

STA-16 STATUS INPUT INTERFACE

TECHNICAL REFERENCE

ELECTRONIC ENERGY CONTROL, INC.
14960 Maple Ridge Rd
Milford Center OH 43045-9016
USA

PHONE* (614) 464-4470
FAX* (614) 464-9656
ORDERS (800) 842-7714
TECH SUPPORT... (614) 464-4470
E-mail* sales@eeci.com
web* http://www.eeci.com

*International & Domestic

TABLE OF CONTENTS

Specifications.....	page 1
Technical Support and Warranty.....	page 1
Connection Diagram.....	page 2
Power Supply Requirements.....	page 2 & 7
Set-Up, Testing & Trouble-Shooting.....	page 3 & 4
Connector Pin-Outs.....	page 4 & 5
Direct Connection to a Modem.....	page 5
Baud Rate & Protocol Selection.....	page 6
RS-422/RS-423 & RS-485 Interfacing..	page 8
RCT-8, RCT-16 Connection Diagram....	page 9
Use of AC (bipolar) Opto Isolators.....	page 9
Commercial use of the STA-16.....	page 9
Status Inputs & High Voltage Input.....	page 10 & 11
Control Software & Program Examples..	page 11, 12 & 13
Input & Relay Expansion Ports.....	page 7, 8, 13 & 14
Security System Applications.....	page 14
Rack Mounting & Repair Service.....	page 14 & 15

SPECIFICATIONS

Power Supply.....	9 to 14 volts DC (300MA)
Serial Data Protocol.....	50 to 19,200 baud (defaults to 8 data bits, no parity & 1 or 2 stop bits)
Status Inputs.....	16
Expansion Capability.....	up to 112 relays (using (7) EX-16 expansion cards) up to 144 status inputs (using (4) ST-32 expansion cards) & up to 36 keypads up to 16 analog inputs (using (1) AD-16 expansion card)
Weight.....	5 ounces
Size.....	7 inches by 5 inches
Options Available.....	Touch Tone Input, RS-422, RS-423 & RS-485

TECHNICAL SUPPORT

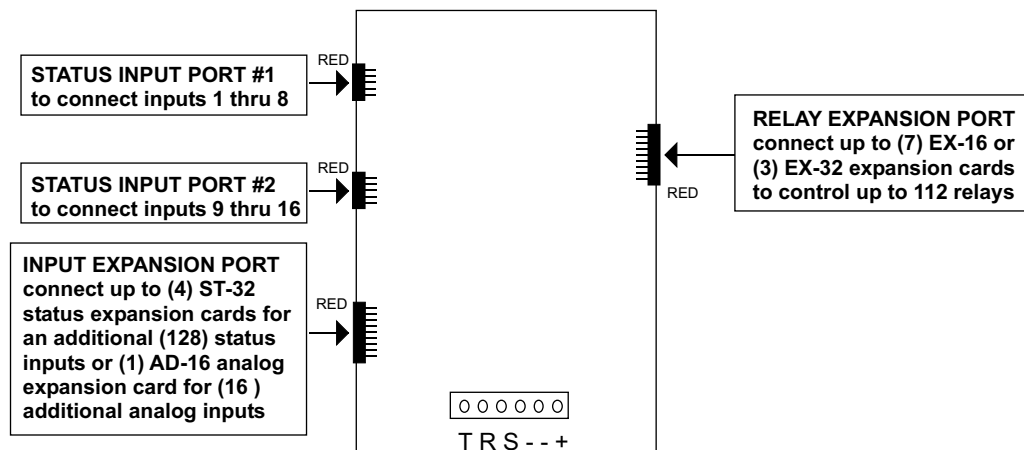
Technical support for our products is available by calling (614) 464-4470. Please have the STA-16 immediately accessible, powered and connected to your computer with the phone, a multimeter and the supplied test software nearby. If a technical adviser is not available, please leave your name, phone number and a time that you can be reached. Your call will be returned as soon as possible and within 24 hours.

WARRANTY AND CARE OF THE STA-16

The STA-16 Status Input Interface is warranted against factory defects for a period of 90 days from the date of purchase. The STA-16 has proven to be extremely reliable in actual operation during field tests. We recommend that the STA-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 serial I/O lines. The best way to prevent this type of damage is to install a Power Protector (Part # SP-120 or Radio Shack #26-1395 or Surgebuster #120K15A) in the electrical outlet which supplies power to the hardware. Shielding the status input lines will provide additional protection. If further protection is desired, install a TransZorb across the power input to the interface card (part #SP-12K) and to the RS-232 lines (part #SP-232K).

CONNECTION DIAGRAM

STA-16 STATUS INPUT INTERFACE



STA-16 TERMINAL BLOCK CONNECTIONS

- (T) RS-232 Transmitter (connect to green wire)
- (R) RS-232 Receiver (connect to white wire)
- (S) (+) 12 volt control signal for use with RS-232 (connect to black wire)
- (-) RS-232 signal ground (connect to red wire)
- (-) Power supply (black wire) (use caution, reversed polarity may cause damage, 9 to 14 volts DC only)
- (+) Power supply (red wire) (use caution, reversed polarity may cause damage, 9 to 14 volts DC only)

POWER SUPPLY REQUIREMENTS

The STA-16 may be powered from any DC voltage source which will supply 300 ma within a voltage range of 9 to 14 volts. The recommend power supply for use with a single STA-16 card is the PS-GP-1 (wall transformer supply). **IMPORTANT:** Use caution when connecting the power source, reversed polarity may cause damage. The heat dissipation of the 7805 regulator on the STA-16 will be greatly reduced with a 9 volt power source. The PS-9VDC-500 and PS-9VDC-1000 wall transformer power supplies may be used to power both the STA-16 and expansion card(s). The PS-12VDC-500 and PS-12VDC-1000 are unregulated supplies and may produce voltages as high as 18 volts. If these supplies are used the 7812 regulator which is supplied with the power supply should be used to regulate voltage to the hardware (as shown on page 7).

POWER SUPPLY FUSING: A 500 milliamp (.5 amp) in-line fuse should be installed in series with the (+) power supply lead to protect the power supply and the STA-16 from damage. Fusing will not be necessary if you ordered the STA-16 with the /T TransZorb option as a self-resetting fuse is provided with this option.

SET-UP AND TESTING

Upon receiving your STA-16, you should connect and test the operation of the hardware to verify proper operation. Please set-up and test the STA-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 STA-16 (as shown on page 2). If you did not order a serial cable, a cable may be fabricated by soldering the wires to the proper connector as shown on the following pages. Care should be taken to prevent any static discharge on the STA-16 by touching a metal ground before handling the STA-16 and associated circuits. Use caution not to set the STA-16 or associated hardware on a metal surface or damage could result.

(2) Connect the power supply (part # PS-GP-1) to the six position terminal block at the bottom of the STA-16. Be sure to observe the (+) and (-) connections on the STA-16 (reversed polarity may cause damage). Connect the RTC-16 terminal block to ports # 1 and #2 on the STA-16. When connecting the ribbon cable from the RCT-16 to the STA-16, the ribbon cable should point up (as shown on page 15) and the red line on the ribbon cable should be on top (closest to the copyright message on the STA-16). The ribbon cables for the RTC-16 should be folded over and routed underneath the STA-16 so that the RCT-16 is on the right side of the STA-16.

(3) The STA-16 is set to 9,600 baud at the factory. This is the proper setting for use with the test software which is provided on CD with your order. Windows users should install the Windows test program provided on CD (Windows 95, 98, ME, 2000, XP and Vista). Run setup.exe in the folder Windows Test Program (on CD supplied). If prompted about an older file, keep your newer file. Once installed, run the test program. The test program defaults to Com 1. Other Com ports may be selected if required.

Your screen should show a row of sixteen numbers. The top eight numbers represent the status inputs for port #1 and the lower eight numbers represent the status inputs for port #2.

(4) Test the inputs by applying 9 to 15 volts DC to each input (one at a time). Connect negative to the proper common terminal on the RCT-16 (pin #9 for inputs 1 thru 4 and pin #10 for inputs 5 thru 8 as shown on page 9). The PS-GP-1 power supply which is used to power the STA-16 may be used to apply power to the inputs. When the positive is connected to the input (input on or voltage applied) the screen should display a "1" for that channel and a "0" should be displayed with no voltage applied to the input (input off).

(5) You may exit the program by pressing any key. If Ctrl break is used to exit the program, you may use CUR-ON.EXE to turn the cursor back on. If operation of the inputs is normal, than testing is now complete and the STA-16 may be placed in service.

NOTE 1: The (S) terminal on the STA-16 is provided for use as an RS-232 control signal for use with the RS-232 control lines CTS, DSR and DCD. If the STA-16 does not function with your software, connect the (S) terminal (black wire) to all three control lines (CTS, DSR and DCD). The pins for these control lines on a DB-25 connector are pins 5, 6 and 8. The (S) terminal may also be used to supply a signal to one of the RS-232 control lines for use as a supervisory signal to sound an alarm with your software when the STA-16 has lost power or has been disconnected.

TROUBLE-SHOOTING THE STA-16

(1) Verify power to the STA-16 by checking for 5 volts DC on the 2200 mf capacitor (low voltage may indicate an overload). Verify that the STA-16 is set to the same baud rate as what appears on the test software screen. Check for a minimum of 9 volts DC at the STA-16 power input (on the 6 position terminal block) and check for correct polarity. The RS-232 driver on the STA-16 requires a minimum of 9 volts for proper operation. A voltage over 14 volts will cause damage to the Maxim RS-232 driver.

(2) Try running the test program with the COM port set to COM 2, COM 3 or COM 4 (the COM port may be marked incorrectly or set wrong). Verify proper operation of the COM 1 serial port (RS-232 port) on your computer. You may do this by connecting a serial printer to COM 1 and using a short Basic program (shown on the following page) to send an ASCII code to your printer (the ASCII code for "0" is 48). 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. Please note that Basic only supports the OPEN COM statement for COM 1 or COM 2 (use the OUT statement for COM 3 or COM 4).

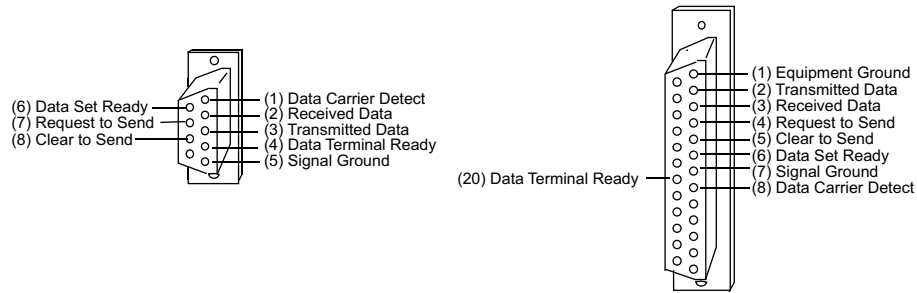
10 OPEN "COM1:1200,N,8,2,DS,CD,CS" AS #1
 20 PRINT #1, CHR\$(48);

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 (such as terminate and stay resident programs, fax drivers etc.). If your printer does print the "0" but the STA-16 still does not function, contact us at (614) 464-4470 for technical support.

NOTE 2: Using a data probe to detect a change in logic level does not necessarily mean that the correct codes are being transmitted. Your software may be transmitting a data stream to configure a modem, mouse or other device.

(3) If erratic operation of the inputs is experienced, check for loose or dirty connections at the ribbon cables. Check for bent or shorted contacts on relay card connectors, the RC-20 or RCT-8 connectors (if used). Check for power supply interruptions or short circuits caused by metal contact to the STA-16 or relay card circuit areas. When more than three EX-16 cards are connected to the STA-16, an external power feed is required (see EX-16 manual). If after checking thoroughly you are still unable to correct the problem, contact us at (614) 464-4470.

CONNECTOR PIN-OUTS



DB-9 CONNECTOR...SOCKET (female)
 (rear view/solder side)

DB-9 Pins	Connection
(1) Data Carrier Detect*	(connect to black wire or terminal (S) on the STA-16) NOTE: This connection is not needed on most computers.
(2) Received Data	(connect to green wire or terminal (T) on the STA-16)
(3) Transmitted Data	(connect to white wire or terminal (R) on the STA-16)
(5) Signal Ground	(connect to red wire or terminal (-) on the STA-16)

DB-25 CONNECTOR...SOCKET (female)
 (rear view/solder side)

DB-25 Pins	Connection
(2) Transmitted Data	(connect to white wire or terminal (R) on the STA-16)
(3) Received Data	(connect to green wire or terminal (T) on the STA-16)
(7) Signal Ground	(connect to red wire or terminal (-) on the STA-16)
(8) Data Carrier Detect*	(connect to black wire or terminal (S) on the STA-16)

*NOTE: This connection is not needed on most computers.

DB-9 CONNECTOR (continued) DB-25 CONNECTOR (continued)

The following pins are optional and may be used as needed for specific applications.

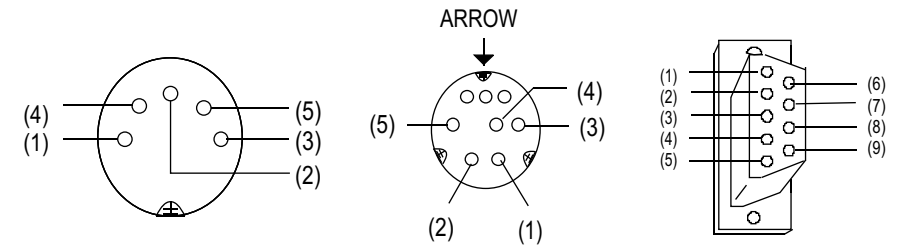
- (4) Data Terminal Ready (DTR)-output from your PC.
- (6) Data Set Ready (DSR)-input to your PC.
- (7) Request To Send (RTS)-output from your PC.
- (8) Clear To Send (CTS)-input to your PC.

The following pins are optional and may be used as needed for specific applications.

- (4) Request to Send (RTS)-output from your PC.
- (5) Clear to Send (CTS)-input to your PC.
- (6) Data Set Ready (DSR)-input to your PC.
- (20) Data Terminal Ready (DTR)-output from your PC.

* On some types of computers, the Data Carrier Detect must be held high (+12 volts) before the RS-232 port is enabled. The (S) terminal on the STA-16 will provide the +12 volts.

ADDITIONAL CONNECTOR PIN-OUTS



5 PIN DIN (Apple)

Pin #	Connection
(1) DTR	
(2) Signal Ground	
(3) DSR	
(4) Transmitted Data	
(5) Received Data	

8 PIN MINI-DIN (Mac & IBM)

Pin #	Connection
(1) DTR	
(2) DSR, DCD & CTS	
(3) Transmitted Data	
(4) Signal Ground	
(5) Received Data	

RS-422 (DB-9 plug)

Pin #	Connection
(2) Transmitter (+)	
(3) Equipment Ground	
(4) Receiver (+)	
(7) Transmitter (-)	
(8) Receiver (-)	

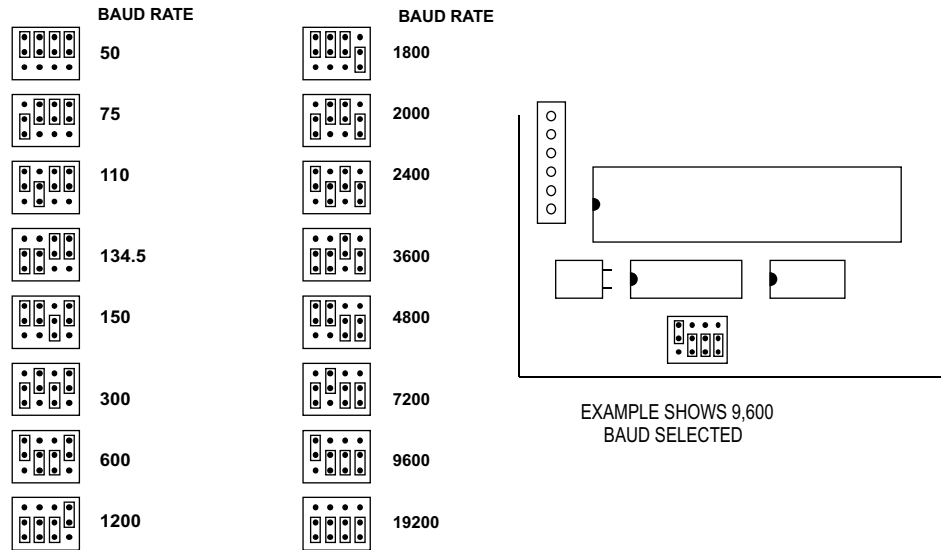
NOTE: The above connector illustrations are viewed from the rear (solder side).

CONNECTION OF THE STA-16 DIRECTLY TO A MODEM

The STA-16 may be connected directly to a modem at a remote location without the need for a PC at the remote site. The modem at the remote site is then considered DCE equipment (Data Communications Equipment) and requires that the serial transmitter and receiver lines be reversed (pins 2 & 3 on a DB-25 and DB-9) when connecting to the STA-16. When the STA-16 is connected directly to a computer, the computer is considered to be DTE equipment (Data Terminal Equipment) and the pin-outs shown on the preceding page are correct. The modem used should be the external auto answer type with the auto answer switch set to the on position (specify part # MDE-232).

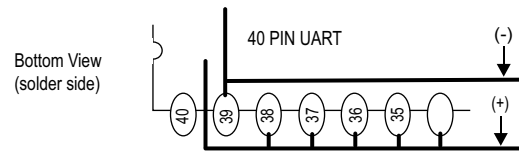
BAUD RATE SELECTION FOR THE STA-16

Select the desired baud rate by placing the removable shunts in the positions which correspond to the desired baud rate. All four of the shunts must be in place for the STA-16 to operate properly.



CHANGING PROTOCOL SETTINGS

PARITY, WORD LENGTH and STOP BITS: These functions are selected using pins 35, 36, 37, 38 and 39 on the 40 pin UART IC on the STA-16. Connect the pins to the (+) 5 volt or (-) ground power feed (located above and below pins 35 thru 39) as shown in the chart on the following page to select the desired protocol. Be sure to cut the existing circuit track using a knife (if different). **IMPORTANT:** All pins must be connected to (+) 5 volts or (-) ground. Do not allow any pins to float (pins left unconnected).



PIN 39 (EPE)	WLS1	WLS2	SBS (PINS 38, 37, 36)	PIN 35 (PI)
0 = Odd Parity	0	0	0 (5 data bits, 1 stop bit)	0 = Parity On
1 = Even parity	0	0	1 (5 data bits, 1.5 stop bits)	1 = Parity Off
	1	0	0 (6 data bits, 1 stop bit)	
	1	0	1 (6 data bits, 2 stop bits)	
	0	1	0 (7 data bits, 1 stop bit)	
	0	1	1 (7 data bits, 2 stop bits)	
	1	1	0 (8 data bits, 1 stop bit)	
	1	1	1 (8 data bits, 2 stop bits)	

NOTE: 1=(+5 VDC), 0=(ground -)

USE OF UNREGULATED WALL TRANSFORMERS

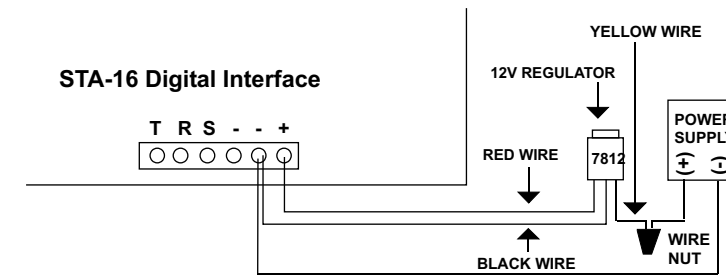
The PS-12VDC-1000 and PS-12VDC-500 power supplies are unregulated and may produce voltages substantially higher than the 12 volts DC that is labeled on the device. The 7805 regulator on the STA-16 and any relays powered by the higher voltage may produce an excessive (and undesirable) amount of heat which may require additional air flow or ventilation to prevent overheating. Voltages over 14 volts DC may damage the Maxim IC on the STA-16. The 7812 regulator (supplied with the power supply) may be used to regulate voltage to the STA-16 and relay card(s). Connect the 7812 regulator as shown:

BLACK WIRE: connect to the (-) terminal on the STA-16 and to the (-) wire coming from the power supply.

RED WIRE: connect to the (+) terminal on the STA-16.

YELLOW WIRE: connect to the (+) wire coming from the power supply.

USE CAUTION: The metal tab on the regulator is electrically connected to the (-) wire (black). Before connecting the red & black wires to the STA-16, check for 12 volts DC across the wires (red should equal (+)).



ADDING RELAY OUTPUT CHANNELS

When control of relays is required, EX-16 expansion cards may be added to control up to 112 relays with the STA-16 connected to a single COM port. Each EX-16 expansion card will provide control for 16 additional relays. A total of seven EX-16 expansion cards may be connected to the AR-16, ADC-4(8)(16) or STA-8(16). The first EX-16 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 expansion cards connect to the preceding EX-16 with the RC-20 ribbon cable. 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.

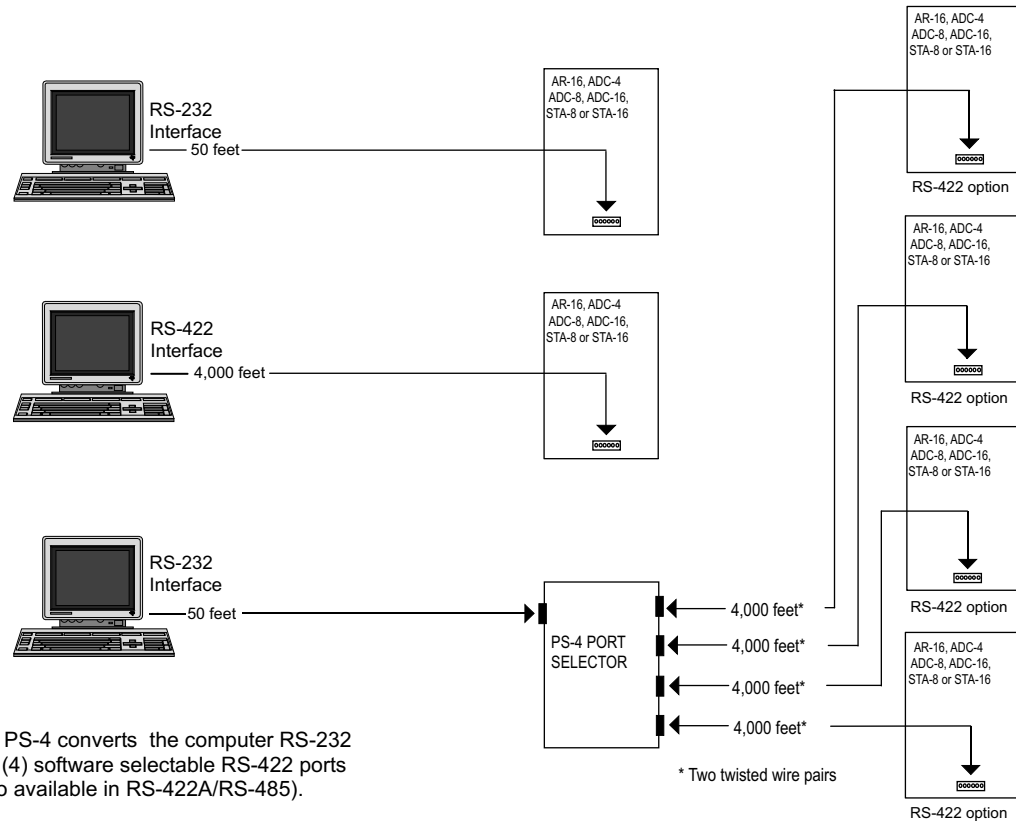
ADDING ANALOG INPUTS OR ADDITIONAL STATUS INPUTS

The STA-16 as a stand alone unit provides 16 status inputs. When additional inputs are required, up to (4) ST-32 expansion cards may be connected to provide up to 144 status inputs or (1) AD-16 analog expansion card may be connected to provide an additional 16 analog inputs. Each ST-32 expansion card will provide an additional 32 status inputs. The first ST-32 card connects to the input expansion port on the STA-16. Additional ST-32 cards connect to the preceding ST-32 card. If more than 16 analog inputs are required, contact technical support for customized hardware.

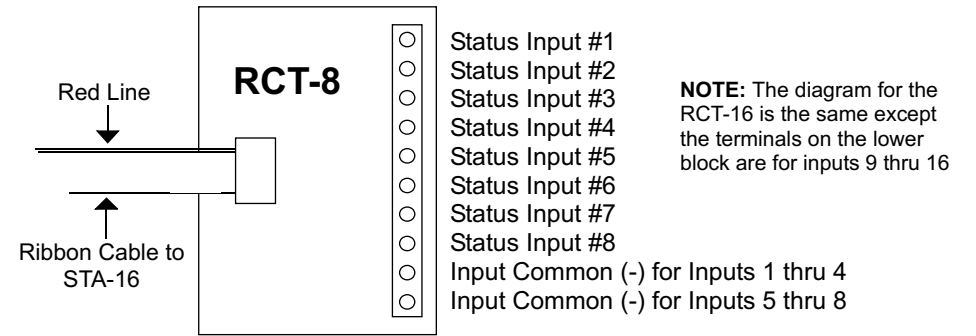
For applications requiring more than 144 status inputs or applications requiring more than 112 relays, the PS-4 or PS-8 port selector may be used as a bank selector to select one bank of 144 status inputs and 112 relays. In this manner, up to 18,432 status inputs may be connected and 14,336 relays may be controlled (128 banks times 112 relays and 144 status inputs). An example of this method is shown below using four banks to provide 576 status inputs and control of 448 relays.

RS-422 INTERFACING AND RS-232 DISTANCE LIMITATIONS

The RS-232 interface will allow the AR-16, ADC-4(8)(16) or STA-8(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.



RCT-8 CONNECTION DIAGRAM



USE OF AC (bipolar) OPTO ISOLATORS

The STA-16 may be ordered with AC opto isolators which will allow the inputs to be turned on in either direction and will allow for both a common anode (+ ground) or common cathode (-ground) configuration of the inputs (or a combination of both). The STA-16 may be ordered with AC opto isolators by specifying the OP-8AC.

COMMERCIAL USE OF THE STA-16

When the STA-16 is to be used in a commercial/industrial environment, additional action must be taken to insure long term reliability and trouble free operation of the hardware. In general, the most serious threat to the hardware will be electrical transients (most often caused by electrical storm activity). The following steps are strongly encouraged to protect the hardware and are listed in the order of highest priority:

- (1) Install a voltage surge/spike protector in the 120 volt AC outlet which supplies power to the STA-16 and to your hardware. Be sure that the electrical outlet has a third prong electrical ground and that it is correctly wired. Install TransZorbs on the DC power input or order the STA-16 with the /T option.
- (2) Install the STA-16 (and any expansion cards) in a metal enclosure and ground the enclosure to a reliable earth ground (an electrical system ground using the third prong on an electrical outlet will usually be sufficient). Connect a TransZorb from the (-) terminal to the metal enclosure. An inline 1/2 amp fast-acting fuse should be installed in series with the DC power input prior to the Transzorbs (the fuse will blow and prevent damage to the STA-16 in the event of a major electrical surge). When the installation site is at higher elevations, in areas that are subject to increased electrical storm activity, the installation of gas-tube discharge devices and other action may be necessary (contact technical support for more information).
- (3) Order the EX-16 with the /C Opto Isolator option. The opto isolators significantly reduce the possibility of voltage transients back-feeding to the EX-16 through the relay output lines.
- (4) Power the STA-16 from a 9 volt regulated DC power supply. The regulation will provide additional protection from voltage transients. A 9 volt power source will significantly reduce the heat produced by the STA-16 and will also reduce the energy consumption of the STA-16. If the STA-16 is to be operated in elevated room temperatures (above 85° F), additional steps should be taken to reduce heating of the STA-16. Install a larger heat sink on the STA-16 regulator and install the STA-16 in a larger metal enclosure.

STATUS INPUTS

Status lines are connected to the STA-16 with one of the following ribbon cable adapters: RCT-8, RCT-16, RCB-8, RCB-16, RCP-8, RRT-8 or RRT-16. The ribbon cable adapters connect to the STA-16 status input ports. The terminal assignments are shown on page 9 (all are the same as the RCT-8). The inputs are electrically isolated from the STA-16 with opto isolators. The STA-16 inputs are turned on by applying a small voltage to the LED inside the opto isolator. We recommend that an isolated power source be used for this purpose to prevent errors or possible damage to the STA-16 which could occur as a result of lightning, voltage surges, EMI or other noise. A separate PS-GP-1 power supply may be used for this purpose (shown below). Each status input port provides two isolated (-) commons so that two different input configurations can be utilized (see RTC-8 terminal connections, page 9). Wire connections between the switch or relay and the STA-16 may be up to several miles long if necessary (the only limiting factor is the voltage drop in the wire). Low cost communication cable is ideal for this purpose (24 gauge typical). The STA-16 is shipped with 1.8K limiting resistors installed in series with the opto isolator to provide a typical voltage input range of 9 to 15 volts DC. The limiting resistor may be replaced with different values to provide different voltage input ranges from 1.2 volts to hundreds of volts (for safety reasons, we recommend that a voltage dividing circuit be used for DC voltages over 50 volts, see figure B on the following page). An inexpensive low power isolation transformer should be used for AC voltages over 50 volts (see figure A). The STA-16 may be ordered without limiting resistors installed or with limiting resistors for different voltage ranges (specify when ordering).

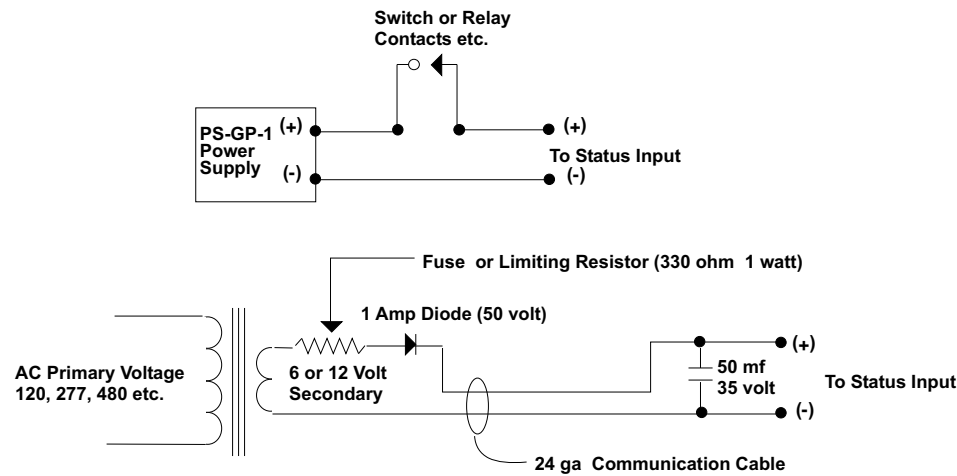


FIGURE A

HIGH VOLTAGE INTERFACING

CAUTION: When working with high voltages, the potential for fire, explosion, electrocution, eye injury or blindness and life threatening injuries exists. If you are not familiar with the precautions needed when working with high voltages, do not attempt to connect high voltage up to these circuits. When connecting the STA-16 to high voltage AC equipment (such as compressors, fans, hot water heaters, lights etc.) the method shown above in figure A is recommended.

The following method is used to divide a high DC voltage down to the range needed for input into the STA-16 (see figure B). This method involves the use of two resistors (R1 and R2) which together add up to R_t (total resistance). The total resistance is determined by using the Ohms Law to compute the resistance needed for a 10 milliamp current flow through the resistors. EXAMPLE: If the input voltage is 100 volts ($R = E$ divided by I) 100 volts divided by

.01 amps = 10,000 ohms (10K ohm) = total resistance. To determine the proper ratio of the resistors divide 12 volts (STA-16 input voltage) by 100 (high voltage input) = .12. The value of $R_2 = .12$ times 10,000 ohms = 1,200 ohms. R_1 is then equal to the difference between the total resistance (10,000 ohms) less R_2 (1,200 ohms) = 8,800 ohms. To determine the power rating needed for the resistor, use the following formula: $P = I$ squared times R . EXAMPLE: .01 squared = .0001 times R_1 (8,800 ohms) = .88 watts. A 1 watt resistor would be sufficient. To prevent the danger of a high voltage feed back to the STA-16 and/or a fire/electrocution hazard caused by an open or short circuit, a 15 volt 5 watt zener diode and a 1/4 amp in-line fuse should be installed as shown in figure B.

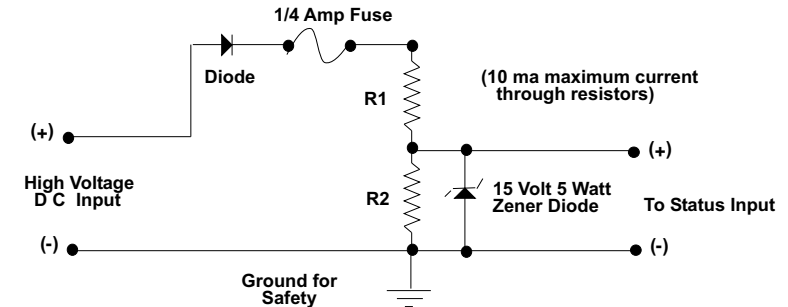


FIGURE B

CONTROL SOFTWARE

Status information is transmitted from the STA-16 upon receipt of a status port code which must be transmitted by the computer. The status port code is equal to the status port number - 1. To acquire the status information for channels 1 thru 8, the computer must first transmit a (0). The STA-16 will then transmit the status information for status port #1. The single byte number will represent the status information in sequence using the LS bit as the lowest status input and the MS bit as the highest status input (0 = OFF, 1 = ON). The STA-16 will only recognize codes 0 to 15 (or 0 to 31 with the AD-32 or ST-32 connected). The STA-16 passes all higher codes to the EX-16 (if connected) for relay control functions.

PROGRAMMING EXAMPLES IN BASIC

The following program has been written for IBM or compatible computers using GW Basic or QuickBasic. The program will continuously display the status information for all 16 status inputs. The screen is continuously updated so that new status information is displayed at intervals only a few milliseconds apart. This program is intended to illustrate the fundamentals needed to develop your own software for specific applications. All values are decimal, the protocol is set as follows: 9600 baud, 8 data bits, 2 stop bits and no parity. To stop program execution, press Ctrl break. If the following program does not run on the first attempt, change the on error statement (line 30) to ON ERROR GOTO 0 while trouble-shooting the software. NOTE: In the software example shown on the following page, we are using GW Basic/Qbasic statements. If you are using another type of Basic, this software will still work in most cases, but minor changes may be necessary (consult your Basic manual and the sections concerning serial communications). All example programs may be loaded from disk using the test disk supplied with your order. An example of a Basic Program using a subroutine for IBM and compatibles (not shown) may be loaded and listed from Basic (file name STA-16SR.BAS). Examples in Visual Basic (versions 3 through 6) may be found in the VB folders.

ERROR TRAPPING: The programs in these examples include an error trapping feature to prevent problems as a result of serial transmission errors when the program is left running for long periods of time. Serial errors may be created when fluctuations in power occur, if electro mechanical interference is encountered, when strong radio signals are nearby, if lightning is in the immediate area or if other types of noise are picked up on the serial transmission lines (much of the noise can be eliminated by using a shielded serial cable). It is important to stress, however, that serial transmission errors are fairly remote and may only occur once in every 20,000 hours of operation. If your application requires 24 hour operation, 365 days a year (such as in energy management) an error which could cause a computer lock-up is unacceptable.

GW BASIC or QUICKBASIC PROGRAM EXAMPLE

```

10 CLS:DIM A(16)                'Clear Screen & Specify Array
20 ON ERROR GOTO 290           'Go to Error Subroutine on Error
30 OPEN "COM1:9600,N,8,2,CS,DS,CD" AS #1 'Set Protocol
40 C=0                         'Clear Malfunction if Set
50 FOR X=0 TO 1                'Codes for Status Port #1 & Port #2
60 PRINT #1, CHR$(X);          'Transmit
70 A=0                         'Clear Delay Loop Count
80 IF A>5000 THEN C=1:GOTO 110 'Check up to 5,000 Times for Received Byte
90 IF EOF(1) = -1 THEN A=A+1:GOTO 80 'Wait for Byte
100 A$(X) = INPUT$(1,1)        'Receive
110 NEXT X
120 IF EOF(1) = -1 THEN 140     'Byte in COM Buffer?
130 A$ = INPUT$(1,1)           'Clear COM Buffer
140 FOR X=0 TO 1               'Select Byte
150 Z=1                         'Set to Bit 0
160 FOR Y=1 TO 8               'Select Bit
170 B= ASC(A$(X)) AND Z        'Test Bit
180 Z=Z*2                       'Advance to Next Bit
190 IF B>0 THEN A(Y+X*8)=1:GOTO 210 'Bit Set?
200 A(Y+X*8)=0                 'Bit Not Set
210 NEXT Y
220 NEXT X
230 IF C=1 THEN LOCATE 1,35:PRINT"MALFUNCTION":GOTO 40
240 LOCATE 1,35:PRINT"      "
250 LOCATE 1,1                 'Position Cursor
260 FOR X=1 TO 16
270 PRINT A(X)                 'Print on Screen, (0)=Off (1)=On
280 NEXT X:GOTO 50             'Start Over
290 CLS:LOCATE 1,35:PRINT"MALFUNCTION":CLOSE:RESUME 30 'Error Subroutine-Start Over

```

SOFTWARE EXAMPLES IN C & ASSEMBLY FOR IBM COMPATIBLES

TO VIEW THE ASSEMBLY LISTING OR C LISTING FOR IBM AND COMPATIBLES, insert the test disk in drive A and enter: A> TYPE STA-16.ASM or STA-16.C To line print the listing, enter: A> PRINT STA-16.ASM or STA-16.C NOTE: PRINT is an external DOS command. The assembly code was assembled and linked on an IBM XT using MS DOS 3.3 and TURBO ASSEMBLER (Borland in Scotts Valley, CA).

SYSTEMS LEVEL PROGRAMMING CONSIDERATIONS

In Basic and other high level programming languages, the Line Status Register is automatically checked for incoming and outgoing bytes and handles the data flow as needed. When reading or writing to the COM port registers directly (such as in Assembly, C or using the OUT command in Basic), it will be necessary to check the Line Status Register before reading or writing the incoming or outgoing byte.

BEFORE TRANSMITTING.... check BIT 5 of the Line Status Register before sending byte (bit must be high)

BEFORE RECEIVING.... check BIT 0 of the Line Status Register before accepting byte (bit must be high)

I/O PORT REGISTER LOCATIONS FOR THE LINE STATUS REGISTER

COM 1	COM 2	COM 3	COM 4	
3FD	2FD	3ED	2ED	(hex values)

IBM BAUD RATE SELECTION

The baud rate for IBM & compatibles may be selected by turning on (decimal) 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
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 through COM 4 are shown below.

COM 1	COM 2	COM 3	COM 4	(hex)
3F8	2F8	3E8	2E8	Transmitter/Receiver
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

NOTE: The STA-16 will function with any RS-232 COM port (or RS-422 & RS-485 with option). The test disk has test programs for use with the standard IBM COM ports (COM 1 through COM 4). Software examples in Basic & C are also provided for using COM 1 through COM 4. Non-standard COM ports may be used by substituting the COM port register values shown for those required.

EXPANSION PORTS

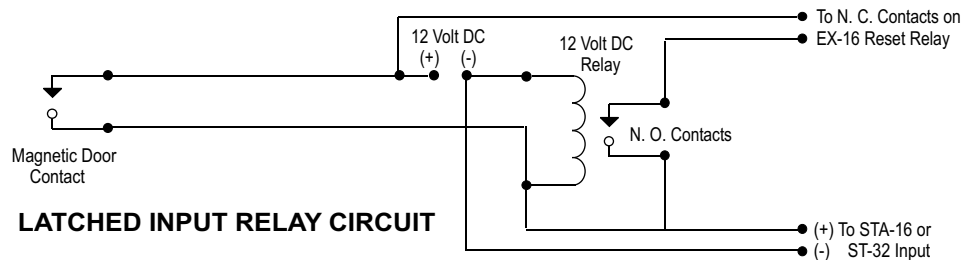
The STA-16 provides two expansion ports for additional I/O operations. The Relay Expansion Port allows up to (112) relays (or other output devices) to be controlled by software or keyboard input (using EX-16 relay expansion cards). A variety of relay cards with various contact configurations are available for connection to the EX-16 expansion cards. The Input Expansion Port allows up to (128) additional status inputs or (16) analog inputs to be read by software (using ST-32 status expansion cards or the AD-16 analog expansion card). The software channel codes for the analog inputs are 16 to 31. The status inputs are read in the same manner except instead of transmitting a channel code, a status port code is transmitted to the STA-16 (transmitting a 16 would request information for the first 8 status inputs on the ST-32 status expansion card. The STA-16 would then transmit a single byte number (each bit representing one status input). Additional information is provided with the ST-32 status expansion card.

Relays are controlled by transmitting a relay code (32 thru 255). Each relay is assigned 2 codes, one to energize the relay and the other to de-energize the relay. The relay code is determined by using the following formula: RELAY CODE = (RELAY # times 2) - 1...to energize the relay or RELAY CODE = (RELAY # times 2) - 2...to de-energize the relay. Additional information is provided with the EX-16 relay expansion card. All expansion cards are connected to the STA-16 using the RC-20 ribbon cable connector. Additional expansion cards plug into the preceding expansion card.

USE OF THE STA-16 IN SECURITY SYSTEM APPLICATIONS

The STA-16 may be used as a security system interface to monitor door and window contacts, smoke detectors, motion detectors, entry keypads and other devices. The KY-12M keypad may be used to remotely enter door entry codes, log entry times and individuals, to arm and disarm the security system and for other functions. The EX-16 with relay card may be used to sound alarm sirens, light indicator lamps or to control other devices. The addition of a modem and a voice sound card will allow the security system to dial out with a message for police or fire protection or to call building owners in the event of an emergency. The modem will also allow incoming calls to download system status or to provide log information etc.

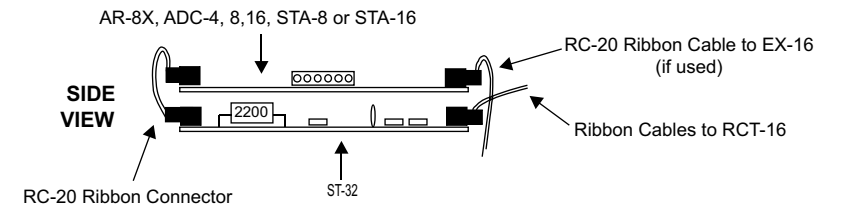
In applications where the information from the STA-16 is collected only periodically (such as once a minute), it may be desirable to latch inputs which are connected to magnetic contacts or to other types of intermittent signals. The easiest way to latch the input is with a small reed relay as shown in the circuit below. After the STA-16 transmits the input information, the latch may be reset using one of the outputs from the EX-16 or by using one of the RS-232 control lines with the AR-2 Relay Interface using DTR or RTS. A latched input relay card with 8 latched inputs is available for this purpose (specify part # LR-8). Please contact technical support for more information.



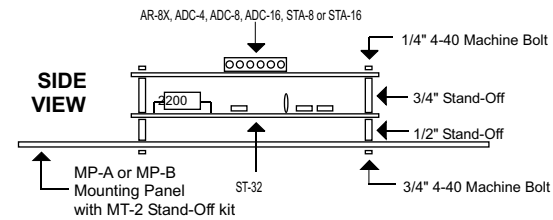
RACK MOUNTING

The STA-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, ST-32 or AD-16) should be installed in the slots below the interface card. All ribbon connectors should be plugged in with the ribbon cable pointing up (see diagram on following page). The RC-20 ribbon connector should be folded over at the top connector when connecting to the interface card or when connecting expansion cards to additional expansion cards. 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).

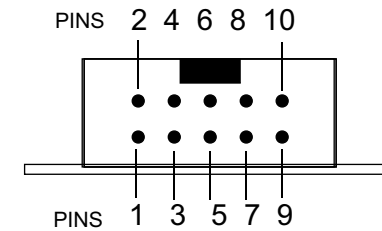
TYPICAL MOUNTING CONFIGURATION (using the CH series card holder rack)



MOUNTING A STAND ALONE UNIT...A single interface card may be mounted in an enclosure or on a metal mounting panel using the MT-1 stand-off mounting hardware. The STA-16 will attach to the 4 stand-off spacers using 4-40 machine screws (4 mounting holes are provided on the STA-16). The STA-16 with an expansion card attached may be mounted in an enclosure or on a metal mounting panel using the MT-2 stand-off mounting hardware. The STA-16 and EX-16 (or other combination) will attach to the 4 stand-off spacers using 4-40 machine screws as shown below (4 mounting holes are provided on the STA-16 & EX-16). Contact technical support for more information on mounting panels and custom made distribution boards for use with the ADC-16, STA-16, EX-16, AD-16 and ST-32.



INPUT CONNECTIONS AND PIN-OUT



HEADER PIN-OUT FOR THE STA-16 & ST-32.

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

PIN CONNECTIONS

- (1) Input #1 +
- (2) Input #2 +
- (3) Input #3 +
- (4) Input #4 +
- (5) Input #5 +
- (6) Input #6 +
- (7) Input #7 +
- (8) Input #8 +
- (9) (-) Common (inputs 1 thru 4)
- (10) (-) Common (inputs 5 thru 8)

REPAIR SERVICE

In the event that the STA-16 is damaged from an inadvertent short circuit or other mishap, repair service is available through us by shipping your STA-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).