RACAL INSTRUMENTS™
1260-116
24 SPDT 5A RELAY
PLUG-IN

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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
4 Goodyear
Irvine, CA 92618

declare under sole responsibility that the

1260-116 24 SPDT 5A Relay Plug In Module
P/N 407748

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 an Astronics Test Systems 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 22, 2001

Quality Manager

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Table of Contents

List of Figures

List of Tables

DOCUMENT CHANGE HISTORY

Revision	Date	Description of Change
A	9/02/09	Revised per EO 29849 Revised format to current standards. Company name revised throughout manual. Manual now revision letter controlled. Added Document Change History Page v. 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

MODULE SPECIFICATIONS

Introduction – 1260-116

The 1260-116 is a plug-in switch module 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 24 SPDT relays.

The 1260-116 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.

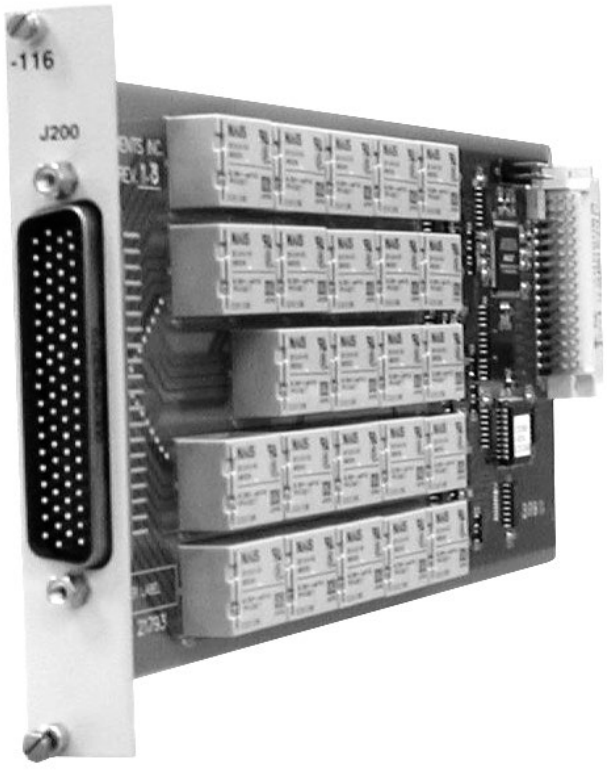

Figure 1-1, 1260-116

Specifications – 1260-116

Channel Input Voltage	30 V DC maximum 250 V AC maximum
Channel Input Current	5.0 Amps maximum
Path Resistance	0.200 Ω maximum
Channel to Chassis Capacitance	5 pF maximum
NO to NC Capacitance	30 pF maximum
Insertion Loss	
DC to 300kHZ	0.7 dB maximum
1MHz	0.5 dB maximum
10MHz	0.8 dB maximum
Isolation	
DC to 300kHz	50 dB minimum
1 MHz	40 dB minimum
10 MHz	20 dB minimum
Crosstalk	
DC to 300kHz	-50 dB maximum
1 MHz	-40 dB maximum
10 MHz	-20 dB maximum
3 dB Band Width	50 MHz minimum
Relay Operate Time	10 ms maximum
Relay Life	
Contact	10^5 operations at rated load
Mechanical	10^7 operations
Max. Operating Speed	20 cps per relay at rated load
Available I/O Channels	24 SPDT 5 Amp
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
Power Requirements +5 VDC Amps Maximum	1.15A
Temperature	
Operating	-20°C to +60°C

Non-Operating	-40°C to +75°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
Weight	5.44 oz (154 gm)
Mean Time Between Failures (MTBF)	440,000 Hours, calculated per MIL-HBK-217, ground-benign, 30°C, as design goal (relay MTBF 100,000 operations per relay at rated load)
Mean Time to Repair (MTTR)	< 5 minutes
Safety	EN 61010-1
Emissions	EN 61326, Class A, Table 3
Immunity	EN 62326, Class A, Table 1

Power Dissipation – 1260-116

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 four 1260-116 plug-ins may be used together in a 1260-100 without exceeding the maximum allowable power dissipation of the carrier.

If the 1260-116 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 1260-116 module would dissipate the following energy:

Quiescent power dissipation = 0.75W maximum.

With 24 relays closed = 5.55 W maximum.

At 0.2 W per relay.

Signal I^2R dissipation is 5.0 W maximum per relay.

At rated 5 A load.

Consideration should be taken to ensure that the total power dissipation, *heat*, does not exceed the cooling limits of the switching system.

Ordering Information

Listed below are part numbers for both the 1260-116 switch module and shipping kit containing the mating connector.

ITEM	DESCRIPTION	PART #
1260-116 24 SPDT 5A Relays	Switch Module Consists of: P/N 405171 PCB Assy P/N 407653-116 Shipping Kit	407748
980824-116	Additional Manual	980824-116
M81969/1-04	Contact Insertion/Removal Tool	991041

Chapter 2

INSTALLATION INSTRUCTIONS

Unpacking and Inspection

1. Remove the 1260-116 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 1260-116 module option and the 1260-116 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 1260-116 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

For instructions on installing the 1260-116 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 web site: www.astronicstestsystems.com.

Module Configuration

The 1260-116 modules are software-selectable multiplexer plug-ins for switching platforms such as Adapt-a-Switch and 1256 System. The 1260-116 contains 24 SPDT 5 Amp relays.

Front Panel Connectors 1260-116

The 1260-116 has one front panel connector, labeled J200. See **Figure 2-1**, 1260-116 Connector Designations for connector pin locations. See **Table 2-1**, User I/O Pin Numbers for the relay I/O pin out, and **Figure 2-2** for the 1260-116 block diagram.

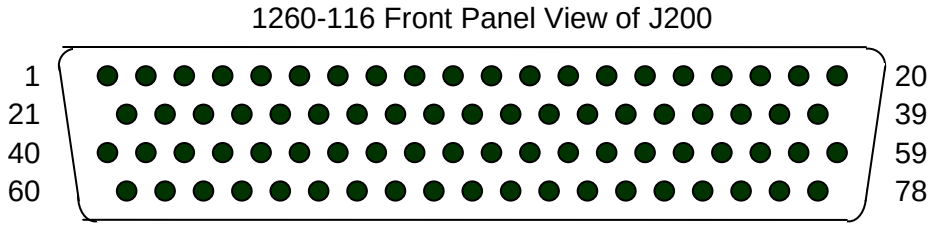

Figure 2-1, 1260-116 Connector Designations

Table 2-1, User I/O Pin Numbers

Relay	Port	J200 Pin C	J200 Pin NC	J200 Pin NO
00	A	25	21	24
01	A	23	22	44
02	A	43	60	06
03	A	42	41	05
04	A	02	03	04
05	A	30	26	29
06	A	28	27	67
07	A	48	45	61
08	B	47	46	10
09	B	07	08	09
10	B	73	72	74
11	B	75	68	71
12	B	70	69	66
13	B	62	63	64
14	B	34	76	33
15	B	32	31	53
16	C	52	49	14
17	C	51	50	13
18	C	65	11	12
19	C	58	35	38
20	C	37	36	77
21	C	57	54	19
22	C	56	55	18
23	C	15	16	17

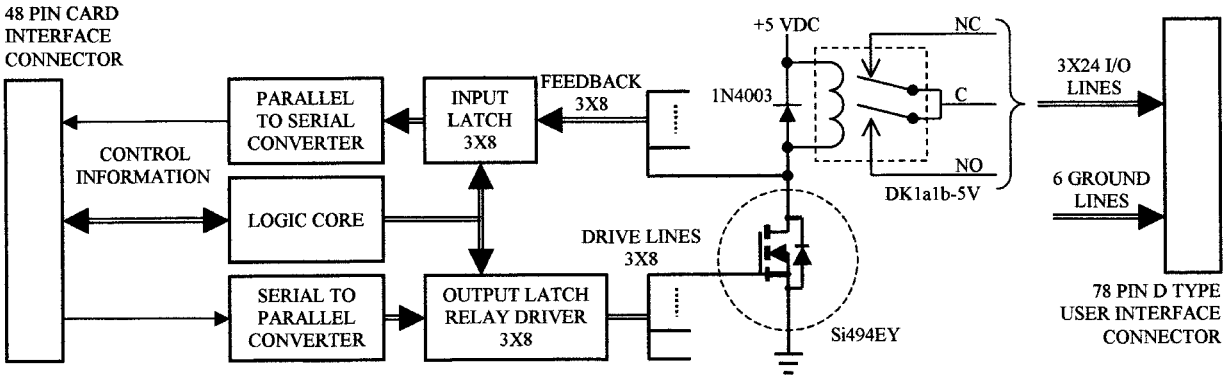

Figure 2-2, 1260-116 Block Diagram

Mating Connectors

Mating connectors are 78 pin High Density 'D' type females. The shipping kit supplied with each 1260-116 module contains the following mating connector items.

Part Number	Description	Qty
M85049/48-1-5	Backshell	1
602461-078	78 Pin Conn., Female	1
602461-900	Contact, Female	78
610846	Lock Screw Assy	2

Chapter 3
MODULE OPERATION

Operating Modes

The 1260-116 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 1260-116 module.

Operating In Message-Based Mode

Channel Descriptors For The 1260-116

The standard 1260-01T commands are used to operate the 1260-116 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 1260-116 module. This is a number is in the range from 1 through 12, inclusive.
- <channel> is the 1260-116 channel to operate. This is a number in the range from 0 through 23, 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 1260-116:

`OPEN (@8(0))`	Open channel 0 on the 1260-116 that has module address 8.
`CLOSE (@8(0,7))`	Close channels 0 and 7 on the 1260-116 that has module address 8.
`CLOSE (@2(7:12))`	Close channels 7 through 12 inclusive on the 1260-116 that has module address 2.

Reply To The MOD:LIST? Command

The chassis containing the 1260-116 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 1260-116 module the string value is:

```
1260-116 24 SPST 5A SWITCHING MODULE
```

Thus, for a 1260-116 whose module address is 2, the reply to this query would be:

```
2 : 1260-116 24 SPST 5A SWITCHING MODULE
```

Operating in Register-Based Mode

The 1260-116 offers register-based mode when installed in VXI platforms that support it. In register-based mode, the 1260-116 is operated by directly writing and reading to/from ports controlling eight 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 1260-116 module. This is a value in the range from 1 and 12 inclusive.

3. The 1260-116 port or control register to be written to or read from. Each register on the 1260-116 has a unique offset from the base address.

The base A24 address for the 1260-116 module may be calculated by:

> (A24 Offset of the 1260-01T) + (1024 x Module Address of 1260-116).

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

A 1260-116 with a module address of 7 would have the base A24 address computed as follows:

> Base A24 Address of 1260-116 = 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 1260-116 reads and writes to the same location. For control registers, the 1260-116 writes to one location, but reads back from another. **Table 3-1 through 3-6** provides offsets relative to the base address of the module for all port and control registers of the 1260-116. To obtain the absolute address where data is to be written or read from, the base address is added to the offset:

> (Base A24 1260-116 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 1260-116 relays. **Table 3-2 through 3-6** provide a detailed explanation of each register and how it interacts with the 1260-116 module.

Table 3-1, Register Offset Addresses of the 1260-116 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
Port C	0x05	0x05
ID	Read Only	0x201
EPROM Descriptor	Read Only	0x203

Table 3-2, ID Register Functionality of the 1260-116 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, Port A Register Functionality of the 1260-116 Module

Register Table		Port A	
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, Port B Register Functionality of the 1260-116 Module

Register Table		Port B	
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, Port C Register Functionality of the 1260-116 Module

Register Table		Port C	
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	(0: relay open 1: relay closed)
	5	Relay 21	(0: relay open 1: relay closed)
	6	Relay 22	(0: relay open 1: relay closed)
	7	Relay 23	(0: relay open 1: relay closed)

Note:

Open: Indicates C connected to NC with NO contact open
Closed: Indicates C connected to NO with NC contact open

Table 3-6, EPROM Descriptor Functionality of the 1260-116 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-Relay carrier for configuration purposes. Additionally, this data contains the card identification string for the specific type of card (i.e. 1260-116). 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 1260-116 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 1260-116 module.

1260-116 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 1260-116 with module address 7, port 1,
and write data of 0xAA */
#define MOD_ADDR_116  7
#define PORT_NUMBER   1
#define DATA_ITEM     0xAA


void example_operate_1260_116(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_116 << 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 */
      }
}
```