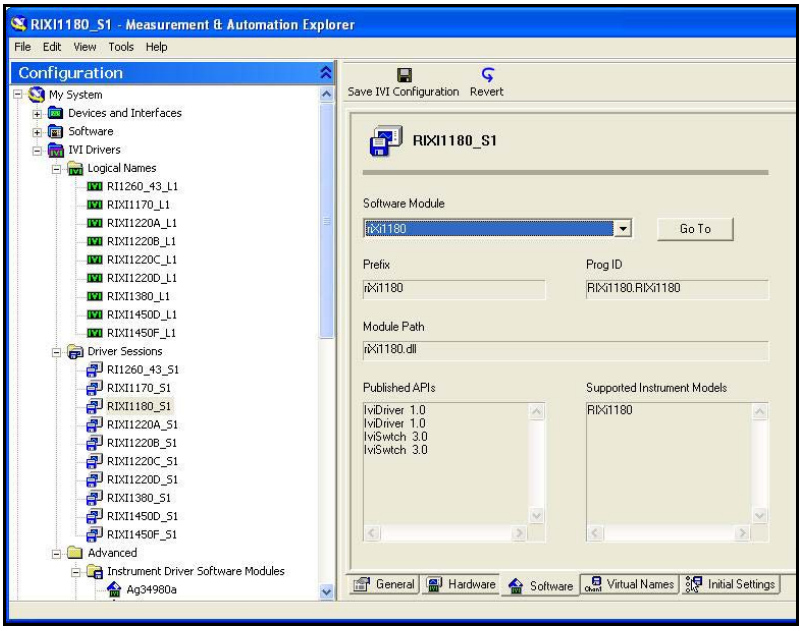


Figure 3-8: Associating Software Module with IVI Driver Session

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 1180 module (in this case via the Ethernet interface). This is shown in Figure 3-9.

Note that the “Resource Descriptor” is the VISA resource descriptor for the 1800 series platform into which the 1180 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.

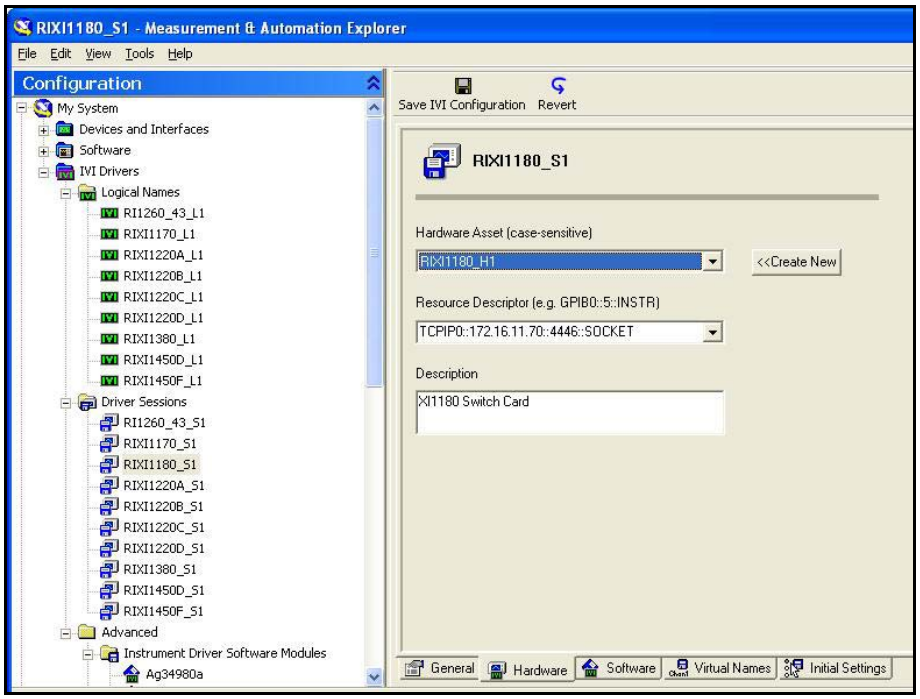


Figure 3-9: Creating a Hardware Asset for the IVI Driver Session

After the hardware asset has been created, the module address must be updated to match the plug-in slot of the 1180. Select the **Initial Settings** tab and modify the **Module Address** entry to match the plug-in slot of the 1180 card. In the example shown in Figure 3-10, the module address is set to 9.

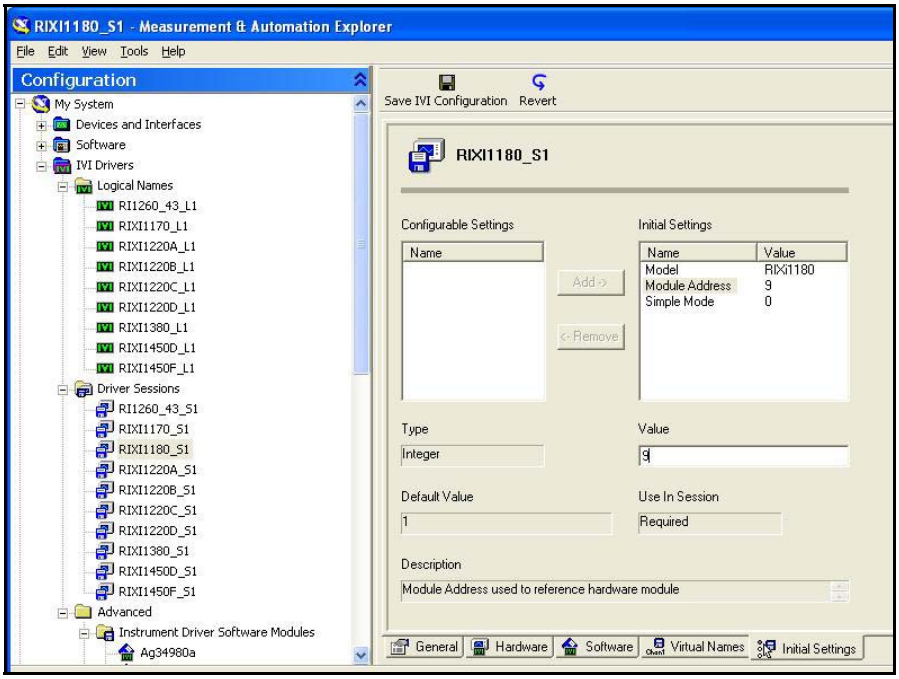


Figure 3-10: Modifying the Module Address for the IVI Driver Session

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 3-11 as "RIXI1180_L1") and then select the driver session created previously ("RIXI1180_S1").

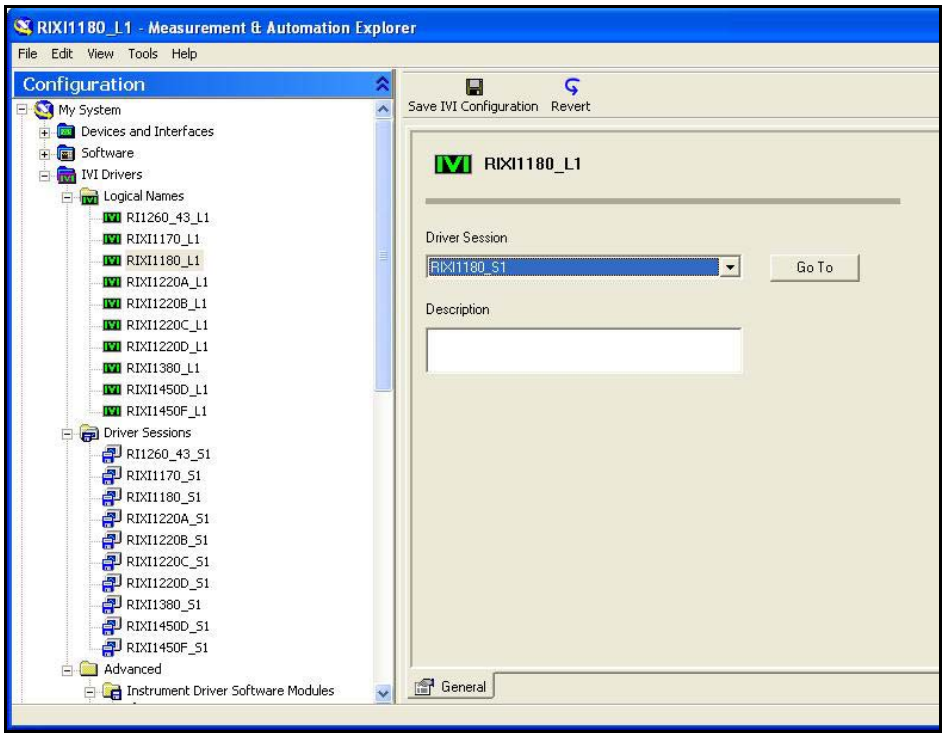


Figure 3-11: Creating a Logical Name for the IVI Driver Session

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 3-12. This example instantiates an instance of the driver, initiates the driver, and closes two channels (channels 0 and 79). 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 1180 IVI driver
//

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

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

      try
      {
            IIviDriverPtr spDriver(__uuidof(RIXi1180));
            IIviSwtchPtr spSwitch;

            try
            {

                  // IIviDriverIdentity 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 = "RIXI1180_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=RIXi1180, Trace=false";

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

```
                                        strDriverSetupOptions;

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

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

                // close channel 0
                _bstr_t channel1 = _bstr_t("COM 0");
                _bstr_t channel2 = _bstr_t("NO 0");

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

                channel1 = _bstr_t("COM 79");
                channel2 = _bstr_t("NO 79");

                // close channel 79
                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 3-12: 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 3-13. This example instantiates an instance of the driver, initiates the driver, and closes two channels (channels 0 and 79). 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.RiXI1180.Interop.dll

The interoperability DLLs are installed when the IVI shared components are installed (first two items above) and when the 1180 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.RIXi1180.Interop.RIXi1180 riDriver =
				new EADS.RIXi1180.Interop.RIXi1180Class();

			Ivi.Swtch.Interop.IIviSwtch switchDriver;

			// Use resource string from IVI configuration store
			string strResourceDesc = "RIXI1180_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=RIXi1180, Trace=false";

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

```
                                        strDriverSetupOptions;

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


                // cast the RIXI1180 driver as an IVISwtch class driver
                switchDriver = riDriver as Ivi.Swtch.Interop.IIviSwtch;


                if (switchDriver != null)
                {
                      // connect channel 0
                      switchDriver.Path.Connect("COM 0", "NO 0");

                      // connect channel 79
                      switchDriver.Path.Connect("COM 79", "NO 79");

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

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

Figure 3-13: Example Visual C# Program Using the IVI Driver

ActivATE Operation

The 1180 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 1180 will be available for your test program. The following methods are the most commonly used to operate the relays on the 1180 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 3-14 illustrates a series of function calls to operate various channels on the 1180 card. Note that the test program reference “xi1180_1” has been assigned as the interface to the 1180 card.

```
Function Sample_Test()

      Dim nErr

      'initialize test node as a failure
      Sample_Test = false

      ' close channel 79
      nErr = xi1180_1.Close(79)
      if nErr <> 0 then exit function

      'close channels 0, 11, 31, and 50
      nErr = xi1180_1.CloseList("0,11,31,50")
      if nErr <> 0 then exit function

      'close channels 21 to 25
      nErr = xi1180_1.CloseRange(21,25)
      if nErr <> 0 then exit function

      ' open channel 0
      nErr = xi1180_1.Open( 0 )
      if nErr <> 0 then exit function

      'open a channels 0, 21, 27, 29
      nErr = xi1180_1.OpenList("0, 21, 27, 29")
      if nErr <> 0 then exit function

      'open channels 0 to 79
      nErr = xi1180_1.OpenRange(0,79)

      ' indicate test has passed
      Sample_Test = true

End Function
```

Figure 3-14: Example ActivATE Test Script for the 1180

The ActivATE environment also has a graphical user interface that can be used both as a control and to display the current status of the relays on the 1180. 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 3-15) displays the present status for the channels of the 1180. By clicking on any of the relays, the state of the relay can be changed from closed to open or from open to closed.

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.

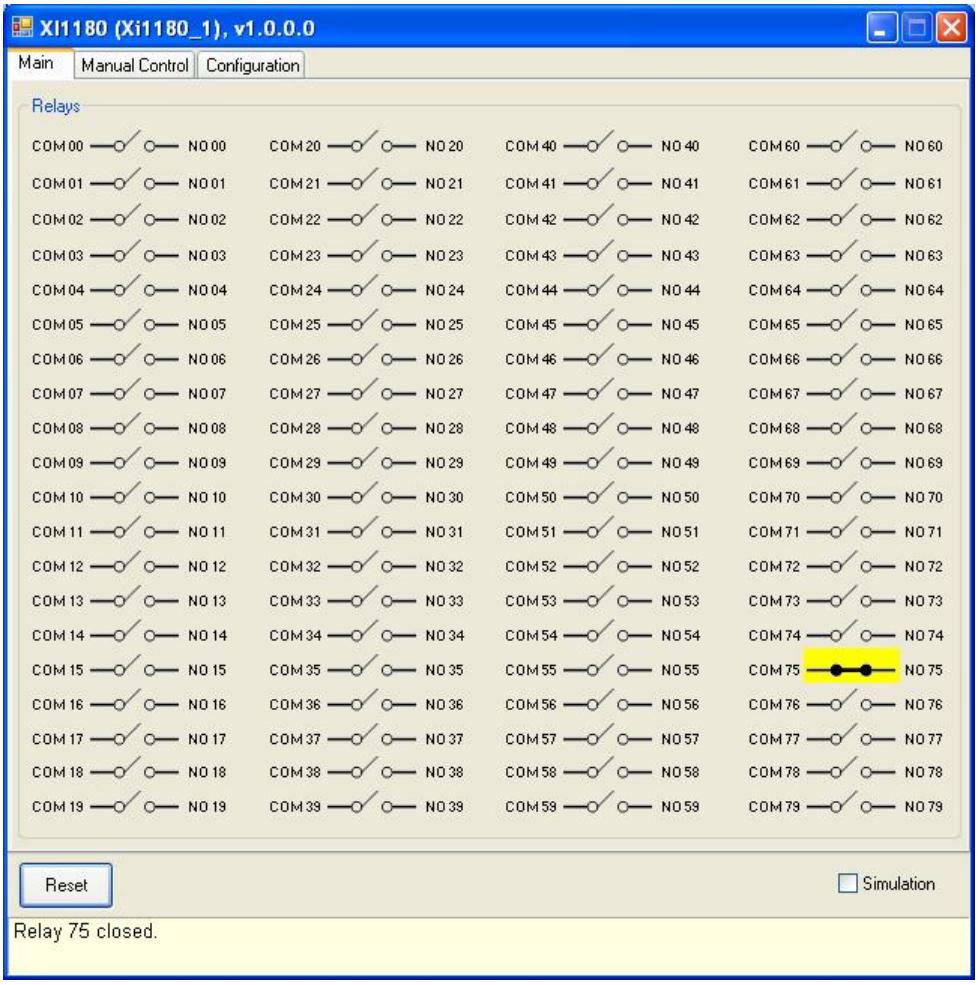


Figure 3-15: ActivATE GUI for the 1180 Card

Main Control Tab

The **Manual Control** tab (Figure 3-16) acts very similar to the web page version. It allows you to send SCPI commands to and read replies from the system.

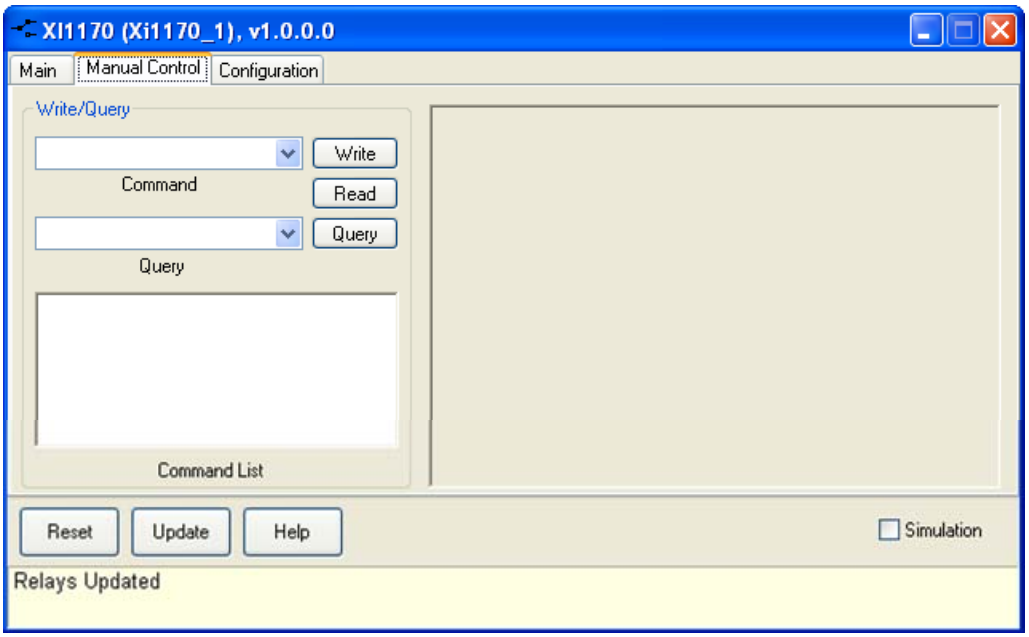


Figure 3-16: ActivATE Manual Control Tab

Configuration Tab

The **Configuration** tab (Figure 3-17) 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.

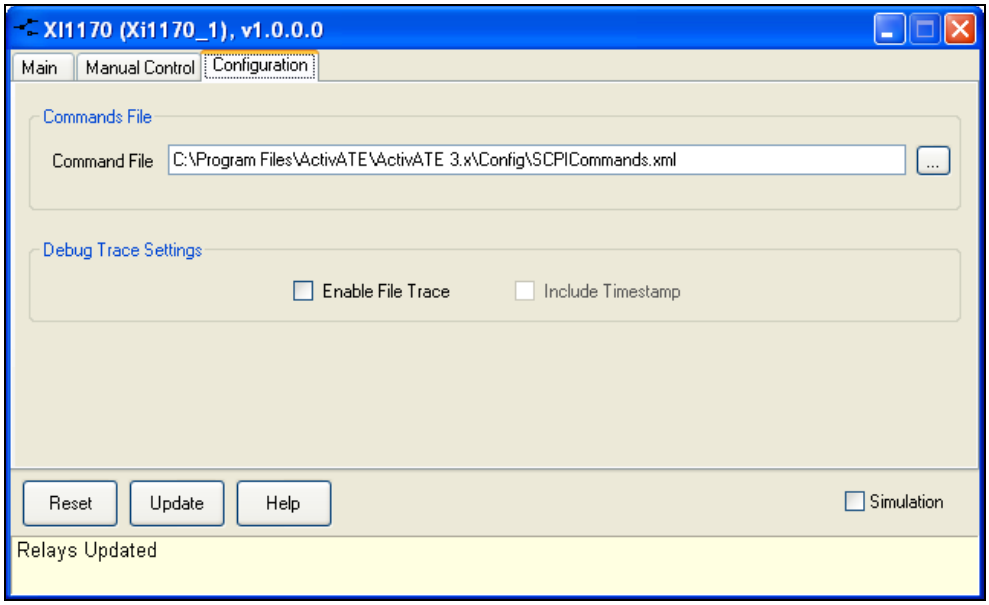


Figure 3-17: ActivATE Configuration Tab

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 1180.

The most commonly used commands used with the 1180 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 an 1180 range from 0 to 79. The correspondence between channel numbers and front panel connection is shown in Figures 2-3 and 2-4 of this manual.

The following would be valid channel descriptors for an 1180 switch card plugged into slot 9:

```
(@9(0))
(@9(23))
(@9(79))
```

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

```
(@9(0,23,79))
```

specifies each channel 0, 23, and 79 on the switch card in slot 9. Also, a range of relays may be specified by using the colon character (':'):

```
(@9(11:15,48:44))
```

specifies that each channel from 11 to 15 and from 44 to 48 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(0,19))
```

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 19 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,(@9(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(0,11:15,23:16,79)
```

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

0,11,12,13,14,15,23,22,21,20,19,18,17,16,79

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 “SEQuence: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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