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EXM-19
Digital I/O Expansion Reference

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March 1993

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1. Product Description

This manual contains the information required to install and use the EXM-19 digital I/O expansion module.

The EXM-19 is available in three versions:

1. The EXM-19-24, which contains 24 I/O channels

2. The EXM-19-48, which contains 48 I/O channels

3. The EXM-19-OPTO, which has 24 opto-isolated input/output connections.

Within this manual, any section referring generically to the EXM-19 applies to all versions. Those sections specific to each version indicate which version is being addressed.

The EXM-19-24 is compatible with the Keithley Metrabyte PIO-12 and the Computer Boards, Inc. CIO-DIO24 board.

The EXM-19-48 is compatible with the Computer Boards, Inc. CIO-DIO48 board.

The EXM-19-OPTO is identical to the EXM-19-24 but provides optical isolation for all inputs and outputs, using Sharp PC314A opto-isolators.

On the bottom of the front panel of the EXM-19-OPTO are the words "Optoisolated Digital IO." There are several versions of the EXM-19-OPTO, and the exact combination of inputs and outputs depends on build-time options specifically ordered. The configuration of the inputs and outputs is recorded on a sticker with six hex digits, located on the circuit board just behind the front panel. Refer to Appendix A.

The EXM-19 uses one or two 82C55 controller chips.

Specifications

Table 1 defines the environmental and electrical specifications of the EXM-19.

Characteristic		Value
Environmental		
Temperature	operating	0° to 60° C (* see below)
	storage	-40° to 85° C
Humidity	operating	5% - 95% (non-condensing)
	storage	5% - 95% (non-condensing)
Vibration	operating	.015"PP 2.5g (max) 5 to 2000 Hz
	storage	.030"PP 5.0g (max) 5 to 2000 Hz
Shock	operating	30g 11 msec duration
	storage	50g 11 msec duration
Power Consumption (EXM card only)		
24 line	maximum	5V @ 0.64A
	typical	5V @ 0.40A
48 line	maximum	5V @ 1.05A
	typical	5V @ 0.70A
Input and Output Logic Levels (**not** optically isolated - see Table 2 for -OPTO)		
Output	low voltage	0.4V max. @ 2.5mA
	high voltage	3.0V min. @ -2.5mA
Input Logic Low	minimum	-0.5V
	maximum	0.8V
Input Logic High	minimum	2.0V
	maximum	5.0V
Input Load ($0 < V_{in} < 5V$)	minimum	-10µA
	maximum	10µA
Input Current Interrupt Inputs	low	max. -0.4mA
	high	max. 20µA
Maximum current available through the front panel voltage pins		
+5V		2A
+12V (24 line version only)		2A
-12V (24 line version only)		1A

Table 1. EXM-19 Environmental and Electrical Specifications.

* Upper temperature limit degrades 2° C per 1000 ft. elevation. Maximum elevation 10,000 ft.

The EXM-19-OPTO is similar to the EXM-19-24 in most respects. Additional specifications for the EXM-19-OPTO beyond those listed in Table 1 are listed below.

Opto-isolated Input	
LED Forward Voltage	± 1.2V Typical
Series Resistance	470Ω
" On" Current	> ± 1.5mA
"Off" Current	< ± 40µA
Maximum Current	± 40 mA
Opto-isolated Output	
Maximum Opto-isolator Power Dissipation Rating	150mW (calculated as voltage multiplied by the amount of current the transistor has to sink)
"On" Voltage @ 1mA	0.4V maximum
"Off" Current	1.0µA maximum
"Off" Voltage maximum	+35V/-6V

Table 2. EXM-19-OPTO Input and Output Logic Levels.

For more information about the Sharp opto-isolator used in the EXM-19-OPTO, refer to the Sharp Corp. documentation.

1 1

NOTES

2. Installation

2 2

Before installing the EXM-19, unpack and inspect it for shipping damage.

✉ **DO NOT REMOVE THE MODULE FROM ITS ANTI-STATIC BAG UNLESS YOU ARE IN A STATIC-FREE ENVIRONMENT. THE EXM-19, LIKE MOST OTHER ELECTRONIC DEVICES, IS SUSCEPTIBLE TO ESD DAMAGE. ESD DAMAGE IS NOT ALWAYS IMMEDIATELY OBVIOUS; IT CAN CAUSE A PARTIAL BREAKDOWN IN SEMICONDUCTOR DEVICES THAT MIGHT NOT IMMEDIATELY RESULT IN A FAILURE.**

✉ **ENSURE THAT THE INSTALLATION PROCESS AS DESCRIBED HEREIN IS ALSO PERFORMED IN A STATIC-FREE ENVIRONMENT.**

The 48-line EXM-19 provides two 50-pin standard headers (100 mil centers), one on the front panel and one on the component side of the circuit board. The ribbon cable for the second header must be installed **before** inserting the EXM-19-48 into the carrier. The front panel has a cut-out for the ribbon cable for the second header but it is not large enough for the ribbon cable connector. See Figure 1 below.

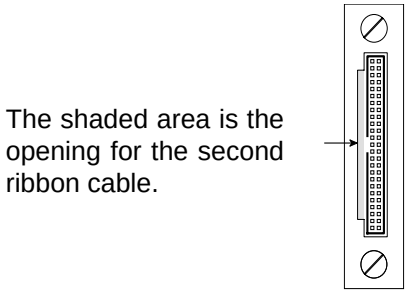


Figure 1. EXM-19-48 Front Panel.

To install this ribbon cable, the front panel must be removed so the ribbon cable connector can be inserted through the front panel opening. Working in an ESD protected area, lay the EXM-19-48 on a flat work surface with the solder side down and the front panel to the right as shown below.

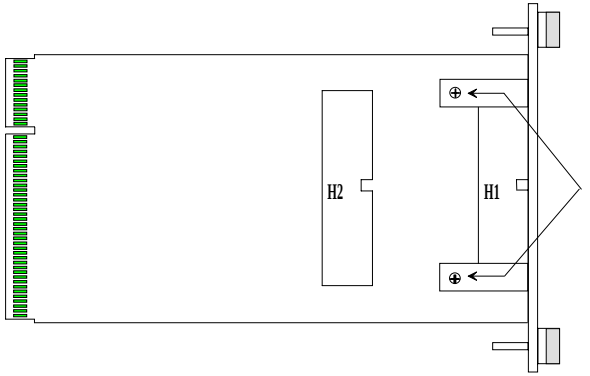


Figure 2. EXM-19-48 Orientation.

Remove the two screws indicated above and slide the front panel to the right away from the circuit board maintaining the same orientation.

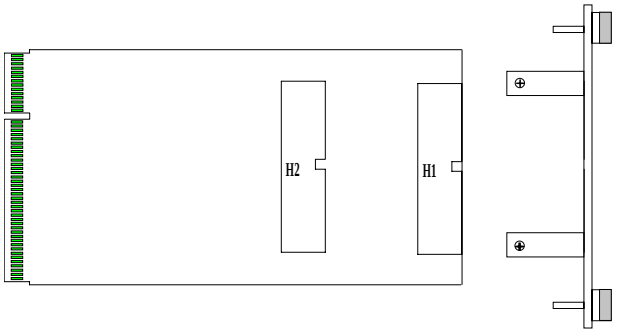


Figure 3. EXM-19-48 Front Panel Removal.

Insert the ribbon cable through the opening in the front panel and connect it to the H2 header shown above. Then slide the front panel back onto the circuit board making sure that the ribbon cable lays flat against the shroud of the H1 connector.

Replace the two screws securing the front panel to the circuit board.

Insertion in an EXM Carrier



Insertion of the EXM-19 into an EXM carrier is straightforward. Remove a blank EXM panel from the carrier (by unscrewing the thumbscrews) and insert the
EXM-19 into the card guides. Firmly press the EXM-19 front panel to ensure that the module is properly seated in the subplane and secure it with the thumbscrews.

- **MAKE SURE THAT POWER TO YOUR SYSTEM IS OFF. THIS EXM IS NOT DESIGNED TO BE INSERTED OR REMOVED FROM A LIVE SYSTEM.**

- **WHEN INSERTING THE EXM, AVOID TOUCHING THE CIRCUIT BOARD, AND MAKE SURE THE ENVIRONMENT IS STATIC-FREE.**

- **INSERT IT WITH ADEQUATE CONTINUOUS FORCE RATHER THAN TAPPING OR HAMMERING ON IT.**

Configuring the BIOS Setup

The EXM configuration data in the EPC to which the EXM-19 is connected needs to be modified to recognize and enable the card and select from the available options. Invoke the BIOS setup function by pressing the CTRL-ALT-ESC keys simultaneously.

Enabling the EXM module

Once in the setup program, a menu will be displayed specifying which function keys are available for further configuration. Press the F2 function key to invoke the EXM menu. The screen display resembles Figure 4 below.

2 2

```
          ID OB1 OB2
Slot 0    FF  00  00
     1    DB  C1  00
     2    F5  05  00
     3    DE  00  39
     4    ED  01  00
     5    DC  F5  91
```

Figure 4. EXM Setup Screen.

The setup screen displays the EXM configuration data (in hexadecimal) stored in nonvolatile memory which the EPC uses at power-up to recognize and configure each installed EXM. The displayed data shows SLOT, ID, OB1 and OB2 for each installed EXM.

Note that all slots are listed on the screen even if the actual system configuration does not have all the possible EXM slots. All slots **not** occupied by an EXM module should show an ID of FF and OB1/OB2 of 00 00 indicating that no EXM is present. A typical value for the EXM-19 is shown in bold letters in slot 5.

Slot, OB1 and OB2 are defined as follows:

SLOT indicates the slot in which the EXM is installed. See the diagram below to determine which EXM slot the EXM-19 occupies. Note that dashed lines indicate EXM slots that may not be available on all systems.

EXM Slots

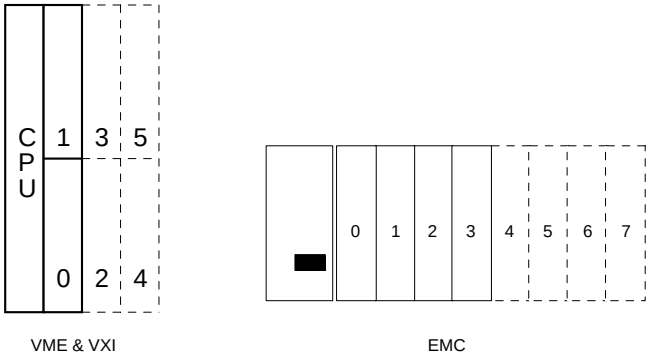


Figure 5. EXM Slot Numbering.



ID is a hard-wired ID value. Each EXM has a unique ID value.

OB1/OB2 are two bytes of option information.

To add or change an EXM configuration, use the cursor keys (arrows) to move between the fields on the screen. Move the cursor to the appropriate slot entry and type in the correct value.

The **ID** for the EXM-19 should be set to **DC**h.

OB1 is a hexadecimal value derived by combining the following:

Unused (bits 7 - 4)	Interrupt Select (bits 3 - 1)	EXM-19 card enable (bit 0)
1111	000 - none 001 - none 010 - IRQ9 (2) 011 - IRQ3 (usually COM2) 100 - IRQ4 (usually COM1) 101 - IRQ5 (usually LPT2) 110 - IRQ6 (usually floppy disk controller) 111 - IRQ7 (usually LPT1)	0 - disabled 1 - enabled

Figure 6. OB1 Register.

For example, a typical OB1 value is F5h (11110101) indicating the card is using IRQ9 and the card is enabled.

OB2 is used by the EXM-19 to set the base address of the 82C55 chip(s). The
EXM-19-24 uses four (4) consecutive I/O addresses and the EXM-19-48 uses eight (8) consecutive I/O addresses. See *Port Addresses*, page 11 for details on port addressing.

The base address must be in the range 100h-3FCh and must be on a 4-byte boundary for the 24-line EXM or on an 8-byte boundry for the 48-line EXM.

The base address is the sum of the bit values for each set bit as shown below.

bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
200h	100h	80h	40h	20h	10h	8h	4h



For example, if OB2 is set to 91h (10010001), the base address is set to the following:

200h + 40h + 4h = 244h.

Make sure that the base address chosen for this EXM-19 does not conflict with any other modules that use a base I/O address (or range).

Some other common address ranges to avoid are:

1F0-1FF	IDE disk controller
278-27F	Parallel port (LPT2)
2E8-2EF	Serial port (COM4)
2F8-2FF	Serial port (COM2)
378-37F	Parallel port (LPT1)
3E8-3EF	Serial port (COM3)
3F0-3F7	Floppy disk controller
3F8-3FF	Serial port (COM1)

3. Operation

3 3

The EXM-19 is available in a 24-line or 48-line version, and an OPTO version.

The 24-line and 48-line versions are implemented using one or two Intel N82C55A chip(s) respectively. Each 8255 provides three ports. Ports A and B are 8-bit ports user-programmable for input or output. Port C can be configured as one 8-bit port or two 4-bit input, output or bi-directional port(s). Port C can also be used for handshaking signals for Ports A and B.

The EXM-19-OPTO is similar to the EXM-19-24, but inputs and outputs are optically isolated. Each port bit is configured at the factory to be either an input or an output, and may not be changed under program control. Refer to Appendix A.

The 8255 chip supports three different modes. In Mode 0 (Basic Input/Output) the ports that are configured for output hold the output data written to them and can be read back. Mode 1 is strobed I/O and Mode 2 is bi-directional strobed I/O.

Port Addresses

The port address for each port on the 8255(s) is calculated as an offset from the base address selected by the OB2 value in the BIOS setup.

EXM-19-24/EXM-19-OPTO			EXM-19-48		
Base	+0	Port A	Base	+0	Port AA
	+1	Port B		+1	Port AB
	+2	Port C		+2	Port AC
	+3	Control Register		+3	A Control Register
				+4	Port BA
				+5	Port BB
				+6	Port BC

				+7	B Control Register

Table 3. Port Addresses.

On the 48-line version, ports AA, AB, and AC are driven by the first 8255 and ports BA, BB, and BC are driven by the second 8255. See the following diagrams for pin locations for each port.

Connectors

The EXM-19-24 contains a single DB-37 male connector that is an AMP 748898-3 connector or equivalent. The mating connector is an AMP 748894-3 female connector or equivalent. The pin-out for this connector is shown below.

Pin	Signal	Pin	Signal
1	INT INPT	20	Fused +5V
2	INT EN	21	GND
3	AB7	22	AC7
4	AB6	23	AC6
5	AB5	24	AC5
6	AB4	25	AC4
7	AB3	26	AC3
8	AB2	27	AC2
9	AB1	28	AC1
10	AB0	29	AC0
11	GND	30	AA7
12	Not used	31	AA6
13	GND	32	AA5
14	Fused -12V	33	AA4
15	GND	34	AA3
16	Fused +12V	35	AA2
17	GND	36	AA1
18	Fused +5V	37	AA0
19	GND		

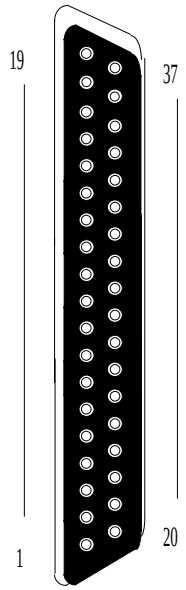
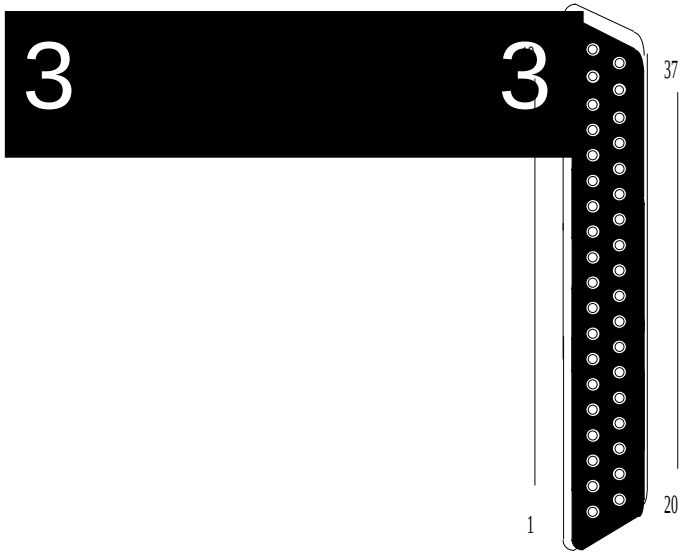


Table 4. EXM-19-24 DB-37 Pin-out.



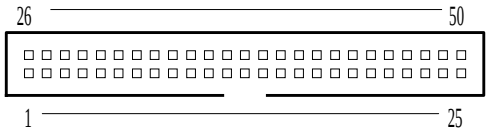
The pin-out for the EXM-19-OPTO is slightly different. Refer to the table below.



Pin	Signal	Pin	Signal
1	INT IN B	20	INT IN A
2	INT EN B	21	INT EN A
3	AB7	22	AC7
4	AB6	23	AC6
5	AB5	24	AC5
6	AB4	25	AC4
7	AB3	26	AC3
8	AB2	27	AC2
9	AB1	28	AC1
10	AB0	29	AC0
11	C COM	30	AA7
12	Not used	31	AA6
13	B COM	32	AA5
14	Not used	33	AA4
15	A COM	34	AA3
16	Not used	35	AA2
17	GND	36	AA1
18	Fused +5V	37	AA0
19	GND		

Table 5. EXM-19-OPTO DB-37 Pin-out.

The EXM-19-48 contains two standard 50-pin (25 x 2, 100 mil centers) male connectors labeled H1 and H2. Both of these connectors are 3M 2550-5002-UB or equivalent. The mating connector is a 3M 3425-7000 female connector or equivalent. The pin-outs for these connectors are shown below.



H1			
Pin	Signal	Pin	Signal
1	AA7	26	GND
2	AA6	27	GND
3	AA5	28	GND
4	AA4	29	GND
5	AA3	30	GND
6	AA2	31	GND
7	AA1	32	GND
8	AA0	33	GND
9	AC7	34	GND
10	AC6	35	GND
11	AC5	36	GND
12	AC4	37	GND
13	AC3	38	GND
14	AC2	39	GND
15	AC1	40	GND
16	AC0	41	GND
17	AB7	42	GND
18	AB6	43	GND
19	AB5	44	GND
20	AB4	45	GND
21	AB3	46	GND
22	AB2	47	GND
23	AB1	48	GND
24	AB0	49	GND
25	Fused +5V	50	GND

Table 6. H1/H2 Connector Pin-outs.

3 3

H2			
Pin	Signal	Pin	Signal
1	BA7	26	GND
2	BA6	27	GND
3	BA5	28	GND
4	BA4	29	GND
5	BA3	30	GND
6	BA2	31	GND
7	BA1	32	GND
8	BA0	33	GND
9	BC7	34	GND
10	BC6	35	GND
11	BC5	36	GND
12	BC4	37	GND
13	BC3	38	GND
14	BC2	39	GND
15	BC1	40	GND
16	BC0	41	GND
17	BB7	42	GND
18	BB6	43	GND
19	BB5	44	GND
20	BB4	45	GND
21	BB3	46	GND
22	BB2	47	GND
23	BB1	48	GND
24	BB0	49	GND
25	Fused +5V	50	GND

Opto-Isolators

In Figures 7, 8, and 9, schematic drawings depict the workings of the opto-isolators used in the EXM-19-OPTO.

Figure 7 is a schematic of what an input looks like. ACOM is the common for the port, and AA0 to AA7 are input pins on the DB-37. This schematic assumes the
A port is set to input.

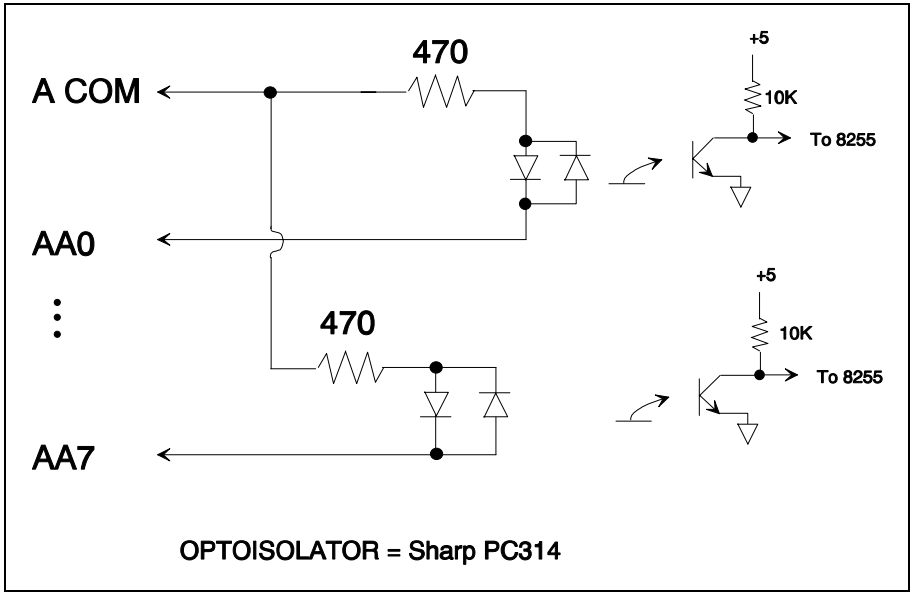


Figure 7. Typical OPTO input.

Figure 8 assumes the A port is set to outputs.

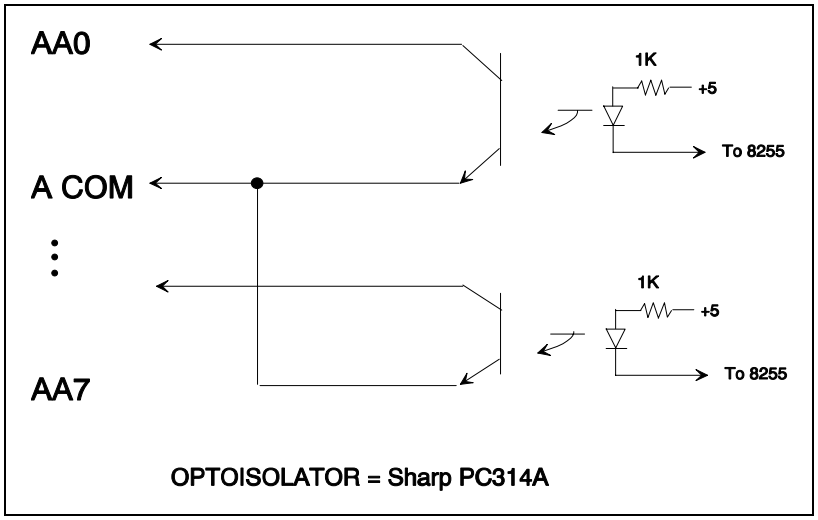


Figure 8. Typical OPTO Output.

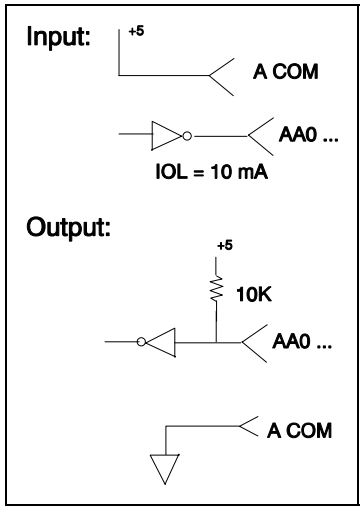


Figure 9. Opto-Isolated Interface to TTL.

Figure 9 shows how to interface an input or an output to TTL logic.

Programming the 8255

When the EXM-19 is reset (power-up or EPC front-panel reset), the 8255 is reset with all lines set for basic input. If this is the desired configuration, no other programming is necessary. The port configuration will remain the same until a write to the control register changes it. If a different mode or port configuration is required, the initialization section of the application code should set the port configuration.

The 8255 provides ports A, B, and C. Ports A and B are 8-bit ports and port C is 2 4-bit ports; Port C upper (bits 4-7) and Port C lower (bits 0-3). Both halves of Port C can be used together in basic I/O mode to act as a single 8-bit port. Care should be taken when splitting Port C as every read and write to Port C carries 8 bits of data so unwanted information must be ANDed out of reads, and writes must be ORed with the current status of the other half of the port.

It is a characteristic of the 8255 that all ports are cleared by a write to the control register. Consequently, if the application program repeatedly changes the port configuration, make provisions for restoring any data to the cleared ports.

The 8255 supports three different modes of operation.

Mode 0 - Basic I/O

- Two 8-bit ports and two 4-bit ports (can be used as three 8-bit ports)
- Any port can be input or output
- Outputs are latched
- Inputs are not latched

Mode 1 - Strobed I/O; part of Port C controls data transfer

- Ports are configured in two groups - Group A and Group B
- Each group contains one 8-bit data port and one 4-bit control/status port
- The 8-bit data port can be either input or output. Both inputs and outputs are latched
- The 4-bit port is used for control and status of the 8-bit port
- Interrupts supported for output only

Mode 2 - Bi-directional I/O; part of Port C controls data transfer

- Only supported for Group A
- One 8-bit, bi-directional bus port (Port A) and a 5-bit control port (Port C)
- Both inputs and outputs are latched
- The 5-bit control port (Port C) is used for control and status for the 8-bit, bi-directional bus port (Port A)
- 8-bit Port B and 3 bits of Port C can simultaneously be used as basic I/O
- Interrupts supported for output only

Mode 0 (basic I/O) is the most commonly used mode. Listed below are simple instructions for the use of Mode 0. To use Mode 1 or Mode 2, consult the Intel data book for the 8255.

Setting Mode 0 for each port requires a simple write to the control register (base address + 3). The tables below show the bit definitions for the mode control word.

bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0

	bit 7	Mode Set Flag	1
Group A	bits 6 & 5	Mode Select (Group A)	00 = Mode 0
	bit 4	Port A	1 = input 0=output
	bit 3	Port C Upper (bits 4-7)	1 = input 0=output
Group B	bit 2	Mode Select (Group B)	0 = Mode 0
	bit 1	Port B	1 = input 0=output
	bit 0	Port C Lower (bits 0-3)	1 = input 0=output

Table 7. Mode Settings.

Note that setting the mode for Group A sets the mode for both Port A and Port C Upper; setting the mode for Group B sets the mode for both Port B and Port C Lower.

On the EXM-19-OPTO, certain pins are dedicated as inputs and certain pins are dedicated as outputs at the factory, according to customer specifications. Note that in order to use the inputs and outputs correctly, your software must programm the 8255 to match the correct input/output configuration of the opto-isolators.

3 3

Using Interrupts

The internal interrupt capabilities of the 8255 are not connected to the interrupt controller chip. Thus, generating EXM-19 interrupts requires an external approach.

EXM-19-24

The EXM-19-24 has two front panel connections that provide interrupt capability: INT EN and INT INPT. INT EN is an interrupt enable signal and is active low. INT INPT is the actual interrupt input signal which can be connected to either an external interrupt source or to one of the output pins (from Port C) when using Mode 1 or Mode 2. The interrupt is signalled on the rising edge on INT INPT.

EXM-19-48

The EXM-19-48 does not provide interrupt capabilities.

EXM-19-OPTO

The EXM-19-OPTO provides two pairs of differential input signals for interrupts; INT EN A & INT EN B and INT INPT A & INT INPT B. Interrupts are enabled when there is a voltage potential across the INT EN signal pair. INT INPT A and INT INPT B are the differential pair used to actually signal the interrupt to the CPU. INT INPT A and INT INPT B should have a voltage potential across the pair most of the time and the interrupt will be signalled when the potential is removed.

Fuses

The EXM-19 provides +5V power to front panel pins for external use. In addition, the EXM-19-24 also supplies +12V and -12V to front panel pins. Each voltage is provided through a 2A fuse. Note that the -12V is specified to only provide 1A of current. Although this may seem like a discrepancy, the 2A fuse is provided for safety reasons while the 1A specification is due to a potential long-term reliability problem if the -12V provides more than 1A at high temperatures over an extended period. All the fuses used on the EXM-19 are Schurter P/N OMF 2A fuses. The fuse sockets are located on the component side of the board. Fuse locations are shown in the figures below.

Note that the EXM-19-48 and the EXM-19-OPTO do not have fuse sockets for +12V and -12V.

3 3

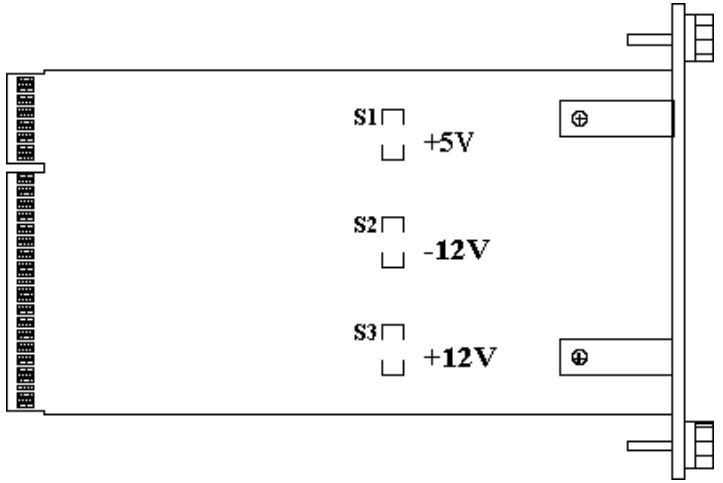


Figure 10. EXM-19-24 Fuse Locations.

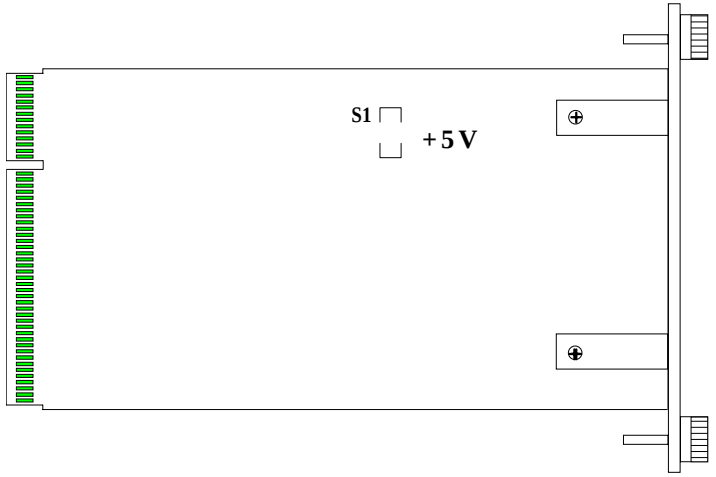


Figure 11. EXM-19-48 Fuse Location.

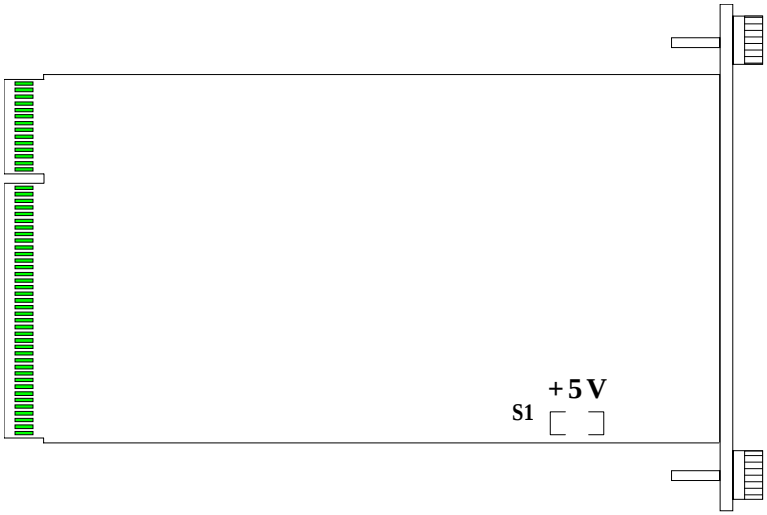


Figure 12. EXM-19-OPTO Fuse Location.

NOTES

3 3

4. Support and Service

In North America

Technical Support

RadiSys maintains a technical support phone line at (503) 646-1800 that is staffed weekdays (except holidays) between 8 AM and 5 PM Pacific time. If you have a problem outside these hours, you can leave a message on voice-mail using the same phone number. You can also request help via electronic mail or by FAX addressed to RadiSys Technical Support. The RadiSys FAX number is (503) 646-1850. The RadiSys E-mail address on Internet is support@radisys.com. If you are sending E-mail or a FAX, please include information on both the hardware and software being used and a detailed description of the problem, specifically how the problem can be reproduced. We will respond by E-mail, phone or FAX by the next business day.



Technical Support Services are designed for customers who have purchased their products from RadiSys or a sales representative. If your RadiSys product is part of a piece of OEM equipment, or was integrated by someone else as part of a system, support will be better provided by the OEM or system vendor that did the integration and understands the final product and environment.

Bulletin Board

RadiSys operates an electronic bulletin board (BBS) 24 hours per day to provide access to the latest drivers, software updates and other information. The bulletin

board is not monitored regularly, so if you need a fast response please use the telephone or FAX numbers listed above.

The BBS operates at up to 14400 baud. Connect using standard settings of eight data bits, no parity, and one stop bit (8, N, 1). The telephone number is (503) 646-8290.

Repair Services

Factory Repair Service is provided for all RadiSys products. Standard service for all RadiSys products covers factory repair with customers paying shipping to the factory and RadiSys paying for return shipment. Overnight return shipment is available at customer expense. Normal turn-around time for repair and re-certification is five working days.

Quick Exchange services (immediate shipment of a loaner unit while the failed product is being repaired) or other extra-cost services can be arranged, but need to be negotiated in advance to allow RadiSys to pool the correct product configurations. RadiSys does not maintain a general "loaner" pool: units are available only for customers that have negotiated this service in advance.

RadiSys does not provide a fixed-price "swap-out" repair service, as customers have indicated that issues of serial number tracking and version control make it more convenient to receive their original products back after repair.



Warranty Repairs

Products under warranty (see warranty information in the front of this manual) will have manufacturing defects repaired at no charge. Products sent in for warranty repair that have no faults will be subject to a recertification charge. Extended Warranties are available and can be purchased at a standard price for any product still under warranty. RadiSys will gladly quote prices for Extended Warranties on products whose warranties have lapsed; contact the factory if this applies.

Customer induced damage (resulting from misuse, abuse, or exceeding the product specifications) is not covered by the standard product warranty.

Non-Warranty Services

There are several classes of non-warranty service. These include repair of customer induced problems, repairs of failures for products outside the warranty period,

recertification (functional testing) of a product either in or out of warranty, and procurement of spare parts.



All non-warranty repairs are subject to service charges. RadiSys has determined that pricing repairs based on time and materials is more cost-effective for the customer than a flat-rate repair charge. When product is received, it will be analyzed and, if appropriate, a cost estimate will be communicated to the customer for authorization. After the customer authorizes the repair and billing arrangements have been made, the product will be repaired and returned to the customer.

A recertification service is provided for products either in or out of warranty. This service will verify correct operation of a product by inspection and testing of the product with standard manufacturing tests. There is a product-dependent charge for recertification.

There are only a few components that are generally considered field-repairable, but, because RadiSys understands that some customers want or need the option of repairing their own equipment, all components are available in a spares program. There is a minimum billing charge associated with this program.

Arranging Service

To schedule service for a product, please call RadiSys Technical Support directly at (503) 646-1800. Have the product model and serial numbers available, along with a description of the problem. A Technical Support representative will issue a Returned Materials Authorization (RMA) number, a code number by which we track the product while it is being processed. Once you have received the RMA number, follow the instructions of the Technical Support representative and return the product to us, freight prepaid, with the RMA number clearly marked on the exterior of the package. If possible re-use the original shipping containers and packaging. In any case, be sure you follow good ESD-control practices when handling the product, and ensure

that anti-static bags and packing materials with adequate padding and shock-absorbing properties are used.

Ship the product, freight prepaid, to the following address:

Product Service Center
RadiSys Corporation
15025 SW Koll Parkway
Beaverton, Oregon 97006-6902



When shipping the product, include the following information: return address, contact names and phone numbers in purchasing and engineering, and a description of the suspected problem. Any ancillary information that might be helpful with the debugging process will be appreciated.

Other Countries

Contact the sales organization from which you purchased your RadiSys product for service and support.



Appendix A: EXM-19-OPTO Hex Sticker

The directional opto-isolators on the EXM-19-OPTO are installed at the factory according to specific customer requirements. To identify the configuration, locate the identification sticker placed on the circuit board behind the front panel. Refer to the figure below.

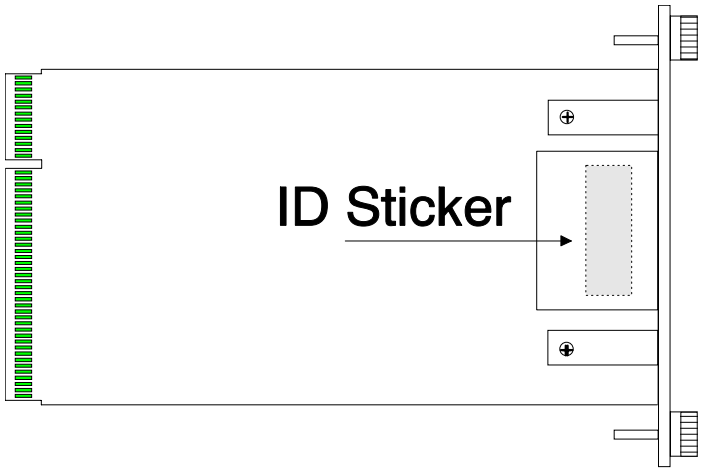


Figure 13. EXM-19-OPTO Identification Sticker.

The ID sticker on the printed circuit board of the EXM-19-OPTO refers to the hexadecimal notation that identifies the opto-isolated inputs and outputs.

There are three channels available: A, B, and C. Each channel has four inputs or outputs mapped to a bit in the ID.

Bit	6	5	4	3	2	1
Channels	C7-C4	C3-C0	B7-B4	B3-B0	A7-A4	A3-A0

For example, an EXM-19-FF00FF would be manufactured with the following setup:

FF00FF= 111111110000000011111111

A bit with a 1 is an opto-isolated output. A bit with a 0 is an opto-isolated input. Thus in this example, the board has sixteen outputs - eight on the C channel and eight on the A channel. The B channel is eight inputs.

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