RACAL INSTRUMENTS
1260-X121
20 CHANNEL PLUG-IN

PUBLICATION NO. 980914-X121

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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.

Racal Instruments

CE Declaration of Conformity

We

Racal Instruments Inc.
4 Goodyear Street
Irvine, CA 92618

declare under sole responsibility that the

1260-X121, 10A SWITCH, 20 SPST, P/N 408008

conforms to the following Product Specifications:

EMC: EN61326: 1997 +A1: 1998 +A2: 2001 +A3: 2003 Class A

EN61000-3-2: 2000 +A2: 2005 Class A

EN61000-3-3: 1995 +A1: 2001

Supplementary Information:

The above specifications are met when the product is installed in a Racal Instruments 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 (modified by 93/68/EEC).

Irvine, CA, May 20, 2006

VP of Engineering
Karen Evensen

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Chapter 1
SPECIFICATIONS

Introduction

The 1260-X121 is a plug-in switch module developed for the 1260-100X Adapt-a-Switch Carrier. The 1260-X121 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-X121

The 1260-X121 is a 20-channel single-wire switch consisting of 20 individual SPST relay switches and 10 1X2 switches by software configuration. The 1260-X121 plug-in fits into a 1260-100X Adapt-a-Switch Carrier.

Specifications

Bandwidth (-3dB)	>300KHz
Insertion Loss	
300 KHz	< 2dB
Isolation	
DC to 100 KHz	> 60dB
100 to 300 KHz	> 50dB
Crosstalk	
DC to 100 KHz	< -60dB
100 to 300 KHz	< -50dB
Switching Voltage	
AC	440V, Max
DC	230V, Max
Switching Current	
AC	10A, Max
DC	10A, Max
Switching Power	
AC	2500VA, Max
DC	300W, Max
Path resistance	< 100mΩ
Capacitance	
Channel-Chassis	< 20pF
Open-Channel	< 20pF
Insulation resistance	> $10^9\Omega$
Impulse Withstand Voltage	>1,000V
Relay Settling Time	< 15ms
Maximum Power Dissipation	60W
Cooling (25% Relays energized operating at full rated current)	4.27 Liters/sec @ 0.39 mmH_2O

Shock	30g, 11ms, ½ sine wave
Vibration	0.013in. P-P, 5-55Hz
Bench Handling	4 in., 45°
Temperature	
Operating	0°C to +60°C
Non-operating	-40°C to +70°C
Relative Humidity	85% Max, non-condensing at < 30°C
Altitude	
Operating	15,000 feet
Non-operating	15,000 feet
Power Requirements	
+5VDC	300mA Max.
+5VDC	40mA per energized relay.
Weight	15.71oz. (0.445kg)
MTBF (MIL-HDBK-217-FN2 method)	
Including relays	783,549 hours at 25°C 718,344 hours at 30°C
Safety Standard	EN61010-1 Pollution Degree 2

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 160 W. The maximum power dissipation for an individual module is 60W. 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-X121 module (containing 20 relays) has 5 relays closed, passing a current of 10 A, then:

Total power dissipation =
$[(\text{current})^2 * (\text{path resistance}) * 5] + (\text{quiescent power})$

By substituting the actual values:

Total power dissipation =
$[(10\ A)^2 * (0.1\ \Omega) * 5] + (1.5\ W) = 51.5\ W$ at 55°C

This is acceptable power dissipation for an individual plug-in module. 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:

3 A	Max. 15 relays closed
5 A	Max. 6 relays closed
10 A	Max. 2 relays closed

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-X121 MTBF is 783,549 hours at 25°C and 718,344 hours at 30°C, calculated in accordance with MIL-HDBK-217E, with the electromechanical relays set at 50% rated load at 85°C. 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.

The relay used on the 1260-X121 plug-in is part no. 310344. The relay manufacturer's specifications for this relay are:

Life Expectancy

Mechanical	10,000,000 operations
Electrical	100,000 operations at full rated load

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

Ordering Information

Listed below are part numbers for 1260-X121 switch module and available mating connector accessories. Each 1260-X121 uses two mating connectors.

Item	Description	Part #
1260-X121 Switch Module	1260-X121	408008
	Consists of:	
	PCB Assembly	405247
	Manual for 1260-X121	980914-X121
20 Pin Mating Connector	20 Pin Conn. Kit w/backshell & solder cup pins	407660
Additional Manual	Manual for 1260-X121	980914-X121

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Chapter 2
INSTALLATION INSTRUCTIONS

Unpacking and Inspection

1. Remove the 1260-X121 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-X121 module option and the 1260-X121 Users Manual. Notify EADS North America Defense Test and Services, Inc. if the module appears damaged in any way. Do not attempt to install a damaged module into a VXI chassis.

3. The 1260-X121 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.

Reshipment Instructions

1. Use the original packing when returning the switching module to EADS North America Defense Test and Services, Inc. for calibration or servicing. The original shipping carton and the instrument's plastic foam will provide the necessary support for safe reshipment.

2. If the original packing material is unavailable, wrap the switching module in an ESD Shielding bag and use plastic spray foam to surround and protect the instrument.

3. Reship in either the original or a new shipping carton.

Installation

Installation of the 1260-X121 Switching Module into a 1260-100X Carrier assembly is described in the Installation section of the 1260-100X Adapt-a-Switch Carrier Manual.

Module Configuration

The 1260-X121 is a 20-channel single-wire switch module consisting of twenty SPST relay switches ten SPST configuration relays. This architecture permits the 1260-X121 module to be organized via software as twenty SPST or ten 1X2 switches.

For a block diagram of the 1260-X121, see **Figure 2-1**.

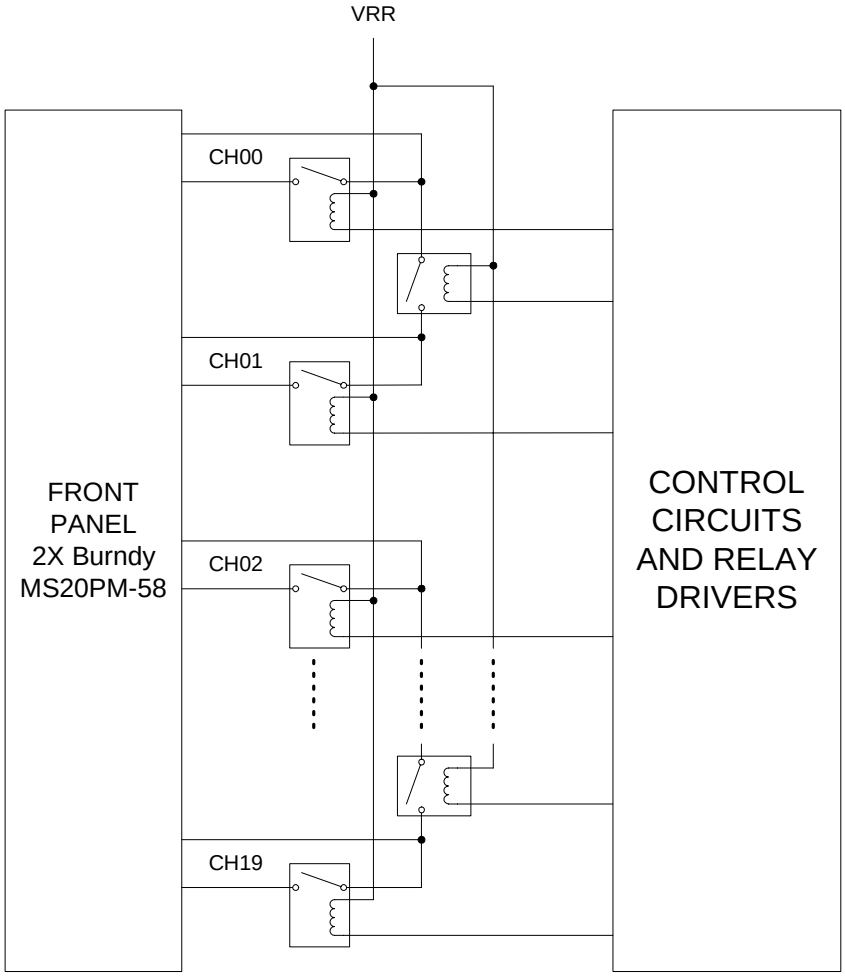


Figure 2-1, 1260-X121 Block Diagram

Front Panel Connectors

The 1260-X121 has two 20-pin front-panel connectors, labeled J200 and J201. It has one pin for each input and one for each output. See **Figure 2-2** for pin numbering. **Table 2-1** shows the mapping of channel numbers to connector pins. Information about available mating connectors is provided immediately after **Table 2-1**.

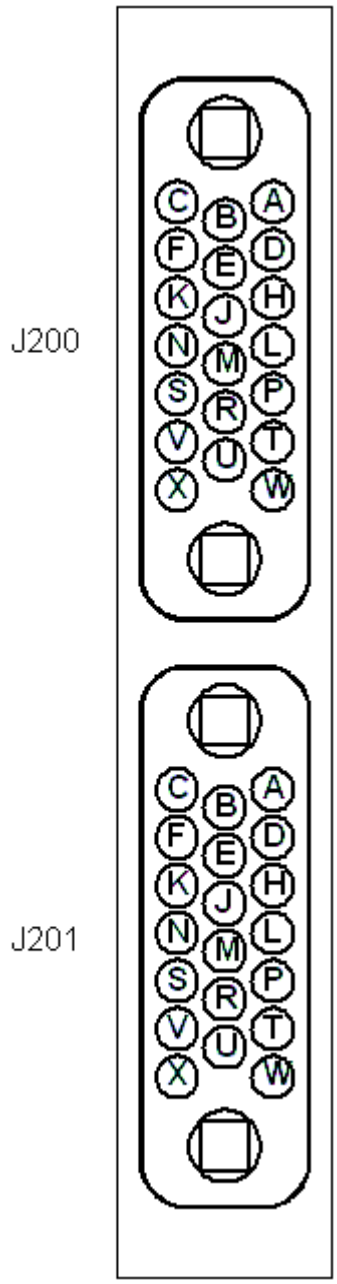
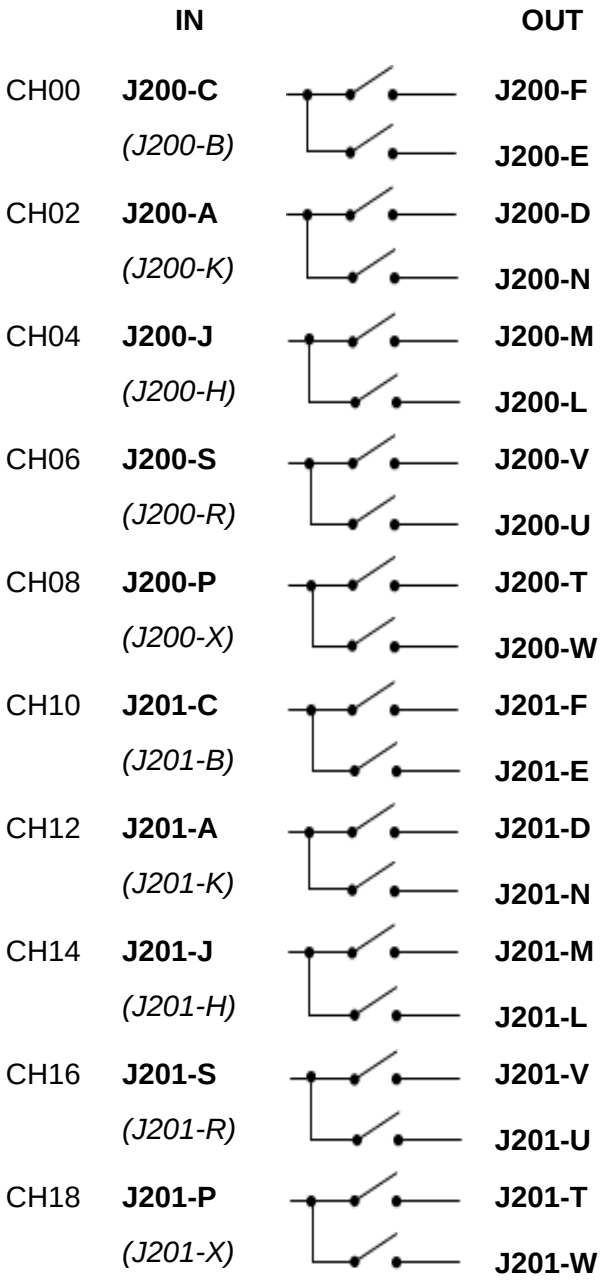


Figure 2-2, Front Panel Connector Pin Numbering

Table 2-1, 1260-X121 Front-Panel Connections

	IN		OUT
CH00	**J200-C**		**J200-F**
CH01	**J200-B**		**J200-E**
CH02	**J200-A**		**J200-D**
CH03	**J200-K**		**J200-N**
CH04	**J200-J**		**J200-M**
CH05	**J200-H**		**J200-L**
CH06	**J200-S**		**J200-V**
CH07	**J200-R**		**J200-U**
CH08	**J200-P**		**J200-T**
CH09	**J200-X**		**J200-W**
CH10	**J201-C**		**J201-F**
CH11	**J201-B**		**J201-E**
CH12	**J201-A**		**J201-D**
CH13	**J201-K**		**J201-N**
CH14	**J201-J**		**J201-M**
CH15	**J201-H**		**J201-L**
CH16	**J201-S**		**J201-V**
CH17	**J201-R**		**J201-U**
CH18	**J201-P**		**J201-T**
CH19	**J201-X**		**J201-W**

1260-X121 as (1x1)’s



1260-X121 as (1x2)'s

NOTE:

Pins shown in parentheses are for reference only.

Mating Connectors

Mating connector accessories are available for the 1260-X121:

20 Pin Connector Kit with backshell and pins
P/N 407660

The 20-pin connector kit consists of a connector housing, aluminum backshell, and twenty solder-cup pins. The pins are also available from Positronic in crimp versions and for smaller wire diameters.

The mating connector pins are solder type. The corresponding removal tool is P/N 9081.

After wire attachment, the pin is inserted in the housing and will snap into place, providing positive retention. To ensure that the pin is locked into place, the assembler should pull on the wire after insertion.

Table 2-2, Mating Connectors and Pins

Part Number	Manufacturer	Mfr. P/N	Description
602349-120	Positronic	GMCT20F0E100J0	Insulator block (diallyl pthalate), 20-position. Mates with front-panel connector. Pins sold separately.
601850-900	Positronic	FC114N2	Female contact, crimp type, for 14 AWG wire. Mates with front-panel connector pins.
None	Positronic	FC116N2	Female contact, crimp type, for 16 AWG wire. Mates with front-panel connector pins.
None	Positronic	FS114N2	Female contact, solder type, for 14 AWG wire. Mates with front-panel connector pins.
None	Positronic	FS116N2	Female contact, solder type, for 16 AWG wire. Mates with front-panel connector pins.

More About Maximum Current Ratings

The front panel connector and pins are rated for 10A DC per pin, with all channels conducting full-rated current. This keeps the temperature rise within 10°C. It should be noted that with all electromechanical relays, the higher the switched power (voltage times current), the shorter the useful life of the relays.

Definitions:

- *Max current carrying capacity*

  The maximum current that the relay can conduct if the relay is not switched while voltage is applied. The maximum current carrying capacity is affected by the size of the conducting section of the contact at its smallest area. The listed values are obtained from several tests in laboratories under room-temperature conditions (21°C). The contact is considered to be in free air. The maximum current carrying for the 1260-X121 is 10 A.

- *Max operating current*

  The current the contacts can switch while conducting, without deteriorating. This depends on working conditions, such as dissipated heat, cooling provisions, ambient temperature, insulation material, etc. The maximum operating current for the 1260-X121 is 10 A.

- *Recommended continuous current*

  The maximum current recommended for indefinitely-long time periods. The primary concern here is the heat generated in the relay. This specification can be applied for normal working conditions. The specification includes a safety margin. However, there are restrictions in the application of the given values. The most important restriction is the cross-sectional area of the connecting wire, insulation temperature range, and wire bundling. The recommended continuous current for the 1260-X121 is 10 A.

Installation

To install the 1260-X121 Switching Module into a 1260-100X Carrier, engage the printed circuit board into the grooves of the desired carrier slot. Slide the 1260-X121 into the carrier until its connector mates with the connector on the carrier backplane. Push firmly to fully seat the connector. Tighten the two retaining screws at the top and bottom of the 1260-X121 plug-in.

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Chapter 3
MODULE OPERATION

Operating Modes

The 1260-X121 may be operated either in *message-based* mode or in *register-based* mode.

In the *message-based* mode, the 1260-01T switch controller interprets commands sent by the slot 0 controller, and determines the appropriate data to send to the control registers of the 1260-X121 module.

Operating In Message-Based Mode

Channel Descriptors For The 1260-121

The standard 1260-01T commands are used to operate the 1260-X121 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-X121 module. This is a number is in the range from 1 through 12, inclusive.
- <channel> is the 1260-X121 channel to operate. This is a number in the range from 0 through 19, 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-X121:

`OPEN (@8(0))`	Open channel 0 on the 1260-X121 that has module address 8.
`CLOSE (@8(0,7))`	Close channels 0 and 7 on the 1260-X121 that has module address 8.
`CLOSE (@2(7:11))`	Close channels 7 through 11 inclusive on the 1260-X121 that has module address 2.

Reply To The MOD:LIST? Command

The chassis containing the 1260-X121 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>

For the 1260-X121 module the string value is:

```
1260-X121 20-CHANNEL SPST 10A SWITCH
```

Thus, for a 1260-X121 whose module address is 2, the reply to this query would be:

```
2 : 1260-X121 20-CHANNEL SPST 10A SWITCH
```

Operating in Register-Based Mode

The 1260-X121 offers register-based mode when installed in VXI platforms that support it. In register-based mode, the 1260-X121 is operated by directly writing and reading to/from ports controlling up to eight relays each. To access the registers the following details must be assembled to generate an absolute address that can be wrote or read from:

The port and control registers are located in the VXIbus A24 Address Space. The A24 address for a port or 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-X121 module. This is a value in the range from 1 and 12 inclusive.

3. The 1260-X121 control register to be written to or read from. Each register on the 1260-X121 has a unique offset from the base address.

The base A24 address for the 1260-X121 module may be calculated by:

> (A24 Offset of the 1260-01T) + (1024 x Module Address of 1260-121).

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

A 1260-X121 with a module address of 7 would have the base A24 address computed as follows:

> Base A24 Address of 1260-X121 = 204000_{16} + (400_{16} x 7_{10}) = $205C00_{16}$

The port and control registers for Adapt-a-Switch plug-ins and conventional 1260-Series modules are always on odd-numbered A24 addresses. For port registers, the 1260-X121 reads and writes to the same location. For control registers, the 1260-X121 writes to one location, but reads back from another. **Table 3-1 and 3-5** provides offsets relative to the base address of the module for all port and control registers of the 1260-121. To obtain the absolute address where data is to be written or read from, the base address is added to the offset:

> (Base A24 1260-X121 Address) + offset = absolute address

So, for our example base A24 address computed earlier, the following absolute addresses would apply for the operations indicated:

205C01	Port A read or written at this location
205E01	ID register read at this location

Before explaining the particulars of reading and writing to port and control registers, it is necessary to understand how the registers interact with the 1260-X121 relays. **Table 3-2 through 3-5** provides a detailed explanation of each register and how it interacts with the 1260-X121 module.

Table 3-1, Register Offset Addresses of the 1260-X121 Module

Register Name	Register Offsets to Add to Base Module Address	
	Write Location (hexadecimal)	Read Location (hexadecimal)
0	0x01	0x01
1	0x03	0x03
2	0x05	0x05
3	0x07	0x07
ID	Read Only	0x201
EPROM Descriptor	Read Only	0x203

Table 3-2, ID Register Functionality of the 1260-X121 Module

Register Table		ID Register
Module Version	Bit	Functionality Description
All	0	Always Reads 0x00 (Read Only)
	1	
	2	
	3	
	4	
	5	
	6	
	7	

Table 3-3, Register0 Functionality of the 1260-X121 Module

Register Table		Register 0	
Module Version	Bit	Functionality Description	
All	0	Relay 00	(0: relay open 1: relay closed)
	1	Relay 01	(0: relay open 1: relay closed)
	2	Relay 02	(0: relay open 1: relay closed)
	3	Relay 03	(0: relay open 1: relay closed)
	4	Relay 04	(0: relay open 1: relay closed)
	5	Relay 05	(0: relay open 1: relay closed)
	6	Relay 06	(0: relay open 1: relay closed)
	7	Relay 07	(0: relay open 1: relay closed)

Table 3-4, Register1 Functionality of the 1260-X121 Module

Register Table		Register 1		
Module Version	**Bit**	**Functionality Description**		
All	0	Relay 08	(0: relay open 1: relay closed)	
	1	Relay 09	(0: relay open 1: relay closed)	
	2	Relay 10	(0: relay open 1: relay closed)	
	3	Relay 11	(0: relay open 1: relay closed)	
	4	Relay 12	(0: relay open 1: relay closed)	
	5	Relay 13	(0: relay open 1: relay closed)	
	6	Relay 14	(0: relay open 1: relay closed)	
	7	Relay 15	(0: relay open 1: relay closed)	

Table 3-5, Register2 Functionality of the 1260-X121 Module

Register Table		Register 2		
Module Version	**Bit**	**Functionality Description**		
All	0	Relay 16	(0: relay open 1: relay closed)	
	1	Relay 17	(0: relay open 1: relay closed)	
	2	Relay 18	(0: relay open 1: relay closed)	
	3	Relay 19	(0: relay open 1: relay closed)	
	4	Relay 20 (Connect J200-C and J200-B)	(0: relay open	1: relay closed)
	5	Relay 21 (Connect J200-A and J200-K)	(0: relay open	1: relay closed)
	6	Relay 22 (Connect J200-J and J200-H)	(0: relay open	1: relay closed)
	7	Relay 23 (Connect J200-S and J200-R)	(0: relay open	1: relay closed)

Table 3-6, Register3 Functionality of the 1260-X121 Module

Register Table		Register 3		
Module Version	**Bit**	**Functionality Description**		
All	0	Relay 24 (Connect J200-P and J200-X)	(0: relay open	1: relay closed)
	1	Relay 25 (Connect J201-C and J201-B)	(0: relay open	1: relay closed)
	2	Relay 26 (Connect J201-A and J201-K)	(0: relay open	1: relay closed)
	3	Relay 27 (Connect J201-J and J201-H)	(0: relay open	1: relay closed)
	4	Relay 28 (Connect J201-S and J201-R)	(0: relay open	1: relay closed)
	5	Relay 29 (Connect J201-P and J201-X)	(0: relay open	1: relay closed)
	6	Not Used		
	7	Not Used		

Note:

Open: Indicates C not connected to NO contact
Closed: Indicates C connected to NO contact

Table 3-7, EPROM Descriptor Functionality of the 1260-X121 Module

Register Table		EPROM Descriptor Register
Module Version	**Bit**	**Functionality Description**
All	0	Each time this register is read, it advances a memory pointer to the next memory location in the on-board EPROM. To reset this pointer to the beginning, read the ID register. This resets the memory pointer. The descriptor register contains a long string of data, typically used by the Adapt-a-Switch carrier for configuration purposes. Additionally, this data contains the card identification string for the specific type of card (i.e. 1260-121). These identification strings are located at EPROM memory locations 0x23 through 0x34.
	1	
	2	
	3	
	4	
	5	
	6	
	7	

Writing to a port location is a straightforward process. Setting a bit high in a port register causes the corresponding relay channel to close.

It is especially important to realize that a single write operation controls eight separate control lines or output devices simultaneously. Therefore if only a single bit change is desired, the following process must be observed.

1. Read the register, inverting the bit pattern.

2. Mask the appropriate bit with an ‘AND’ operation and a byte mask with all undesired bits set to a ‘1’ and the desired bit set to a ‘0’ or ‘1’ depending on whether the bit is to be set or cleared in the desired register.

3. Write the masked data back into the register.

As simple as this may seem, a number of products reported as faulty and sent back for repair are typically the result of inappropriate register accesses.

Because of the 1260-X121 relay driver architecture, registers A and B will read back inverted from what was written to them.

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-X121 module.

Chapter 4
PRODUCT SUPPORT

Product Support

EADS North America Defense Test and Services, Inc. has a complete Service and Parts Department. If you need technical assistance or should it be necessary to return your product for repair or calibration, call 1-800-722-3262. If parts are required to repair the product at your facility, call 1-949-859-8999 and ask for the Parts Department.

When sending your instrument in for repair, complete the form in the back of this manual.

For worldwide support and the office closest to your facility, refer to the website for the most complete information http://www.eads-nadefense.com.

Warranty

Use the original packing material when returning the 1260-X121 to EADS North America Defense Test and Services, Inc. for calibration or servicing. The original shipping container and associated packaging material will provide the necessary protection for safe reshipment.

If the original packing material is unavailable, contact EADS North America Defense Test and Services, Inc. Customer Service at 1-800-722-3262 for information.

REPAIR AND CALIBRATION REQUEST FORM

To allow us to better understand your repair requests, we suggest you use the following outline when calling and include a copy with your instrument to be sent to the EADS North America Defense Test and Service, Inc. Repair Facility.

Model_____ Serial No._____ Date_____

Company Name_____ Purchase Order #_____

Billing Address_____

City

State/Province Zip/Postal Code Country

Shipping Address_____

City

State/Province Zip/Postal Code Country

Technical Contact_____ Phone Number ( )_____
Purchasing Contact_____ Phone Number ( )_____

1. Describe, in detail, the problem and symptoms you are having. Please include all set up details, such as input/output levels, frequencies, waveform details, etc.

2. If problem is occurring when unit is in remote, please list the program strings used and the controller type.

3. Please give any additional information you feel would be beneficial in facilitating a faster repair time (i.e., modifications, etc.)

4. Is calibration data required? Yes No (please circle one)

Call before shipping
Note: We do not accept "collect" shipments.

Ship instruments to nearest support office.