RACAL INSTRUMENTS
1260-164 A/B
RF SP4T PLUG-IN

PUBLICATION NO. 980824-164

EADS
NORTH AMERICA
DEFENSE

PUBLICATION DATE: November 07, 2001

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EADS NORTH AMERICA DEFENSE TEST AND SERVICES PRODUCT

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http://www.eads-nadefense.com/downloads

If you have any questions about software driver downloads or our privacy policy, please contact us at

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All EADS North America Defense Test and Services, Inc. products are designed and manufactured to exacting standards and in full conformance to EADS ISO 9001:2000 processes.

This warranty does not apply to defects resulting from any modification(s) of any product or part without EADS North America Defense Test and Services, Inc. express written consent, or misuse of any product or part. The warranty also does not apply to fuses, software, non-rechargeable batteries, damage from battery leakage, or problems arising from normal wear, such as mechanical relay life, or failure to follow instructions.

This warranty is in lieu of all other warranties, expressed or implied, including any implied warranty of merchantability or fitness for a particular use. The remedies provided herein are buyer's sole and exclusive remedies.

For the specific terms of your standard warranty, or optional extended warranty or service agreement, contact your EADS North America Defense Test and Services, Inc. customer service advisor. Please have the following information available to facilitate service.

1. Product serial number

2. Product model number

3. Your company and contact information

You may contact your customer service advisor by:

E-Mail:	Helpdesk@eads-nadefense.com	
Telephone:	+1 800 722 3262	(USA)
Fax:	+1 949 859 7309	(USA)

RETURN of PRODUCT

Authorization is required from EADS North America Defense Test and Services, Inc. before you send us your product for service or calibration. Call or contact the Customer Support Department at 1-800-722-3262 or 1-949-859-8999 or via fax at 1-949-859-7139. We can be reached at: helpdesk@eads-nadefense.com.

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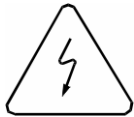
FOR YOUR SAFETY

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

CAUTION
RISK OF ELECTRICAL SHOCK
DO NOT OPEN

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

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

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

CAUTION
SENSITIVE ELECTRONIC DEVICES
DO NOT SHIP OR STORE NEAR STRONG ELECTROSTATIC, ELECTROMAGNETIC, MAGNETIC OR RADIOACTIVE FIELDS

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

EC Declaration of Conformity

We

Racal Instruments Inc.
4 Goodyear Street
Irvine, CA 92718

declare under sole responsibility that the

1260-164A,-164B
RF SP4TR Switch Plug-In
P/N 407778-001,-002

conforms to the following Product Specifications:

Safety: EN 61010-1

EMC: Immunity: EN61326, Class A, Table 1
              Emissions: EN61326, Class A, Table 3

Supplementary Information:
The above specifications are met when the product is installed in a Racal Instruments certified enclosure, with faceplates installed over all unused slots, as applicable.

The product herewith complies with the requirements of EN61010-1 and EN61326.

Irvine, CA, January 15, 2002

Quality Manager

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Chapter 1
SPECIFICATIONS

Introduction – 1260-164A/B

The 1260-164A and 1260-164B are RF plug-in switch modules developed for a variety of platforms such as the 1260-100 Adapt-a-Switch® Carrier and the 1256 Switching System. These switches are software-configurable single (–164A) and dual (–164B) SP4T RF Relays for DC to 18GHz.

The 1260-164 modules include the following features:

- Standard Adapt-a-Switch and 1256 Switching System plug-in design, providing for ease of replacement.

- Data-Driven embedded descriptor, allowing immediate use with any platform compatible with the Adapt-a-Switch standard, regardless of firmware level.

Figure 1-1, 1260-164B

Specifications – 1260-164A/B

Input / Output Specifications				
Frequency Range (GHz)	DC-3	3-8	8-12.4	12.4-18
VSWR (Max dB)	1.15:1	1.25:1	1.35:1	1.45:1
Insertion loss (Max dB)	0.15	0.25	0.35	0.45
Isolation (Max dB)	85	75	65	65
RF Input Power				
Frequency Range (GHz)	DC-0.1	0.1-1	1-10	10-18
Max Input Power (Watts)	490	180	60	50

Relay Operate Time	15m sec typical
Switch Contact Lifetime	1 Million cycles per position
Available I/O Channels	Single SP4T RF Relay
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	-20°C to +60°C
Non-operating	-40°C to +71°C
Relative Humidity	95 +/-5% RH non condensing; 75+/-5 %RH above 30°C; 45+/-5 %RH above 40°C
Altitude	
Operating	10,000 feet
Non-operating	15,000 feet
Power Requirements +5 VDC Amps Maximum	1260-164A 1.0A
	1260-164B 1.95A
Weight	1260-164A 5.8 oz, 160 gm
	1260-164B 8.0 oz, 230 gm

| Mean Time Between Failures (MTBF) | 1260-164A | 860,000 hrs |
| | 1260-164B | 560,000 hrs |

Calculated per MIL-HBK-217, ground-benign, 30°C, as design goal excluding relays. (RF relay MTBF 1,000,000 operations per switch at rated load)

| Mean Time to Repair (MTTR) | < 5 minutes |

Power Dissipation – 1260-164A/B

The cooling of the Adapt-a-Switch carrier is dependent upon the chassis into which it is installed. The carrier can nominally dissipate approximately 100W. Even with all channels driven to maximum outputs, up to two 1260-164A plug-ins may be used together in a 1260-100 without exceeding the maximum allowable power dissipation of the carrier.

If the 1260-164A will be used in conjunction with other cards, the dissipation should be computed and summed with the total worst-case dissipation of the remaining modules.

For example, a 1260-164A module would dissipate the following energy:

Quiescent power dissipation = 0.75W maximum

With one coil energized = 5.00 W maximum

For example, a 1260-164B module would dissipate the following energy:

Quiescent power dissipation = 0.75W maximum

With one coil energized = 5.00 W maximum

With two coils energized = 9.75 W maximum

This is acceptable power dissipation for an individual plug-in module. If one additional module is likewise loaded, then the overall carrier dissipation is approximately 10.0W for the –164A and 19.5W for the –164B, both of which are well within the cooling available in most commercial VXIbus chassis.

Ordering Information

Listed below are part numbers for both the 1260-164 switch modules.

ITEM	DESCRIPTION	PART #

1260-164A Single SP4T RF Switch Module	Switch Module, 1 SP4T DC-18 GHz
	
	Consists of:
	    P/N 407783-001 PCB Assy
	    P/N 980824-164 Manual
		407778-001

1260-164B Dual SP4T RF Switch Module	Switch Module, 2 SP4T DC-18 GHz
	
	Consists of:
	    P/N 407783-002 PCB Assy
	    P/N 980824-164 Manual
		407778-002

Additional Manual		980824-164

Chapter 2

INSTALLATION INSTRUCTIONS

Unpacking and Inspection

CAUTION
SENSITIVE ELECTRONIC DEVICES
DO NOT SHIP OR STORE NEAR
STRONG ELECTROSTATIC,
ELECTROMAGNETIC, MAGNETIC OR
RADIOACTIVE FIELDS

1. Remove the 1260-164 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 1260-164 module option and the 1260-164 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 1260-164 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.

CAUTION:

ESD sensitive devices. Open the instrument at an ESD safe work station.

WARNING:

Connections to the 1260-164 module should be made with all RF power removed.

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:

For instructions on installing the 1260-164 into a switching platform, refer to the user manual for that platform, in the "Getting Started" chapter under the "Inserting and Removing Plug-ins" section. Manuals are available at the Racal Instruments' web site: http://www.racalinstruments.com.

Module Configuration

The 1260-164 modules are software-selectable multiplexer plug-ins for switching platforms such as Adapt-a-Switch and 1256 System. The 1260-164A is a single SP4T RF Switch, and the 1260-164B is a dual SP4T RF Switch.

Front Panel Connectors 1260-164A

The 1260-164A has one front panel RF relay, labeled SW1, with 5 SMA connectors. See **Figure 2-1** for SMA connector designations. See **Figure 2-2** for the relay diagram, and **Figure 2-3** for a block diagram of 1260-164A.
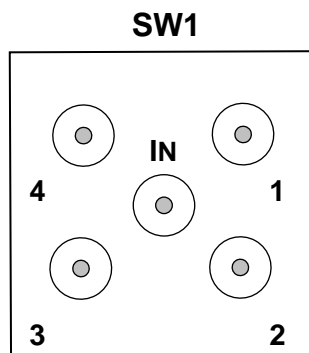
Figure 2-1, 1260-164A SMA Connector Designations

Channel Number	Front Panel Designation	SW1
00	1	
01	2	
02	3	
03	4	
	IN	

Figure 2-2, 1260-164A Relay Diagram
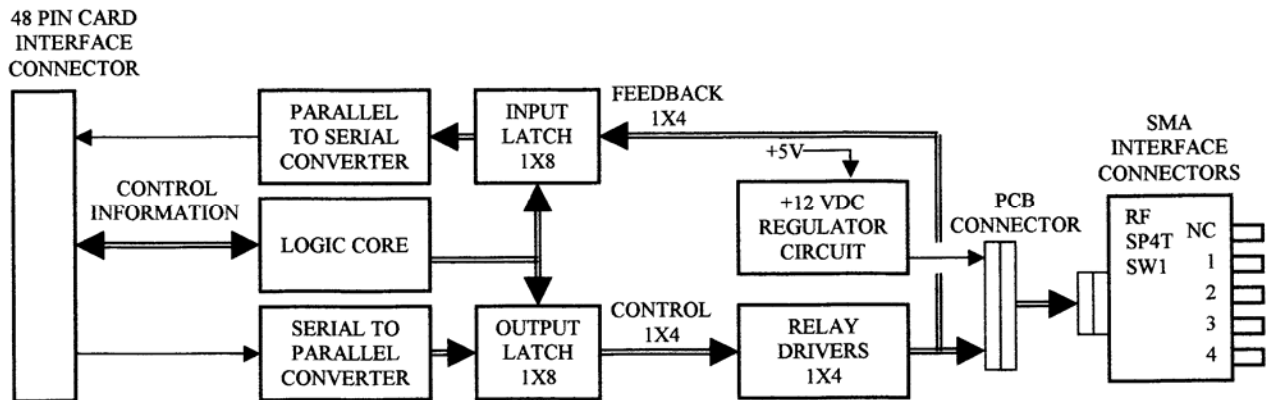
Figure 2-3, 1260-164A Block Diagram

Front Panel Connectors 1260-164B

The 1260-164B has two front panel RF relays, labeled SW1 and SW2, with 5 SMA connectors each. See **Figure 2-4** for SMA connector designations. See **Figure 2-5** for the relay diagram and **Figure 2-6** for a block diagram of 1260-164B.
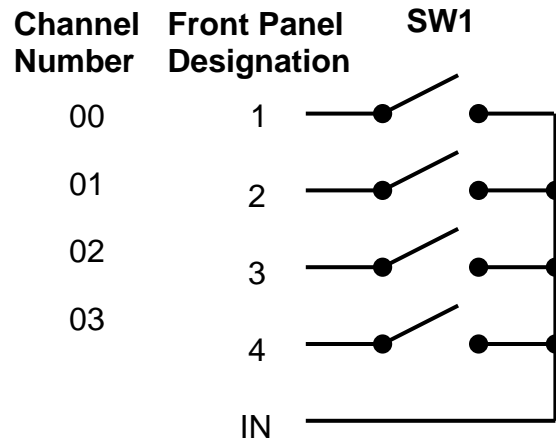
See page 2-6 for torque requirements.

SW1

IN

4   1

3   2

SW2

IN

4   1

3   2
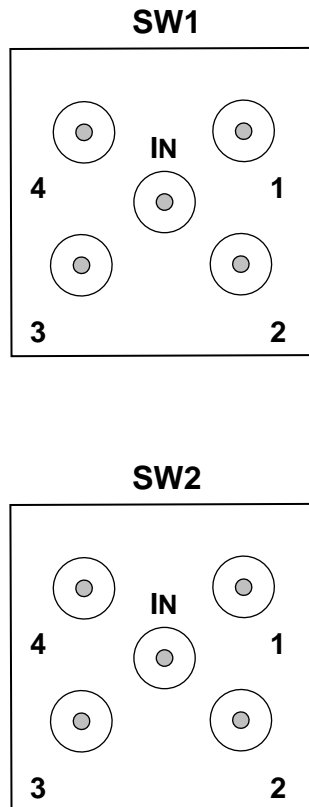
Figure 2-4, 1260-164B SMA Connector Designations

Channel Number	Front Panel Designation	SW1	Channel Number	Front Panel Designation	SW2
00	1		10	1	
01	2		11	2	
02	3		12	3	
03	4		13	4	
	IN			IN	
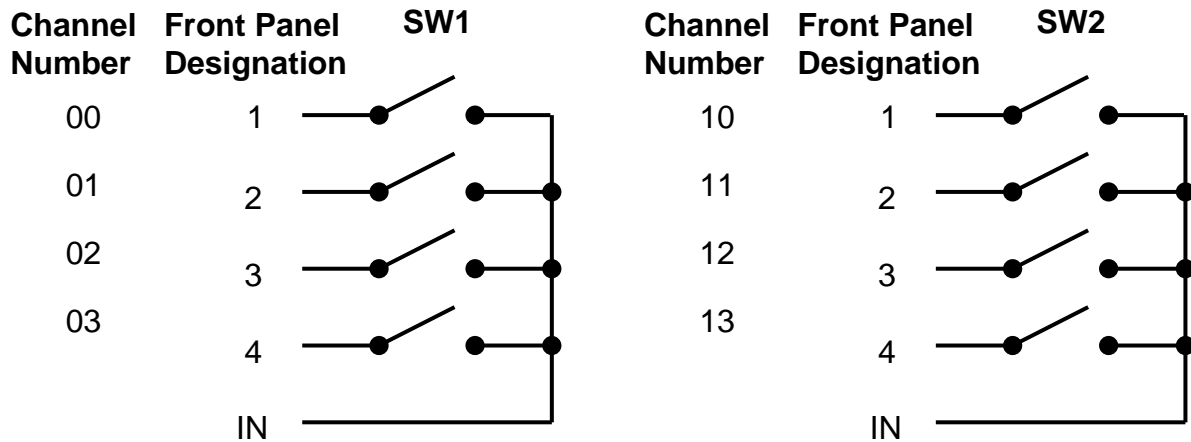
Figure 2-5, 1260-164B Relay Diagram
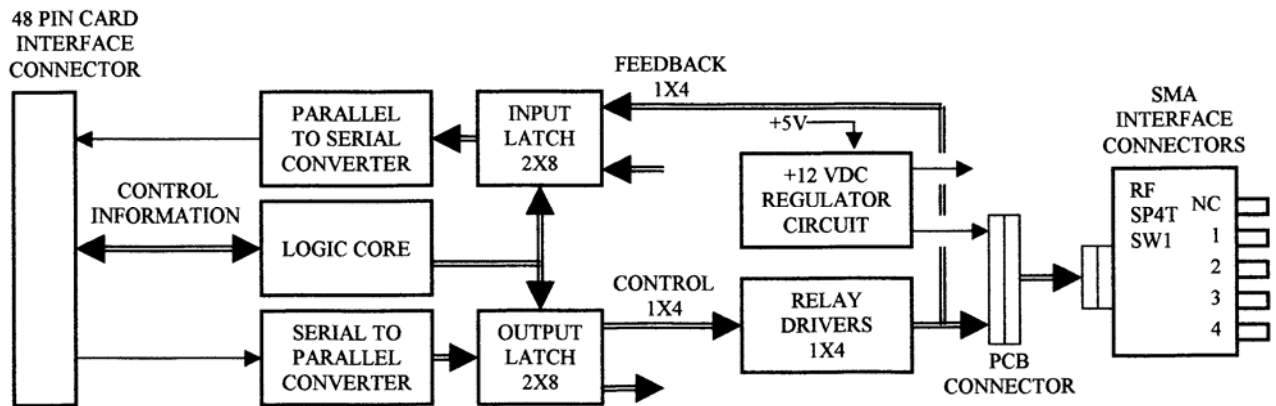
Figure 2-6, 1260-164B Block Diagram

Mating Connectors

Mating connectors are SMA type. Use connectors that are suitable for the type of connecting coax and frequency range to be used. **Maximum connector engagement should not exceed 9 in. lbs. torque**. It is highly recommended that a torque wrench (Ma-Com P/N 2098-5065-54 or equivalent) be used to torque the SMA connectors. A ¼ inch drive Deep Slotted Socket, P/N 456890, is available for installation and removal of connectors.

Chapter 3

MODULE OPERATION

Reply to the MOD:LIST? Command

The platform containing the 1260-164 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 value of <module-specific identification string> for the 1260-164 depends on the version (1260-164A or 1260-164B). For the single SP4T switch (1260-164A), the string value is:

```
1260-164A SINGLE SP4T RF SWITCHING MODULE
```

For the two SP4T switch (1260-164B), the string value is:

```
1260-164B DUAL SP4T RF SWITCHING MODULE
```

Thus, for a 1260-164A whose module address is 2, the reply to this query would be:

```
2 : 1260-164A SINGLE SP4T RF SWITCHING
MODULE
```

Operating in Register-Based Mode

The 1260-164 offers register-based mode when installed in VXI platforms that support it. In register-based mode, the 1260-164 is operated by directly writing and reading to/from ports controlling four relays each. To access the various 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 1260-164 module. This is a value in the range from 1 and 12 inclusive.

3. The 1260-164 port or control register to be written to or read from. Each register on the 1260-164 has a unique offset from the base address.

The base A24 address for the 1260-164 module may be calculated by:

(A24 Offset of the 1260-01T) + (1024 x Module Address of 1260-164).

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

A 1260-164 with a module address of 7 would have the base A24 address computed as follows:

Base A24 Address of 1260-164 = 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 1260-164 reads and writes to the same location. For control registers, the 1260-164 writes to one location, but reads back from another. **Table 3-1** provides offsets relative to the base address of the module for all port and control registers of the 1260-164. To obtain the absolute address where data is to be written or read from, the base address is added to the offset:

(Base A24 1260-164 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 1260-164 relays. **Table 3-1 through 3-5** provide a detailed explanation of each register and how it interacts with the 1260-164 module.

Table 3-1, Register Offset Addresses of the 1260-164 Module

Register Name	Register Offsets to Add to Base Module Address	
	Write Location (hexadecimal)	Read Location (hexadecimal)
Port A	0x01	0x01
Port B	0x03	0x03
ID	Read Only	0x201
EPROM Descriptor	Read Only	0x203

Table 3-2, ID Register Functionality of the 1260-164

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, Port A Register Functionality of the 1260-164 Module

Register Table		Port A	
Module Version	**Bit**	**Functionality Description**	
All	0	Relay SW1-1 (0: switch open	1: switch closed)
	1	Relay SW1-2 (0: switch open	1: switch closed)
	2	Relay SW1-3 (0: switch open	1: switch closed)
	3	Relay SW1-4 (0: switch open	1: switch closed)
	4	(not used)	
	5	(not used)	
	6	(not used)	
	7	(not used)	

Table 3-4, Port B Register Functionality of the 1260-164 Module

Register Table		Port B	
Module Version	**Bit**	**Functionality Description**	
-164B only	0	Relay SW2-1 (0: switch open	1: switch closed)
	1	Relay SW2-2 (0: switch open	1: switch closed)
	2	Relay SW2-3 (0: switch open	1: switch closed)
	3	Relay SW2-4 (0: switch open	1: switch closed)
	4	(not used)	
	5	(not used)	
	6	(not used)	
	7	(not used)	

Table 3-5, EPROM Descriptor Functionality of the 1260-164 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. 1260-164A or 1260-164B). 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 1260-164 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 1260-164 module.

1260-164 Example Code

```c
#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 1260-164 with module address 7, port 1,
and write data of 0xAA */
#define MOD_ADDR_164 7
#define PORT_NUMBER  1
#define DATA_ITEM    0xAA


void example_operate_1260_164(void)
{
    ViUInt8 creg_val;
    ViBusAddress portA_addr, offset;
    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 */
    portA_addr = (MOD_ADDR_164 << 10) + 1;
     offset = portA_addr + (PORT_NUMBER << 1);

     error = viOut8 (vi, VI_A24_SPACE, offset, DATA_ITEM);

   if (error < 0)

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

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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 1260-164 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   Ship instruments to nearest support office.
Note: We do not accept
"collect" shipments.