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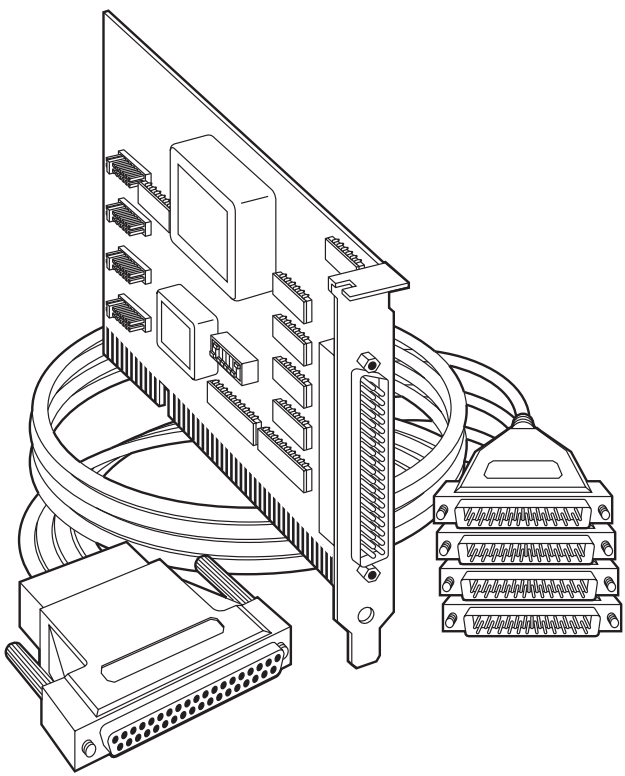
BLACK BOX®
NETWORK SERVICES

APRIL 2000
IC102C-R2
IC180C

4-Port Serial Host Adapter with ISP



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FEDERAL COMMUNICATIONS COMMISSION
AND
CANADIAN DEPARTMENT OF COMMUNICATIONS
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 the Canadian Department of Communications.

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

EMC Directive Statement

Products bearing the CE label fulfill the requirements of the EMC directive (89/336/EEC) and of the low-voltage directive (73/23/EEC) issued by the European Commission.

To obey these directives, these European standards must be met:

- **EN55022 Class A —** "Limits and methods of measurement of radio interference characteristics of information technology equipment."
- **EN50082-1 —** "Electromagnetic compatibility — Generic immunity standard" Part 1: Residential, commercial, and light industry.
- **EN60950 (IEC950) —** "Safety of information technology equipment, including electrical business equipment."

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WARNING

Always use the cabling provided with this product if possible. If no cable is provided or if an alternate cable is required, use high-quality shielded cabling to maintain compliance with FCC/EMC directives.

Contents

Chapter **Page**

1. Specifications

Maximum Data Rate —	IC102C-R2: Up to 460.8 Kbps; IC180C: 460.8 kbps and higher
Maximum Data Distance —	Up to 50 feet (15.2 m)
Number of Ports —	(4) RS-232
Connectors —	DB37 to (4) DB25 male
Communications Chip —	IC102C-R2: 16554 UART; IC180C: 16950 UART
Manufacturing —	IPC 610-A Class-III standards are adhered to with a 0.1 visual A.Q.L. and 100% functional testing. This circuit board is built to UL® 94V0 rating and is 100% electrically tested. This printed circuit board is solder mask over bare copper or solder mask over tin nickel.
Operating Temperature —	32 to 122°F (0 to 50°C)
Storage Temperature —	-4 to +158°F (-20 to +70°C)
Humidity Range —	10 to 90% relative humidity, non-condensing
MTBF —	Greater than 150,000 hours
Power —	+5V @ 210 mA, ±12V @ 80 mA each
Size —	3.4"H x 5.2"L (8.6 x 13.2 cm)
Cable Length —	36 inches (91.4 cm)

2. Introduction

2.1 Overview

The 4-Port Card Serial Host Adapter with ISP provides the PC with four RS-232 asynchronous ports. This Adapter allows for connection to any device (such as modems, data-entry terminals, and plotters) using the RS-232 electrical interface.

The Adapter is shipped with the items listed below. If any of these items are missing or damaged, call Black Box.

- The 4-Port Card Serial Host Adapter with ISP,
- a DB37 to (4) DB25 spider cable (an optional DB9 spider cable is available; call Technical Support for details),
- (2) 3.5" serial utility diskettes, and
- this user's manual.

The Adapter's factory-default settings are:

Port #	Base Address	IRQ	IRQ Mode	Clock Divisor
Port 1	280	5	M	4
Port 2	288	5	S	4
Port 3	290	5	S	4
Port 4	298	5	S	4

To install the 4-Port Card Serial Host Adapter with ISP using factory-default settings, refer to **Chapter 4**.

For your reference, record your installed Adapter settings below.

Port #	Base Address	IRQ	IRQ Mode	Clock Divisor
Port 1				
Port 2				
Port 3				
Port 4				

2.2 Technical Description

The IC102C-R2 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 IC180C uses 16950 UARTs, which feature a 128-byte FIFO.

This Adapter features:

- Sharable IRQs that allow more than one port to share a single IRQ.
- Support for IRQs 3–7, 9–12, and 15.
- 16554 buffered Quad UART (IC102C-R2) or 16950 UART (IC180C).
- Easier integration with 16-bit address decode.
- Speeds up to 460.8 Kbps.
- Multiple clocking modes that ensure compatibility with existing software products.

2.2.1 Interrupt Status Port (ISP)

The 4-Port Card Serial Host Adapter with ISP provides you with an Interrupt Status Port (ISP) for greater throughput when servicing multiple ports on a single interrupt line. 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 ISP is located at Base+7 on each port. (For example, Base = 280 Hex, Status Port = 287.) This allows any one of eight 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 to determine which interrupt is pending. In the example below, 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

2.2.2 Connector Pin Assignments

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

DB9 (EIA-574 DTE)

Signal	Name	Pin #	Mode
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

DB37

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

3. Configuration

The 4-Port Card Serial Host Adapter with ISP contains several jumper straps that must be set for proper operation.

3.1 Address Selection

Each port on the 4-Port Card Serial Host Adapter with ISP occupies eight consecutive I/O locations. A DIP switch is used to set the base address for these locations.

The Adapter has a unique addressing scheme that provides the ability to select specific non-linear address combinations (for example, 3F8, 2F8, 3E8, 2E8).

One way to select port addresses is to choose them from the table of available address combinations below. If different address combinations are required, contact Technical Support about custom PAL® options.

Table 3-1. Available address combinations

Switch 6	Switch 7	Switch 8	Port 1	Port 2	Port 3	Port 4
On	On	Off	3F8	2F8	3E8	2E8
On	Off	On	2F8	3E8	2E8	2E0
On	Off	Off	3E8	2E8	280	288
Off	On	On	500	508	510	518
Off	On	Off	580	588	590	598
Off	Off	On	1500	1508	1510	1518
Off	Off	Off	3220	3228	4220	4228
On	On	On	Addresses set up by switches 1–5.			

NOTE

Each COM: port in the system should have a unique address. Typically COM1:–COM4: addresses are 3F8, 2F8, 3E8, and 2E8 Hex. Refer to *Chapter 5* for common address contentions.

There's also a second mode of address selection. In this mode, the DIP switch sets the base address and the Adapter occupies 32 consecutive I/O locations. The table below illustrates the location of each port and its relationship to the other ports.

NOTE

For switches 1–5 to become active, switches 6, 7, and 8 must be set in the "On" (Up) position.

Table 3-2. Address selection

	Switch Settings				
Address Lines→	A9	A8	A7	A6	A5
Address Selected	1	2	3	4	5
280-29F	Off	On	Off	On	On
2A0-2BF	Off	On	Off	On	Off
380-39F	Off	Off	Off	On	On
1A0-1BF	On	Off	Off	On	Off
2E0-2FF	Off	On	Off	Off	Off

The illustration below shows the correlation between the DIP-switch setting and the address bits used to determine the base address. In the example below, the address 2E0 is selected as a base. Address 2E0 in binary is XX 10 111X XXXX, where X = a non-selectable address bit.

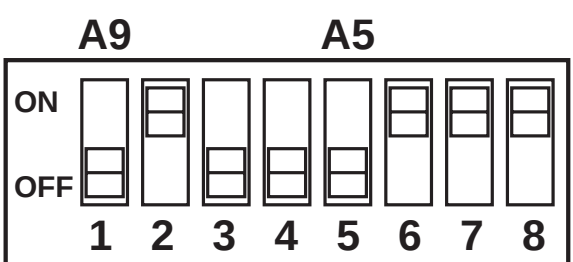

Figure 3-1. DIP-switch settings.

Table 3-3. Port to connector

Port #	Connector Location	Address	Example (Base=2E0)
1	1	Base+0	2E0-2E7
2	2	Base+8	2E8-2EF
3	3	Base+16	2F0-2F7
4	4	Base+24	2F8-2FF

3.2 Jumper Selections

For ease of configuration, the headers are grouped by port. Port 1 headers have a "J1" prefix, Port 2 headers have the "J2" prefix, etc. For example, the header that controls the Port 1 IRQ selection is J1B, the header that controls the Port 2 IRQ selection is J2B. The silk-screen also provides information for configuring the Adapter without the use of the manual. This is particularly useful in field re-configuration.

3.3 IRQ Selection

Headers J1B through J4B select the interrupt request for each serial port. If COM1: is selected, the corresponding jumper must be on the IRQ4 setting. If COM2: is selected, the corresponding jumper must be on IRQ3. (This only applies to the traditional DOS COM port assignments; in Windows® COM1: can use I/O address 300 and IRQ15 if it is available).

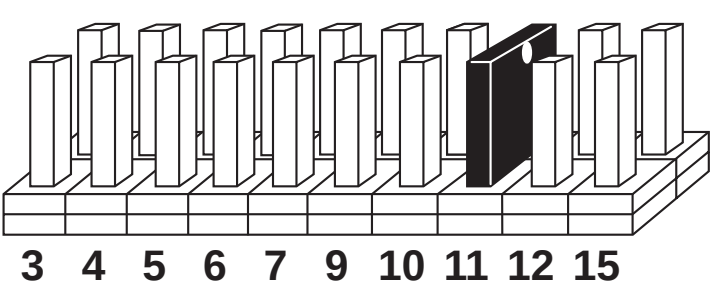

Figure 3-2. Headers J1B-J4B, IRQ selection.

NOTE

Most DOS 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 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 J1A through J4A. When sharing IRQs, many operating systems (for example, Windows NT™) will require the location of the Interrupt Status Port (ISP). See **Section 2.2** for a description of the ISP and how it is used.

3.4 Interrupt Modes

Headers J1A through J4A select the interrupt modes for each port. Each port must be set in the correct mode to ensure proper operation.

"N" indicates the normal, single interrupt per port mode. "S" indicates the shared interrupt mode, which allows more than one port to access a single IRQ. "M" indicates that a 1K-ohm pull-down resistor is required on one port when sharing interrupts.

Figure 3-3. Header J1A, normal IRQ mode.

Set the jumpers to “S” for shared interrupt mode on all blocks sharing an IRQ except one. Set that port block for “M.” This provides the pull-down resistor circuit that makes sharing IRQs possible. If you are using more than one 4-Port Card Serial Host Adapter with ISP or a compatible adapter in a bus, you should only have one port set to “M.” The following example shows two ports sharing a single IRQ.

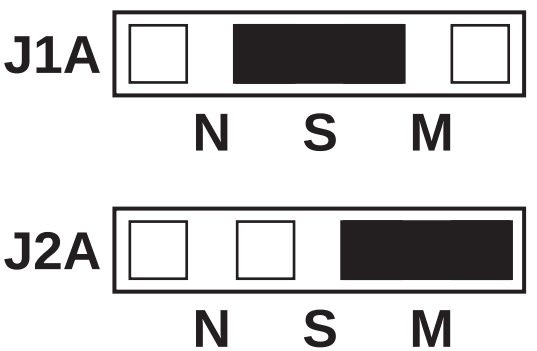

Figure 3-4. Header J1A and J2A, shared IRQ mode.

Set the jumper to “S” if you are using more than one 4-Port Card Serial Host Adapter with ISP in a bus or to completely remove the pull-down resistor for hardware compatibility. *Setting the adapter in this configuration when it is not accompanied by a pull-down resistor will prevent the ports from triggering an interrupt.*

3.5 Clock Modes

You can select from “divide by 4,” “divide by 2,” and “divide by 1” clocking modes. This mode is selected at J5.

To select the baud rates commonly associated with COM ports (for example, 2400, 4800, 9600, 19.2,...115.2 Kbps) place the jumper in the divide by 4 mode (silk-screened DIV4).

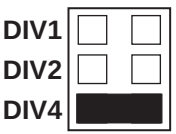

Figure 3-5. Clocking mode "Divide By 4."

To double these rates up to a maximum rate of 230.4 Kbps, place the jumper in the divide by 2 (silk-screened DIV2) position.

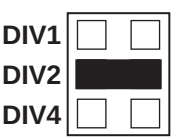

Figure 3-6. Clocking mode "Divide By 2."

To select the maximum data rate (460.8 Kbps), place the jumper in the divide by 1 (silk-screened DIV1) position.

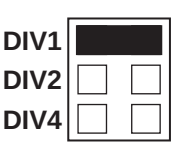

Figure 3-7. Clocking mode "Divide By 1."

3.6 Baud Rates and Divisors for the "DIV1" Mode

The following table shows some common data rates and the rate you should choose to match them if using the Adapter in the 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

If your communications package allows the use of baud rate divisors, choose the appropriate divisor from this table:

For this data rate...	choose this data rate
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

3.7 Baud Rates and Divisors for the "DIV2" Mode

The following table shows some common data rates and the rate you should choose to match them if using the Adapter in the DIV2 mode.

For this data rate...	choose this data rate
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	38.4 Kbps
115.2 Kbps	57.6 Kbps
230.4 Kbps	115.2 Kbps

If your communications package allows the use of baud-rate divisors, choose the appropriate divisor from this table:

For this data rate...	choose this divisor
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

4. Installation

The 4-Port Card Serial Host Adapter with ISP can be installed in any of the PC expansion slots. The Adapter contains several jumper straps for each port that must be set for proper operation—see **Chapter 3**.

IMPORTANT

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

4.1 Installing the Adapter in Your Operating System

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

4.1.1 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.

4.1.2 WINDOWS 95/98 USERS

For the ISA card, run setup on the Serial Utilities Diskette 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.

4.1.3 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.
Installation is complete.

4.2 Installing the Hardware

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 Adapter into the slot. Make sure that the Adapter is seated properly.

5. For the IC102C-R2 or IC180C connect the DB37 female connector end of the octopus cable to the DB37 male connector on the card.

6. Replace the screw.

7. Replace the cover.

8. Install the spider cable.

9. Connect the power cord.

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. Troubleshooting

A Serial Utility Diskette is supplied with the Adapter and will be used in the troubleshooting procedures. By using this diskette and following these simple steps, most common problems can be eliminated without the need to call Technical Support.

1. Identify all I/O adapters currently installed in your system. This includes your on-board serial ports, controller cards, sound cards, etc. The I/O addresses used by these adapters, as well as the IRQ (if any) should be identified.

2. Configure the 4-Port Card Serial Host Adapter with ISP so that there is no conflict with currently installed adapters. No two adapters can occupy the same I/O address.

3. Make sure the Adapter is using a unique IRQ. While the 4-Port Card Serial Host Adapter with ISP does allow the sharing of IRQs, many other adapters, such as SCSI adapters and on-board serial ports, *do not*. The IRQ is typically selected via an on-board header block. Refer to **Chapter 3** for help in choosing an I/O address and IRQ.

4. Make sure the Adapter is securely installed in a motherboard slot.

5. Use the supplied diskette and this manual to verify that the Adapter is configured correctly. The supplied diskette contains a diagnostic program ("SSD") that will verify if the Adapter is configured properly. Refer to the "README" file on the diskette for detailed instructions on using "SSD."

6. Refer to the diskette for any postproduction manual updates and application-specific information.

7. Always use this diagnostic software when troubleshooting a problem. This will eliminate the software issue from the equation.

Appendix A. The RS-232 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 RS-232-C/D/E or EIA/TIA-232-C/D/E. It is defined as "*Interface between Data Terminal Equipment and Data Circuit-Terminating Equipment Employing Serial Binary Data Interchange*."

The mechanical implementation of RS-232 is on a DB25 connector. The IBM® PC computer defined the RS-232 port on a DB9 connector and subsequently the EIA/TIA approved this implementation as the EIA/TIA-574 standard. This standard has been 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/50 ft. (15.2 m). The absolute maximum data rate may vary with line conditions and cable lengths. RS-232 often operates at 38.4 Kbps or more over very short distances.

The voltage levels defined by RS-232 range from -12 to +12 volts. 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. A voltage of +12 volts (usually +3 to +10 volts) represents a binary 0 (space), and -12 volts (-3 to -10 volts) represents a binary 1 (mark).

The RS-232 and the EIA/TIA-574 specification define two types of interface circuits: Data Terminal Equipment (DTE) and Data Circuit-Terminating (DCE). This adapter is a DTE interface.

Appendix B. Asynchronous Communications

Serial data communications implies that 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 starting 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 (usual 1, 1.5, or 2).

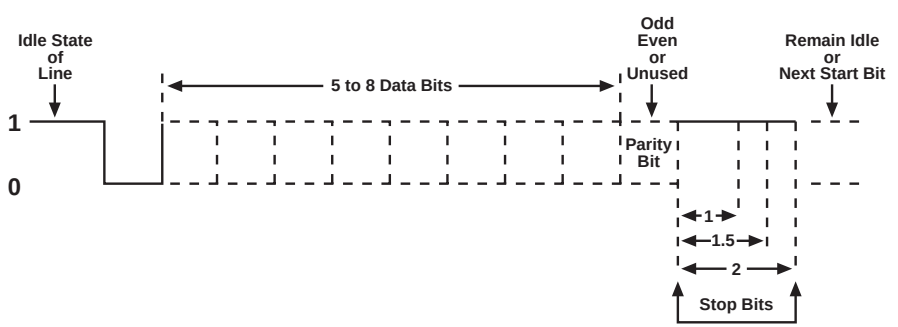

Figure B-1. Asynchronous communications bit.

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 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 (for example, 9600, N, 8, 1).

Appendix C. Circuit-Board Diagram