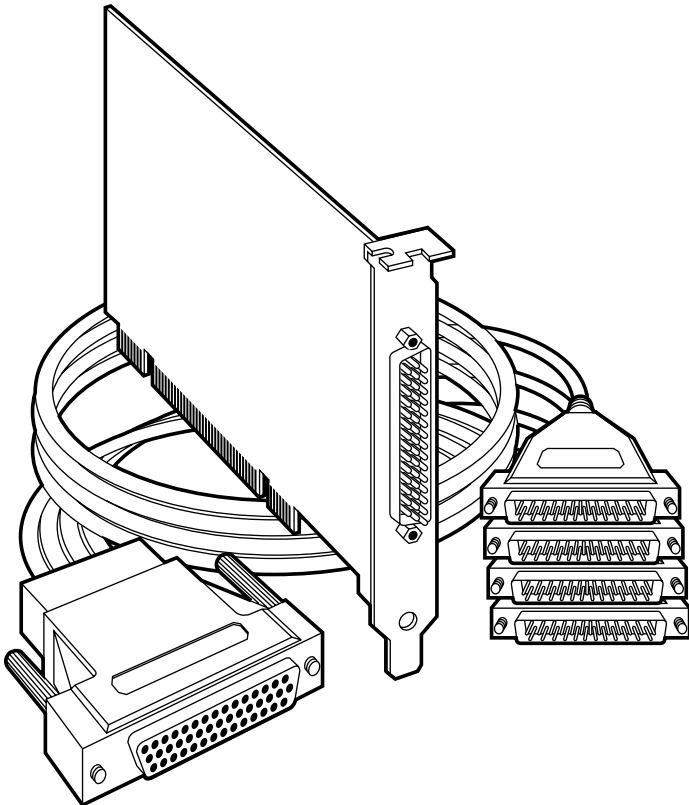




# 4-Port RS-232 PCI Serial Adapter 4-Port RS-232 HS PCI Serial Adapter



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**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 B 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.*

### 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 aparato 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 conectado 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 física 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 equipo 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 líneas de energía.
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 objetos líquidos 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: Objetos 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.

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# 1. Specifications

**Communication Chip:** IC132C: 16554 UART;  
IC132C-HS: 16654 UART;  
IC188C-R2: 16854 UART

**Speed:** IC132C: Sustained rates of 115.2 kbps, bursts of 460.8 kbps;  
IC132C-HS: Sustained rates of 460.8 kbps;  
IC188C-R2: 460.8 kbps and above

**Distance:** Up to 50 ft. (15.2 m)

**Connectors:** IC132C, IC132C-HS: (1) DB37 male on card, (1) DB37 female to (4) DB25 male cable;  
IC188C-R2: (1) DB44 female on card, (1) DB44 male to (4) DB25 male

**Cable Length:** 36" (91.4 cm)

**Temperature:** *Operating:* 32 to 122°F (0 to 50°C);  
*Storage:* -4 to +158°F (-20 to +70°C)

**Humidity:** 10 to 90%, noncondensing

**MTBF:** Greater than 150,000 hours

**Power:** IC132C, IC132C-HS: +12 VDC @ 60 mA, -12 VDC @ 100 mA,  
+5 VDC @ 250 mA;  
IC188C-R2: Universal bus 3.3 VDC and 5 VDC PCI expansion slot

**Size:** IC132C, IC132C-HS: 3.3"H x 4.9"L (8.4 x 12.5 cm);  
IC188C-R2: 2.5"H x 4.7"L (6.4 x 11.9 cm)

**Weight:** 2.3 lb. (1 kg)

## 2. Introduction

### 2.1 Description

The 4-Port RS-232 PCI Serial Adapter Card (IC132C), the 4-Port RS-232 HS PCI Serial Adapter Card (IC132C-HS), and the 4-Port RS-232 PCI Serial Adapter Card (IC188C-R2) each provide the PC with four RS-232 asynchronous ports. The adapter card allows for connection to any device using the RS-232 electrical interface, such as modems, data-entry terminals, and plotters. The IC132C features a 16554 UART chip and has a 16-byte FIFO to allow sustained data rates of 115.2 kbps and bursts of 460.8 kbps, while the IC132C-HS uses a 16654 UART and has a 64-byte FIFO to allow sustained rates of 460.8 kbps. The IC188C-R2 features a 16854 UART for speeds of 460.8 kbps and above, and has a 128-byte FIFO.

### 2.2 What's Included

The adapter card is shipped with the following items. If any of these items are missing or damaged, contact Black Box at 724-746-5500.

- (1) 4-Port RS-232 PCI Serial Adapter Card (IC132C or IC188C-R2) or 4-Port RS-232 HS PCI Serial Adapter Card (IC132C-HS)
- (1) DB37 female to (4) DB25 male “spider” cable (IC132C, IC132C-HS) or (1) DB44 male to (4) DB25 male “spider” cable (IC188C-R2)
- CD-ROM containing serial utility software for Windows® 95, 98, 2000, Me, Windows NT®, DOS, and Windows 3.1x, and this users' manual in PDF format

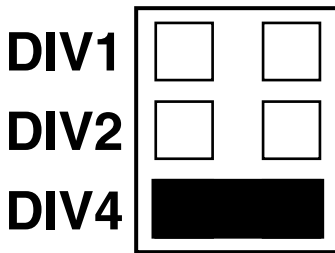


## 3. Card Setup

### 3.1 Clock Modes

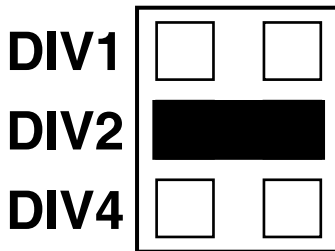
The adapter employs a unique clocking option that allows the end user to select from divide by 4, divide by 2, and divide by 1 clocking modes. This mode is selected at J2.

To select the baud rates commonly associated with COM ports (2400, 4800, 9600, 19.2, ... 115.2 kbps), place the jumper in the divide by 4 mode (marked DIV4).



**Figure 3-1. Clocking mode “Divide by 4.”**

To double these rates up to a maximum rate for 230.4 kbps, place the jumper in the divide by 2 position (marked DIV2).



**Figure 3-2. Clocking mode “Divide by 2.”**

To select the maximum data rate (460.8 kbps) place the jumper in the divide by 1 position (marked DIV1).

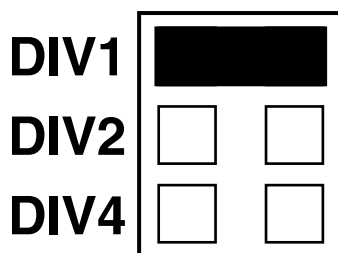


Figure 3-3. Clocking mode “Divide by 1.”

### 3.2 Baud Rates and Divisors for the “DIV1” Mode

Table 3-1 shows some common data rates and the rates you should choose to match them if using the adapter in the “DIV1” mode.

Table 3-1. Choosing baud rates for DIV1 mode.

For this Data Rate	Choose this Data Rate
1200 bps	300 bps
2400 bps	600 bps
4800 bps	1200 bps
9600 bps	2400 bps
19.2 kbps	4800 bps
57.6 kbps	9600 bps
115.2 kbps	19.2 kbps
230.4 kbps	57.6 kbps
460.8 kbps	115.2 kbps

## 4-PORT RS-232 PCI AND HS PCI SERIAL ADAPTERS

If your communications package allows the use of baud-rate divisors, choose the appropriate divisor from Table 3-2.

**Table 3-2. Baud rates and divisors for the “DIV1” mode.**

<b>For this Data Rate</b>	<b>Choose this Divisor</b>
1200 bps	384
2400 bps	192
4800 bps	96
9600 bps	48
19.2 kbps	24
38.4 kbps	12
57.6 kbps	8
115.2 kbps	4
230.4 kbps	2
460.8 kbps	1

### 3.3 Baud Rates and Divisors for the “DIV2” Mode

Table 3-3 shows some common data rates and the rates you should choose to match them if using the adapter in the “DIV2” mode.

**Table 3-3. Choosing baud rates for DIV2 mode.**

<b>For this Data Rate</b>	<b>Choose this Data Rate</b>
1200 bps	600 bps
2400 bps	1200 bps
4800 bps	2400 bps
9600 bps	4800 bps
19.2 kbps	9600 bps
38.4 kbps	19.2 kbps
57.6 kbps	28.8 kbps
115.2 kbps	57.6 kbps
230.4 kbps	115.2 kbps

## 4-PORT RS-232 PCI AND HS PCI SERIAL ADAPTERS

If your communications package allows the use of baud-rate divisors, choose the appropriate divisor from Table 3-4.

**Table 3-4. Baud rates and divisors for the “DIV2” mode.**

<b>For this Data Rate</b>	<b>Choose this Divisor</b>
1200 bps	192
2400 bps	96
4800 bps	48
9600 bps	24
19.2 kbps	12
38.4 kbps	8
57.6 kbps	4
115.2 kbps	2
230.4 kbps	1

### 3.4 Address and IRQ Selection

The adapter is automatically assigned I/O addresses and IRQs by your motherboard BIOS. Only the I/O address may be modified by the user.

Adding or removing other hardware may change the assignment of I/O addresses and IRQs.

# 4. Installation

## IMPORTANT

**You must install software before you physically install the card.**

### 4.1 Install the Software

For Windows users, start by choosing **Install Software** at the beginning of the CD. Choose **Asynchronous COM: Port Software, SeaCOM**.

For other operating systems, refer to the appropriate section of the serial utilities software. For additional help on setting up the operating system, call Technical Support.

### 4.2 Hardware Installation

The adapter can be installed in any of the PCI expansion slots and contains a single jumper strap that must be set for proper operation. Please see **Chapter 3** for information on this jumper.

1. Install any necessary software before installing the adapter.
2. Turn off PC power. Disconnect the power cord.
3. Remove the PC case cover.
4. Locate an available PCI slot. Remove the screw holding the blank metal slot cover, and then remove the cover itself.
5. Gently insert the adapter into the slot. Make sure that the adapter is seated properly.
6. Replace the screw.
7. Replace the cover.
8. Connect the power cord.

#### SELECTING THE PCI COM NUMBER IN WINDOWS 95

When installing a PCI serial adapter in Windows 95, the default starting COM: number assigned to the first port will be COM:5 if no COM:5 exists. If there is a COM:5, COM:6, etc., the next available COM: number will be assigned to the first port, with all additional ports following in ascending order.

To change the first two ports so that Windows assigns them COM:3 and COM:4 port enumeration, double-click the “Systems” icon in the control panel or right-click on “My Computer.” Choose “Properties,” which will bring you to “System

## 4-PORT RS-232 PCI AND HS PCI SERIAL ADAPTERS

Properties.” Choose the “Device Manager” tab and double-click on the “Multi-Function Adapter” heading. This will show all the information concerning the PCI serial adapter. Choose the “Resources” tab, which will show all resources assigned to the PCI adapter. Uncheck the “Use Automatic Settings” box. Five input/output (I/O), ranges will be listed. The first I/O range is for the PCI bus and should not be changed. The second and third I/O ranges are the ones that need to be changed in order to have those ports enumerated as COM:3 and COM:4. Double-click on the second I/O range; this allows you to change the address. Highlight the entire I/O range and type: 03e8–03ef for COM:3. Click **OK**. Windows will inform you that you have made modifications that may affect other devices. Click **OK**. Next, double-click on the third I/O range. Highlight the entire I/O range and type: 02e8–02ef for COM:4. Again, Windows will inform you that you have made modifications that may affect other devices. Click **OK**.

Following these steps will change the COM: number assignments on the first two ports to COM:3 and COM:4.

# 5. Technical Description

The IC132C adapter uses the 16554 UART. This chip features programmable baud rate, data format, interrupt control and a 16-byte input and output FIFO, and is functionally (4) 16550 UARTs. The IC132C-HS uses the 16654 UART, which has a 64-byte FIFO as opposed to the 16-byte FIFO available in the 16554. The IC188C-R2 uses the 16854 UART, which has a 128-byte FIFO buffer.

## 5.1 Interrupts

A good analogy of a PC interrupt would be the phone ringing. The phone “bell” is a request for us to stop what we are currently doing and take up another task (speak to the person on the other end of the line). This is the same process the PC uses to alert the CPU that a task must be performed. The CPU, upon receiving an interrupt, makes a record of what the processor was doing at the time and stores this information on the “stack”; this allows the processor to resume its predefined duties after the interrupt is handled, exactly where it left off. Every main sub-system in the PC has its own interrupt, frequently called an IRQ (short for Interrupt ReQuest).

The ability to share IRQ is an important feature for any add-in I/O card. Consider that in the IBM® XT™, the available IRQs were IRQ0 through IRQ7. Of these interrupts, only IRQ 2–5 and IRQ 7 were actually available for use. This made the IRQ a very valuable system resource. To make the maximum use of these system resources, an IRQ-sharing circuit that allowed more than one port to use a selected IRQ was devised. This worked fine as a hardware solution but presented the software designer with a challenge to identify the source of the interrupt. The software designer frequently used a technique referred to as “round robin polling.” This method required the interrupt service routine to “poll” or interrogate each UART as to its interrupt pending status. This method of polling was sufficient for use with slower-speed communications, but as modems increased their throughput abilities, this method of servicing shared IRQs became inefficient.

## 5.2 Why Use an ISP?

The answer to the polling inefficiency was the Interrupt Status Port (ISP). The ISP is a read-only 8-bit register that sets a corresponding bit when an interrupt is pending. Port 1 interrupt line corresponds with Bit D0 of the status port, Port 2 with D1, etc. The use of this port means that the software designer now only has to poll a single port to determine if an interrupt is pending.



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The ISP is at Base+7 on each port (Example: Base = 280 Hex, Status Port = 287, 28F... etc.). The adapter will allow any one of the available locations to be read to obtain the value in the status register. All four status ports on the adapter are identical, so any one of the four can be read.

Example: This indicates that Channel 2 has an interrupt pending.

Bit Position:	7	6	5	4	3	2	1	0
Value Read:	0	0	0	0	0	0	1	0

### NOTE

**Bits 4–7 are not driven and can report back as a 1 or a 0. Most application software will mask the unused bits to determine if an interrupt is pending.**

### 5.3 Connector Pin Assignments

Table 5-1. DB25 (RS-232 DTE).

Signal	Name	Pin #	Mode
GND	Ground	7	—
TD	Transmit Data	2	Output
RTS	Request To Send	4	Output
DTR	Data Terminal Ready	20	Output
RD	Receive Data	3	Input
CTS	Clear To Send	5	Input
DSR	Data Set Ready	6	Input
DCD	Data Carrier Detect	8	Input
RI	Ring Indicator	22	Input

**Table 5-2. DB9 (EIA-574 DTE).**

<b>Signal</b>	<b>Name</b>	<b>Pin #</b>	<b>Mode</b>
GND	Ground	5	—
TD	Transmit Data	3	Output
RTS	Request To Send	7	Output
DTR	Data Terminal Ready	4	Output
RD	Receive Data	2	Input
CTS	Clear To Send	8	Input
DSR	Data Set Ready	6	Input
DCD	Data Carrier Detect	1	Input
RI	Ring Indicator	9	Input

**NOTE**

Refer to the above chart if your RS-232 device has a DB9 connector. Use a DB9-to-DB25 adapter with your device to adapt it to the cable's DB25 port. Call Technical Support for details.

## 4-PORT RS-232 PCI AND HS PCI SERIAL ADAPTERS

Table 5-3. DB37 male on card (IC132C, IC132C-HS).

Port #	1	2	3	4
GND	33	14	24	5
TD	35	12	26	3
RTS	17	30	8	21
DTR	34	13	25	4
RD	36	11	27	2
CTS	16	31	7	22
DSR	18	29	9	20
DCD	37	10	28	1
RI	15	32	6	23

**Table 5-4. DB44 female on card (IC188C-R2).**

<b>Port #</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
GND	17	21	24	28
RD	4	8	12	30
RI	33	37	41	44
DCD	3	7	11	15
DTR	32	36	40	43
RTS	2	6	10	14
DSR	31	35	39	42
TD	1	5	9	13
CTS	16	20	23	27

# Appendix A. Troubleshooting

## **A.1 Using the Serial Utilities CD-ROM**

A serial utility CD-ROM is supplied with the adapter and will be used in the troubleshooting procedures. By using this CD-ROM and following these simple steps, most common problems can be eliminated without having to call Technical Support.

1. Make sure the adapter is securely installed in a PCI slot.
2. Use the supplied CD-ROM (including the PDF file for this user manual) to verify that the adapter is configured correctly.
3. Please refer to the CD-ROM for any manual updates and application-specific information.
4. Always use the diagnostic software when troubleshooting a problem. This will eliminate the software issue from the equation.

## **A.2 Calling Black Box**

If you determine that your adapter is malfunctioning, do not attempt to alter or repair the unit. It contains no user-serviceable parts. Contact Black Box at 724-746-5500.

Before you do, make a record of the history of the problem. We will be able to provide more efficient and accurate assistance if you have a complete description, including:

- the nature and duration of the problem.
- when the problem occurs.
- the components involved in the problem.
- any particular application that, when used, appears to create the problem or make it worse.

### **A.3 Shipping and Packaging**

If you need to transport or ship your adapter:

- Package it carefully. We recommend that you use the original container.
- If you are shipping the adapter for repair, make sure you include everything that came in the original package. Before you ship, contact Black Box to get a Return Authorization (RA) number.

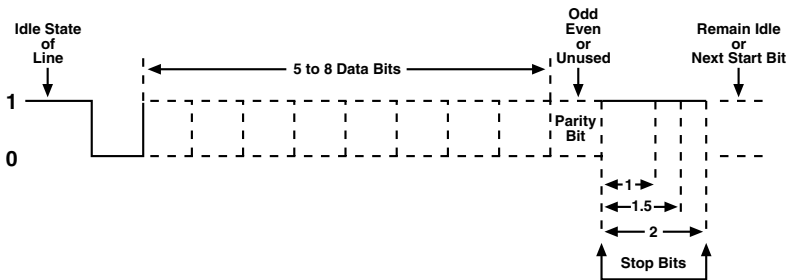
## Appendix B. Electrical Interface

Quite possibly the most widely used communication standard is RS-232. This implementation has been defined and revised several times and is often referred to as EIA/TIA-232. The IBM AT<sup>®</sup> computer defined the RS-232 port on a 9-pin D sub connector and subsequently the EIA/TIA approved this implementation as the EIA/TIA-574 standard. This standard is defined as the 9-Position Non-Synchronous Interface between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange. Both implementations are in widespread use and are referred to as RS-232 in this document. RS-232 is capable of operating at data rates up to 20 kbps at distances less than 50 ft. (15.2 m). The absolute maximum data rate may vary due to line conditions and cable lengths. RS-232 is a single-ended or unbalanced interface, meaning that a single electrical signal is compared to a common signal (ground) to determine binary logic states. The RS-232 and the EIA/TIA-574 specification define two types of interface circuits, Data Terminal Equipment (DTE) and Data Circuit-Terminating Equipment (DCE). The adapter is a DTE device.

# Appendix C. Asynchronous Communications

In serial data communication, individual bits of a character are transmitted consecutively to a receiver that assembles the bits back into a character. Data rate, error checking, handshaking, and character framing (start/stop bits) are pre-defined and must correspond at both the transmitting and receiving ends.

Asynchronous communications is the standard means of serial data communication for PC compatibles and PS/2® computers. The original PC was equipped with a communication or COM port that was designed around an 8250 Universal Asynchronous Receiver Transmitter (UART). This device allows asynchronous serial data to be transferred through a simple and straightforward programming interface. A start bit, followed by a pre-defined number of data bits (5, 6, 7, or 8), defines character boundaries for asynchronous communications. The end of the character is defined by the transmission of a pre-defined number of stop bits (usually 1, 1.5, or 2).



**Figure C-1. Asynchronous communications bit diagram.**

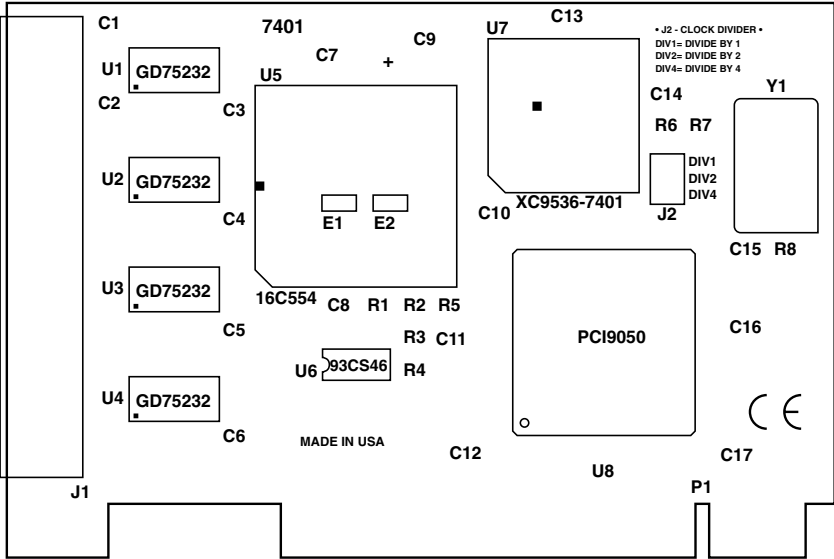
An extra bit used for error detection is often appended before the stop bits. This special bit is called the parity bit. Parity is a simple method of determining if a data bit has been lost or corrupted during transmission. There are several methods for implementing a parity check to guard against data corruption. Common methods are called (E)ven Parity or (O)dd Parity. Sometimes parity is not used to detect errors on the data stream. This is referred to as (N)o parity. Because each bit in asynchronous communications is sent consecutively, it is easy to generalize



## 4-PORT RS-232 PCI AND HS PCI SERIAL ADAPTERS

asynchronous communications by stating that each character is wrapped (framed) by pre-defined bits to mark the beginning and end of the serial transmission of the character. The data rate and communication parameters for asynchronous communications have to be the same at both the transmitting and receiving ends. The communication parameters are baud rate, parity, number of data bits per character, and stop bits (usually listed in that order, like this: 9600,N,8,1).

# Appendix D. Board Layout





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