RACAL INSTRUMENTS™

1260-118 80 CHANNEL SPST

1260-118A 24 CHANNEL

SPST PLUG-IN

Publication No. 980824-118 Rev. A

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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.

EC Declaration of Conformity

We

Astronics Test Systems Inc.
4 Goodyear
Irvine, CA 92618

declare under sole responsibility that the

1260-118 Switch Plug In Module
P/N 407632

conforms to the following Product Specifications:

Safety: EN 61010-1

EMC: EN50081-1
CISPR 11:1990/EN 55011 (1991): Group 1 Class A
IEC 801-2:1991/EN 50082-1 (1992): 4 kV CD, 8 kV AD
IEC 801-3:1984/EN 50082-1 (1992): 3 V/m, 27-500 MHz
IEC 801-4:1988/EN 50082-1 (1992): 1 kV

Supplementary Information:

The above specifications are met when the product is installed in an Astronics Test Systems Adapt-a-Switch Carrier with faceplates installed over all unused slots, as applicable. The carrier is installed in a certified mainframe.

The product herewith complies with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC.

Irvine, CA, November 12, 1998

Quality Manager

EC Declaration of Conformity

We

Astronics Test Systems Inc.
4 Goodyear
Irvine, CA 92618

declare under sole responsibility that the

1260-118A Switch Plug In Module
P/N 407632-001

conforms to the following Product Specifications:

Safety: EN61010-1:1993+A2:1995

EMC: EN61326:1997+A1:1998, Class A

Supplementary Information:

The above specifications are met when the product is installed in an Astronics Test Systems certified mainframe with faceplates installed over all unused slots, as applicable

The product herewith complies with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC.

Irvine, CA, February 24, 2003

Karen L Evensen

Karen Evensen, Engineering Director

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DOCUMENT CHANGE HISTORY

Revision	Date	Description of Change
A	10/02/08	Revised per EO 29417 Revised format to current standards. Company name revised throughout manual. Manual now revision letter controlled. Added Document Change History Page v.
No change	03/23/09	Back of cover sheet. Revised Warranty Statement, Return of Product, Proprietary Notice and Disclaimer to current standards. Removed Reshipment Instructions in (Chap. 2-1) and removed (Chap 4). Information. Now appears in first 2 sheets behind cover sheet. Updated table of contents to reflect changes made.

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Chapter 1
SPECIFICATIONS

Introduction

The 1260-118, (80-channels), and the 1260-118A, (24-channels), are SPST (Form A), relay plug-in switch modules for the 1260-100 VXI Adapt-a-Switch Carrier or 1256 GPIB/RS232 Switching System Mainframe. The 1260-118/-118A includes the following features:

- Standard Adapt-a-Switch plug-in design, providing for ease of replacement.
- Data-Driven embedded descriptor, allowing immediate use with any Option-01T switch controller, regardless of firmware revision level.

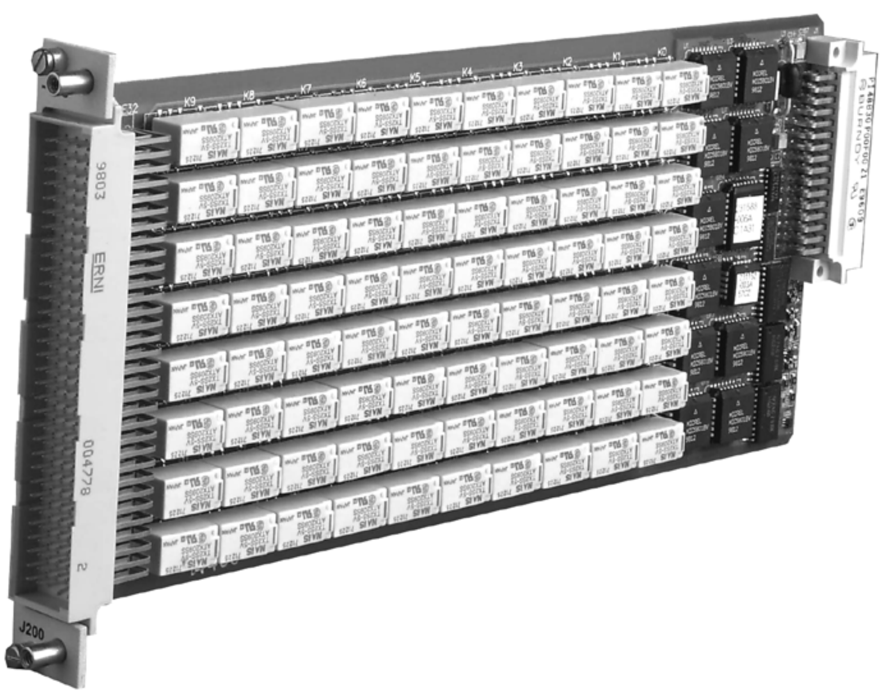


Figure 1-1, The 1260-118

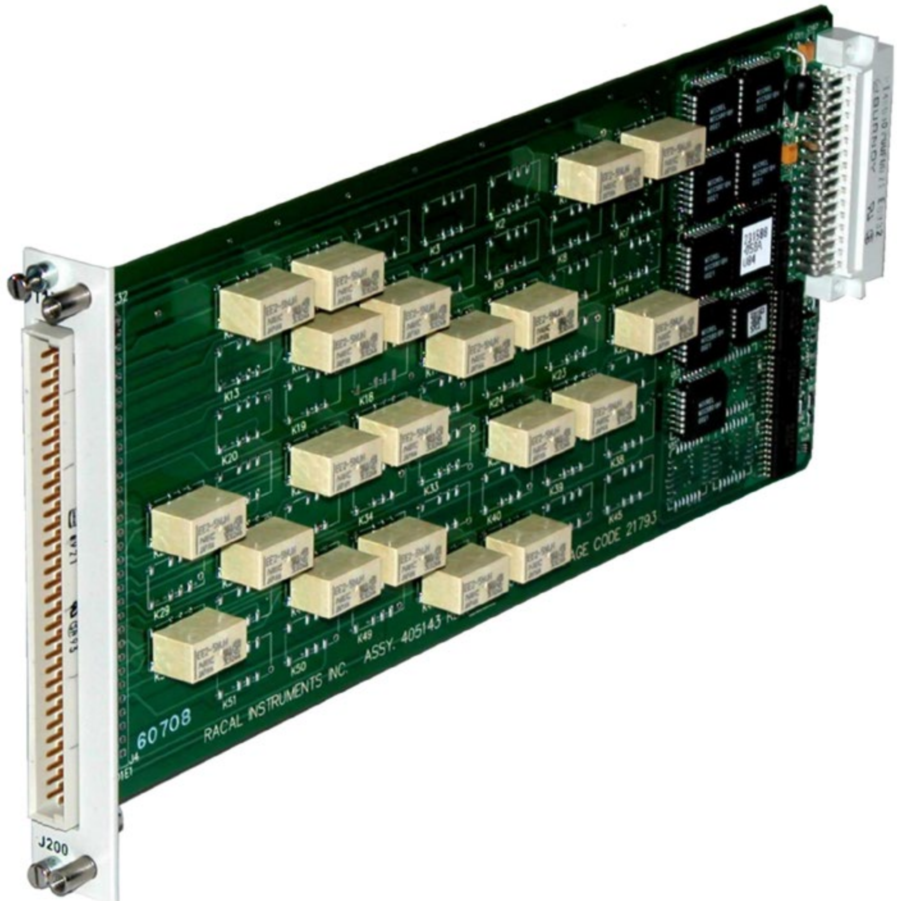


Figure 1-2, The 1260-118A

Specifications

Unless otherwise stated the specifications for the 1260-118 and the 1260-118A are the same.

Bandwidth (-3dB)	100 MHz	
Insertion Loss		
100 KHz	< 0.5 dB	
1 MHz	< 1.0 dB	
Isolation		
100 KHz	> 80 dB	
1 MHz	> 40 dB	
Crosstalk		
100 KHz	< -80 dB	
1 MHz	< -40 dB	
Switching Voltage		
AC	250 V, Max	
DC	220 V, Max	
Switching Current	-118	-118A
AC	2 A, Max	2 A, Max*
DC	2 A, Max	2 A, Max*
*1 A AC/DC with IDC mating connector		
Switching Power		
AC	125 VA, Max	
DC	60 W, Max	
Path resistance	< 500 mΩ	
Thermal EMF	< 50 uV	
Capacitance		
Channel-Chassis	< 200 pF	
Open-Channel	< 20 pF	
Insulation resistance	> 10^9 Ω	
Relay Settling Time	< 10 ms	
Shock	30g, 11 ms, ½ sine wave	
Vibration	0.013 in. P-P, 5-55 Hz	
Bench Handling	4 in., 45°	
Cooling	See 1260-100 cooling data	
Temperature		
Operating	0°C to +55°C	
Non-operating	-40°C to +75°C	
Relative Humidity	5% to 95% non-condensing ≤ 30°C 5% to 75% non-condensing > 30°C 5% to 45% non-condensing > 40°C	

Altitude		
Operating	10,000 feet	
Non-operating	15,000 feet	
Power Requirements		
+5 VDC	150 mA + 30 mA per energized relay max.	
Weight Current	-118	-118A
	9 oz. (260 g)	7 oz. (200 g)
Mean Time Between Failures (MTBF)	783,668 hours (MIL-HDBK-217E)	
Mean Time to Repair (MTTR)	< 5 minutes	

Power Dissipation

While the cooling of the Adapt-a-Switch carrier is dependent upon the chassis into which it is installed, the carrier can normally dissipate approximately 100 W. Care must be taken, then, in the selection and loading of the plug-in modules used in the carrier. It is not possible to fully load the carrier, energize every relay, and run full power through every set of contacts, all at the same time. In practice this situation would never occur.

To properly evaluate the power dissipation of the plug-in modules, examine the path resistance, the current passing through the relay contacts, the ambient temperature, and the number of relays closed at any one time.

For example, if a 1260-118 module (containing 80 relays) has 25 relays closed, passing a current of 0.5 A, then:

Total power dissipation =

$[(\text{current})^2 * (\text{path resistance}) * 25\ ] + (\text{quiescent power})$

By substituting the actual values:

Total power dissipation =

$[(0.5\text{ A})^2 * (1\ \Omega) * 25] + (\ 0.75\text{ W}) = 7\text{ W at }55°\text{C}$

This is acceptable power dissipation for an individual plug-in module. If five additional modules are likewise loaded, then the overall carrier dissipation is approximately 36 W, which is well within the cooling available in any commercial VXIbus chassis. In practice, rarely are more than 25% of the module's relays energized simultaneously, and rarely is full rated current run through every path. In addition, the actual contact resistance is typically one-half to one-fourth the specified maximum, and temperatures are normally not at the rated maximum. The power dissipated by each plug-in should be no more than 15 W if all six slots are used simultaneously. This yields the following guideline:

0.5 A	Max. 80 relays closed
1.0 A	Max. 14 relays closed
2.0 A	Max. 4 relays closed

Most users of a signal-type switch, such as the 1260-118, switch no more than a few hundred milliamperes and are able to energize all relays simultaneously, should they so desire. The numbers in the above table represent worst-case, elevated-temperature, end-of-life conditions.

Additionally, if fewer plug-in modules are used, more power may be dissipated by the remaining cards. By using a chassis with high cooling capacity, such as the 1261B, almost any configuration may be realized.

About MTBF

The 1260-118 MTBF is 783,668 hours, calculated in accordance with MIL-HDBK-217E, with the exception of the electromechanical relays. The MTBF for the 1260-118A will be the same or better depending on the number of relays engaged. Relays are excluded from this calculation because relay life is strongly dependent upon operating conditions. 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.

For more details about the above life expectancy factors, refer to the data sheet for the switch plug-in module.

The relays used on the 1260-118/-118A plug-ins are part no. 310256-001. The relay manufacturer's specifications for this relay are:

Life Expectancy

Mechanical	100,000,000 operations
Electrical	100,000 operations at 60 W / 62.5 VA

For additional relay specifications, refer to the relay manufacturer's data sheet.

Ordering Information

Listed below are part numbers for the 1260-118 and -118A switch modules and available mating connector accessories. Each 1260-118 uses a single mating connector.

Item	Description	Part #
1260-118 Switch Module 1260-118A Switch Module	Switch Module, 80-Channel SPST, 2 A Switch Module, 24-Channel SPST, 2 A with Crimp Connector 1 A with IDC Connector	407632 407632-001
160-pin Mating Connector	160 Pin Conn. Kit w/strain relief & pins (1260-118 only)	407664
Cable Assy. 6ft., Sleeved	160 Pin Cable Assy, 6ft., 24 AWG (1260-118 only)	407408-001
IDC Connector	64 Pin DIN Connector, IDC (1260-118A only)	602004
Crimp Connector	64 Pin DIN Crimp Body (1260-118A only)	602159-064
Crimp Pin	64 Pin DIN Crimp Pin (1260-118A only)	602159-900
Additional Manual		980824-118

Chapter 2

INSTALLATION INSTRUCTIONS

Unpacking and Inspection

1. Remove the 1260-118/-118A module and inspect it for damage. 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 1260-118/-118A module option and the 1260-118/-118A Users Manual. Notify Customer Support if the module appears damaged in any way. Do not attempt to install a damaged module into a VXI chassis.

3. The 1260-118/-118A module is shipped in an anti-static bag to prevent electrostatic damage to the module. Do not remove the module from the anti-static bag unless it is in a static-controlled area.

Installation

Installation of the 1260-118/-118A Switching Module into a 1260-100 Carrier assembly is described in the Installation section of the 1260-100 Adapt-a-Switch Carrier Manual.

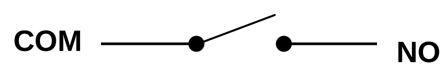
Module Configuration

The 1260-118 is an 80-channel, SPST plug-in for the Adapt-a-Switch Series.

The 1260-118A is an 24-channel, SPST plug-in for the Adapt-a-Switch Series.

Figure 2 1 shows a typical block diagram of a single switch.

Figure 2-1, 1260-118/118A Block Diagram



One channel shown

Front Panel Connectors

The 1260-118 has one 160-pin front-panel connector, labeled J200. It is a 160-pin, modified DIN style, with 0.025” square posts. See **Figure 2-2** for a diagram of the front panel connector pin numbering.

The 1260-118A has one 64-pin front-panel connector, labeled J200. It is a 64-pin, modified DIN style, with 0.025” square posts. See **Figure 2-3** for a diagram of the front panel connector pin numbering.

For connector pin assignments, refer to **Table 2-1** and **Table 2-2** for the 1260-118 and 1260-118A respectively.

Figure 2-2, 1260-118 Front-Panel Connector Pin Numbering

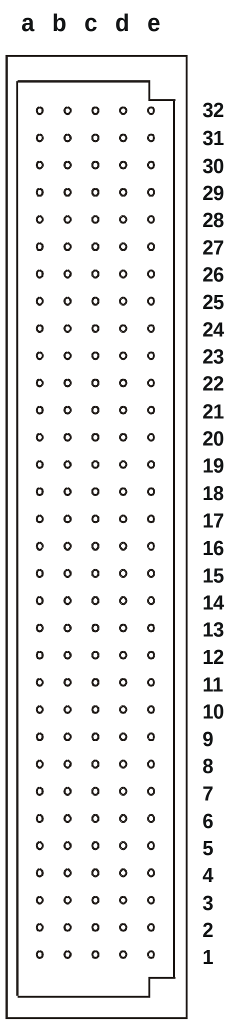


Figure 2-3, 1260-118A Front-Panel Connector Pin Numbering

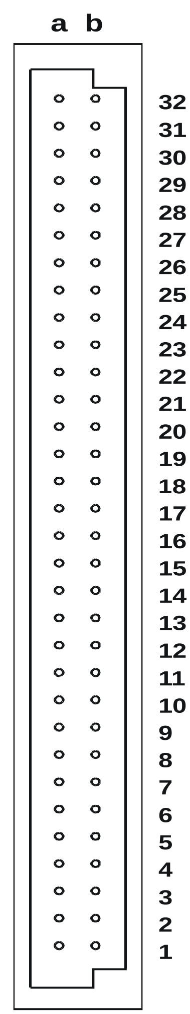


Table 2-1, 1260-118 Channel to Connector Pin Mapping

Channel	In	Out
00	P32E	P31E
01	P30A	P31B
02	P31A	P30B
03	P32A	P29B
04	P32D	P32C
05	P29D	P31C
06	P29E	P30E
07	P30D	P30C
08	P32B	P29C
09	P31D	P29A
10	P28E	P27E
11	P26A	P27B
12	P27A	P26B
13	P28A	P25B
14	P28D	P28C
15	P25D	P27C
16	P25E	P26E
17	P26D	P26C
18	P28B	P25C
19	P27D	P25A
20	P24E	P23E
21	P22A	P23B
22	P23A	P22B
23	P24A	P21B
24	P24D	P24C
25	P21D	P23C
26	P21E	P22E
27	P22D	P22C
28	P24B	P21C
29	P23D	P21A
30	P20E	P19E
31	P18A	P19B
32	P19A	P18B
33	P20A	P17B
34	P20D	P20C

Channel	In	Out
35	P17D	P19C
36	P17E	P18E
37	P18D	P18C
38	P20B	P17C
39	P19D	P17A
40	P16E	P15E
41	P14A	P15B
42	P15A	P14B
43	P16A	P13B
44	P16D	P16C
45	P13D	P15C
46	P13E	P14E
47	P14D	P14C
48	P16B	P13C
49	P15D	P13A
50	P12E	P11E
51	P10A	P11B
52	P11A	P10B
53	P12A	P09B
54	P12D	P12C
55	P09D	P11C
56	P09E	P10E
57	P10D	P10C
58	P12B	P09C
59	P11D	P09A
60	P08E	P07E
61	P06A	P07B
62	P07A	P06B
63	P08A	P05B
64	P08D	P08C
65	P05D	P07C
66	P05E	P06E
67	P06D	P06C
68	P08B	P05C
69	P07D	P05A
70	P04E	P03E
71	P02A	P03B

Channel	In	Out
72	P03A	P02B
73	P04A	P01B
74	P04D	P04C
75	P01D	P03C
76	P01E	P02E
77	P02D	P02C
78	P04B	P01C
79	P03D	P01A

Table 2-2, 1260-118A Channel to Connector Pin Mapping

Channel	In	Out
00	P30A	P31B
01	P31A	P30B
02	P32A	P29B
03	P26A	P27B
04	P27A	P26B
05	P28A	P25B
06	P22A	P23B
07	P23A	P22B
08	P24A	P21B
09	P18A	P19B
10	P19A	P18B
11	P20A	P17B
12	P14A	P15B
13	P15A	P14B
14	P16A	P13B
15	P10A	P11B
16	P11A	P10B
17	P12A	P09B
18	P06A	P07B
19	P07A	P06B
20	P08A	P05B
21	P02A	P03B
22	P03A	P02B
23	P04A	P01B

Mating Connectors

The following **1260-118** mating connector accessories are available:

160 Pin Connector Kit with backshell and pins, P/N 407664

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 407408-001

The 160 Pin Cable Assembly uses 24 AWG cable with crimp pins to mate with the 1260-118. The other cable end is unterminated. Refer to **Table 2-1** for channel-to-pin mapping information.

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.

The following **1260-118A** mating connector accessories are available:

64 Pin DIN, IDC Connector P/N 602004

This connector is for use with flat ribbon cable. This allows an economical means of cable assembly. Not recommended for currents greater than 1 A AC/DC per pin.

64 Pin DIN Crimp Connector Body P/N 602159-064

64 Pin DIN Crimp Pin P/N 602159-900

The crimp connector and pins allow more flexibility and better performance, 2 Amps, rather than the 1 Amp for the IDC connector. The crimp hand tool is P/N 990897. The insertion tool is P/N 990898. The extraction tool is P/N 990899.

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Chapter 3

MODULE OPERATION

Command Set

The 1260-118/-118A cards use the existing 1260 and 1256 Series switch card command set. All commands supported by other relay modules (such as CLOSE, OPEN, SCAN, EXCLUDE, INCLUDE) are supported.

The OPEN, CLOSE, EXCL, INCL, and SCAN commands all use relay descriptors to specify a single relay or a range of relays to operate.

The following operational descriptions refer mostly to the 1260-118 for clarity and apply in the same manner to the 1260-118A except where indicated otherwise.

Operating In Message-Based Mode

Channel Descriptors For The 1260-118

The standard 1260-01T commands are used to operate the 1260-118 module. These commands are described in the 1260-01T User's Manual.

Each 1260-01T relay command uses a *channel descriptor* to select the channel(s) of interest. The syntax for a channel descriptor is the same for all 1260 series modules. In general, the following syntax is used to select a single channel:

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

Where:

- <module address> is the address of the 1260-118 module. This is a number is in the range from 1 through 12, inclusive.
- <channel> is the 1260-118 channel to operate. This is a number in the range from 0 through 79, inclusive.

Multiple individual channels may be specified using the following channel descriptor syntax:

```
@ <module address> ( <chan1> , <chan2>
, . . ., <chanN> ))
```

A range of channels may be specified using the following channel descriptor syntax:

```
@ <module address> ( <first channel> :
<last channel> ))
```

The following examples illustrate the use of the channel descriptors for the 1260-118:

`OPEN (@8(0))`	Open channel 0 on the 1260-118 that has module address 8.
`CLOSE (@8(0,7))`	Close channels 0 and 7 on the 1260-118 that has module address 8.
`CLOSE (@2(7:12))`	Close channels 7 through 12 inclusive on the 1260-118 that has module address 2.

Reply To The MOD:LIST? Command

The 1260-01T returns a reply to the MOD:LIST? command. This reply is unique for each different 1260 series switch module. The syntax for the reply is:

<module address> : <module-specific identification string>

The <module-specific identification string> for the 1260-118 is:

```
1260-118 80-CHANNEL SPST 2A SWITCH MODULE

1260-118A 24-CHANNEL SPST 2A SWITCH MODULE
```

So, for a 1260-118 whose <module address> is set to 8, the reply to this query would be:

```
8 : 1260-118 80-CHANNEL SPST 2A SWITCH
MODULE

8 : 1260-118A 24-CHANNEL SPST 2A SWITCH
MODULE
```

Operating The 1260-118 in Register-Based Mode

In register-based mode, the 1260-118 is operated by directly writing and reading control registers on the 1260-118 module. The first control register on the module operates channels 0 through 7. The second control register operates channels 8 through 15. The third control register operates channels 16 through 19, etc. When a control register is written to, all channels controlled by that register are operated simultaneously.

The control registers are located in the VXIbus A24 Address Space. The A24 address for a control register depends on:

1. The A24 Address Offset assigned to the 1260-01T module by the Resource Manager program. The Resource Manager program is provided by the VXIbus slot-0 controller vendor. The A24 Address Offset is placed into the “Offset Register” of the 1260-01T by the Resource Manager.
2. The <module address> of the 1260-118 module. This is a value in the range from 1 and 12 inclusive.
3. The 1260-118 control register to be written to or read from. Each control register on the 1260-118 has a unique address.

The base A24 address for the 1260-118 module may be calculated by:

(A24 Offset of the 1260-01T) + (1024 x Module Address of 1260-118).

The A24 address offset is usually expressed in hexadecimal. A typical value of 204000_{16} is used in the examples that follow.

A 1260-118 with a module address of 7 would have the base A24 address computed as follows:

Base A24 Address of 1260-118 = $204000_{16} + (400_{16} \times 7_{10}) = 205C00_{16}$

The control registers for Adapt-a-Switch plug-ins and conventional 1260-Series modules are always on odd-numbered A24 addresses. The control registers for the 1260-118 reside at sequential odd-numbered A24 addresses for the module:

(Base A24 Address of 1260-118) + 1 = Control Register 0

(Base A24 Address of 1260-118) + 3 = Control Register 1

(Base A24 Address of 1260-118) + 5 = Control Register 2

..., and so on.

So, for our example, the first control register is located at:

205C01	Control Register 0, controls channels 0 through 7

The second control register is located at:

205C03	Control Register 1, controls channels 8 through 15

Tables 3-1 and **3-2** show the channel assignments for each control register.

Table 3-1, 1260-118 Control Register Channel Assignments

Control Register	**Channels**							
	Bit 7 (MSB)	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0 (LSB)**
0	7	6	5	4	3	2	1	0
1	15	14	13	12	11	10	9	8
2	23	22	21	20	19	18	17	16
3	31	30	29	28	27	26	25	24
4	39	38	37	36	35	34	33	32
5	47	46	45	44	43	42	41	40
6	55	54	53	52	51	50	49	48
7	63	62	61	60	59	58	57	56
8	71	70	69	68	67	66	65	64
9	79	78	77	76	75	74	73	72

Table 3-2, 1260-118A Control Register Channel Assignments

Control Register	Channels							
	Bit 7 (MSB)	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0 (LSB)
0	unused	unused	unused	unused	2	1	0	unused
1	unused	unused	5	4	3	unused	unused	unused
2	8	7	6	unused	unused	unused	unused	unused
3	9	unused	unused	unused	unused	unused	unused	unused
4	unused	unused	unused	unused	unused	unused	11	10
5	unused	unused	unused	unused	14	13	12	unused
6	unused	unused	17	16	15	unused	unused	unused
7	20	19	18	unused	unused	unused	unused	unused
8	21	unused	unused	unused	unused	unused	unused	unused
9	unused	unused	unused	unused	unused	unused	23	22

For the 1260-118 setting a control bit to 1 closes the corresponding channel, and clearing the bit to zero opens the corresponding channel. Thus, if you write the value 1000 0101 binary = 133 decimal = 85 hexadecimal to Control Register 0, channels 0, 2, and 7 will close, while channels 1, 3, 4, 5, and 6 will open.

Unlike the 1260-118, not all bits in the control registers are used. Thus, for the 1260-118A if you write the value 1000 0101 binary = 133 decimal = 85 hexadecimal to Control Register 0, only channel 1 will close, while channels 0 and 2 will open.

The present control register value may be read back by reading an 8-bit value from the control register address. **The value is inverted.** In other words, the eight-bit value read back is the one's complement of the value written. If an unused bit in the control register is set to 1 it will give a 0 readback.

If you want to change the state of a single relay without affecting the present state of the other relays controlled by the control register, you must:

1. Read the control register

2. Invert the bits (perform a one's complement on the register data)

3. Perform a bit-wise AND operation, leaving all but the specific control register bit for the relay to change

4. To open: continue to step 5. To close: OR in the bit for the

relay to close.

5. Write the modified value back to the control register.

For example, to close channel 13:

6. Read Control Register 1 (this register controls channels 8 through 15, with channel 8 represented by the LSB)

7. Invert the bits in the value read in step 1

8. AND with 1101 1111 binary (the zero is in the position corresponding to channel 13)

9. OR with 0010 0000 binary

10. Write the value to Control Register 1

The VISA I/O library may be used to control the module. The VISA function viOut8() is used to write a single 8-bit byte to a control register, while viIn8() is used to read a single 8-bit byte from the control register. The following code example shows the use of viOut8() to update the 1260-118 module.

1260-118 Example Code

```
#include <visa.h>

/* This example shows a 1260-01T at logical
address 16 and a VXI/MXI */
/* interface */
#define RI1260_01_DESC     "VXI::16"

/* For a GPIB-VXI interface, and a logical
address of 77 */
/* the descriptor would be:  "GPIB-VXI::77" */


/* this example shows a 1260-118 with module
address 7 */
#define MOD_ADDR_120  7


void example_operate_1260_118(void)
{
```

```
ViUInt8 creg_val;
ViBusAddress creg0_addr;
ViBusAddress creg1_addr;
ViBusAddress creg2_addr;
ViSession hdl1260;    /* VISA handle to the 1260-01T */
ViSession hdlRM;      /* VISA handle to the resource manager */
ViStatus error;       /* VISA error code */

/* open the resource manager */
/* this must be done once in application program */
error = viOpenDefaultRM (&hdlRM);

if (error < 0) {
     /* error handling code goes here */
}

/* get a handle for the 1260-01T */
error = viOpen (hdlRM, RI1260_01_DESC, VI_NULL,VI_NULL, &hdl1260);
if (error < 0) {
     /* error handling code goes here */
}


/* form the offset for control register 0 */
/* note that the base A24 Address for the 1260-01T */
/* is already accounted for by VISA calls viIn8() and */
/* viOut8() */

   /* module address shifted 10 places = module address x 1024 */
creg0_addr = (MOD_ADDR_118 << 10) + 1;
creg1_addr = creg0_addr + 2;
creg2_addr = creg1_addr + 2;

/* close relays 14 without affecting the state of */
/* relays 9, 10, 11, 12, 13, 15, and 16 */
error = viIn8 (hdl1260, VI_A24_SPACE, creg1_addr, &creg_val);
if (error < 0) {
     /* error handling code goes here */
}

/* invert the bits to get the present control register value */
creg_val = ~creg_val;

/* AND to leave every relay except 14 unchanged */
```

```
      creg_val &= ~ (0x20);

      /* OR in the bit to close relay 14 */
      creg_val |= 0x20;

      /* write the updated control register value */
      error = viOut8 (hdl1260, VI_A24_SPACE, creg1_addr, creg_val);
      if (error < 0) {
            /* error handling code goes here */
      }


      /* open relay 17 without affecting channels 18 through 24 */
      error = viIn8 (hdl1260, VI_A24_SPACE, creg2_addr, &creg_val);
      if (error < 0) {
            /* error handling code goes here */
      }

      /* invert the bits to get the present control register value */
      creg_val = ~creg_val;

      /* AND to leave every relay except 17 unchanged */
      /* leave bit 0 clear to open relay 17 */
      creg_val &= ~ (0x01);

      /* write the updated control register value */
      error = viOut8 (hdl1260, VI_A24_SPACE, creg2_addr, creg_val);
      if (error < 0) {
            /* error handling code goes here */
      }


      /* close the VISA session */
      error = viClose( hdl1260 );
      if (error < 0) {
            /* error handling code goes here */
      }
}
```