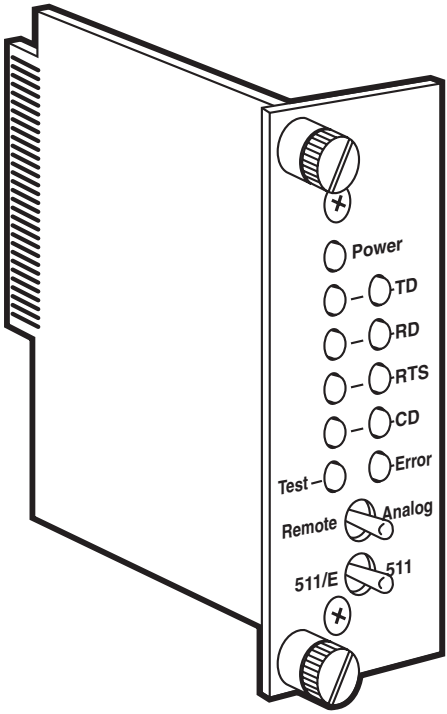
BLACK BOX®
NETWORK SERVICES

JULY 1995
ME355C
ME356C
ME357C
ME358C

Async/Sync LD 56/64 Cards



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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.

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

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NORMAS OFICIALES MEXICANAS (NOM)
ELECTRICAL SAFETY STATEMENT

INSTRUCCIONES DE SEGURIDAD

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

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

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

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

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

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

7. El 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.

Contents

1. Specifications

Hardware Required — Cards can be installed only in MicroRacks (see **Section 4.1**)

Cable Required — For modem-to-modem line: Two- or four-wire unconditioned twisted-pair, 19 to 26 AWG (see the **Appendix**), pinned as shown in **Section 4.5**

Compliance — FCC Part 15 Class A, DOC Class/MDC classe A

Interfaces — Serial:
ME355C, ME356C units: EIA RS-232/ITU-TSS [CCITT] V.24;
ME357C, ME358C units: ITU-TSS V.35;
Line: Two- or four-wire telco;
Internal: Card-edge for module↔MicroRack interconnection

Protocol — Synchronous or asynchronous

Clock Source — Internal, external (from DTE) or received (from other Card) (user-selectable)

Data Format — Word length (including start bit, data bits, stop bits, and parity bit) must equal 8, 9, 10, or 11 bits (user-selectable)

Flow Control — Transparent to all types of software (X-ON/X-OFF, robust X-ON/X-OFF, etc.) flow control; can be set to support hardware flow control

Operating Mode — Two-wire half-duplex or four-wire full- or half-duplex, point to point or multipoint (user-selectable)

Data Rates — 64, 56, or 32 Kbps (user-selectable)

Maximum Distance — 6 miles (9.7 km), but see **Appendix A**

Isolation — 1500 volts RMS minimum using custom transformers

Surge-Protection Method — Silicon Avalanche Diodes

Surge-Response Time — 1 ps

Maximum Surge Protection — 600 watts dissipated after 1 ms

User Controls —
(2) Front-panel toggle switches:
Remote or (local) Analog loopback;
511 or 511/E V.52 diagnostics;
(2) 8-position DIP switches on main module:
(1) for data rate, clock source, carrier control, and diagnostics;
(1) for RTS/CTS delay, word length, signaling-rate range, protocol, and DTE loopback control;
(1) Jumper on main module for for 2-wire/4-wire operation
(3) Frame-ground-connection jumpers on interface module:
To Line Shield, DTE Shield (Protective Ground), and Signal Ground

Indicators —
(11) Front-panel LEDs:
(1) each for Power, Test, and Error;
(2) each for TD, RD, RTS, and CD

Diagnostics — ITU-TSS V.54 remote digital and local analog loopbacks; ITU-TSS V.52 BERT testing

Connectors —

On main module:
All models:
(1) 50-position card-edge male (to MicroRack);
On interface module:
All models:
(1) 50-position card-edge male (to MicroRack);
ME355C:
(1) 6-pin RJ-11 female for modem-to-modem line,
(1) DB25 female for modem-to-DTE line;
ME356C:
(1) RJ-45 female for modem-to-modem line,
(1) DB25 female for modem-to-DTE line;
ME357C:
(1) 6-pin RJ-11 female for modem-to-modem line,
(1) 34-pin M-block female for modem-to-DTE line;
ME358C:
(1) RJ-45 female for modem-to-modem line,
(1) 34-pin M-block female for modem-to-DTE line

Power —

From MicroRack's power supply (see **Section 4.2**):
Input 120 VAC or 240 VAC (user-selectable);
Output: 10 VAC;
Consumption: 1.8 watts typical

Fuse —

On MicroRack (see **Section 4.2.2**):
400 mA when power supply is set to 120-VAC input;
200 mA when power supply is set to 240-VAC input

Temperature —

32 to 122˚ F (0 to 50˚ C)

Humidity —

0 to 95% noncondensing

Maximum Altitude —

15,000 ft. (4572 m)

Size — Main (front) module: 3.1"H x 1"W x 5.4"D (7.9 x 2.5 x 13.7 cm);
Interface (rear) module: 3.5"H x 1"W x 2.9"D (8.9 x 2.5 x 7.4 cm)

Weight — Total for main and interface modules: 0.2 lb. (0.1 kg)

2. Introduction

2.1 Overview

The Async/Sync LD Card 56/64 is a short-range modem on a dual rack card (it has a main [front] module and an interface [rear] module). The Card operates across two wires (half-duplex) or four wires (full- or half-duplex), transmitting data at 32, 56, or 64 Kbps, up to a maximum range of 6 miles (9.7 km). Local and remote modems on Async/Sync LD Cards 56/64 always communicate with each other synchronously. When connected to an asynchronous RS-232 device, the Card performs synchronous↔asynchronous conversion.

The Async/Sync Line Driver 56/64 has several features that enhance its overall performance, including transformer isolation and Silicon Avalanche Diode surge protection. The A/SLD also has strong diagnostics: It features V.52-compliant bit-error-rate (BERT) pattern tests and two V.54 test modes. With the Card's 11 easy-to-read front-panel LEDs, you can easily monitor the status of data transmission and diagnostic testing.

The Async/Sync LD Card 56/64 is fabricated using the latest surface-mount technology, so you get high-quality short-range-modem performance on a convenient rack card. The Card comes in RS-232 and V.35 versions with a female DB25 or 34-pin M-block serial connector respectively and either an RJ-11 or RJ-45 line jack. It fills one function-card slot in our MicroRacks (RM202, RM204, RM208, or RM216).

2.2 Features

- Convenient rack-card design
- Synchronous or asynchronous communication
- Data rates up to 64 Kbps, distances up to 6 miles (9.7 km)
- 2-wire/half-duplex or 4-wire/full- or half-duplex operation
- Point-to-point or multipoint operation
- Internal, external, or received loopback clocking

- Hardware or software flow control
- Built-in transformer isolation and high-speed surge protection
- V.52 and V.54 test modes
- Eleven LED indicators show you status at a glance
- Error LED lights when Card detects broken or inferior cable

This chapter describes the locations and posssible settings of the Async/Sync LD Card 56/64's configuration controls, and provides detailed instructions for setting them. **Section 3.1** tells you about the two 8-position DIP switches, the single jumper ("strap"), and the daughterboard on the Card's main (front) module. **Section 3.2** tells you about the three jumpers on the Card's interface (rear) module. Once you've configured the Async/Sync LD Card 56/64, it is designed to operate transparently, without needing to be frequently reconfigured. Just set it and forget it!

3.1 Configuring the Main Module

3.1.1 Where the Controls Are

The Async/Sync LD Card 56/64 has three 8-position DIP switches (S1, S2, and S3), a single jumper (JP3), and a reversible daughterboard mounted on the circuit board of its main (front) module, as shown in Figure 3-1 below. These configuration devices allow you to select data rates, clocking methods, V.52 and V.54 tests, word lengths, signaling-rate range, sync or async protocol, 2- or 4-wire operation, and RS-232 or V.35 interface. As shown in Figure 3-2 on the next page, the "ON" and "OFF" points are the same for all of the DIP switch positions.

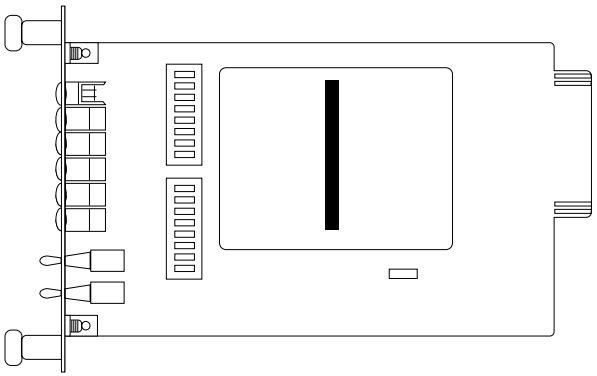


Figure 3-1. The main-module controls.

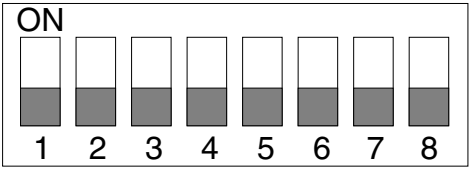


Figure 3-2. The ON and OFF settings of the DIP switches.

3.1.2 Configuration Switch "S1"

Use the individual positions on DIP switch S1 to set data rate, clock source, sync vs. async protocol, and carrier-control method. The factory-default settings are summarized in Table 3-1 below.

Table 3-1. Switch S1 Summary

Position	Function	Default Setting	
S1-1	Data Rate	Off	56 Kbps
S1-2	Data Rate	On	
S1-3	Data Rate	Off	
S1-4	Data Rate	Off	
S1-5	Clock Source	On	Internal
S1-6	Clock Source	On	
S1-7	Carrier Control	Off	Constantly ON
S1-8	V.52, V.54 Tests	Off	Enable

S1 Positions 1 through 4: Data-Rate Setting
Set positions 1 through 4 of switch S1 to determine the data rate (valid for both synchronous and asynchronous protocols) of the Async/Sync LD Card 56/64.

S1-1	S1-2	S1-3	S1-4	Data Rate
Off	Off	On	Off	32 Kbps
Off	On	Off	Off	56 Kbps (default)
On	Off	Off	Off	64 Kbps

S1 Positions 5 and 6: Clock Source
Set positions 5 and 6 of switch S1 to determine which transmit-clock source the Async/Sync LD Card 56/64 uses.

S1-5	S1-6	Clock Source
On	On	Internal transmit clock (default)
Off	On	Receive-recover clock
On	Off	External transmit clock

S1 Position 7: Carrier-Control Method
Set position 7 of switch S1 to determine whether the carrier is "constantly on" or "controlled by RTS." In the "controlled by RTS" setting, the Switch can support switched-carrier, multipoint, or hardware-flow-control applications.

S1-7	Carrier
Off	Constantly ON (default)
On	Controlled by RTS

S1 Position 8: V.52 and V.54 Diagnostic Testing
To reset the V.54 circuit, turn switch S1 position 8 ON, then back OFF.

S1-8	Test Mode
Off	Normal Operation (default)
On	Test Disabled

3.1.3 Configuration Switch "S2"

Use the individual positions on DIP switch S2 to set word length, signaling-rate range, RTS/CTS delay, or 2- or 4-wire operation, as well as to control diagnostic testing. The factory-default settings are summarized in Table 3-2 below.

Table 3-2. Switch S2 Summary

Position	Function	Default Setting
S2-1 S2-2	RTS/CTS Delay RTS/CTS Delay	On On > 7 ms
S2-3 S2-4	Word Length Word Length	Off Off > 10 bits
S2-5	Signaling-Rate Range	On -2.5 to +1%
S2-6	Protocol	On Async.
S2-7	DTE Ctrl. of Ana. Loopback	On Enabled
S2-8	DTE Ctrl. of Dig. Loopback	On Enabled

S2 Positions 1 and 2: RTS/CTS Delay

Set positions 1 and 2 of switch S2 to determine the amount of time the Async/Sync LD Card 56/64 waits after it "sees" RTS before it sends CTS. Possible settings are no delay, 7 ms, or 53 ms.

S2-1	S2-2	RTS/CTS Delay
On	On	7 ms (default)
On	Off	53 ms
Off	On	No delay
Off	Off	No delay

S2 Positions 3 and 4: Word Length
Set positions 3 and 4 of switch S2 to determine the word length that the Async/Sync LD Card 56/64 will expect for synchronous or asynchronous data. For example, if you are using the most common data format (1 start bit, 8 data bits, 1 stop bit, and no parity), you would use the factory-default word-length setting (10 bits).

S2-3	S2-4	Word Length
On	Off	8 bits
On	On	9 bits
Off	Off	10 bits (default)
Off	On	11 bits

S2 Position 5: Signaling-Rate Range
Set position 5 of switch S2 to determine the degree of asynchronous data-rate fluctuation that the Async/Sync LD Card 56/64 will accept (that is, how much variance from a given frequency level the Card will tolerate).

S2-5	Signaling-Rate Range
Off	-2.5% to +1% (default)
On	-2.5% to +2.3%

S2 Position 6: Protocol
Set position 6 of switch S2 to determine whether the Async/Sync LD Card 56/64 operates synchronously or asynchronously.

S2-6	Protocol
On	Asynchronous (default)
Off	Synchronous

S2 Position 7: DTE Initiation of Local Analog Loopback Test
Set position 7 of switch S2 to determine whether the Async/Sync Line Driver 56/64's local analog loopback (LAL) test (see **Section 5.3.1**) can be initiated by raising the signal on Pin 18 (RS-232) or Pin N (V.35) at the DTE.

S2-7	Pin 18/N Test Initiation
On	Enabled (default)
Off	Disabled

S2 Position 8: DTE Initiation of Remote Digital Loopback Test
Set position 8 of switch S2 to determine whether the Async/Sync Line Driver 56/64's remote digital loopback (RDL) test (see **Section 5.3.2**) can be initiated by raising the signal on Pin 21 (RS-232) or Pin L (V.35) at the DTE.

S2-8	Pin 21 Test Initiation
On	Enabled (default)
Off	Disabled

3.1.4 The Configuration Jumpers Illustrated

Figure 3-3, below, shows the possible settings of the Async/Sync LD Card 56/64's jumpers. Each jumper can be either on pegs 1 and 2, as shown at left, or on pegs 2 and 3, as shown at right.

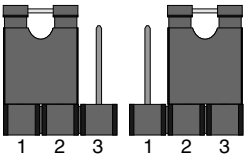


Figure 3-3. The possible jumper settings.

3.1.5 The Jumper "JP3"

Set jumper JP3 on the main module (refer to Figure 3-1 on page 7) to determine whether the Async/Sync LD Card 56/64 operates in 2-wire or 4-wire mode. Figure 3-2 above shows the two possible settings. Note that for this jumper, the 1-and-2 setting is toward the *front* of the main module and the 2-and-3 setting is toward the *rear* of the main module. Be careful not to lose this jumper!

JP3	Operation
Jumper on 1 and 2	2-wire (half-duplex only)*
Jumper on 2 and 3	4-wire (full- or half-duplex) (default)
Jumper removed	Not a valid setting

*NOTE

For 2-wire operation, carrier control must be set to "controlled by RTS" (that is, S1 position 7 must be set to "ON").

3.1.6 The Reversible Daughterboard

The Async/Sync LD Card 56/64 supports either the RS-232 or V.35 interface for connection to a DTE. Which electrical interface is active depends on which way you plug the small reversible daughterboard into the main module (see Figure 3-4 below). The daughterboard is clearly marked with the phrases "This side up for RS-232" and "This side up for V.35." When you plug the daughterboard into the socket, the arrow should always point toward the *front* of the main module.

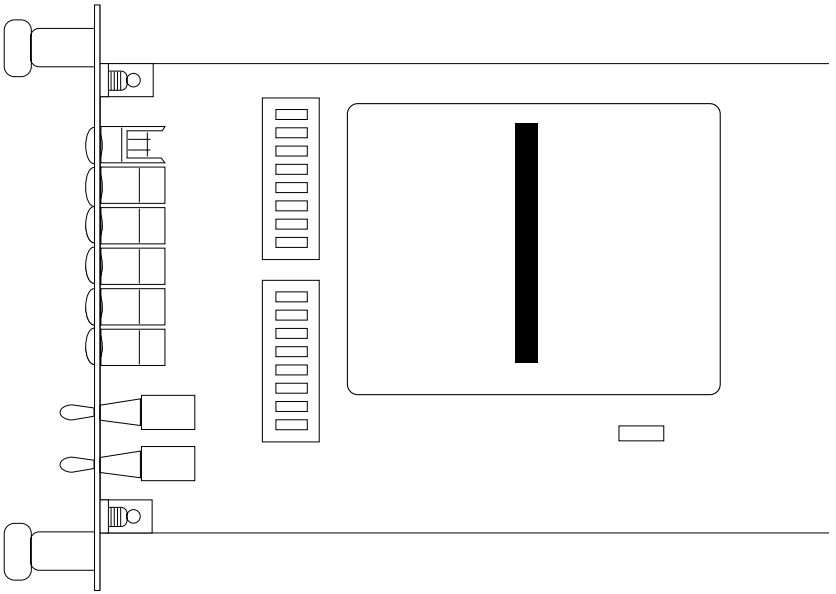


Figure 3-4. Selecting the serial interface with the daughterboard.

3.2 Setting the Jumpers on the Interface Module

3.2.1 The Interface-Module Options

The Async/Sync LD Card 56/64 has four interface-module options:

- The ME355C has a DB25 connector for an RS-232 serial port and an RJ-11 modem-to-modem port.
- The ME356C has a DB25 connector for an RS-232 serial port and an RJ-45 modem-to-modem port.
- The ME357C has a 34-pin M-block (also known as "M/34") connector for a V.35 serial port and an RJ-11 modem-to-modem port.
- The ME358C has a 34-pin M-block (also known as "M/34") connector for a V.35 serial port and an RJ-45 modem-to-modem port.

Figure 3-5, below, shows the rear panels of each of these interface modules.

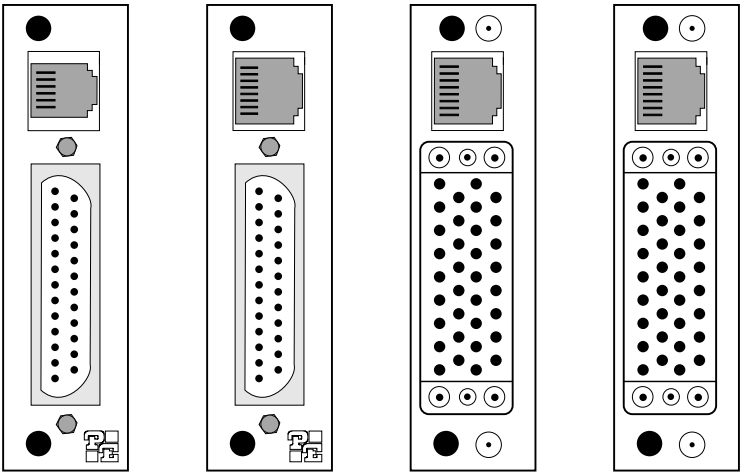


Figure 3-5. The four interface modules.

Before you install the Card, you should examine the interface module you have selected and make sure that it is configured for your application. Each interface module has three jumpers on its circuit board, as described in the following sections.

3.2.2 Where the Jumpers Are

Figure 3-6, below, shows the locations of the jumpers on the interface modules (the locations are the same for both the -RJ11 and -RJ45 models). These jumpers determine various grounding and signal characteristics for the serial and modem-to-modem lines. See Figure 3-3 on page 13 for an illustration of the possible jumper settings.

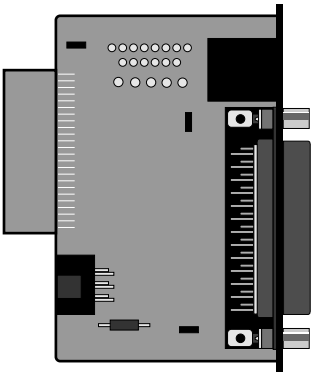


Figure 3-6. The jumper locations.

Table 3-3, below, provides a summary of the functions of these jumpers. The functions are described in more detail afterward.

Table 3-3. Summary of Interface-Module Jumper Functions

Jumper	Function	Pos. 1 & 2	Pos. 2 & 3
JB2	Line Shield and FGND	Connected	N/C*
JB3	PGND (DTE Pin 1) and FGND	Connected	N/C*
JB4	SGND and FGND	Connected	N/C*
*factory-default settings			

Line Interface: Line Shield Connection to Frame Ground (JB2)
This jumper applies to the line interface. When this jumper is in positions 1 and 2, it links RJ-11 Pins 1 and 6 or RJ-45 Pins 2 and 7 on the corresponding line to the interface module's frame ground. (If you are using shielded twisted-pair cable, the shield can be connected to these pins.) In positions 2 and 3, RJ-11 Pins 1 and 6 or RJ-45 Pins 2 and 7 remain connected to each other, but are disconnected ("lifted") from frame ground.

JB2
Positions 1 and 2 = Line Shield and FGND Connected
Positions 2 and 3 = Line Shield and FGND Not Connected (default)

CAUTION!

If you connect shield to frame ground, make sure that RJ-11 Pins 1 and 6 or RJ-45 Pins 2 and 7, as well as the cable shield, are connected to ground at one end of the cable only. Connecting them at both ends of the cable will defeat the transformer isolation and will leave your system open to damage from ground loops.

Serial Interface: DTE Shield (Pin 1) Connection to Frame Ground (JB3)
This jumper applies to the serial interface. In position 1 and 2, this jumper links the Protective Ground (PGND)/Frame Ground (FGND) or "DTE Shield" lead (DB25 Pin 1 or M/34 Pin A) of the RS-232 or V.35 line to the interface module's frame ground (FGND). When this jumper is in positions 2 and 3, the line's Protective Ground/Frame Ground on DB25 Pin 1 or M/34 Pin A is disconnected ("lifted") from the Card's frame ground.

JB3
Positions 1 and 2 = Serial PGND/FGND Connected to Card FGND
Positions 2 and 3 = Serial PGND/FGND Not Connected to Card FGND (default)

Serial Interface: Signal Ground and Frame Ground (JB4)
This jumper also applies to the serial interface. In position 1 and 2, this jumper links the Signal Ground (SGND) lead (DB25 Pin 7 or M/34 Pin B) of the RS-232 or V.35 line to the interface module's frame ground (FGND). When this jumper is in positions 2 and 3, RS-232/V.35 Signal Ground on DB25 Pin 7 or M/34 Pin B is disconnected ("lifted") from frame ground.

JB4
Positions 1 and 2 = Serial SGND Connected to Card's FGND
Positions 2 and 3 = Serial SGND Not Connected to Card's FGND (default)

4. Installation

This chapter describes the functions of the MicroRacks, tells how to install the front and rear modules of the Async/Sync LD Cards 56/64 in them, and provides diagrams for wiring the interface connections correctly.

4.1 The MicroRacks: An Overview

Async/Sync LD Cards 56/64 are designed to be installed in our MicroRacks (product codes RM202 for the 2-card models, RM204 for the 4-card models, RM208 for the 8-card models, and RM216 for the 16-card models). You will install Async/Sync LD Cards 56/64 in any MicroRack the same way.

As an example of these products, the MicroRack 16, shown in Figure 4-1 below, features sixteen slots for short-range modem cards, plus its own power supply. Measuring only 3.5" (8.9 cm) high, the MicroRack 16 is designed to occupy only 2U in a 19" rack. Sturdy front handles allow the MicroRack 16 to be extracted and transported conveniently.

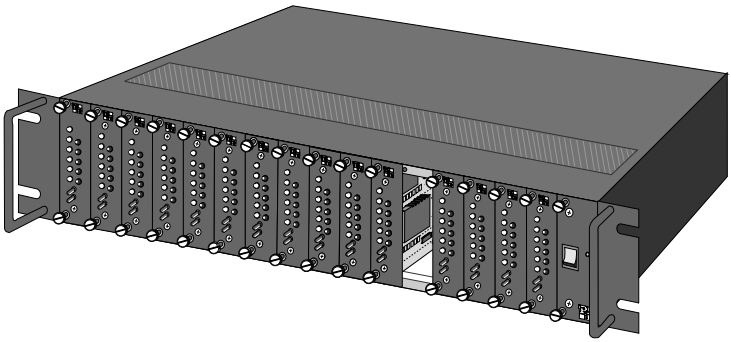


Figure 4-1. The MicroRack 16 (shown with fifteen Async/Sync LD Cards 56/64 installed).

4.2 The MicroRacks' Power Supply

The power supply included with the MicroRacks uses the same mid-plane architecture as the line-driver cards. Slide the front module of the power supply into the MicroRack from the front, and slide the rear module in from the rear. The two modules plug into one another in the middle of the rack. Secure the front module with thumbscrews and the rear module with conventional metal screws; these screws and thumbscrews come with the rack.

4.2.1 Switching the Power Supply On and Off

The MicroRack's power switch is located on the power supply's front panel. When the MicroRack is plugged in and switched on, the power supply will light the red LED on its front panel. Since the MicroRack is a "hot-swappable" rack, *you don't have to install any cards before switching on the power supply.* Also, the power supply may be switched off at any time without harming the installed cards, and you can install or remove cards without turning off the power supply. However, you should always unplug the power cord before removing, replacing, or swapping the power supply or its fuses.

4.2.2 Replacing the Power Supply's Fuse

The MicroRack's 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 power supply's rear module. To replace the fuse, follow these steps:

1. Making sure the rack is turned off and unplugged, use a small screwdriver to pop the compartment open: It will slide open like a drawer.
2. Notice that there are two fuses in the compartment: The rear fuse is "active," and the front fuse is the "spare."
3. If the active fuse appears to be blown, remove it from the clips and replace it with the spare from the front of the compartment. Note the size and rating of the blown fuse before discarding it.
4. Order a new replacement fuse. Both the 400-mA fuses (Littelfuse® 239.400 or equivalent) and the 200-mA fuses (Littelfuse 239.200 or equivalent) measure 5 x 20 mm.

CAUTION!

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

4.2.3 Switching the Power Supply Between 120 and 240 Volts

Although the MicroRack 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 VAC and 240 VAC:

1. Making sure the rack is turned off and unplugged, remove the power supply's front module and locate the two-position switch (labeled either "110/220" or "115/230") near the back of the card. Slide the switch to the setting corresponding to your desired voltage.
2. Replace the existing fuses with fuses of the correct type (see step 4 of **Section 4.2.2**).
3. If necessary, replace the power-supply cord with a country-specific cord. (For certain countries, your supplier might be able to give you a special quote on country-specific cords.) Plug the cord back in.

4.3 Installing the Async/Sync LD Card 56/64 in the MicroRack

The Async/Sync LD Card 56/64 is made up of a main (front) module and an interface (rear) module. The two cards meet inside the rack chassis; their mating 50-pin card-edge connectors plug into each other. Use these steps to install each Async/Sync LD Card 56/64 into a MicroRack:

1. Slide the rear module into the back of the MicroRack on the metal rails.
2. Secure the rear module using the included metal screws.
3. Slide the front module into the front of the chassis. It should meet the rear module when it is almost completely in the chassis.
4. Push the front module gently into the card-edge receptacle of the rear module. It should "click" into place.
5. Secure the front module using the thumbscrews.

NOTE

Since the MicroRacks allow "hot swapping" of cards, it is not necessary to power down the rack when you install or remove an Async/Sync LD Card 56/64.

4.4 The RS-232 Serial Cables and Connectors

The Async/Sync LD Card 56/64's RS-232 or V.35 port is always the *lower* port on its interface module. On ME355C and ME356C models the RS-232 port is a standard DB25 connector (pinout shown in Table 4-1 below, top). On ME357C and ME358C models the V.35 port is a standard 34-pin M-block connector, as shown in Table 4-2 below (bottom).

Table 4-1. Pinout of the RS-232 Interface

DIRECTION	STANDARD RS-232/V.24 DCE PINNING	DIRECTION
	1 Protective Ground (PGND)	
From Card	Transmit Clock DCE (TCC) 15 — 2 Transmit Data (TD)	To Card
	3 Receive Data (RD)	From Card
From Card	Receive Clock DCE (RCC) 17 — 4 Request to Send (RTS)	To Card
To Card	Local Loopback (LL) 18 — 5 Clear to Send (CTS)	From Card
	6 Data Set Ready (DSR)	From Card
To Card	Data Terminal Ready (DTR) 20 — 7 Signal Ground (SGND)	
To Card	Remote Loopback (RL) 21	
To Card	Transmit Clock DTE (TCT) 24	
From Card	Test Mode (TM) 25	

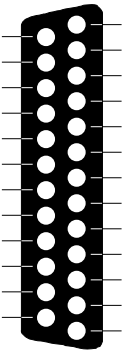
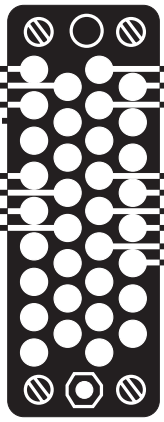


Table 4-2. Pinout of the Card's V.35 Interface

PIN		PIN	
Signal Ground (SGND)	B	A	Frame Ground (FGND)
Clear to Send (CTS)	D	C	Request to Send (RTS)
Carrier Detect (CD)	F	E	Data Set Ready (DSR)
		H	Data Terminal Ready (DTR)
Remote Loopback (RL)*	L		
Local Loopback (LL)*	N		
Receive Data A (RD A)	R	P	Transmit Data A (TD A)
Receive Data B (RD B)	T	S	Transmit Data B (TD B)
Serial Clock Receive A (SCR A)	V	U	Ser. Clock Trans. Ext. A (SCTE A)
Serial Clock Receive B (SCR B)	X	W	Ser. Clock Trans. Ext. B (SCTE B)
		Y	Ser. Clock Transmit A (SCT A)
		AA	Ser. Clock Transmit B (SCT B)



*In the official V.35 specification, Local Loopback and Remote Loopback are on Pins J and BB respectively.

The Async/Sync LD Card 56/64 is wired as a DCE (Data Communications Equipment) device. Therefore, it would normally be connected to a DTE (Data Terminal Equipment) RS-232 device. You might need to run a special cable or use a special adapter if the serial port of the RS-232 device you want to attach is not the same type of connector as the one on your Card. Even if the serial ports on the Card and the DTE are both RJ-45 connectors, you might still need to use a specially pinned cable. Call your supplier for technical support with these issues, or if you want to attach a DCE device to the Card.

4.5 The Modem-to-Modem Line Cables and Connectors

The Async/Sync LD Card 56/64's line port is always the *upper* port on its interface module. It is a 6-pin RJ-11 connector on the -RJ11 models or an 8-pin RJ-45 connector on the -RJ45 models, pinned for a standard telco-wiring environment, as shown in Table 4-3 and Figure 4-2 on the next page.

The Async/Sync LD Card 56/64 operates half-duplex over two wires (one twisted pair) or full- or half-duplex over four wires (two twisted pairs). In all applications, the twisted-pair wire must be 26 AWG or thicker, unconditioned, dry, and metallic. Both shielded and unshielded cable yield favorable results.

NOTE

The Async/Sync LD Card 56/64 can only communicate in a closed data circuit with another Async/Sync LD Card 56/64. It will not work with dialup analog circuits, such as those used with standard modems. For further information about acceptable wire grades, refer to the recommendations in the Appendix.

The modem-to-modem cable connection must be specially cross-pinned, as shown in Table 4-3 and Figure 4-2 on the next page. If your cabling includes punchdown blocks, you can easily do the cross-pinning at a punchdown block. If you will be running cable directly between two Async/Sync LD Cards 56/64, you can get a custom cable from your supplier as a special quote, or you can use regular straight-through-pinned cable and repin one of the cable's RJ connectors (that is, rearrange the wiring connections between the terminal block and the actual contacts). You might need special crimping tools or new connectors; call your supplier for these items, or for technical support if you have difficulty.

Table 4-3. Line-Cable Pinouts

RJ-11 (Four-Wire)

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**

RJ-45 (Four-Wire)

SIGNAL	PIN#	COLOR*	COLOR*	PIN#	SIGNAL
GND**	2	Orange	Brown	7	GND**
RCV–†	3	Black	Green	5	XMT–
XMT+	4	Red	Yellow	6	RCV+
XMT–	5	Green	Black	3	RCV–
RCV+	6	Yellow	Red	4	XMT+
GND**	7	Brown	Orange	2	GND**

RJ-11 (Two-Wire)

SIGNAL	PIN#	COLOR*	COLOR*	PIN#	SIGNAL
XMT+†	3	Green	Green	3	XMT+
XMT–	4	Red	Red	4	XMT–

RJ-45 (Two-Wire)

SIGNAL	PIN#	COLOR*	COLOR*	PIN#	SIGNAL
XMT+†	4	Red	Red	4	XMT+
XMT–	5	Green	Green	5	XMT–

*Standard color codes—wire colors in your cable might be different
**Connection to ground is optional
†The Async/Sync LD Card 56/64 is not sensitive to polarity

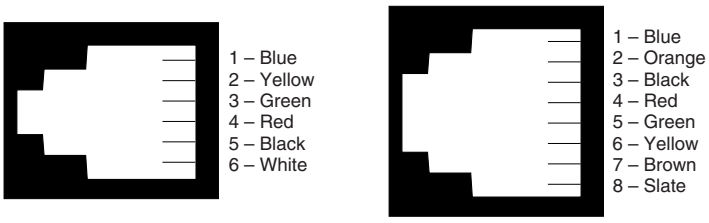


Figure 4-2. AT&T® standard modular color codes.

4.6 Multipoint Applications

The Async/Sync Line Driver 56/64 supports multipoint applications if position 6 of switch SW2 is turned On (moved to the "controlled by RTS" setting). Maximum distance between the units will vary based on the number of drops, data rate, wire gauge, etc. Call your supplier's technical support for distance estimates more specific to your application.

Figure 4-3 below shows how to wire two-pair cables for a Async/Sync Line Driver 56/64 network. (We do not recommend arranging multipoint equipment in a star topology.)

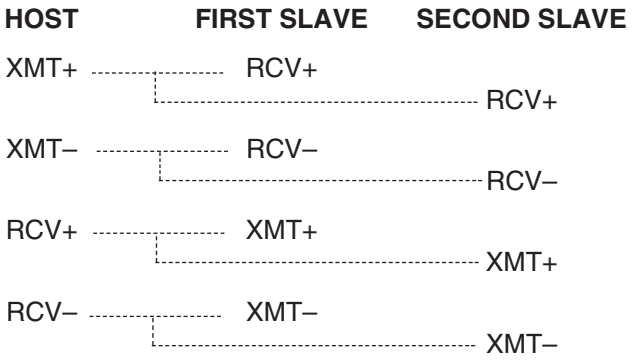


Figure 4-3. Two-pair wiring for host and slave Cards.

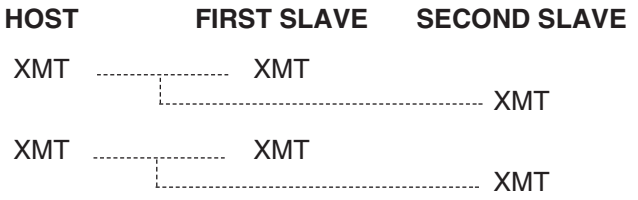


Figure 4-4. Single-pair star wiring for host and slave Cards.

5. Operation and Diagnostics

Once you have configured each Async/Sync LD Card 56/64 and connected the cables, you are ready to operate the units. This chapter describes the Card's LEDs, the power-up procedure, and diagnostic testing.

5.1 Status LEDs

The Async/Sync LD Card 56/64 features 11 front-panel status LEDs (shown in Figure 5-1 below) that indicate the condition of the modem and the communication link.

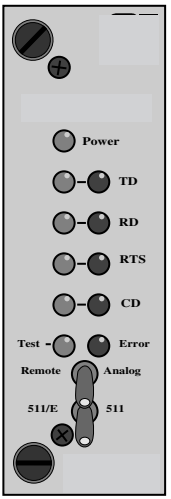


Figure 5-1. The Card's front panel.

5.1.1 The TD and RD Indicators

The TD and RD indicators (one red and one green LED for each signal) blink when data activity occurs: The red LEDs indicate a low serial-interface logic level, while the green LEDs indicate a high serial-interface logic level. Also, since RS-232 and V.35 devices idle in a low state, the red LED will be steadily lit if the connections are correct and the RS-232/V.35 device is in an idle state.

5.1.2 The RTS and CD Indicators

The RTS and CD indicators (again, one red and one green LED for each signal) function much like the TD and RD LEDs: The red LEDs light for a "low" signal, while the green LEDs light for a "high" signal. The RTS LEDs light for an incoming RTS signal on the DTE side (DB25 Pin 4 or M/34 Pin C). The CD LEDs light for an incoming signal on the line side and the resulting output signal on the DTE side (DB25 Pin 8 or M/34 Pin F).

5.1.3 The Power Indicator

The green Power LED lights to indicate that the Card is receiving power.

5.1.3 The Test Indicator

The green Test LED lights to indicate that V.52 or V.54 tests are running.

5.1.4 The Error Indicator

The red Error LED lights whenever bit errors occur in 511 testing; it stays lit for the duration of 511/E testing.

5.2 Power-Up

There is no power switch on the Async/Sync LD Card 56/64: Power is automatically applied to the Card whenever—and for as long as—its card-edge connector is plugged into the MicroRack's mid-plane socket and the MicroRack's power supply is turned on.

NOTE

The Async/Sync LD Card 56/64 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 Async/Sync LD Cards 56/64 are *both* powered up and are passing data *normally*, the LEDs on the Cards will look like this:

- Power: Steadily lit
- TD and RD: Flashing red and green
- RTS and CD: Green steadily lit, red dark
- Test and Error: Dark

5.3 V.54 and V.52 Diagnostic Tests

The Async/Sync LD Card 56/64 offers two V.54 test modes and two V.52 test modes to evaluate the condition of the modems and the communication link. Both sets of tests can be activated physically from the front panel. The V.54 test can also be activated from the RS-232 or V.35 interface.

NOTE

V.54 and V.52 test modes on the Async/Sync LD Card 56/64 are available for point-to-point applications only.

5.3.1 Local Analog Loopback (LAL)

The Local Analog Loopback (LAL) test checks the operation of the local Async/Sync LD Card 56/64, and is performed separately on each unit. Any data sent to the local Async/Sync LD Card 56/64 in this test mode will be echoed back (returned) to the user device. For example, characters typed on the keyboard of a terminal will appear on the terminal's screen. To perform a LAL test, follow these steps:

1. Activate LAL. You can do this in either of two ways. One is to move the upper front-panel toggle switch labeled "Remote—Analog" to the "Analog" (right-hand) position. The other is to raise the signal on Pin 18 of the RS-232 interface or Pin N of the V.35 interface (switch S1 position 8 must be "Off" and switch S2 position 7 must be "On"—see **Section 3.1.4**). Once LAL is activated, the Card's transmit output is connected to its own receiver. The Test LED should light.

NOTE

The standard pin used to activate local loopback on the V.35 interface is Pin J. The Async/Sync LD Card 56/64 responds to Pin N rather than Pin J.

2. Verify that the attached DTE is operating properly and can be used for a test.

3. Move the lower front-panel toggle switch labeled "511/E—511" to the "511" (right-hand) position. This will activate the V.52 BERT test mode and inject a 511 test pattern into the local loop. If any errors are present in the loop, the Error LED will blink *sporadically*.

4. If the BERT test indicates *no errors* are present, move the "511/E—511" toggle switch to the left-hand position to activate the "511/E" test with periodic errors. If this test is working properly, the Error LED will blink *regularly*. A successful 511/E test will confirm that the loop is in place, and that the Async/Sync LD Card 56/64's built-in 511 generator and detector are working properly.

5. If the BERT test indicates that errors *are* present, make sure that the serial cable connecting the DTE to the Async/Sync LD Card 56/64 is wired straight-through, and is plugged in properly. Also, make sure that the Card is configured properly. Then recheck your DTE equipment. If you still get errors and can't find the cause, call your supplier for technical support (see **Section 6.1**).

5.3.2 Remote Digital Loopback (RDL)

The Remote Digital Loopback (RDL) test checks the performance of both the local and remote Async/Sync LD Cards 56/64, and the communication link between them. Any characters sent to the remote Card in this test mode will be echoed back (returned) to the originating device. For example, characters typed on the keyboard of the local terminal will appear on the local terminal's screen after having been passed to the remote Async/Sync LD Card 56/64 and looped back. To perform an RDL test, follow these steps:

1. Activate RDL from the local side. You can do this in either of two ways. One is to move the upper front-panel toggle switch labeled "Remote—Analog" to the "Remote" (left-hand) position. The other is to raise the signal on Pin 21 of the RS-232 interface or Pin L of the V.35 interface (switch S1 position 8 must be "Off" and switch S2 position 8 must be "On"—see **Section 3.1.4**). Once RDL is activated, the remote Card's receive input is connected to its own transmitter. The Test LED should light on both Cards.

NOTE

The standard pin used to activate remote loopback on the V.35 interface is Pin BB. The Async/Sync LD Card 56/64 responds to Pin L rather than Pin BB. Since Pin L is used for the Test Pattern signal in standard V.35, see the manual for your V.35 DTE to find out how to raise the signal on Pin L.

2. Verify that the DTE attached to the local Card is operating properly and can be used for a test.

3. Move the lower front-panel toggle switch labeled "511/E—511" to the "511" (right-hand) position. This will activate the V.52 BERT test mode and inject a 511 test pattern into the remote loop. If any errors are present in the loop, the Error LED will blink *sporadically*.

4. If the BERT test indicates *no errors* are present, move the "511/E—511" toggle switch to the left-hand position to activate the "511/E" test with periodic errors. If this test is working properly, the Error LED will blink *regularly*. A successful 511/E test will confirm that the loop is in place, and that the Async/Sync LD Card 56/64's built-in 511 generator and detector are working properly.

5. If the remote BERT test indicates that errors *are* present, but the local analog loopback BERT tests showed that both Async/Sync LD Cards 56/64 were functioning properly, there is probably a problem with the twisted-pair communication line connecting the two modems. A common problem is improper crossing of the pairs. Also, check the cable's pinning (see **Section 4.5**) and continuity. If you still get errors and can't find the cause, call your supplier for technical support (see **Section 6.1**).

5.3.3 Using the V.52 BERT Test Independently

The Async/Sync LD Card 56/64 can perform its V.52 BERT test independently of the V.54 loopback tests. This requires two operators: one to initiate and monitor the test at the local Card, and one to do the same at the remote Card. To use the V.52 BERT test by itself, both operators should simultaneously follow these steps:

1. Move the lower front-panel toggle switch labeled "511/E—511" to the "511" (right-hand) position. This will activate the V.52 BERT test mode and transmit a 511 test pattern to the other unit. If any errors are present, the receiving modem's Error LED will blink *sporadically*.

NOTE

For this independent test to work properly, the "511/E—511" switch on both Async/Sync LD Cards 56/64 must be set the same way (that is, moved to the "511" position for this step and to the "511/E" position for the next step).

2. If the BERT test indicates *no errors* are present, move the "511/E—511" toggle switch to the left-hand position to activate the "511/E" test with periodic errors. If this test is working properly, the receiving modem's Error LED will blink *regularly*. A successful 511/E test will confirm that the link is in place, and that the Async/Sync LD Card 56/64s' built-in 511 generators and detectors are working properly.

6. Troubleshooting

6.1 Calling Black Box

If you determine that your Async/Sync LD Card 56/64 is malfunctioning, *do not attempt to alter or repair it.* Contact Black Box at 724-746-5500. The problem might be solvable over the phone.

Before you do, make a record of the history of the problem. Your supplier 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.

6.2 Shipping and Packaging

If you need to transport or ship your Async/Sync LD Card 56/64:

- Package it carefully. We recommend that you use the original container.
- Before you ship a unit for repair or return, contact Black Box to get a Return Authorization number, and make sure you include everything you received with the unit when you ship it.

Appendix: Cable Recommendations

The Async/Sync LD Card 56/64 has been performance-tested using twisted-pair cable with these characteristics:

Wire Gauge	Capacitance	Resistance
19 AWG	83 nf/mi. or 15.72 pf/ft.*	16.3 Ω/1000 ft. (53.5 Ω/km)
22 AWG	83 nf/mi. or 15.72 pf/ft.*	32.6 Ω/1000 ft. (107 Ω/km)
24 AWG	83 nf/mi. or 15.72 pf/ft.*	51.65 Ω/1000 ft. (169.5 Ω/km)
26 AWG	83 nf/mi. or 15.72 pf/ft.*	82.35 Ω/1000 ft. (270.2 Ω/km)

*Alternatively, 51.6 nf/km or 51.6 pf/m

If you use the Async/Sync LD Card 56/64 with a different type of twisted-pair cable, make sure that the cable has characteristics similar to, or better than, those listed above (for example, lower capacitance or lower resistance).

Bench tests yield the following data-rate/maximum-distance results:

Data Rate in bps	Absolute Maximum Distance in miles (km)			
	19 AWG	**22 AWG**	**24 AWG**	**26 AWG**
32,000	9.1 (14.6)	6.3 (10)	4.7 (7.6)	3 (4.9)
56,000	6.8 (11)	5.1 (8.2)	4.2 (6.7)	2.7 (4.3)
64,000	5.3 (8.5)	4.9 (7.9)	3.8 (6.1)	2.5 (4)

Note that these distances are absolute maxima for constant-carrier performance between two Cards under ideal conditions. Many environmental factors can affect transmission distance, so the distances you can attain at your site might vary, and in fact will probably be less. Also, the absolute maximum distance at which remote digital loopback will be successful for any given data rate and wire gauge will be as much as a mile (1.6 km) less than the constant-carrier figure shown above. For these reasons, we do not recommend running more than 6 miles (9.7 km) of cable between two Cards.

To gain optimum performance from the Async/Sync LD Card 56/64, please keep these guidelines in mind:

- Always use twisted-pair cable—this is *not* an option.

- Use twisted-pair cable with a capacitance of 20 pf/ft. (65.6 pf/m) or less.
- Avoid twisted-pair cable thinner than 26 AWG (that is, avoid higher AWG numbers than 26).
- Using twisted-pair cable with a resistance greater than that listed at the top of this page might reduce the maximum distance you can run the cable, but should not otherwise affect your system.

1000 Park Drive • Lawrence, PA 15055-1018 • 724-746-5500 • Fax 724-746-0746