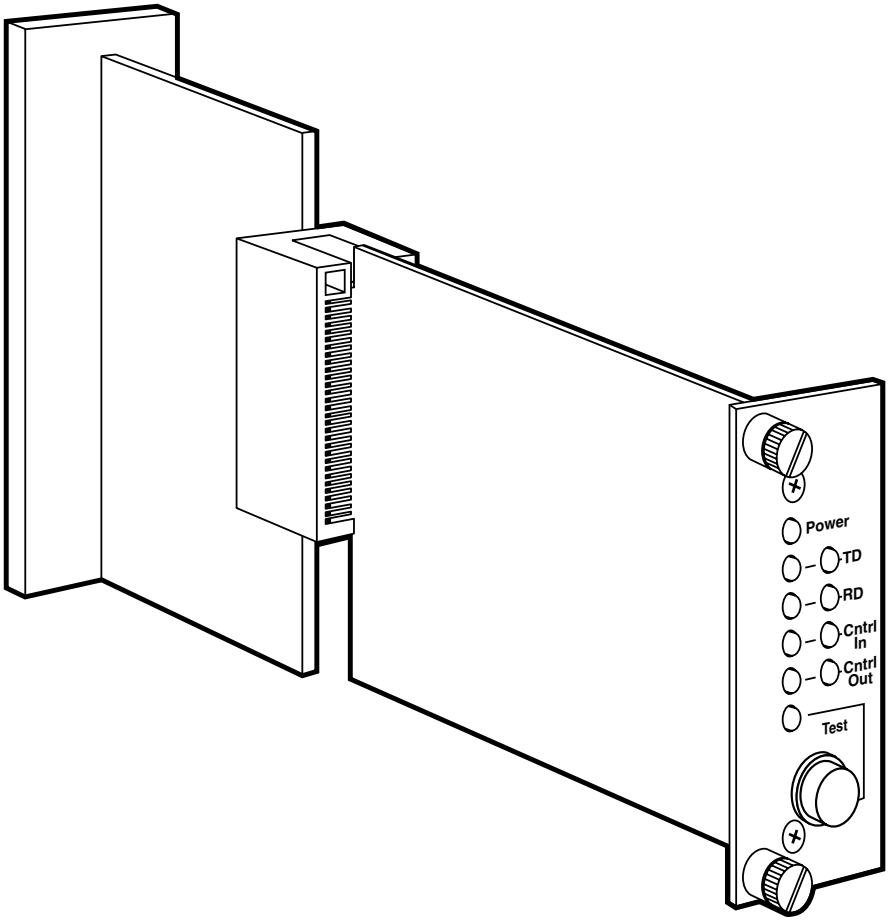
BLACK BOX®
NETWORK SERVICES

JANUARY 1999
ME931C-RJ11

Async MP Line Driver Card



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Order **toll-free** in the U.S.: Call **877-877-BBOX** (outside U.S. call **724-746-5500**)
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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 la 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 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 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 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 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.

TRADEMARKS

Any trademarks mentioned in this manual are acknowledged to be the property of the trademark owners.

Contents

1. Specifications

Transmission Format—Asynchronous

External Interface—RS-232C/CCITT V.24 connection via DB25 female; twisted-pair connection via RJ-11

Internal Interface—Connection to the rack chassis (part number RM202, RM204, RM208, or RM216) via 50-pin male card edge

Transmission Line—4-wire, unconditioned twisted-pair, 19–26 AWG, 20 pF/ft. or better

Data Rates—0 to 57.6 kbps

Controls—Carrier constantly on or controlled by RTS

Applications—Point-to-point or multipoint

Indicators—Bi-level LED indicators (two each) for Transmit Data, Receive Data, Control In and Control Out; bi-level indicators (one each) for Power and Test

Diagnostics—Local and remote analog loopback, activated by front-panel pushbutton

Receiver Optical Isolation—150 VAC

Surge Protection—Silicon avalanche diodes, 600 watts RMS power dissipation @ 1 ms, with response time of less than 1 pS

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

Humidity—0 to 95%, noncondensing

Power Supply—Rackmount power supply is switchable between 120 V and 240 VAC; rack chassis supplies 10 VAC to the Card, typical Card consumption is 700 mW

Fuse—400 mA for 120 V applications; 200 mA for 240 V applications

Size—0.95"H x 3.1"W x 5.4"D (2.4 x 7.8 x 13.7 cm)

Weight—0.25 lb. (0.11 kg)

2. Introduction

2.1 Description

The Async MP Line Driver Card operates full duplex over two unconditioned twisted pair wires. Supporting data rates to 57.6 kbps, the Card has a maximum range of 14 miles (22.5 km) (at 1200 bps over 19 AWG wire). It passes one control signal in each direction, and features both optical isolation and Silicon Avalanche Diode surge protection on the data line side.

The Card actually consists of two cards: a front “brains” card and a rear “interface” card, and mounts in a 19" rack chassis (part number RM202, RM204, RM208, or RM216). This 16-card chassis has a switchable 120/240-volt power supply and mounts cards in a mid-plane architecture.

The Card has two built-in diagnostic tools: local and remote loopback test. There are also bi-level LEDs on the Card’s front panel to allow you to visually monitor communication.

2.2 Features

- Data rates to 57.6 kbps
- Receiver optical isolation
- High speed surge protection
- Supports distances up to 14 miles (22.5 km)
- Mounts in a rack chassis (part number RM202, RM204, RM208, or RM216)
- Bi-state LED indicators
- Point-to-point or multipoint operation
- Local and remote loopback test modes
- Hardware and software flow-control support
- Pin-assignable control signals

3. Configuration

This section describes the location and orientation of the Async MP Line Driver Card's configuration switches and provides detailed instructions on setting each of the switches.

The Card uses a set of eight DIP switches that allow configuration to a wide range of asynchronous applications. You can access these DIP switches by sliding the card out of the rack chassis (see **Figure 3-1**). Once configured, the Card is designed to operate transparently, without frequent reconfiguration.

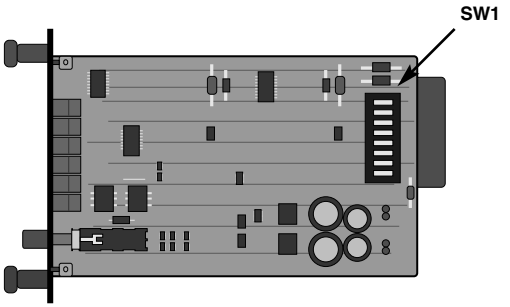

Figure 3-1. Async MP Line Driver Card.

3.1 Switch Locations and Orientation

The eight DIP switches on the Card allow you to specify control-signal pin assignments and carrier-control method. **Figure 3-2** shows the orientation of the DIP switches with respect to "ON" and "OFF" positions. **Table 3-1** summarizes the switch settings, including the factory-default settings.

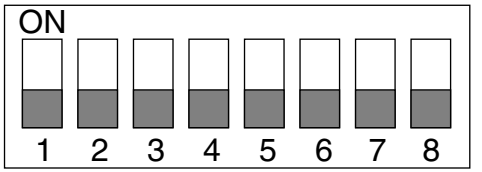

Figure 3-2. Close-up of DIP switches showing ON/OFF positions.

3.2 Quick Setup Instructions

For most applications, you will not need an in-depth knowledge of the Card's capabilities to get up and running. The following quick-setup DIP-switch configurations cover most Async MP Line Driver Card operating environments.

3.2.1 Point-to-Point Applications

If you are installing these units in a point-to-point application with a computer, printer or terminal, configure the DIP switches on both Cards as follows:

Switch Number	1	2	3	4	5	6	7
Positions	OFF	OFF	OFF	ON	ON	ON	OFF

3.2.2 Multipoint Applications

If you are installing these units in a multipoint application, configure the DIP switches for master and slave units as follows:

Switch Number	1	2	3	4	5	6	7
Master positions	ON	ON	ON	OFF	OFF	OFF	OFF
Slave positions	ON	ON	ON	OFF	OFF	OFF	ON

3.3 Special Configuration

If your installation requires special configuration of the Card, use **Table 3-1** as a guide. It shows all possible Card switch settings. Following the table are brief descriptions of the Control Input, Control Output, +Voltage Output and Carrier Controlled by (C_{in}) parameters shown in the table.

Table 3-1. Configuration Settings.

Mode (DCE/DTE)	Control Input (C_{in})	Control Output (C_{out})	+Voltage Output (V_{out})	Carrier Controlled by (C_{in})	Switch Settings 1	2	3	4	5	6	7
DCE	4	8	6	Disabled	ON	ON	ON	OFF	OFF	OFF	OFF
DCE	4	8	6	Enabled	ON	ON	ON	OFF	OFF	OFF	ON
DCE	4,11,20*	8	6	Disabled	OFF	ON	ON	ON	OFF	OFF	OFF
DCE	4,11,20*	8	6	Enabled	OFF	ON	ON	ON	OFF	OFF	ON
DCE	4	6	8	Disabled	ON	OFF	OFF	OFF	ON	ON	OFF
DCE	4	6	8	Enabled	ON	OFF	OFF	OFF	ON	ON	ON
DCE	4,11,20*	6	8	Disabled	OFF	OFF	OFF	ON	ON	ON	OFF
DCE	4,11,20*	6	8	Enabled	OFF	OFF	OFF	ON	ON	ON	ON

*Multiple input pins are “or-tied”—if any input goes low, carrier is dropped

3.4 Rear Card Configuration

The Async MP Line Driver Card comes with an interface card with DB-25/RJ-11 connectors. It supports one RS-232 connection and one 4-wire connection (the RS-232 port is the lower port on the interface card). **Figure 3-3** illustrates the interface Card.

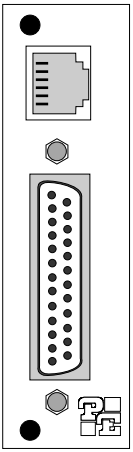

Figure 3-3. Interface Card.

Before installation, you will need to examine the rear card and make sure that it is configured properly for your application. You can configure each rear card by setting straps on the PC board. **Sections 3.4.1** and **3.4.2** describe the strap locations and possible settings for each rear card.

DB25/RJ-11 Strap Settings

Figure 3-4 shows strap locations for the DB25/RJ-11 rear card. These straps determine various grounding characteristics for the RS-232 and twisted-pair lines.

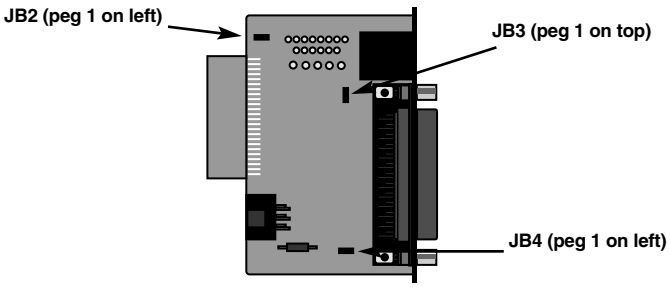

Figure 3-4. DB25/RJ-11 Strap Locations.

Table 3-2 provides an overview of strap functions for the DB25/RJ-11 card. Following this overview is a detailed description of each strap's function.

Table 3-2. DB25/Modular Interface Card Strap Summary.

Strap	Function	Position 1 and 2	Position 2 and 3
JB2	Line Shield & FRGND	Connected	Open*
JB3	DTE Shield (Pin 1) & FRGND	Connected	Open*
JB4	FRGND & SGND	Connected	Open*

*Factory default setting.

Line Shield and FRGND (JB2)

This strap pertains to the line interface. In the connected (closed) position, it links RJ-11 pins 1 and 6 to frame ground. You can use these pins as connections for the twisted-pair cable shield. In the open (disconnected) position, pins 1 and 6 remain connected to each other, but are "lifted" from the frame ground.

JB2

Position 1&2 = Line Shield and FRGND Connected
Position 2&3 = Line Shield and FRGND Not Connected

DTE Shield (Pin 1) and FRGND (JB3)

In the connected (closed) position, this strap links DB25 pin 1 and frame ground. In the open (disconnected) position, pin 1 is "lifted" from frame ground.

JB3

Position 1&2 = DTE Shield (Pin 1) and FRGND Connected
Position 2&3 = DTE Shield (Pin 1) and FRGND Not Connected

SGND and FRGND (JB4)

In the connected (closed) position, this strap links DB25 pin 7 (Signal Ground) and frame ground. In the open (disconnected) position, pin 1 is "lifted" from frame ground.

JB4

Position 1&2 = SGND (pin 7) and FRGND Connected
Position 2&3 = SGND (Pin 7) and FRGND Not Connected

4. Installation

This section describes the functions of the Rack Chassis (part number RM216), tells how to install front and rear cards into the chassis, and provides diagrams for wiring the interface connections correctly.

4.1 The Rack Chassis

The Rack Chassis (shown in **Figure 4-1**) has sixteen short-range modem card slots, plus its own power supply. Measuring only 3.5" (8.9 cm) high, each Async MP Line Driver Card is designed to occupy only 2U in the 19" Rack Chassis. Sturdy front handles allow the Chassis to be extracted and transported conveniently.

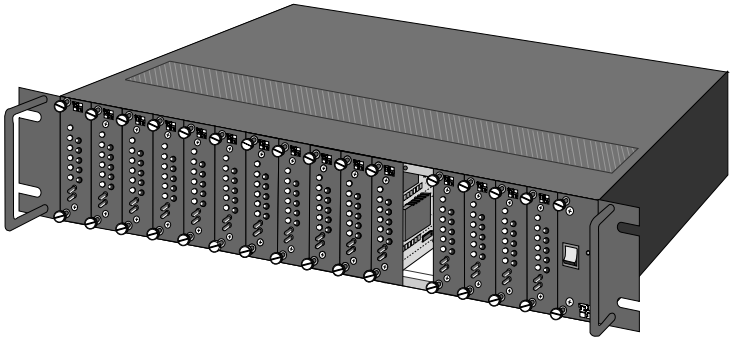

Figure 4-1. Rack Chassis with Power Supply.

The Rack Power Supply

The power supply included in the Rack Chassis 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 thumb screws 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 plugged in and switched on, a red front panel LED will glow. Since the Rack Chassis is a "hot-swappable" rack, you don't need to install any cards before switching on the power supply. You may switch the power supply 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-volt AC circuits, and a 200 mA fuse for 240-volt AC circuits. The fuse compartment is located just below the AC socket on the rear card. To replace the fuse, follow these steps:

1. Using a small screwdriver, pop the compartment open; it will slide open like a drawer. Depending on the exact part used, the drawer may slide completely out of the fuse holder or it may stop part way out.

2. **Two** fuses are in the drawer: the front fuse is the spare, and the rear fuse is the "active" fuse.

3. 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.

4. Replace the fuse.

WARNING

To protect against fire, replace only with the same type and rating of fuse.

Switching the Power Supply Between 120 and 240 Volts

Although the Rack Chassis is shipped from the factory with a customer-specified power supply configuration, you may change the configuration yourself. Follow these steps to switch the configuration of the power supply between 120 and 240 volts AC:

1. Remove the front power supply card and locate the 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 Card in the Chassis

The Card consists of a front "brains" card and a rear "connections" card. The two cards meet inside the rack chassis and plug into each other via mating 50-pin card-

edge connectors. Use the following steps as a guideline for installing each Card into the Rack Chassis:

1. Slide the rear "connections" 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 "brains" 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 thumb screws.

NOTE

Since the Chassis allows "hot swapping" of cards, you don't need to power down the rack when you install or remove a Card.

4.3 Wiring the Card

The rear interface card has one RS-232C port (DB25 female) and one 4-wire twisted-pair port (RJ-11 female).

4.3.1 RS-232 Connection

The Async MP Line Driver Card connects the RS-232 interface to your computing hardware via a DB25 female connector. The DB25 is pinned according to the RS-232C/V.24 interface standard. For the interface pin-out, please refer to the diagram in **Appendix B**.

The Line Driver Card is wired to connect to a DTE. If your RS-232 output device is a DTE, use a straight-through cable to connect to the Card. If your RS-232 output device is DCE, call Black Box Technical Support at 724-746-5500 for specific installation instructions.

4.3.2 Twisted-Pair Connection

The Async MP Line Driver Card operates 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 MP Line Driver Card can only communicate in a closed data circuit with another Async MP Line Driver Card. The Card will NOT work with dial-up analog circuits, like those used with a standard Hayes-type modem. For more information about acceptable wire grades, see Appendix A.

Point-to-Point Twisted-Pair Connection

The 6-position RJ-11 jack for the Async MP Line Driver Card is prewired for a standard telco wiring environment. To connect a 4-wire twisted-pair circuit between two or more Cards, you'll need a crossover cable as shown in **Tables 4-1** and **4-2** and **Figure 4-2**.

Table 4-1. RJ-11 Cable Pinout.

Signal	Pin #	Color	Color	Pin #	Signal
GND*	1	Blue**	White	6	GND*
RCV-***	2	Yellow	Red	4	XMT-
XMT+	3	Green	Black	5	RCV+
XMT-	4	Red	Yellow	2	RCV-
RCV+	5	Black	Green	3	XMT+
GND*	6	White	Blue	1	GND*

*Connection to ground is optional.
**Standard color codes—yours may be different.
***The Async MP Line Driver Card is not sensitive to polarity.

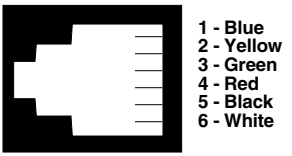

Figure 4-2. AT&T Standard Modular Color Codes.

Multipoint Twisted-Pair Connection

The Async MP Line Driver Card supports multipoint applications using a star topology (review **Section 3.2.2** for proper multipoint configuration). Maximum distance between the units will vary based upon the number of drops, data rate, wire gauge, etc. Call Black Box Technical Support at 724-746-5500 for specific distance estimates. **Figure 4-3** shows how to wire two-pair cables properly for an Async MP Line Driver Card star topology.

NOTE

For this configuration, you don't need the ground connection.

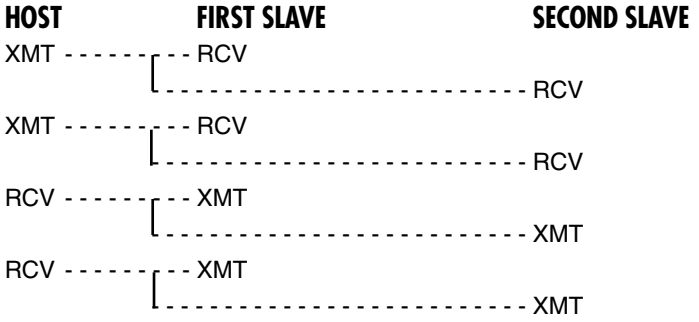

Figure 4-3. Two-Pair Star Wiring for Async MP Line Driver Card Host and Slaves.

5. Operation

Once you have configured each Async MP Line Driver Card and connected the cables, you are ready to operate the units. This Chapter describes the LED status monitors, the power-up procedure and the built-in loopback test modes.

5.1 LED Status Monitors

The Async MP Line Driver Card features ten front-panel status LEDs that indicate the condition of the modem and communication link. **Figure 5-1** shows the relative front-panel positions of the LEDs. A description of each LED's function follows.

Figure 5-1. Front Panel, Showing LED Positions.

- The green PWR LED glows when power is applied to the Card through its mid-plane chassis connection.
- The green TD and RD indicators blink to show positive-state data activity. The red TD and RD indicators blink to show negative-state data activity. Solid red indicates a connection in an idle state.
- The green "Control In" and "Control Out" indicators glow solid to show the control signal is on. The red "Control In" and "Control Out" indicators glow solid to show the control signal is off. When the Card is connected to a DTE,

"Control In" will glow green for an incoming RTS signal on RS-232 pin 4. "Control Out" will glow green for an incoming signal from the line, and an outgoing CD signal on RS-232 pin 8.

- The green TEST LED will glow when the loopback test modes are activated.

5.2 Power-On

There is no power switch on the Async MP Line Driver Card: Power is automatically applied to the Card when its card-edge connector makes contact with the chassis' mid-plane socket, or when the chassis' power supply is turned on.

NOTE

The Async MP Line Driver Card is a "hot-swappable" card—it will not be damaged by plugging it in or removing it while the rack is powered up.

When the local and remote Cards are both powered on, and are passing data normally, the LEDs will indicate the following:

- PWR=green
- TD and RD=flashing red and green
- Control In and Control Out=green
- TEST=off

5.3 Test Modes

The Async MP Line Driver Card offers two diagnostic modes: local analog loop and remote analog loop.

5.3.1 Local Analog Loop

The Local Analog Loop test mode causes any data sent to the local Card by the local RS-232 device to be echoed back to that RS-232 device. For example, characters typed on the keyboard of a terminal will appear on the terminal screen (see **Figure 5-2**). If characters are not echoed back, check the connection between the local RS-232 device and the local Card. Test all Async MP Line Driver Cards in the system.

5.3.2 Remote Analog Loop

The Remote Analog Loop test mode causes any characters sent from the remote Line Driver Card to the local Card to be returned to the remote device (see **Figure 5-2**).

Start the test by pressing the Test button on one of the Cards. Then send data from the other card (which must be in normal operating mode). If the data is echoed back to the card in normal mode (for example, if characters you type appear on your screen), the link to the Card in loopback mode is working.

NOTE

Only one Async MP Line Driver Card should be in test mode. The other Card should be in "normal" operating mode or the test will not work.

If no characters are echoed back, check the wiring between the two Cards. Wire the units according to the instructions in **Section 4.3**.

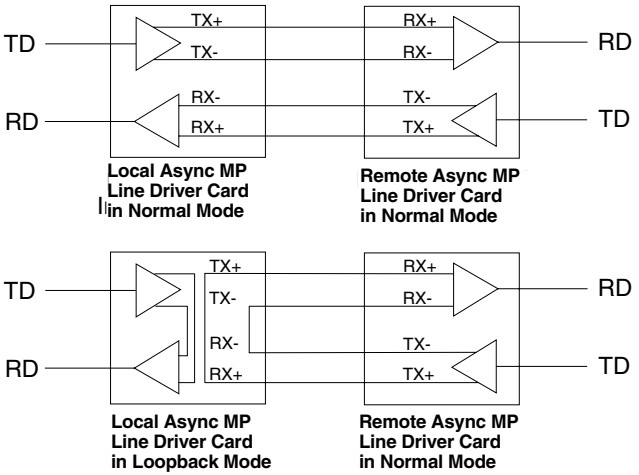

Figure 5-2. Normal operating mode vs. loopback operating mode.

Appendix A: Recommended Cable

The Async MP Line Driver Card operates at frequencies of 100 kHz. We've performance-tested it using twisted-pair cable with the following characteristics described in **Table A-1**.

Table A-1. Cable Characteristics.

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

Using or simulating cable with the characteristics described in **Table A-1**, we obtained the data rate/distance results described in **Table A-2**.

Table A-2. Cable Results.

Data Rate (bps)	Gauge (AWG)/Distance (mi)		
	19	22	24
57,600	2.5	1.8	1.3
38,400	3.7	2.3	1.7
19,200	5.1	3.4	2.4
9,600	6.7	4.6	3.7
4,800	9.4	6.6	5.3
2,400	11.5	9.3	7.6
1,200	14.0	12.0	9.6

To gain optimum performance from the 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 (avoid higher AWG numbers than 26).
- Using twisted pair with a resistance greater than that described in **Table A-1** may reduce the maximum distance you can obtain. However, the Line Drivers will still work.

- Environmental factors too numerous to mention can affect the maximum distances you can obtain at a particular site. Use the data rate/distances described in **Table A-2** as a general guideline only.

Appendix B: Interface Standards

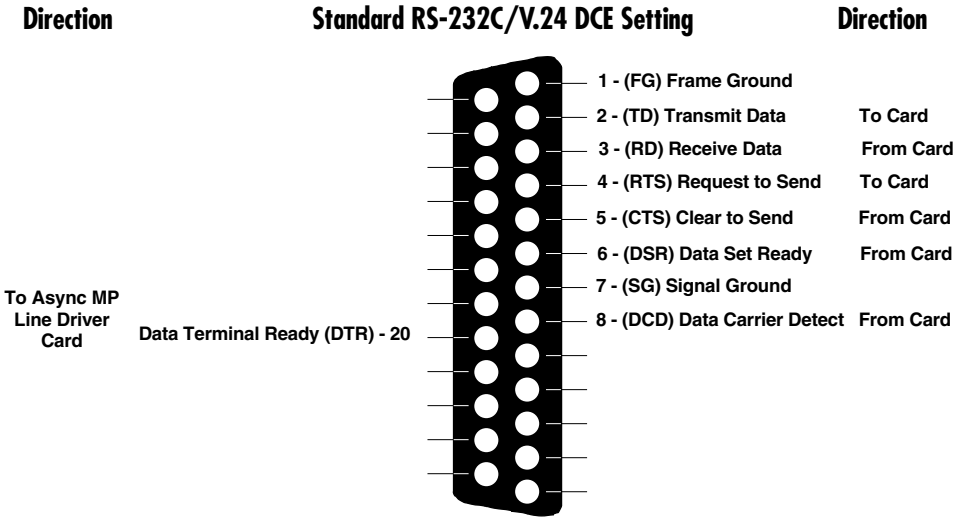

Figure B-1. Standard RS-232C/V.24 DCE Setting.

Appendix C: Block Diagram

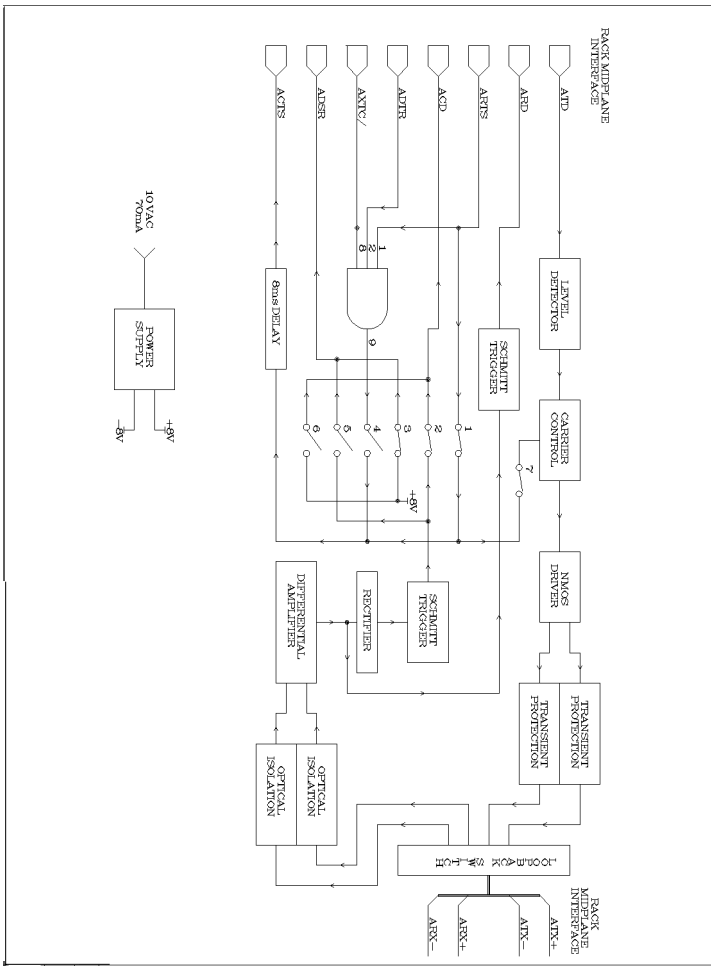

Figure C-1. Block Diagram.

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