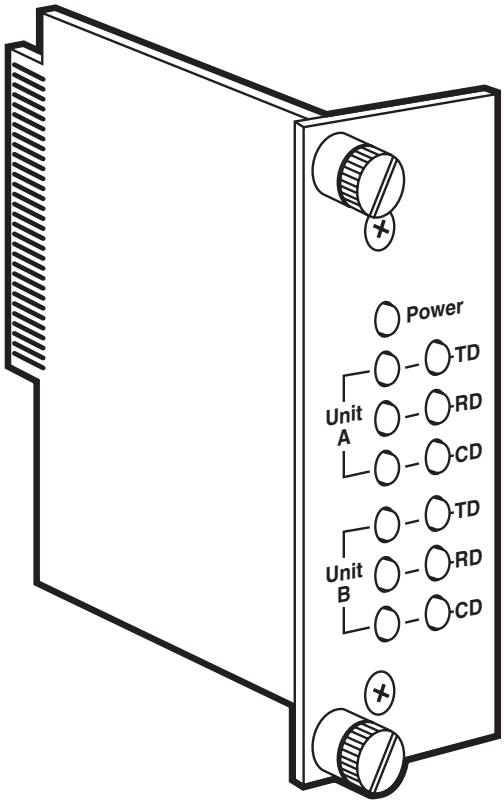
BLACK BOX®
NETWORK SERVICES

APRIL 2000
IC479C
IC480C

Async 232↔422/485 Card



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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

Data Rate	0 to 115.2 Kbps
Connectors	IC479C: (2) RJ-11 (upper ports) RS422/485, (2) RJ-45 (lower ports) DCE RS-232; IC480C: (2) RJ-45 (upper ports) RS-422/485, (2) RJ-45 (lower ports) DCE RS-232
Transmission Format	Asynchronous
Transmission Mode	Full/half-duplex
Transmission Line	2- or 4-wire, unconditioned twisted pair
Transmit Level	2V ±10% differential output voltage
Control Signals	DSR turns ON immediately after the terminal raises DTR; DCD turns on after recognizing the receive signal from the line; CTS turns on after the terminal raises RTS
Carrier	Constantly on or controlled by RTS
Echo Mode	Echo and No Echo, supported in both 2- and 4-wire modes
Receiver Impedance	Low (120 ohms), High (typ. 16K ohms)
Fuse	400 mA for 120V applications; 200 mA for 240V applications
MTBF	239,906 hours
MTTR	1 hour
Operating Temperature	32° to 122°F (0° to 50°C)
Humidity	0 to 95%, noncondensing
Altitude	Up to 15,000 feet (4570 m)

Power Supply	Rackmount power supply is switchable between 120 and 240 VAC; rack chassis supplies 10 VAC to the Card, typical consumption is 700 mW per card
Size	3.1"H x 0.95"W x 5.4"D (7.88 x 2.4 x 13.7 cm)

2. Introduction

The Async 232↔422/485 Card is a dual rack card incorporating two converters. Both units support asynchronous data rates up to 115.2 Kbps over one or two twisted pairs and support distances to 9.4 miles (15.1 km).

The Async 232↔422/485 Card can handle up to 50 terminal drops in a multipoint polling environment. The Async 232↔422/485 Card may be configured for high- or low-impedance operation and the carrier may be set to "constantly on" or "controlled by RTS."

The Async 232↔422/485 Card uses the latest surface-mount technology for high-quality interface-converter performance in a convenient rack card. Filling one function card slot on the MicroRack (RM202, RM204, RM208, and RM216) chassis, the Async 232↔422/485 Card is available with RJ-11 or RJ-45 rear interface cards.

3. Configuration

This section describes the location and orientation of the Async 232↔422/485 Card's configuration switches, provides detailed instructions on setting each switch, and describes the settings for each of the rear connection cards.

The Async 232↔422/485 Card houses two interface converters, *each* using two sets of switches and one jumper. The locations of these switches and jumpers on the Async 232↔422/485 Card PC board are shown in Figure 3-1. These switches and jumpers are accessible when the card is slid out of the rack chassis. Once configured, the Async 232↔422/485 Card is designed to operate transparently, without need for frequent re-configuration: Just set it and forget it.

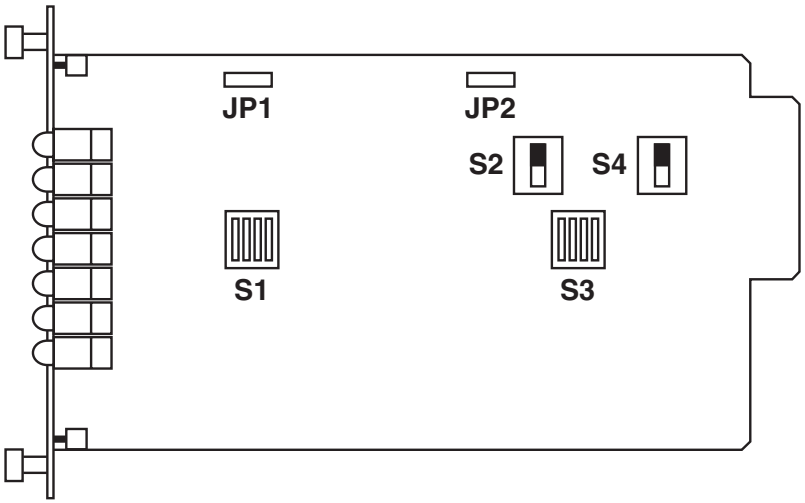

Figure 3-1. Location of configuration switches and jumpers on the Async 232↔422/485 Card board.

3.1 Switch Allocations

The configuration switches and jumpers on the Async 232↔422/485 Card PC board allow you to specify impedance, carrier control, RTS/CTS delay, echo, receiver squelch, and 2- or 4-wire mode. The table below shows which switches/jumpers are allocated to which short haul.

	Unit A	Unit B
Hi-Z/Lo-Z	JP1	JP2
RTS/CTS, Echo, Carrier, Rcvr Squelch	S1	S3
2W/4W	S2	S4

3.2 Configuration Overview

Table 3-1 provides a quick reference guide to configuration switch/jumper settings you are likely to find most useful. The factory-default settings for the Async 232↔422/485 Card are in **bold** type.

Table 3-1. Summary of switch/jumper settings

Typical Switch Applications					
Switch Settings	**Point-to-Point**			**Multipoint**	
	4W	**4W HDX**	**2W**	**4W**	**2W**
S1-1, S3-1: Driver	Off	On	On	Master-Off Slaves-On	**On**
S1-2, S3-2: RTS/CTS	On	On	On	On	**On**
S1-3, S3-3: Echo	Off	On	Off	Off	**Off**
S1-4, S3-4: Rcvr Squelch	Off	Off	On	Off	**On**
JP1, JP2: Impedance	Lo-Z	Lo-Z	Lo-Z	**Master-Lo-Z** Slaves-Hi-Z Last Slave-Lo-Z	
S2, S4: 2-wire/4-wire	4W	4W	2W	4W	**2W**

3.3 Detailed Switch and Jumper Settings

The following section provides detailed information about the function of each DIP switch and lists all possible settings. Use this section as a configuration guide for applications where the Async 232↔422/485 Card's default would not provide correct results.

3.3.1 Driver Control (S1-1 and S3-1)

The settings for S1-1 and S3-1 determine whether the driver is "constantly on" or "controlled by RTS." These switches allow for operation in switched carrier, multipoint, or hardware-handshaking applications. S1-1 controls Unit A and S3-1 controls Unit B.

Switch	Setting
On	Controlled by RTS
Off	Constantly on

3.3.2 RTS/CTS Delay (S1-2 and S3-2)

The settings for S1-2 and S3-2 determine the amount of delay between the time the Async 232↔422/485 Card "sees" RTS and when it sends CTS. S1-2 controls Unit A and S3-2 controls Unit B.

Switch	Setting
Off	No delay
On	8 ms (turn-off delay is <1 ms)

3.3.3 Echo (S1-3 and S3-3)

The settings for S1-3 and S3-3 determine whether the data transmitted on TD will appear on RD. This feature is only available in 4-wire mode. S1-3 controls Unit A and S3-3 controls Unit B.

Switch	Setting
On	Echo on
Off	Echo off

3.3.4 Receiver Squelch (S1-4 and S3-4)

The settings for S1-4 and S3-4 determine whether the receiver is constantly running, or is squelched by RTS. If receiver squelch is enabled and RTS is high, the receiver will be squelched and RD and CD will be held inactive. This feature is useful in 2-wire mode, where the receiver and transmitter are connected to the same pair of wires. (In 4-wire mode, this switch should be set to "off.") S1-4 controls Unit A, and S3-4 controls Unit B.

Switch	Setting
On	Receiver squelch enabled
Off	Receiver squelch disabled

3.3.5 2-Wire/4-Wire Mode (S2 and S4)

The settings for S2 and S4 determine whether the Async 232↔422/485 Card is operating in 2-wire or 4-wire mode. To operate in 2-wire mode, set the switch to "2W." To operate in 4-wire mode, set the switch to "4W."

3.3.6 Receiver Impedance (JP1 and JP2)

Proper impedance selection results in the most efficient coupling of the receiver to the transmission line, and thus the greatest distance. For point-to-point twisted pair, the LOW setting is the most common. For multipoint configurations, most receivers should be set to HIGH, with the one or two most distant receivers set to LOW. (The Async 232↔422/485 Card can drive 50 multidrop receivers, including two receivers set for low impedance.)

Jumper	Setting
Lo-Z	Low impedance
Hi-Z	High impedance

3.4 Rear-Card Configuration

The Async 232↔422/485 Card has two interface-card options: the IC479C (which comes equipped with two RJ-11 ports and two RJ-45 ports) and the IC480C (which comes equipped with four RJ-45 ports). Figure 3-2 shows these options.

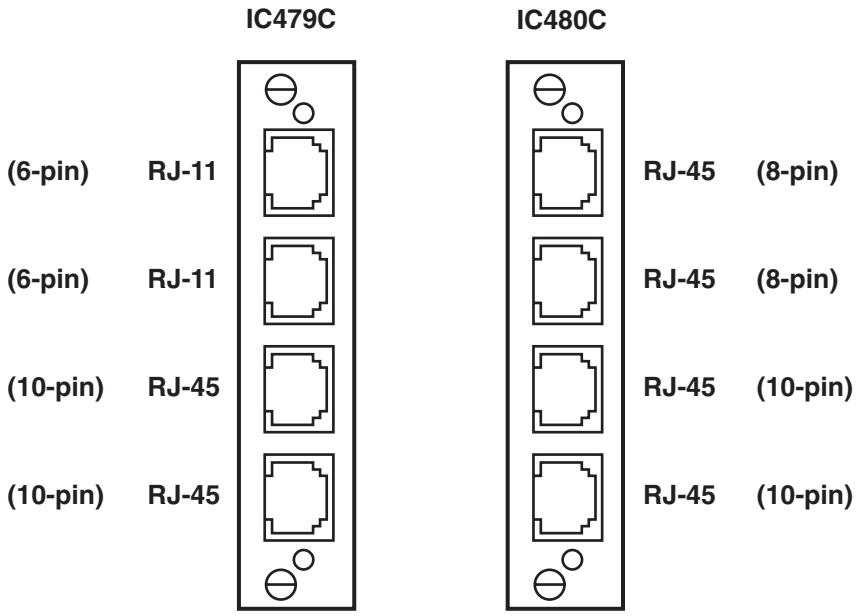

Figure 3-2. Async 232↔422/485 Card interface cards.

Before installation, you should examine the rear card you have selected and make sure that it is suitable for your application. Each rear card is configured by settings straps on the PC board. Descriptions of the strap locations and settings for each card are on the next page.

Figure 3-3 shows the strap locations for the IC479C and the IC480C rear cards. These straps determine various grounding characteristics for the RS-232 and twisted-pair lines.

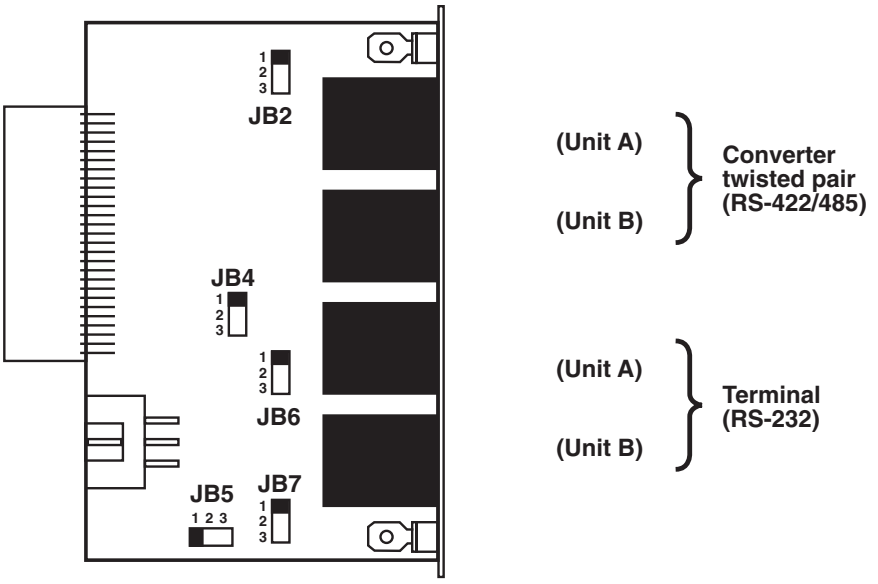

Figure 3-3. Strap locations for both rear cards.

Table 3-2 (on the next page) provides a summary of strap functions for both of the rear cards. The next page describes each strap's function.

Table 3-2. Summary of strap settings

Interface Card Strap Summary		
Strap	**Position 1 & 2**	**Position 2 & 3**
JB2	Line A Shield	No Shield*
JB4	Line B Shield	No Shield*
JB5	SGND & FRGND	Open*
JB6	DTE A DSR*	N/A
JB7	DTE B DSR*	N/A

*Indicates factory default

Line A Shield and Line B Shield (JB2 and JB4)

This strap pertains to the line interface. In the connected (closed) position, the strap links RJ-11 pins 1 and 6 (RJ-45 pins 2 and 7) to frame ground. These pins can be used as connections for the twisted-pair cable shield. In the open (disconnected) position, pins 1 and 6 (or 2 and 7) remain connected, but are "lifted" from the frame ground.

JB2

Position 1 & 2 = Line A Shield Connected to Frame Ground
Position 2 & 3 = No Shield

JB4

Position 1 & 2 = Line B Shield Connected to Frame Ground
Position 2 & 3 = No Shield

SGND and FRGND (JB5)

In the connected (closed) position, this strap links signal ground and frame ground. In the open (disconnected) position, pin 1 is "lifted" from frame ground.

JB5

Position 1 & 2 = SGND and FRGND Connected
Position 2 & 3 = SGND and FRGND Not Connected

DTE as DSR or RI (JB6 and JB7)

Because this rear card is designed to function in more applications than the Async 232↔422/485 Card, this jumper must be installed only in one position. Place the jumper across pins 1 and 2 so that the terminal (DTE) sees DSR as high when the rack is powered. The other positions, across pins 2 and 3, are for Ring Indicate as defined by EIA/TIA-561. The RI function is irrelevant (and on the Async 232↔422/485 Card is also disconnected) and can cause improper operation if the jumper is installed incorrectly.

JB6 and JB7

Position 1 & 2 = DSR
Position 2 & 3 = N/A (Do not use.)

4. Installation

This chapter describes the functions of the MicroRacks, tells how to install front and rear Async 232↔422/485 Cards in the chassis, and provides diagrams for wiring the interface connections correctly.

4.1 The MicroRack Chassis

The MicroRack 16 has sixteen short-range modem card slots, plus its own power supply. Measuring only 3.5 inches high, the MicroRack is designed to occupy only 2U in a 19-inch rack. Sturdy front handles allow the MicroRack 16 to be extracted and transported conveniently.

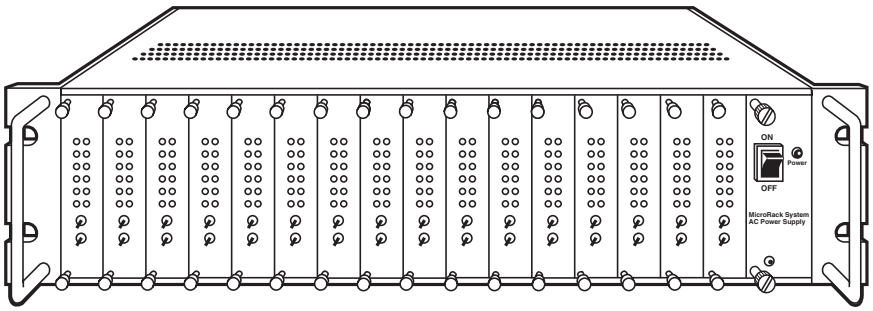

Figure 4-1. The MicroRack 16 with power supply.

The power supply used in the MicroRack 16 uses the same mid-plane architecture as the modem cards. The front card of the power supply slides in from the front, and the rear card slides in from the rear. They plug into one another in the middle of the rack. The front card is then secured by thumbscrews and the rear card by conventional metal screws.

Switching the Power Supply On and Off

The power-supply on/off switch is located on the front panel. When the MicroRack is plugged in and switched on, a red front-panel LED will glow. Since the MicroRack is a hot-swappable rack, it is not necessary for any cards to be installed before switching on the power supply. The power supply may be switched off at any time without harming the installed cards.

Replacing the Power-Supply Fuse

The rack chassis power supply uses a 400-mA fuse for 120-VAC circuits, and a 200-mA fuse for 240-VAC circuits. The fuse compartment is located just below the AC socket on the rear card. To replace the fuse:

1) Turn the power switch off and remove the power cord.

2) Using a small screwdriver, pop the compartment open (it will slide open like a drawer). Depending upon the exact part used, the drawer may slide completely out of the fuse holder or it may stop partway out.

3) Note that there are two fuses in the drawer. The front fuse is the spare, and the rear fuse is the "active" fuse.

4) If the active fuse appears to be blown, remove it from the clips and replace it with the spare from the front compartment. Note the size and rating of the blown fuse before discarding it.

5) Buy a replacement fuse at an electronics store.

WARNING!

For continued protection against the risk of fire, replace only with the same type and rating of fuse.

Switching the Power Supply Between 120 and 240 Volts

Although the MicroRack 16 is shipped from the factory with a customer-specified power-supply configuration, you can change the configuration yourself. Follow the steps at the top of the next page to switch the configuration of the power supply between 120 and 240 VAC:

1) Remove the front power-supply card and locate the two-position switch near the back of the card. Slide the switch to the desired voltage. (Note: The actual values on the switch may be "110/220" or "115/230.")

2) Replace the existing fuse with one of the correct value.

3) Replace the power supply cord, if necessary.

4.2 Installing the Async 232↔422/485 Card in the Chassis

The Async 232↔422/485 Card is made up of a front card and a rear card. The two cards meet inside the rack chassis and plug into each other by way of mating 50-pin card-edge connectors. Use the following steps as a guideline for installing each Async 232↔422/485 Card in the rack chassis.

1) Slide the rear card into the back of the chassis along the metal rails provided.

2) Secure the rear card using the metal screws provided.

3) Slide the card into the front of the chassis. It should meet the rear card when it's almost all the way into the chassis.

4) Push the front card *gently* into the card-edge receptacle of the rear card. It should click into place.

5) Secure the front card using the thumbscrews.

NOTE

Since the MicroRack chassis allows hot-swapping of cards, it is not necessary to power down the rack when you install or remove a Async 232↔422/485 Card.

4.3 RS-232 Connection

The RS-232 ports are always the *lower* RJ-45 ports on the interface card. The 10-pin RJ-45 is based on the EIA/TIA-561 Standard. For specific interface pinouts, refer to the chart in **Appendix B**.

The Async 232↔422/485 Card is wired as a DCE (Data Communications Equipment). Therefore, it wants to connect to a DTE (Data Termination Equipment). If your RS-232 output device is a DTE, you may need to use a

special adapter (such as a DB25 to modular adapter; see **Appendix C** for pinning). If your RS-232 output device is DCE, call your supplier for specific installation instructions.

4.4 Twisted-Pair Connection

The Async 232↔422/485 Card operates full duplex over two twisted pairs. In *all* applications, the twisted-pair wire must be 26 AWG or thicker, unconditioned, dry, metallic wire. Both shielded and unshielded wire yield favorable results.

NOTE

The Async 232↔422/485 Card can only communicate in a closed data circuit with another Async 232↔422/485 Card. Dialup analog circuits, such as those used with a standard Hayes® compatible modem, are *not* acceptable. For more information about acceptable wire grades, refer to Appendix A.

4.4.1 Point-to-Point Twisted-Pair Connection

The six-position RJ-11 and 8-position RJ-45 jack options for the Async 232↔422/485 Card (always the *upper* jack on the rear interface card) are prewired for a standard telco wiring environment. Connection of a 4-wire twisted-pair circuit between two or more Async 232↔422/485 Cards requires a crossover cable. Refer to the next page for more information.

CROSSOVER CABLES

RJ-11

Signal	Pin No.	Color‡	Color	Pin No.	Signal
GND†	1	Blue	White	6	GND†
RCVB	2	Yellow	Red	4	XMTB
XMTA	3	Green	Black	5	RCVA
XMTB	4	Red	Yellow	2	RCVB
RCVA	5	Black	Green	3	XMTA
GND†	6	White	Blue	1	GND†

RJ-45

Signal	Pin No.	Color‡	Color	Pin No.	Signal
GND†	2	Orange	Brown	7	GND†
RCVB	3	Black	Green	5	XMTB
XMTA	4	Red	Yellow	6	RCVA
XMTB	5	Green	Black	3	RCVB
RCVA	6	Yellow	Red	4	XMTA
GND†	7	Brown	Orange	2	GND†

IMPORTANT!

In the pinouts above, “A” means positive and “B” means negative.

†Connection to ground is optional

‡Standard color codes—yours may be different

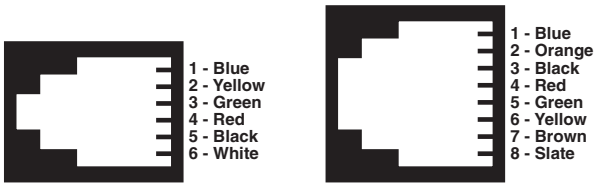

Figure 4-2. AT&T® standard modular color codes.

4.4.2 Multipoint 4-wire Twisted-Pair Connection

The Async 232↔422/485 Card supports multipoint applications using a star topology (**Chapter 3** describes proper multipoint configuration). Maximum distance between the units will vary based on the number of drops, data rate, wire gauge, etc. Call your supplier for specific distance estimates. Figure 4-3 shows how to wire the two-pair cables properly for an Async 232↔422/485 Card star topology. Note that the ground connection is not needed.

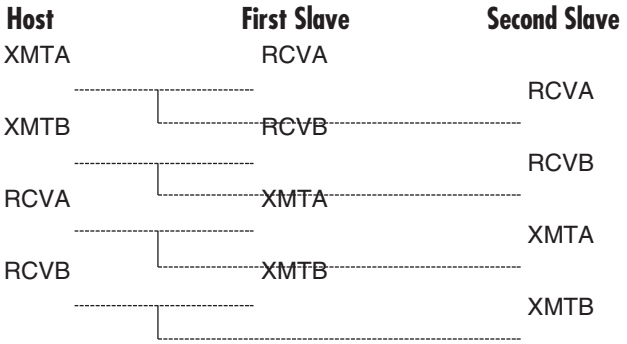

Figure 4-3. Star wiring for the Async 232↔422/485 Card host and slaves.

IMPORTANT!

In the pinout above, "A" means positive and "B" means negative.

4.4.3 2-Wire Connection

Most RS-485 devices employ a two-wire, half-duplex configuration. When using this configuration, be sure to set the converter switches to "two wire" mode as shown in Table 3-1. Then use only the Transmit (XMT) pair, as shown below:

Converter Signal	RS-485 Signal
XMTA (Positive)	+ (Positive)
XMTB (Negative)	- (Negative)

5. Operation

Once you have configured each Async 232↔422/485 Card and connected the cables, you are ready to operate the units.

5.1 LED Status Monitors

The Async 232↔422/485 Card features front-panel LEDs that indicate the status of the control leads on the RS-232 interface. Figure 5-1 shows the positions of the LEDs.

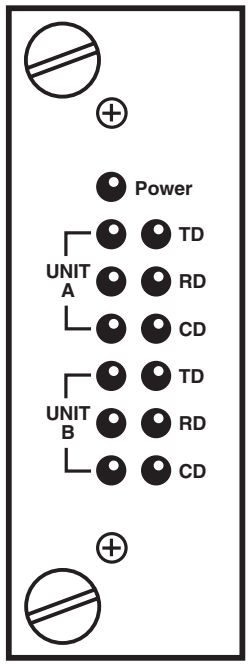

Figure 5-1. The Async 232↔422/485 Card front panel, showing LED positions.

- The green “PWR” LED glows when power is applied to the modem through its mid-plane chassis connection.
- The green “TD” and “RD” LEDs show positive-state data activity. The red LEDs remain solid whether there is data activity or not. They never flicker. A solid red light indicates an idle state.
- The green “CD” LED lights when the receive carrier is detected; the red LED lights when the receive carrier is absent.

5.2 Power-Up

There is no power switch on the Async 232↔422/485 Card: Power is automatically applied to the Async 232↔422/485 Card when its card-edge connector touches the chassis’s mid-plane socket, or when the chassis’s power is turned on.

NOTE

The Async 232↔422/485 Card is a hot-swappable card—it will not be damaged by plugging it in or removing it while the rack is powered up.

Appendix A. Cable Recommendations

The Card operates at frequencies of 20 KHz or less and has been performance-tested using twisted-pair cable with the following characteristics:

Wire Gauge	Capacitance	Resistance
19 AWG	83nf/mi or 15.72 pf/ft.	0.0163 ohms/ft.
22 AWG	83nf/mi or 15.72 pf/ft.	0.0326 ohms/ft.
24 AWG	83nf/mi or 15.72 pf/ft.	0.05165 ohms/ft.

The following data rate/distance results were obtained during bench tests using or simulating cable with the characteristics listed above:

Data Rate (bps)	Gauge (AWG)/Distance (Mi)		
	19	22	24
38.4—115.2	5.6	3.1	2.5
0—19.2	9.4	5.6	4.4

For optimum performance from your Async 232↔422/485 Card, keep the following guidelines in mind:

- *Always use twisted-pair wire*—this is not an option.
- Use twisted-pair wire with a capacitance of 20 pf/ft. or less.
- Avoid twisted-pair wire thinner than 26 AWG (in other words, avoid higher AWG numbers than 26).
- Use of twisted pair with a resistance greater than the above specifications may cause a reduction in maximum distance obtainable. Functionality should not be affected.
- Many different environmental factors can affect the maximum distances obtainable at a particular site. Use the data rate/distance table as a general guideline only.

Appendix B. Interface Settings

RS-232 Modular Interface: 10-Wire RJ-45		
Contact Number	**Circuit**	**Description**
1	N/A	Not Used
2	125	DSR
3	109	Received Line Signal Indicator (CD)
4	108/2	DTE Ready (DTR)
5	102	Signal Common
6	104	Received Data
7	103	Transmitted Data
8	106	Clear to Send
9	105/133	Request to Send/Ready for Receiving
10	N/A	Not Used

Pins 2–9 conform to the EIA/TIA-561 eight-position non-synchronous interface standard.

Appendix C. PC (DTE) Adapters

	DB25	RJ-45 (8-Pin)
DSR	6	1
CD	8	2
DTR	20	3
Signal Ground	7	4
RD	3	5
TD	2	6
CTS	5	7
RTS	4	8

	DB9	RJ-45 (8-Pin)
DSR	6	1
CD	1	2
DTR	4	3
Signal Ground	5	4
RD	2	5
TD	3	6
CTS	8	7
RTS	7	8

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