

EX-16 EX-32 RELAY EXPANSION CARD

(for use with the AR-8X, AR-16, ADC-4, ADC-8, ADC-16, STA-8 & STA-16)

TECHNICAL REFERENCE

Click to see photo: www.eeci.com/ex-16p.htm

PHONE..... (937) 349-6000
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SPECIFICATIONS

Power Supply.....	5 volts DC, 200ma (powered thru ribbon cable)
Output Channels.....	16
Expansion Capability.....	up to 112 relays (using up to (7) EX-16 or up to (3) EX-32 expansion cards)
Weight.....	4 ounces
Size.....	7 inches by 5 inches
Options Available.....	Opto-isolators, locking headers

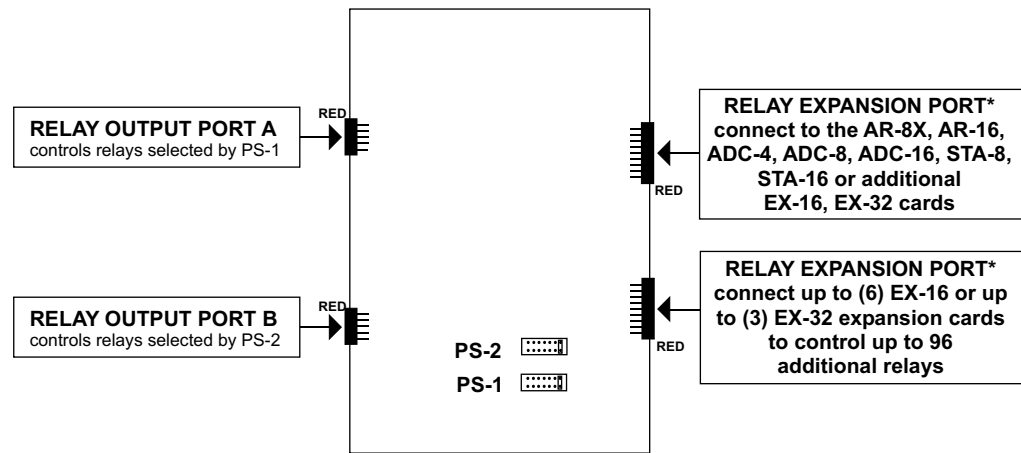
TECHNICAL SUPPORT

Technical support for our products is available by calling (937) 349-6000. If a technical adviser is not available, please leave your name, phone number and a time that you can be reached. Your call will be returned as soon as possible and within 24 hours. Before contacting technical support be sure that you have your PC and interface hardware powered up with a telephone at hand. The interfacing hardware (ADC-16, EX-32, etc.) should not be inside an enclosure and should be immediately accessible. A multimeter should be available for checking voltage levels and the test software provided with your hardware should be ready to run.

WARRANTY AND CARE OF THE EX-16

The EX-16 Relay Interface is warranted against factory defects for a period of 90 days from the date of purchase. The EX-16 has proven to be extremely reliable in actual operation during field tests. We recommend that the EX-16 and associated hardware be installed in a suitable enclosure (4 mounting holes are provided on the circuit board) and that reasonable precautions be taken to protect the circuit from static discharge. The most likely damage to occur is that caused by lightning discharge through the power supply or relay output lines. The best way to prevent this type of damage is to install a Power Protector (Radio Shack #26-1395 or Surgebuster #120K15A) in the electrical outlet which supplies power to the hardware. Shielding the relay output lines or installing opto-isolators on the EX-16 will further reduce the possibility of damage caused by lightning. If further protection is desired, install a TransZorb across the power input to the interface card (part #SP-12K).

CONNECTION DIAGRAM
EX - 16 RELAY
EXPANSION CARD



*All contacts on both relay expansion ports are pin equivalent and may be connected to either the AR-16, ADC-16, STA-16 or additional EX-16 or EX-32 cards.

Connection of the ST-32 or AD-16 expansion cards with the EX-16, will require the use of an extended length RC-20 ribbon cable. Use the RC-20/4" to connect the first EX-16, when one AD-16 or ST-32 expansion card is connected. Add one inch to the RC-20 for each additional card.

POWER SUPPLY REQUIREMENTS

The EX-16 or EX-32 may be powered from the interface card (AR-16, ADC-16, STA-16 etc.) if no more than two EX-16 or EX-32 cards are connected. Use the PS-GP-1 for one EX-16 card or the PS-9VDC-1000 for three EX-16 cards (connect to the AR-16, ADC-16 or STA-16 terminal block). The power feed will be provided through the ribbon cable with no additional connections required. You may verify power to the EX-16 by testing for 5 volts on the 2200 mf capacitor on the EX-16.

CONNECTION OF 3 TO 5 EX-16, EX-32 CARDS: When 3 EX-32 cards are connected to an interface card, power should be supplied to the #3 EX-32 card to avoid overloading the ribbon cable. To supply the power feed, install a molex connector on the EX-32 card and connect to the molex connector on the interface card with a short cable. Use caution when connecting to the molex connectors (connect the (+) to the (+) and the (-) to the (-)).

If the regulator on the interface card becomes too hot to touch, a larger heat sink should be installed on the regulator.

SET-UP AND TESTING

Upon receiving your EX-16, you should connect and test the operation of the hardware to verify proper operation. Please set-up and test the EX-16 as follows (IBM and Compatibles):

- (1) Plug the serial cable into COM 1 of your computer and connect the other end to the terminal block on the AR-16, ADC-16 or STA-16 (as shown in it's reference manual).
- (2) Connect the EX-16 or EX-32 to the AR-16, ADC-16 or STA-16 using the RC-20 ribbon cable (see diagram page 7 and 14). Power will be supplied to the EX-16 thru the RC-20 ribbon cable. Connect the relay card(s) to the EX-16 and supply power directly to the relay card terminal block (power will not be supplied through the ribbon cable). When connecting the ribbon cable from the relay card to the EX-16, the notch on the ribbon cable connector should point up. Use caution not to set the EX-16 or relay cards on a metal surface or damage could result.
- (3) Set your AR-8X, AR-16, ADC-4/8/16 or STA-8/16 to 9,600 baud (this is the proper setting for use with the test software which is provided on CD with your order). Use the test software provided for the AR-8X, AR-16, ADC-4/8/16 or STA-8/16 for testing. The relays should sequence on starting with relay #17 at about 1 second intervals. After all 16 relays have energized, the relays will de-energize and sequence on in reverse order starting with relay #32. After all the relays have energized, the relays will de-energize and the process will repeat. Verify that each relay energizes one at a time and in the correct sequence (the relay # should correspond with the relay # shown on the screen).
- (4) If operation of the relays is normal, than testing is now complete and the EX-16 may be placed in service. If the relays do not energize or operation of the relays is erratic, proceed to the next section.

TROUBLE-SHOOTING THE EX-16

- (1) Verify power to the EX-16 by checking for 5 volts DC on the 2200 mf capacitor. Low voltage could indicate a short circuit somewhere or a power supply that is too small. Verify power to the relay card by checking for 12 volts DC at the power input terminals on the relay card (see page 11). Check the serial cable connection to your AR-8X/16, ADC-4/8/16 or STA-8/16 by pulling each conductor at the terminal block and check continuity for the correct pin connections to your RS-232 port. Verify that the interface card is set to the same baud rate as what appears on the test software screen and verify that the port selection shunts are in the correct positions (see page 4). Restart your computer in MS DOS mode before running the DOS test program to eliminate the possibility that Windows may have rerouted or disabled your COM 1 port.

- (2) Verify proper operation of the COM 1 serial port (RS-232 port) on your computer. You may do this by connecting another computer or serial printer to COM 1 and using a short Basic program (shown below) to send an ASCII code to your printer or computer. The following example should print a "0" on your printer. The protocol is set for a printer using 1200 baud, no parity, 8 data bits and 2 stop bits. The ASCII code for "0" is 48.

```
10 OPEN "COM1:1200,N,8,2,DS,CD,CS" AS #1
20 PRINT #1, CHR$(48);
```

- If your serial port is not transmitting the ASCII code, check to make sure that you have the cable connected to COM 1 and check the dip switch settings on your RS-232 serial card. If you are still unable to transmit the ASCII code from COM 1, check for possible software conflicts or failure of your RS-232 card. Some programs may disable your serial port (terminate and stay resident programs such as fax drivers).

- (3) If erratic operation of the relays is experienced, check for loose or dirty connections at the ribbon cable. Check for power supply interruptions or short circuits caused by metal contact to the EX-16 or relay card circuit areas. When more than three EX-16 cards are connected to the AR-8X/16, ADC-4/8/16 or STA-8/16, an external power feed and larger power supply is required (see page 2). If after checking thoroughly you are still unable to correct the problem, contact us at (937) 349-6000 for technical support.

PORT SELECTION SHUNTS FOR THE EX-16

SHUNT BANKS	RELAYS CONTROLLED	PORT #	RELAY CARD
PS1	17 THRU 24	3	A
PS2	25 THRU 32	4	B
PS1	33 THRU 40	5	A
PS2	41 THRU 48	6	B
PS1	49 THRU 56	7	A
PS2	57 THRU 64	8	B
PS1	65 THRU 72	9	A
PS2	73 THRU 80	10	B
PS1	81 THRU 88	11	A
PS2	89 THRU 96	12	B
PS1	97 THRU 104	13	A
PS2	105 THRU 112	14	B
PS1	113 THRU 120	15	A
PS2	121 THRU 128	16	B

To select the relay control port, place the shunts as shown to the left. The relay ports should be to your right with the expansion ports on your left.

The example shown on page 2 has Port # 3 selected for PS1 and Port # 4 selected for PS2.

No more than 1 shunt per bank should be on. Ports #1 & #2 are located on the AR-16 and are not used with the ADC or STA cards. The first relay for use with the EX-16 is relay #17.

NOTE: Relay ports #3 and 4 must be on the first EX-16 card which connects directly to the AR-8X,16, ADC-4,8,16 or STA-8,16.

USING OPTO-ISOLATORS TO ISOLATE RELAY CONTROL LINES

Opto-isolators (or opto-couplers) are generally used to protect the EX-16 (or possibly the RS-232 port) from damage which could be caused by noise or voltages which may feed back to the EX-16. The IC's which provide the relay output signal are of the CMOS variety and are sensitive to static discharge, high noise levels and voltage spikes. Shown below are applications which require the use of opto-isolators:

- (1) Applications where the relay card(s) are located more than 3 feet from the EX-16.
- (2) When TRIACS or SCR's are used in place of relays. (triacs are generally used for lighting applications or lighting control systems).
- (3) Applications which require a common collector output (positive ground). Opto-isolators are configured for common collector unless specified otherwise. Contact us for information on common emitter (negative ground) configurations.
- (4) Applications which require an isolated power supply for the control of relays or devices.
- (5) Applications in which the relay card(s) or output devices are installed in an environment which could generate strong RF, EMI, electrostatic or other types of interference.
- (6) When the device(s) to be connected directly to the EX-16 are capable of generating a significant induced EMF caused by coil inductance or other means.

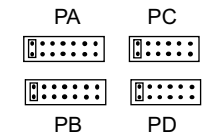
PORT SELECTION SHUNTS FOR THE EX-32

SHUNT BANKS	RELAYS CONTROLLED	PORT #	RELAY CARD
PA	17 THRU 24	3	A
PB	25 THRU 32	4	B
PA	33 THRU 40	5	A
PB	41 THRU 48	6	B
PA	49 THRU 56	7	A
PB	57 THRU 64	8	B
PA	65 THRU 72	9	A
PB	73 THRU 80	10	B
PA	81 THRU 88	11	A
PB	89 THRU 96	12	B
PA	97 THRU 104	13	A
PB	105 THRU 112	14	B
PA	113 THRU 120	15	A
PB	121 THRU 128	16	B

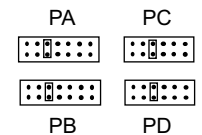
To select the relay control port, place the shunts as shown to the left.

No more than 1 shunt per bank should be on. Ports #1 & #2 are located on the AR-16 and are not used with the ADC or STA cards. The first relay for use with the EX-16 is relay #17.

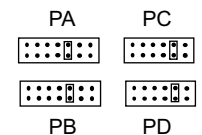
DEFAULT SETTINGS
(selects relays 17 thru 48)



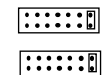
2ND EX-32
(selects relays 49 thru 80)



3RD EX-32
(selects relays 81 thru 112)



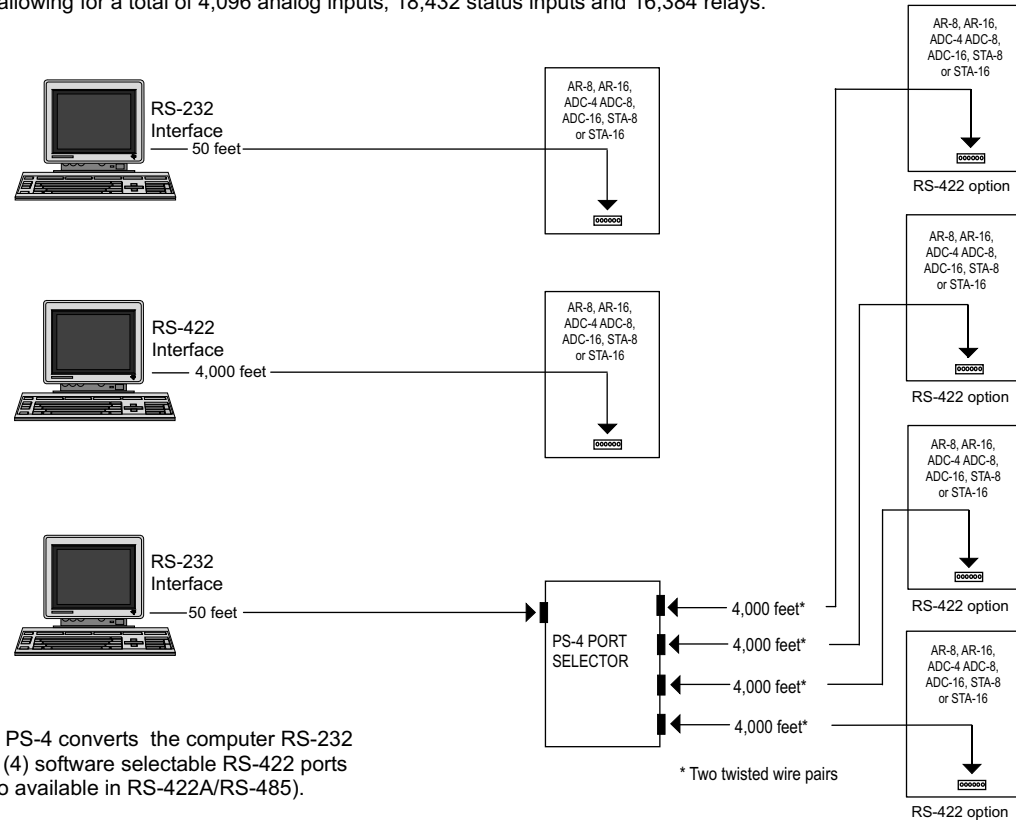
EX-16
(selects relays 113 thru 128)



SHUNT BANKS	RELAYS CONTROLLED	PORT #	RELAY CARD
PC	33 THRU 40	5	C
PD	41 THRU 48	6	D
PC	49 THRU 56	7	C
PD	57 THRU 64	8	D
PC	65 THRU 72	9	C
PD	73 THRU 80	10	D
PC	81 THRU 88	11	C
PD	89 THRU 96	12	D
PC	97 THRU 104	13	C
PD	105 THRU 112	14	D
PC	113 THRU 120	15	C
PD	121 THRU 128	16	D

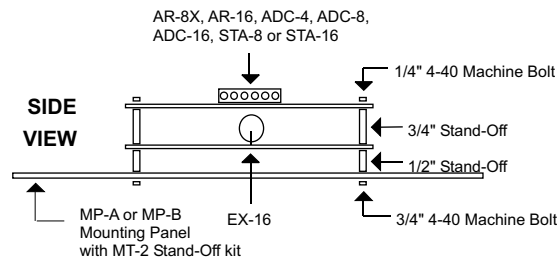
RS-422 INTERFACING AND RS-232 DISTANCE LIMITATIONS

The RS-232 interface will allow the AR-16, ADC-16 or STA-16 interface cards to be located up to 50 feet from the computer using a single 2 or 3 conductor wire. When distances need to be greater, the RS-422/RS-423 and the RS-422A/RS-485 interfaces will allow the Interface card to be located up to 4,000 feet from the computer using a 1 or 2 paired communications cable (2 or 4 conductor/1 or 2 twisted pairs of wire). The PS-4 or PS-8 port selector may be used to select one port (1 of 4 or 1 of 8) to control up to 8 interface cards (ADC-16, STA-16 or AR-16) at various locations up to 4,000 feet from the port selector, providing up to 256 analog inputs, up to 1,152 status inputs and providing control of up to 1,024 relays. A total of up to (16) PS-8 port selectors may be connected to a single RS-232 port, allowing for a total of 4,096 analog inputs, 18,432 status inputs and 16,384 relays.



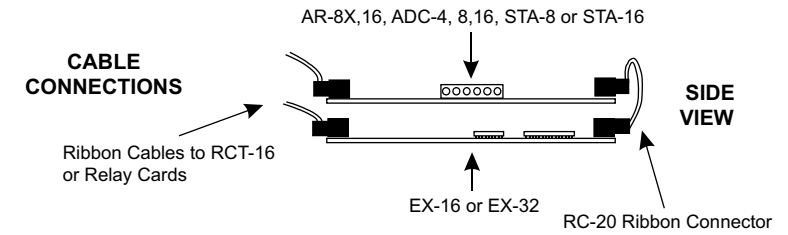
The PS-4 converts the computer RS-232 into (4) software selectable RS-422 ports (also available in RS-422A/RS-485).

TYPICAL MOUNTING CONFIGURATION (using the MP-A or MP-B Mounting Panel)



RACK MOUNTING

The EX-16 may be rack mounted with any of the 5" by 7" cards in the CH series card holder racks. The CH-2 will hold up to (2) of the 5" by 7" cards, the CH-4 will hold up to (4) of the 5" by 7" cards and the CH-8 will hold up to (8) of the 5" by 7" cards. The interface card (AR-16, ADC-16 or STA-16) should be installed in the top slot of the card holder rack. The expansion cards (EX-16, EX-32, ST-32 or AD-16) should be installed in the slots below the interface card. All ribbon connectors should be plugged in with the keyed notch pointing up. The use of an extended length RC-20 ribbon cable will be necessary when the AD-16 or ST-32 expansion cards are used with the EX-16 expansion cards (add one inch for each AD-16 or ST-32 card).



CONTROL SOFTWARE

Development of control software is a relatively simple task. To energize or de-energize a relay, a code (0 thru 255) is transmitted from the RS-232 port.

NOTE: The first relay controlled by the EX-16 will be relay #17. Relays #1 thru #16 are controlled by the AR-16.

ODD CODES WILL ENERGIZE RELAYS EVEN CODES WILL DE-ENERGIZE RELAYS

RELAY CODE	FUNCTION	RELAY CODE	FUNCTION
32	De-energize relay #17	40	De-energize relay #21
33	energize relay #17	41	energize relay #21
34	De-energize relay #18	42	De-energize relay #22
35	energize relay #18	43	energize relay #22
36	De-energize relay #19	44	De-energize relay #23
37	energize relay #19	45	energize relay #23
38	De-energize relay #20	46	De-energize relay #24
39	energize relay #20	47	energize relay #24

RELAY CODE = (RELAY # times 2) - 1 ...To energize relay

RELAY CODE = (RELAY # times 2) - 2 ...To de-energize relay

The above formula is used to control additional relays up to relay #128 (including those in the chart). Transmitting a (255) will energize relay #128. EXAMPLE: 255 = (128 x 2) - 1 Use this formula in your software to compute relay code as a function of relay number and status.

The following pages will provide software examples in GW BASIC, QUICKBASIC, VISUAL BASIC, TURBO C and TURBO ASSEMBLY. All program examples are provided on the enclosed disk. The programs are intended to demonstrate the fundamentals needed for development of your own software. The program examples may be copied to your program and used as a subroutine if desired. Each of the programs will de-energize all 16 relays and then will energize each relay one at a time and in sequence, waiting for a key on the keyboard to be pressed before continuing.

PROGRAMING EXAMPLE IN C

PROGRAMING EXAMPLE IN ASSEMBLY

PROGRAMING EXAMPLES IN BASIC

NOTE 8: Do not include the upper case remarks in your C program.

```
#include <conio.h>
#include <dos.h>
#include <stdio.h>

transmit(a)      TRANSMIT RELAY CODE
{
int status, s;
do
{
status=inportb(0x3FD);
s=status & 32;
}
while (s==0);
outportb(0x3F8,a);
shown)
}

reset()         DE-ENERGIZE RELAYS
{
int a;
for (a=32; a<=62; a=a+2)
{
transmit(a);
}
}

main()
{
int a,b;
outportb(0x3FB,128);  BAUD RATE LATCH ON
outportb(0x3F8,12);  STORE BAUD 9,600, LSB
outportb(0x3F9,0);   STORE BAUD 9,600, MSB
outportb(0x3FB,3);   BAUD RATE LATCH OFF
while (1)
{
clrscr();
printf("PRESS KEY\n");
reset();
for (a=33; a<=63; a=a+2)
{
getch();
printf("RELAY #%2d: \n",(a+1)/2);
transmit(a);
}
}
}
```

```
To view the assembly listing,
insert the test disk and enter:
TYPE EX-16.ASM

To line print the listing, enter:
PRINT EX-16.ASM

NOTE: PRINT is an external DOS command.

*Listed below are the I/O ports for COM 1 thru COM 4
for IBM compatibles (see page 14 for baud rates)

COM 1  COM 2  COM 3  COM 4  (hex values)
3F8    2F8    3E8    2E8    Transmitter
3F8    2F8    3E8    2E8    Baud Latch LSB
3F9    2F9    3E9    2E9    Baud Latch MSB
3FB    2FB    3EB    2EB    Line Control
```

LINE CONTROL

(Bit 0)	(Bit 1)	Word Length
0	0	5 data bits
1	0	6 data bits
0	1	7 data bits
1	1	8 data bits

(Bit 2) 0 = 1 stop bit
1 = 2 stop bits

(Bit 3) 0 = no parity
1 = parity enabled

(Bit 4) 0 = even parity
1 = odd parity

(Bit 5) 0 = logical 1
1 = logical 0

(Bit 6) 1 = break command

(Bit 7) 0 = baud latch off
1 = baud latch on

The **VISUAL BASIC** programming example may be viewed from the VB directory on the disk provided.

Before using the following programs, please read the Control Software section on page 7 to provide a general understanding of the relay control codes. To transmit the relay code from GW Basic, QuickBasic and other types of basic use the following command: PRINT #1,CHR\$(X); (where X = relay code, see chart on page 7)

```
EXAMPLE: PRINT #1,CHR$(32); Will de-energize relay #17
PRINT #1,CHR$(255); Will energize relay #128
```

Be sure to include the semicolon (;) at the end of the command to suppress the carriage return and line feed. GW Basic or QuickBasic will require an OPEN COM statement to configure the RS-232 port (see software example below). The Basic OUT command may also be used to transmit the relay code. Since GW Basic only supports the OPEN COM statement for COM 1 & COM 2, it will be necessary to use the OUT command when using COM 3 or COM 4. An example of this software method is provided on the test disk supplied with your order. The VISUAL BASIC programming example may be viewed from the VB directory on the disk provided.

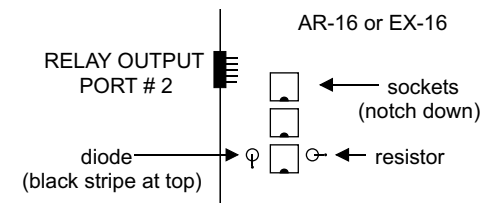
GW BASIC or QUICKBASIC EXAMPLE (IBM & compatibles)

```
10 OPEN "COM1:9600,N,8,1,DS,CS" AS #1 :CONFIGURE SERIAL PORT*
20 CLS:PRINT"PRESS KEY"
30 FOR X=32 TO 62 STEP 2
40 PRINT #1,CHR$(X); :DE-ENERGIZE ALL RELAYS
50 NEXT X
60 FOR X=33 TO 63 STEP 2
70 K$=INKEY$:IF K$="" THEN 70 :WAIT FOR KEY PRESSED
80 PRINT"RELAY ";(X+1)/2
90 PRINT #1,CHR$(X); :ENERGIZE RELAY
100 NEXT X
110 GOTO 20
120 *SETS COM 1 TO 9600 BAUD, NO PARITY, 8 DATA BITS AND 1 STOP BIT, TURNS OFF DSR AND CTS
```

INSTALLING OPTO-ISOLATORS

The AR-16, EX-16 or EX-32 may be ordered with the opto-isolators installed by specifying the /C Option or an opto-isolator kit may be ordered for field installations. Install the opto-isolators as follows:

NOTE 6: The opto-isolators will require a positive power feed from the isolated circuit or device which is to be used (opto-isolators with common emitter will require a negative power feed to pin #9). Connect the positive power feed to pin #9 on the 10 conductor ribbon connector which attaches to the EX-16 (or terminal #9 on the RCT-8).



IBM BAUD RATE SELECTION

The baud rate for IBM & compatibles may be selected by turning on the baud rate latch (bit 7 of the line control register) and setting the registers as shown to the right. Basic programmers may use the OPEN COM command to set the baud rate for COM 1 & 2 in place of this method. The baud rate and protocol for COM 3 & 4 should be selected from Basic by using the above procedure and the OUT command. An example is provided on the test disk using COM 3 & 4 from Basic.

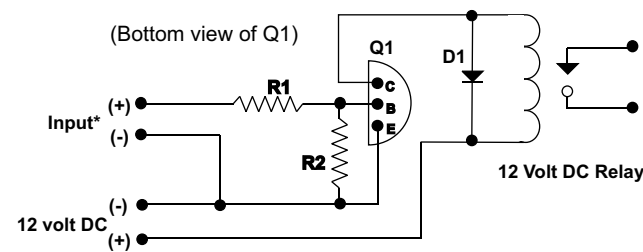
Baud Rate	MSB	LSB (decimal)
300	1	128
600	0	192
1200	0	96
9600	0	12
19200	0	6

Other standard baud rates may be selected by adjusting the given values. EXAMPLE: 4800 baud = 1/2 of 9600 = 24

The Com port register locations for COM 1 thru COM 4 are shown on page 8.

RELAY INTERFACING

In the event that you wish to use existing control relays with the EX-16, you may use the RYD-8 relay driver card or construct a relay driver circuit as shown below. We recommend the use of opto-isolators to protect the EX-16 from possible damage which could occur as a result of voltage incompatibility. The voltage and current output of the relay output ports are too low for most relays (with the exception of some types of solid state relays). We recommend the use of the following circuit to drive most types of mechanical and reed relays with 12 volt DC coils (200 MA maximum).



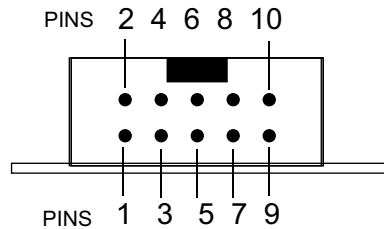
PARTS LIST

- (Q1) NPN Transistor...MPS6560 or (Radio Shack 276-2009)
- (D1) Diode.....1N4148 or (Radio Shack 276-1122)
- (R1, R2) Resistor.....3K, 33K (Radio Shack 271-1328, 1341)
- (Relay) Radio Shack 275-214, 275-206, 275-233 or equivalent

*connect to TTL level output from the EX-16 using the RCT-8 (- is common)

NOTE: When using opto-couplers, connect terminal #9 on the RCT-8 to the (+) 12 volt supply.

RELAY PORT HEADER CONNECTOR PIN-OUT



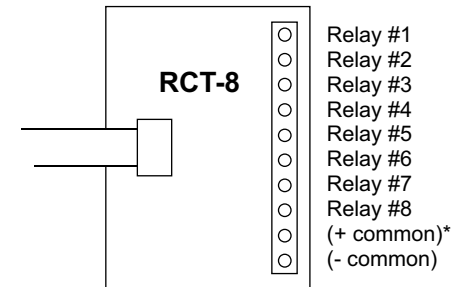
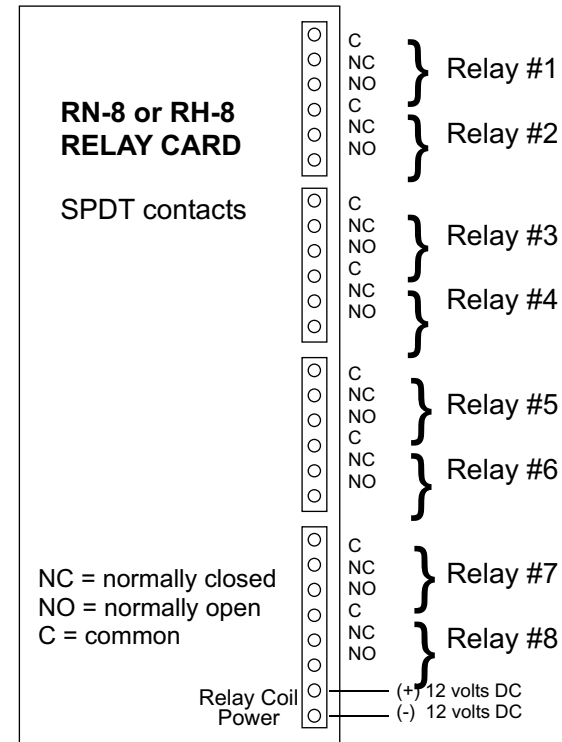
HEADER PIN-OUT FOR AR-16, EX-16 & EX-32.

NOTE: Key notch is on top. View is looking into header pins.

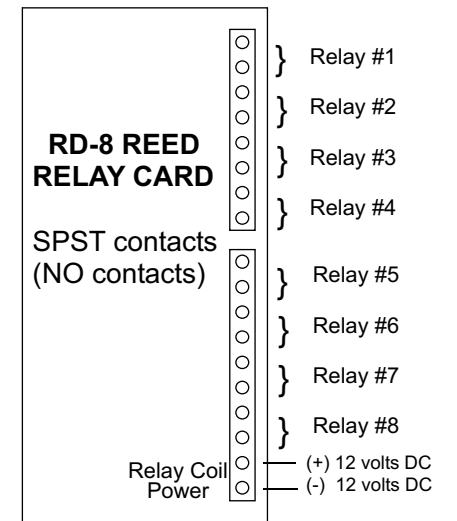
PIN CONNECTIONS

- (1) Relay #1
- (2) Relay #2
- (3) Relay #3
- (4) Relay #4
- (5) Relay #5
- (6) Relay #6
- (7) Relay #7
- (8) Relay #8
- (9) Opto (+) (used only with opto isolators)
- (10) Signal Ground

CONNECTION DIAGRAMS FOR RELAY CARDS AND RCT-8



*for use with opto-isolators



SPECIFICATIONS RH-8 RELAY CARD

Size.....	2.75" by 6"
Weight.....	8 ounces
Number of Relays.....	8
Contact rating (AC).....	10 amp 250 VAC
Contact rating (tungston).....	3 amp 360 watt
Contact rating (DC).....	10 amp 24 VDC
Contact rating (horsepower)...	1/3 HP 240 VAC
Contacts.....	SPDT
Power requirements.....	12 volts DC 500ma

SPECIFICATIONS RD-8 REED RELAY CARD

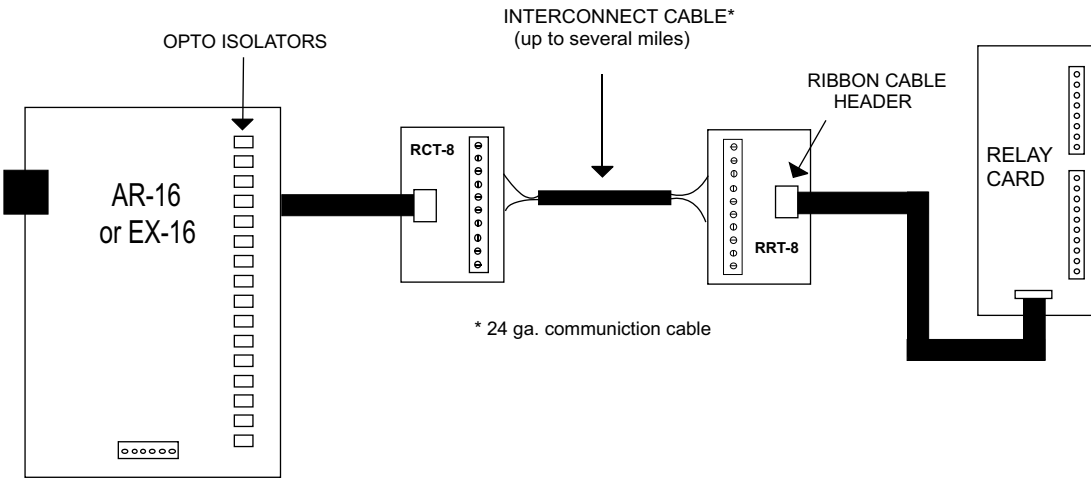
Size.....	2.25" by 4.875"
Weight.....	3.5 ounces
Number of relays.....	8
Contact rating (DC).....	10 VA 200 VDC
Contact rating (AC).....	10 VA 200 V peak
Max switching current.....	1/2 amp
Contacts.....	SPST
Power requirements.....	12 Volts DC 200ma

REMOTE CONNECTION OF RELAY CARDS OR RELAY DRIVER CARDS

Relay cards may be located up to several miles away from the EX-16 (provided that opto isolators are installed on the EX-16). The relay card may then be connected to the EX-16 using low cost 24 gauge communication cable (or other types of cable). The RCT-16 terminal blocks or RCP-8 (DB-9 connector) ribbon cable adapters should be used at the EX-16 for connection to the interconnect cable (see illustration below). At the remote side, the ribbon cable connector on the relay card will then connect to the keyed header on the RRT-8 or RRT-16 terminal blocks which allow for connection to the interconnect cable. The relay card connector may be replaced with a DB-9 connector in place of the header socket for direct connection to the interconnect cable. All relay cards are available with DB-9 connectors installed in place of the header socket (specify when ordering).

The following illustration shows how relay cards or relay driver cards may be connected to the EX-16.

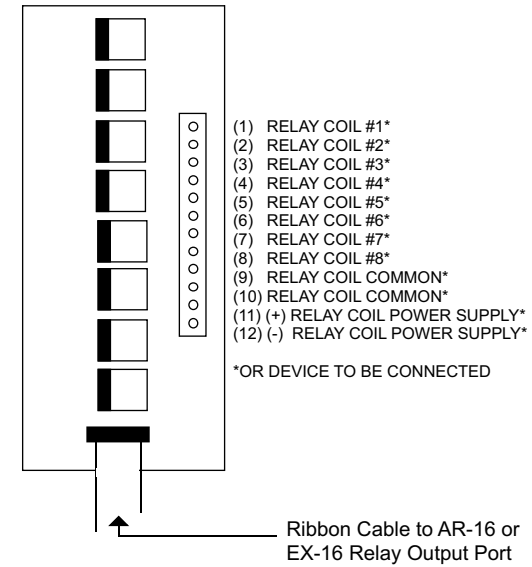
NOTE 11: Opto-isolators must be installed on the AR-16 or EX-16 to protect sensitive CMOS devices on the cards when remotely connecting relay cards or other devices.



CONNECTION OF THE RYD-8 TO THE AR-16 OR EX-16

DESCRIPTION: The RYD-8 relay driver card provides (8) relay drivers for connection directly to relay coils, contactor coils or other devices (such as motors, lamps, solenoids, etc.). The ribbon cable provided with the RYD-8 will connect directly to a relay output port on the AR-16 Relay Interface or the EX-16 or EX-32 Relay Expansion Card to allow the RYD-8 relay driver to provide software control of the relay or device to be connected to the terminal block on the RYD-8. The RYD-8 relay driver card will power relays or other devices which require 3 amps or less and operate within the voltage range of 5 to 48 volts DC. The output voltage of the RYD-8 (for powering the relay coil or device) is equal to the RYD-8 power input which is applied to terminals (11) and (12) on the RYD-8 terminal block. All eight relay coils (or other devices which are connected to the RYD-8) must operate at the same voltage and must operate at the voltage that is applied to terminals (11) and (12) on the RYD-8 terminal block. If the RYD-8 is ordered with LED indicator lamps, the limit resistors for the LED must be the correct value for the voltage applied to terminals (11) and (12). The limit resistor will be 1.8K for voltages up to 15 volts or 3K for voltages up to 25 volts.

RYD-8 CONNECTION DIAGRAM



One side of the relay coil of each relay must be connected to one of the relay common terminals (two terminals are provided for all eight relays, terminal #9 and terminal #10).

ALL EIGHT RELAY COILS (or connected device) MUST OPERATE AT THE SAME VOLTAGE.

NOTE 10: When opto-isolators are installed on the AR-16 relay interface or EX-16 relay expansion card, a separate isolated power supply should be used for the power input to the RYD-8 to power the relay coils or other devices. Failure to use an isolated power supply will defeat the purpose of the opto-isolators.

HEAT SINKS: Heat sinks should be installed on the power transistors on the RYD-8 relay driver card if the relay coil or the device to be connected requires more than 1.5 amps continuous. A heat sink kit is available for this purpose (specify RYD-8 heat sink kit). Please contact technical support for additional information.

Relays or devices connected to the RYD-8 may be located up to several miles from the RYD-8 if opto-isolators are installed on the AR-16 or EX-16. The only limiting factor is the voltage drop in the relay interconnect wire. A number of different types of relays with various contact configurations are available for connection to the RYD-8. Contact technical support for more information.

The ribbon cable on the RYD-8 may be connected to any of the relay output ports on the AR-16 or EX-16 (in the same manner as the relay cards are connected).

SPECIFICATIONS RYD-8 RELAY DRIVER CARD

- Size.....2.25" by 4.875"
- Weight.....2.5 ounces
- Relay Outputs.....8
- Maximum current rating.....3 amp (requires heat sinks above 1.5 amps)
- Input voltage range.....5 to 48 volts DC (voltage must match relay coil requirement)

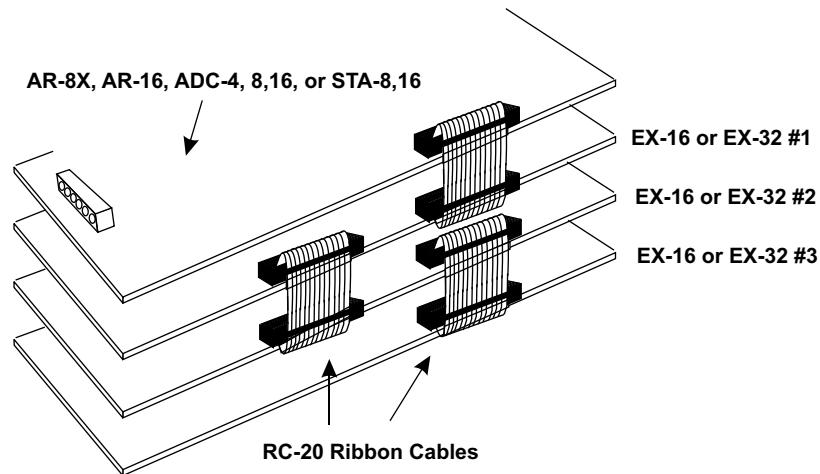
EXPANDING RELAY OUTPUT CHANNELS

The EX-16 as a stand alone unit will control up to 16 relays. When control of additional relays is required, additional EX-16 or EX-32 expansion cards may be added to control up to 128 relays (AR-16) or 112 relays (ADC & STA). Each additional EX-16 expansion card will provide control for 16 additional relays. A total of seven EX-16 expansion cards or three EX-32 expansion cards may be connected to the AR-16, ADC-4/8/16 or STA-8/16. The first EX-16 or EX-32 expansion card is connected to the relay expansion port on the AR-16, ADC-16 or STA-16 using the RC-20 ribbon cable. Additional EX-16 or EX-32 expansion cards connect to the preceding EX-16 or EX-32 with the RC-20 ribbon cable (see illustration on page 14). The relay output ports on the EX-16 are identical to those on the AR-16 and accept the same relay cards and other accessories as the AR-16. Shunts on the EX-16 are used to select the relay output port desired (see page 4).

For applications requiring more than 128 relay control channels, the PS-4 or PS-8 port selector may be used as a bank selector to select one bank of 128 relays. In this manner, up to 16,384 relays may be controlled (128 banks times 128 relays). An example of this method is shown on the following page using four banks to control 512 relays.

CONNECTION OF RC-20 RIBBON CABLES

The RC-20 ribbon cables should be connected as shown below. The first EX-16 or EX-32 will connect directly to the AR-16, ADC-16 or STA-16 and additional EX-16 cards will connect to the preceding EX-16 card.



START-UP RELAY STATUS

When the EX-16 or EX-32 is first powered, the relays which are connected will normally power-up in a de-energised state. It is possible under certain conditions (such as fluctuating power) that the relays may power-up in a random state (several relays may energize, while others may not). This is a characteristic of the RAM memory devices used on the AR-16, EX-16 & EX-32. Your program should reset all the relays to a known state when the program is first started.

REPAIR SERVICE FOR THE EX-16

In the event that the EX-16 is damaged from an inadvertent short circuit or other mishap, repair service is available through us by shipping your EX-16 to the address on the rear cover of this manual. The charge for minor repair is \$15.00 and takes about 3 business days (not including shipping).

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