Dual Port RS-232/422/485 Serial Interface

FEDERAL COMMUNICATIONS COMMISSION
AND
INDUSTRY CANADA
RADIO FREQUENCY INTERFERENCE STATEMENTS

This equipment generates, uses, and can radiate radio frequency energy and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio communication. It has been tested and found to comply with the limits for a Class A computing device in accordance with the specifications in Subpart J of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference when the equipment is operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be necessary to correct the interference.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This digital apparatus does not exceed the Class A limits for radio noise emission from digital apparatus set out in the Radio Interference Regulation of Industry Canada.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la classe A prescrites dans le Règlement sur le brouillage radioélectrique publié par Industrie Canada.

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NORMAS OFICIALES MEXICANAS (NOM)
ELECTRICAL SAFETY STATEMENT

INSTRUCCIONES DE SEGURIDAD

1. Todas las instrucciones de seguridad y operación deberán ser leídas antes de que el aparato eléctrico sea operado.

2. Las instrucciones de seguridad y operación deberán ser guardadas para referencia futura.

3. Todas las advertencias en el aparato eléctrico y en sus instrucciones de operación deben ser respetadas.

4. Todas las instrucciones de operación y uso deben ser seguidas.

5. El aparato eléctrico no deberá ser usado cerca del agua—por ejemplo, cerca de la tina de baño, lavabo, sótano mojado o cerca de una alberca, etc..

6. El aparato eléctrico debe ser usado únicamente con carritos o pedestales que sean recomendados por el fabricante.

7. El parato eléctrico debe ser montado a la pared o al techo sólo como sea recomendado por el fabricante.

8. Servicio—El usuario no debe intentar dar servicio al equipo eléctrico más allá a lo descrito en las instrucciones de operación. Todo otro servicio deberá ser referido a personal de servicio calificado.

9. El aparato eléctrico debe ser situado de tal manera que su posición no interfiera su uso. La colocación del aparato eléctrico sobre una cama, sofá, alfombra o superficie similar puede bloquea la ventilación, no se debe colocar en libreros o gabinetes que impidan el flujo de aire por los orificios de ventilación.

10. El equipo eléctrico deber ser situado fuera del alcance de fuentes de calor como radiadores, registros de calor, estufas u otros aparatos (incluyendo amplificadores) que producen calor.

11. El aparato eléctrico deberá ser connectado a una fuente de poder sólo del tipo descrito en el instructivo de operación, o como se indique en el aparato.

12. Precaución debe ser tomada de tal manera que la tierra fisica y la polarización del equipo no sea eliminada.

13. Los cables de la fuente de poder deben ser guiados de tal manera que no sean pisados ni pellizcados por objetos colocados sobre o contra ellos, poniendo particular atención a los contactos y receptáculos donde salen del aparato.

14. El equio eléctrico debe ser limpiado únicamente de acuerdo a las recomendaciones del fabricante.

15. En caso de existir, una antena externa deberá ser localizada lejos de las lineas de energia.

16. El cable de corriente deberá ser desconectado del cuando el equipo no sea usado por un largo periodo de tiempo.

17. Cuidado debe ser tomado de tal manera que objectos liquidos no sean derramados sobre la cubierta u orificios de ventilación.

18. Servicio por personal calificado deberá ser provisto cuando:

    A: El cable de poder o el contacto ha sido dañado; u

    B: Objectos han caído o líquido ha sido derramado dentro del aparato; o

    C: El aparato ha sido expuesto a la lluvia; o

    D: El aparato parece no operar normalmente o muestra un cambio en su desempeño; o

    E: El aparato ha sido tirado o su cubierta ha sido dañada.

Contents

1. Specifications

Protocol — Asynchronous

Speed — IC113C: Up to 115.2 Kbps; IC175C: 460.8 kbps and higher

Operation — RS-232 or RS-485/422, 2- or 4-wire (individually selectable on each port)

Connectors — (2) DB9M

Communications Chip — IC113C: 16550 UART; IC175C: 16950 UART

MTBF — >150,000 hours

MTTR — <0.25 hours

Materials — Boards are solder mask over bare copper or tin nickel

Operating Temperature — 32° to 122°F (0° to 50°C)

Storage Temperature — -4° to 158°F (-20° to 70°C)

Humidity — 0 to 90% relative humidity, noncondensing

Power — +5 VDC @ 195 mA ±12 V @ 25 mA (derived from PC bus)

Size — 5"W x 7.5 "D (12.7 x 19 cm)

Weight — 0.2 lb. (0.1 kg)

2. Introduction

2.1 Overview

If you need to operate RS-232, RS-422, or RS-485 devices from your PC, use the Dual Port RS-232/422/485 Serial Interface. Connect to any device that uses the RS-232 interface, such as modems, data-entry terminals, and plotters.

This card allows you to configure two RS-232 ports, two RS-422/485 ports, or one of each. The Dual Port RS-232/422/485 also features greater maximum distance and allows multi-drop communications.

The card also includes a serial utility disk with Seacom, a DOS interrupt and driver package. Seacom allows data to be buffered, eliminating data loss in high-speed data transfers. It also allows more than 4 ports (256 max.) to be configured and utilized under DOS.

The README file on the serial utility disk contains information about the latest changes and revisions. To view this file, insert the diskette into drive A or B and type `A:TYPE READ.ME|MORE [ENTER]` or `B:TYPE READ.ME|MORE [ENTER]`.

2.2 What's Included

Your Serial Interface should come with the following items. If any of these items are missing or damaged, contact Black Box at 724-746-5500.

(1) Dual Port RS-232/422/485 Serial Interface card,

(2) serial utility software diskettes: (1) for 32-bit Windows®,
(1) for DOS and Windows®3.1x,

This manual

2.3 Features

Listed below are the special features your Serial Interface offers.

- Each port is independently addressable.

- Eleven interrupt options, including AT interrupts, for simple integration into existing systems.

- IRQs (2 [9], 3, 4, 5, 6, 7, 10, 11, 12, and 15) supported.

- IRQs can be shared or individually set for each port.

- Supports Interrupt Sharing—only one interrupt line required for multiple ports.

- Supports any character set defined by binary notation.

- 16550 UARTs on the IC113C help ensure against data loss. This chip features programmable baud rate, data format, interrupt control, and a 16-byte FIFO. The IC175C uses 16950 UARTs, which feature a 128-byte buffer for even better performance.

- Faster baud rates—up to 115.2 Kbps (IC113C) or 460.8 kbps and above (IC175C).

- Addressable as COM1: through COM4: or any other address up to 3FF Hex.

- Support for non-standard baud rates available. These baud rates (such as 31.25K or 76.8K baud) are supported by installing a different oscillator at location Y1. Call Technical Support for more information.

2.4 Technical Description

The Dual Port RS-232/422/485 Serial Interface utilizes the same 16550 UART chip found in the IBM® asynchronous adapter. This chip features programmable baud rate, data format, and interrupt control. Refer to the *IBM Technical Reference* for details on programming the chip.

RS-232
The Dual Port RS-232/422/485 Serial Interface meets the RS-232C specifications and provides an asynchronous serial I/O port. This is the standard port configuration found in the IBM AT® computer, including the DB9 style connector.

The table below shows the connector pinouts for ports J1 (port 1) and J2 (port 2) on the Interface while using RS-232.

Pin Number	Signal Name	Mode
3	Transmit Data (TD)	Output RS-232
7	Request To Send (RTS)	Output RS-232
4	Data Term Ready (DTR)	Output RS-232
5	Ground (GND)	————————
2	Receive Data (RD)	Input RS-232
1	Data Carrier Detect (DCD)	Input RS-232
6	Data Set Ready (DSR)	Input RS-232
8	Clear To Send (CTS)	Input RS-232
9	Ring Indicator (RI)	Input RS-232

RS-422
RS-422 allows very long distance communications—4000 feet (about 1219 meters) at 9600 baud—based on use of Category 3, UTP, or better, with virtually error-free differential drive characteristics. RS-422 signal levels are the standard electrical specification used in RS-449 and EIA-530. This allows interfacing with equipment that meets these specifications.

RS-485

RS-485 is backward-compatible with RS-422; however, it is optimized for multidrop applications. The output of the RS-422/485 driver is capable of being active (enabled) or tri-state (disabled). This capability allows multiple ports to be connected in a multidrop bus and selectively polled. Half-duplex two-wire communications are possible by connecting TX+ to RX+ and TX- to RX- in your cable connector. The enable to the driver is connected to the UART Request To Send (RTS) line for RS-485 communications. This allows the RS-485 driver to be tri-stated (disabled) when inactive on a multidrop polled network. The software that you are using must "know how" to enable the driver when it is answering a poll. **Failure to set this jumper correctly can cause transmitter contention problems, preventing operation by any nodes on the network.**

The table below shows the connector pinouts for ports J1 (port 1) and J2 (port 2) on the Interface while using RS-422/485.

| Pin Number	Signal Name	Mode
4	Transmit Data Pos. (TX+)	Output RS-422
3	Transmit Data Neg. (TX-)	Output RS-422
6	Req. To Send Pos. (RTS+)	Output RS-422
7	Req. To Send Neg. (RTS-)	Output RS-422
5	Ground (GND)	--------------------
1	Receive Data Pos. (RX+)	Input RS-422
2	Receive Data Neg. (RX-)	Input RS-422
9	Clear To Send Pos. (CTS+)	Input RS-422
8	Clear To Send Neg. (CTS-)	Input RS-422

3. Address Selection

NOTE

Be sure to set the address selections and jumper options *before* installation.

Each serial port on the Dual Port RS-232/422/485 Serial Interface occupies 8 consecutive I/O locations. DIP switch SW1 sets the base address for Port 1, and DIP switch SW2 sets the address for Port 2. Be careful when selecting the base address, since some selections conflict with existing PC ports. The following table shows several examples that usually do not cause a conflict.

Address	Binary		Switch Position Setting						
Hex	A9	A0	1	2	3	4	5	6	7
280-287	1010000XXX		OFF	ON	OFF	ON	ON	ON	ON
2A0-2A7	1010100XXX		OFF	ON	OFF	ON	OFF	ON	ON
2E8-2EF	1011101XXX		OFF	ON	OFF	OFF	OFF	ON	OFF
2F8-2FF	1011111XXX		OFF	ON	OFF	OFF	OFF	OFF	OFF
3E8-3EF	1111101XXX		OFF	OFF	OFF	OFF	OFF	ON	OFF
300-307	1100000XXX		OFF	OFF	ON	ON	ON	ON	ON
328-32F	1100101XXX		OFF	OFF	ON	ON	OFF	ON	OFF
3F8-3FF	1111111XXX		OFF	OFF	OFF	OFF	OFF	OFF	OFF

Typically COM1:=3F8h; COM2:=2F8h; COM3:=3E8h; COM4:=2E8h

The following illustration shows the correlation between the DIP switch setting and the address bits used to determine the base address. In the figure below, the address 300 hex through 307 hex is selected (300 hex =11 0000 0XXX in binary representation). Note that setting the switch ON (or closed) corresponds to a "0" in the address, while leaving it OFF (or open) corresponds to a "1."
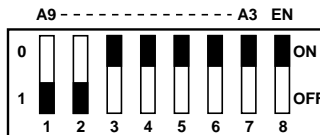
4. Option Selection

NOTE

Be sure to set the address selections and jumper options *before* installation.

The board contains several jumper straps for each port which must be set for proper operation.

4.1 Port Enable/Disable

Each port on the Dual Port RS-232/422/485 can be enabled or disabled with switch position 8 on the DIP switch. The port is enabled with the switch ON (or closed) and disabled when OFF (or open). If any port is disabled, be sure to also disable the interrupt request for that port by removing the IRQ jumper (see Figure 4-1).

INTERFACE SELECTION

RS-422/485

To select the RS-422/485 mode of operation, install DIP shunts in sockets found at E6 and E7. E6 sets Port 1 and E7 sets Port 2.

RS-232

To select the RS-232 mode of operation, install DIP shunts in sockets found at E5 and E8. E5 sets Port 1 and E8 sets Port 2.

IRQ Selection

Headers E1 and E2 select the interrupt request for each serial port (E1–Port 2, E2–Port 1). If COM1: is selected, this jumper must be on the IRQ4 setting. If COM2: is selected, this jumper must be on IRQ3.

NOTE

Most communications software applications default COM3: to IRQ4 and COM4: to IRQ3. This requires the sharing of interrupts between COM1: and COM3:, and between COM2: and COM4:. While this is the default, it is not always the best setting. Check your software configuration instructions to determine the most appropriate IRQ setting.
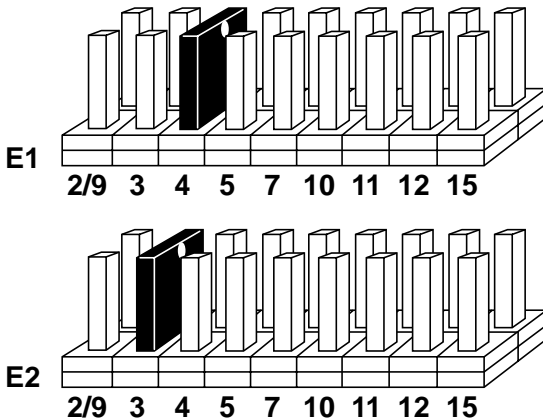
Figure 4-1. Header E1 and E2 (IRQ selection).

Any two or more ports can share a common IRQ by placing the jumpers on the same IRQ setting, and setting the appropriate selections at E9 and E10. Consult your particular software for IRQ selection. If no interrupt is desired, remove the jumper.

NOTE

IRQ 2 on AT class machines is not available. IRQ 9 is substituted in place of IRQ 2. To select IRQ 9, place jumper in the IRQ 2 position.

Figure 4-2 shows Headers E9 and E10. "N" indicates the normal, single interrupt per port mode. The "S" indicates the shared interrupt mode, which allows more than one port to access a single IRQ. The "M" indicates that the inclusion of a 1K-ohm pull-down resistor is required on one port when sharing interrupts. E10 sets Port 1 and E9 sets Port 2.

Figure 4-2. Headers E9 and E10 in Normal Mode.

Set jumpers to "N" for single interrupt mode. This setting is the normal setting for most applications.

Set jumpers to "S" for shared interrupt mode for all ports sharing an IRQ except one. Set that port block for "M." This provides the pull-down resistor circuit that makes sharing of IRQ's possible. *If you are using more than one Dual Port RS-232/422/485 Serial Interface or a compatible card in a bus, you should only have one port set to "M."*

Set jumpers to "S" if you are using more than one Dual Port RS-232/422/485 in a bus or if you wish to completely remove the pull-down resistor for hardware compatibility. Setting the board in this configuration when it is not accompanied by a pull-down resistor will prevent the ports from triggering an interrupt.

4.2 RS-232 Interface Options

To select the RS-232 mode of operation, install DIP shunts in the sockets found at E5 and E8. E5 sets Port 1 and E8 sets Port 2. These DIP shunts are completely independent of each other, allowing the user to select a single-port RS-232 or a single-port RS-422.

There are no modem control options for the RS-232 interface: all control signals are implemented. If your software requires certain handshaking signals to be active, then you must connect them either to the device with which you are communicating or you can satisfy the handshake signal requirements by connecting pins 7 to 8 (RTS to CTS) and pins 4 to 6 to 1 (DTR to DSR & DCD). Make these connections on the DB9 connector that connects to each port. Refer to Figure 4-3 when making these connections. (The table on page 4 lists the RS-232 pinout descriptions.)
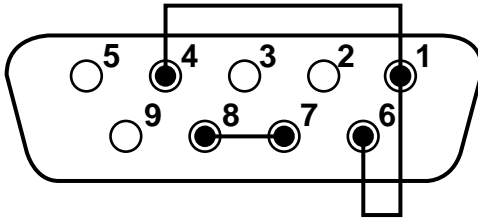
**Figure 4-3. DB9 Handshake Loopback connections for RS-232
(shown from rear or cable side of connector).**

4.3 RS-422/485 Interface Options

To select the RS-422/485 mode of operation, install DIP shunts in the sockets found at E6 and E7. E6 sets Port 1 and E7 sets Port 2.

Figure 4-4 shows Headers E3 and E4. Position "A" determines whether the RS-485 driver is enabled by the UART signal Request To Send (RTS) or always enabled. With the jumper installed in position "A," RTS enables the driver. Removing the jumper enables the driver, regardless of RTS. E4 sets Port 1 and E3 sets Port 2. This jumper should be set to "A" only if you are running the board in a multidrop polled environment such as RS-485, and you have software that "knows how to talk" on the RS-485 bus. For normal point-to-point RS-422 (such as terminal emulation), make sure that a jumper at position "A" is not in place.

Positions "B" and "C" determine whether the board provides a direct ground connection (as in RS-232 and most RS-422), or a 100-ohm high-impedance ground. The high-impedance ground is normally used by RS-485 (and some RS-422) to avoid ground-loop currents with long cables. Position "B" selects the direct ground, and position "C" selects the 100-ohm high-impedance ground. "C" should be selected when RS-422/485 operation is selected.
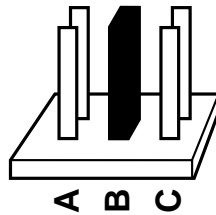
Figure 4-4. Headers E3 and E4, RS-485 Enable/Ground Selection.

4.4 Line Termination

Typically each end of the RS-422/485 bus must have line-terminating resistors. A 100-ohm resistor is across each RS-422/485 input, and a 1K-ohm pull-up/pull-down combination biases the receiver inputs. If more than two RS-485 nodes are configured in a multidrop network, only the nodes at each end of the bus should have the 100-ohm resistors installed.

5. Installation

The Dual Port RS-232/422/485 can be installed in any of the PC expansion slots, except J8 on the original IBM XT® and Portable.

IMPORTANT

You MUST set up the operating system BEFORE you physically install the Card.

5.1 Software Installation

If you are installing an ISA adapter in DOS, OS/2®, or QNX, please refer to the appropriate directory on one of the Serial Utilities Disks for instructions.

5.1.1 WINDOWS 3.1X

Please refer to the /WINDOWS sub-directory on the Serial Utilities Diskette for help files and current information on the installation of the Card in this operating environment.

5.1.2 WINDOWS 95/98 USERS

For the ISA card, run setup on disk two of the Serial Utilities Diskettes before installing the card. Make note of the resources that Windows assigns the adapter, and set the adapter to match those resources. Power down the computer and install the adapter as described in **Section 5.2**. If you wish to change any resources assigned to the adapter, refer to the help file installed in the Black Box folder in the **Start, Programs** menu.

5.1.3 WINDOWS NT

For the ISA card, run setup on disk two of the Serial Utilities Diskettes before installing the card. After installing the software, refer to the help file that automatically comes up for installation instructions.

5.2 Hardware Installation

The ISA Card can be installed in any of the PC expansion slots. The Card contains several jumper straps for each port that you must set for proper operation.
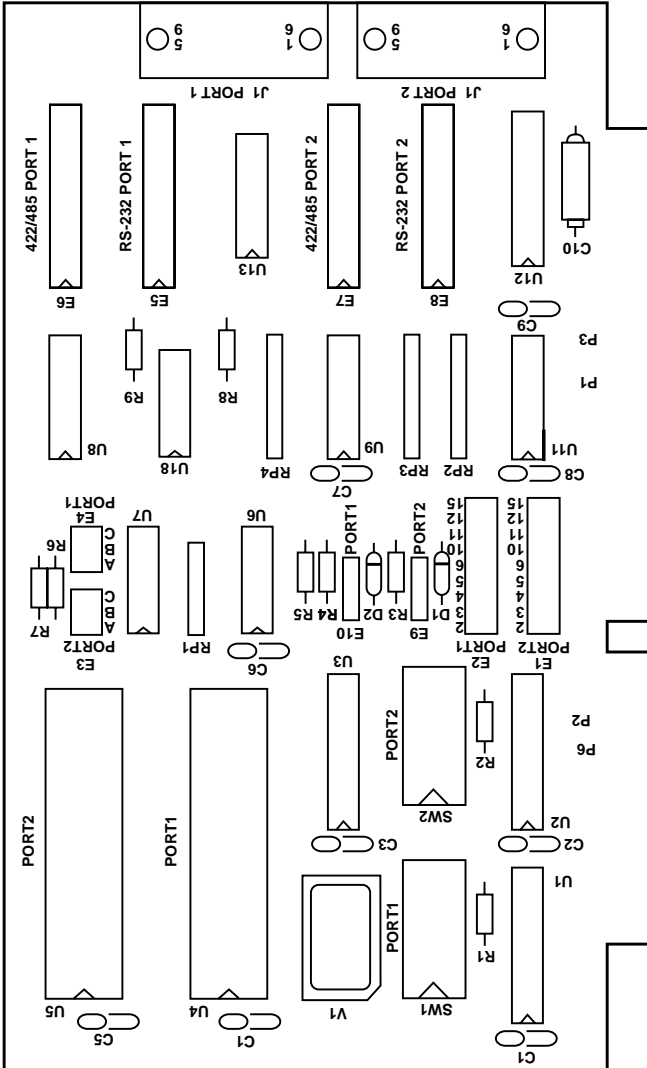
1. Turn off PC power. Disconnect the power cord.

2. Remove the PC case cover.

3. Locate an available slot and remove the blank metal slot cover.

4. Gently insert the Card into the slot. Make sure that the Card is seated properly.
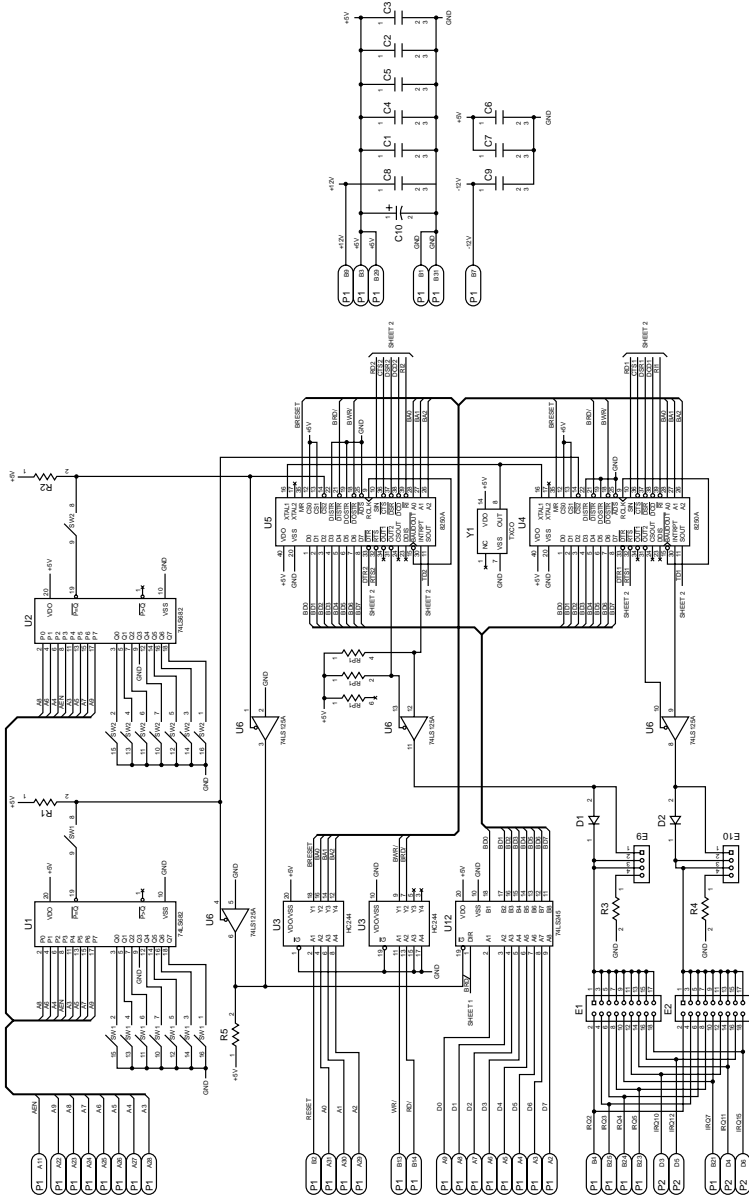
5. Replace the screw.

6. Replace the cover.

7. Connect the power cord.

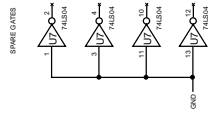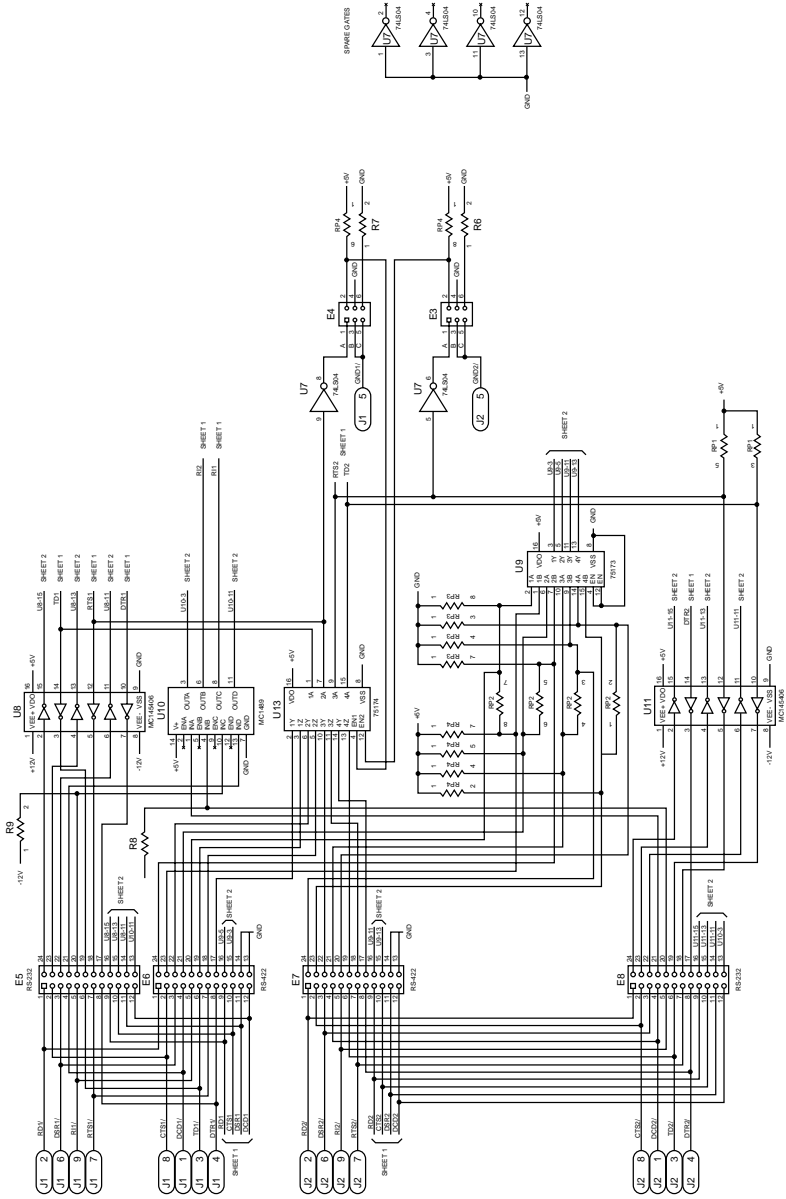   Installation is complete.

Self-Test

To perform a self-test on the card, connect the transmit and receive data pins together. If running 422/485, make sure the plus leads are not connected to the minus leads. Execute the SLT program provided on the supplied utility diskette.

Appendix: Circuit-Board Design

BLACK BOX®

NETWORK SERVICES