Mini Driver Cards

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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 Industry Canada.

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

Chapter   **Page**

1. Specifications

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

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

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

Interfaces —   Serial: EIA/TIA-561 (compatible with EIA RS-232 and ITU-TSS [CCITT] V.24);
Line: Four-wire telco;
Internal: Card-edge for module↔MicroRack interconnection

Protocol —   Asynchronous

Data Format —   Transparent to numbers of data bits and stop bits and types of parity

Flow Control —   Transparent to all types of software (X-ON/X-OFF, robust X-ON/X-OFF, etc.) flow control; does *not* support hardware (RTS/CTS, DTR/DSR, etc.) flow control

Operating Mode —   Full duplex

Data Rates —   Transparent to all data rates up to 19,200 bps

Transmit Level —   6 dBm

Maximum Distance —   See the maximum distance chart in **Appendix A**

MINI DRIVER CARD

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 — (5) Jumpers on interface module:
  (2) Connect/disconnect Line A or B Shield to/from
  Frame Ground;
  (1) Connect/disconnect Signal Ground to/from
  Frame Ground;
  (2) DSR tracks DTR (can not be set differently)

Indicators — (9) Front-panel LEDs:
  (1) Power;
  (2) each for TD A and RD A;
  (2) each for TD B and RD B

Connectors — On main module:
  Both models:
  (1) 50-position card-edge male (to MicroRack);
  On interface module:
  Both models:
  (1) 50-position card-edge male (to MicroRack);
  (2) 10-pin RJ female for modem-to-DTE lines;
  ME780C-RJ11:
  (2) RJ-11 female for modem-to-modem lines;
  ME780C-RJ-45:
  (2) RJ-45 female for modem-to-modem lines

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)
Power —	From MicroRack's power supply (see **Section 4.2**): Input 120 VAC or 240 VAC (user-selectable); Output: 10 VAC; Consumption: 700 mW typical
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 Mini Driver Card is a dual rack card (it has a main [front] module and an interface [rear] module) incorporating two short-range modems. Pairs of these Cards make communication between buildings safer, because custom-designed ferrite-core transformers give the Cards DC isolation. The Mini Driver Card operates full duplex, at data rates up to 19,200 bps, over two twisted pairs. Maximum distances are up to 10 miles (16.1 km) at 1,200 bps and up to 2.5 miles (4 km) at 19,200 bps. The Card also incorporates Silicon Avalanche Diodes for protection against the damaging effects of nearby lightning strikes and other harmful transients.

   The Mini Driver Card is fabricated using the latest surface-mount technology, so you get high-quality short-range-modem performance on a convenient rack card. The Card is available with either RJ-11 or RJ-45 line-interface connectors on its interface (rear) module. It fills one function-card slot in our MicroRacks (RM202, RM204, RM208, or RM216).

2.2 Features

- Convenient rack card features two short-range modems

- Supports asynchronous communication over two twisted pairs

- Data rates to 19.2 Kbps, distances to 10 miles (16.1 km)

- Loops back all handshaking signals on the RS-232 interface

- Transformer coupling between modems eliminates ground loops

- Silicon Avalanche Diode surge protection

- Nine front-panel LEDs show you status at a glance

- Fits conveniently in our MicroRacks (RM202, RM204, RM208, RM216)

3. Configuration

The Mini Driver Card is designed to be easy to use. There are no internal jumpers or DIP switches to set on the main (front) module of the Card. However, you may have to configure the jumpers on the interface (rear) module that you have selected. This chapter describes these jumpers and how to set them.

The Mini Driver Card has two interface-module options. The ME780C-RJ11 model comes equipped with two RJ-11 line-interface ports and two 10-pin RJ-style serial-interface ports. The ME780C-RJ45 model comes equipped with two RJ-45 line-interface ports and two 10-pin RJ-style serial-interface ports. Figure 3-1, below, shows these two different interface-module options.
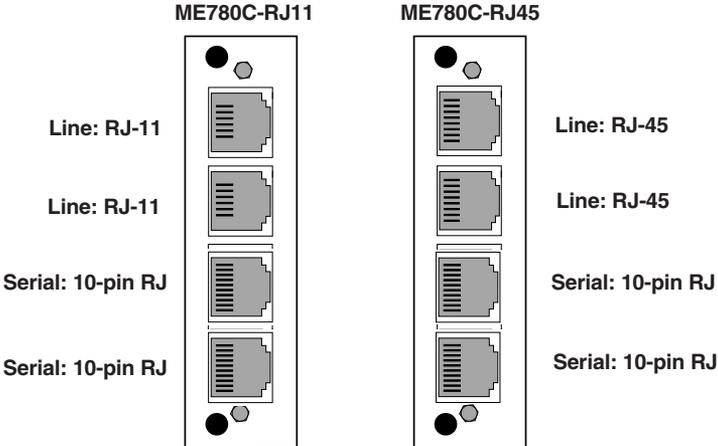

Figure 3-1. The two interface modules.

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 is configured by setting jumpers ("straps") on its circuit board, as described in the rest of this section.

3.1 The Configuration Jumpers Illustrated

Figure 3-2, below, shows the possible settings of the Mini Driver Card'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.
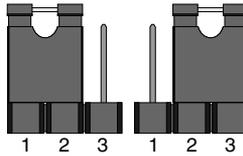

Figure 3-2. The possible jumper settings.

3.2 Setting the Configuration Jumpers

Figure 3-3, 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.
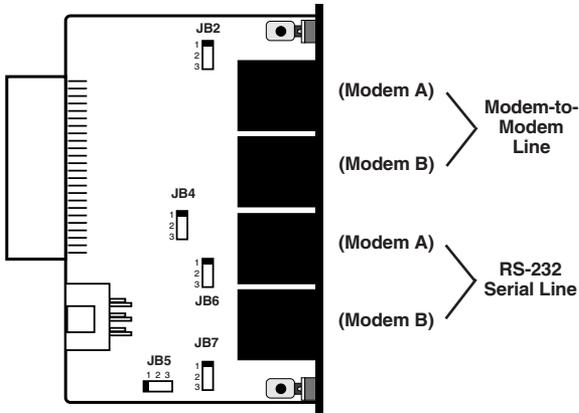

Figure 3-3. The jumper locations.

Table 3-1, below, provides a summary of jumper functions. The functions are described in more detail afterward.

Table 3-1. Summary of Jumper Functions

Jumper	In Positions 1 and 2	In Positions 2 and 3
JB2	Line A Shield	No Shield*
JB4	Line B Shield	No Shield*
JB5	SGND tied to FGND	SGND not tied to FGND*
JB6	DSR A tracks DTR*	N/A
JB7	DSR B tracks DTR*	N/A
*factory-default settings		

Line Interface: Line A Shield and Line B Shield (JB2 and JB4)
These jumpers apply to the line interface. When one of these jumpers 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 modules's frame ground. (If you are using shielded twisted-pair cable, the shield can be connected to these pins.) In positions 2 and 3, Pins 1 and 6 or 2 and 7 remain connected to each other, but are disconnected ("lifted") from frame ground.

JB2
Positions 1 and 2 = Line A Shield Connected
Positions 2 and 3 = No Shield (default)

JB4
Positions 1 and 2 = Line B Shield Connected
Positions 2 and 3 = No Shield (default)

CAUTION!

If you connect shield to frame ground, make sure that Pins 1 and 6 or 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: Signal Ground and Frame Ground (JB5)
This jumper applies to the serial interface. In position 1 and 2, this jumper links the Signal Ground (SGND) line (Pin 5) of both serial lines to the interface module's frame ground (FGND). When this jumper is in positions 2 and 3, Pin 5 of both lines are disconnected ("lifted") from frame ground.

JB5
Positions 1 and 2 = SGND and FGND Connected
Positions 2 and 3 = SGND and FGND Not Connected (default)

DSR tracks DTR (JB6 and JB7)
These jumpers <u>must</u> be left in their default positions. Because the interface module is designed to work with a whole family of products, and not just the Async Line Driver Card, it is capable of supporting some functions that are not used by the Async Line Driver Card. Some products in this family might require these jumpers to be set differently, but the Async Line Driver Card might malfunction if either of these jumpers is in the wrong position. Make sure the jumper is placed across Pins 1 and 2. Do *not* place the jumper across Pins 2 and 3.

JB6
Positions 1 and 2 = DSR Tracks DTR (default)
Positions 2 and 3 = N/A

4. Installation

This chapter describes the functions of the MicroRacks, tells how to install the front and rear modules of the Mini Driver Cards in them, and provides diagrams for wiring the interface connections correctly.

4.1 The MicroRacks: An Overview

Mini Driver Cards 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 Mini Driver Cards 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.
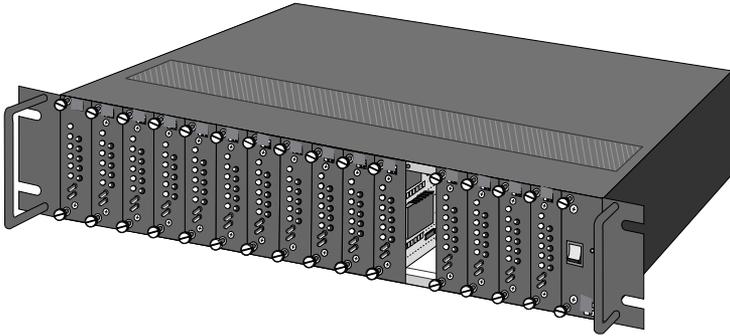
Figure 4-1. The MicroRack 16 (shown with line-driver cards of a different type installed).

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 switching 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, Black Box might be able to give you a special quote on country-specific cords.) Plug the cord back in.

4.3 Installing the Mini Driver Card in the MicroRack

The Mini Driver Card 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 Mini Driver Card 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 a Mini Driver Card.

4.4 The RS-232 Serial Cables and Connectors

The Mini Driver Card's RS-232 ports are always the *lower* two ports on its interface module. They are 10-pin female RJ-style connectors (compatible with regular male RJ-45 cable connectors), pinned according to a modified version of the EIA/TIA-561 standard, as shown in Table 4-1 below.

Table 4-1. The 10-Pin RJ Interface

Pin Number	ITU-TSS V.24 Circuit	Signal Name/Description
1	N/A	Not Used
2	107	DCE Ready (DCR [DSR])
3	109	Received Line Signal Detector (RLSD [CD])
4	108/2	DTE Ready (DTR)
5	102	Signal Common (SCOM [SGND])
6	104	Receive Data (RD)
7	103	Transmitted Data (TD)
8	106	Clear to Send (CTS)
9	105 or 133	Request to Send (RTS)/Ready for Receiving (RR)
10	N/A	Not Used

Pins 3 through 9 correspond to Pins 2 through 8 of the EIA/TIA-561 non-synchronous interface standard. Pin 2 corresponds to Pin 1 of the EIA/TIA TSB-25 preliminary interface standard.

The Mini Driver Card is wired as a DCE (Data Communications Equipment) device. Therefore, it would normally be connected to DTE (Data Terminal Equipment) RS-232 devices. You might need to run a special cable or use a special modular adapter if either of the RS-232 devices you want to attach have DB25 or DB9 serial-port connectors. Even if the DTEs' serial ports are RJ-45 connectors, you might still need to use a specially pinned cable. Call Black Box 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 Mini Driver Card's line ports are always the *upper* two ports on its interface module. They are 6-pin RJ-11 connectors on the ME780C-RJ11 model or 8-pin RJ-45 connectors on the ME780C-RJ45 model, pinned for a standard telco-wiring environment, as shown in Table 4-2 and Figure 4-2 on the next page.

The Mini Driver Card operates full 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 Mini Driver Card can only communicate in a closed data circuit with another Mini Driver Card. 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 Appendix A.

The modem-to-modem cable connection must be specially cross-pinned, as shown in Table 4-2 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 Mini Driver Cards, you can get a custom cable from Black Box as a special quote, or you can use regular straight-through-pinned cable and repin one of the 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 Black Box for these items, or for technical support if you have difficulty.

Table 4-2. Line-Cable Pinouts

<u>RJ-11</u>

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**

<u>RJ-45</u>

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**

*Standard color codes—wire colors in your cable might be different
**Connection to ground is optional
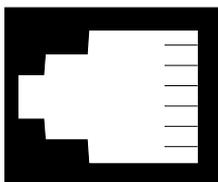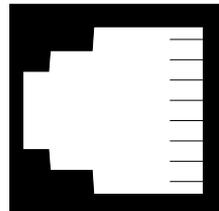
Figure 4-2. AT&T® standard modular color codes.

5. Operation

Once you have configured each Mini Driver Card and connected the cables, you are ready to operate the units. This chapter describes the Card's LEDs and the power-up procedure.

5.1 Status LEDs

The Mini Driver Card features nine front-panel status LEDs (shown in Figure 5-1 below) that indicate the condition of the modem and the communication link.
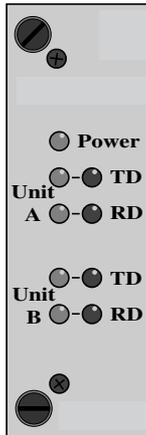

Figure 5-1. The Card's front panel.

- The Card will steadily light its green "PWR" LED as long as it is receiving power through its mid-plane MicroRack connection.

- The green "TD" and "RD" LEDs blink to show positive-state data activity. The red "TD" and "RD" LEDs blink to show negative-state data activity. If the red "TD" and "RD" LEDs are steadily lit, the modem-to-modem connection for that unit is idle.

5.2 Power-Up

There is no power switch on the Mini Driver Card: 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 Mini 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.

6. Troubleshooting

6.1 Calling Black Box

If you determine that your Mini Driver Card is malfunctioning, *do not attempt to alter or repair it.* Contact Black Box Technical Support at 724-746-5500. The problem might be solvable over the phone.

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

- The nature and duration of the problem.

- When the problem occurs.

- The components involved in the problem.

- Any particular application that, when used, appears to create the problem or make it worse.

6.2 Shipping and Packaging

If you need to transport or ship your Mini Driver Card:

- 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 Materials Authorization (RMA) number, and make sure you include everything you received with the unit when you ship it.

Appendix A: Cable Recommendations

The Mini Driver Card operates at frequencies of 20 KHz or less and 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)

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

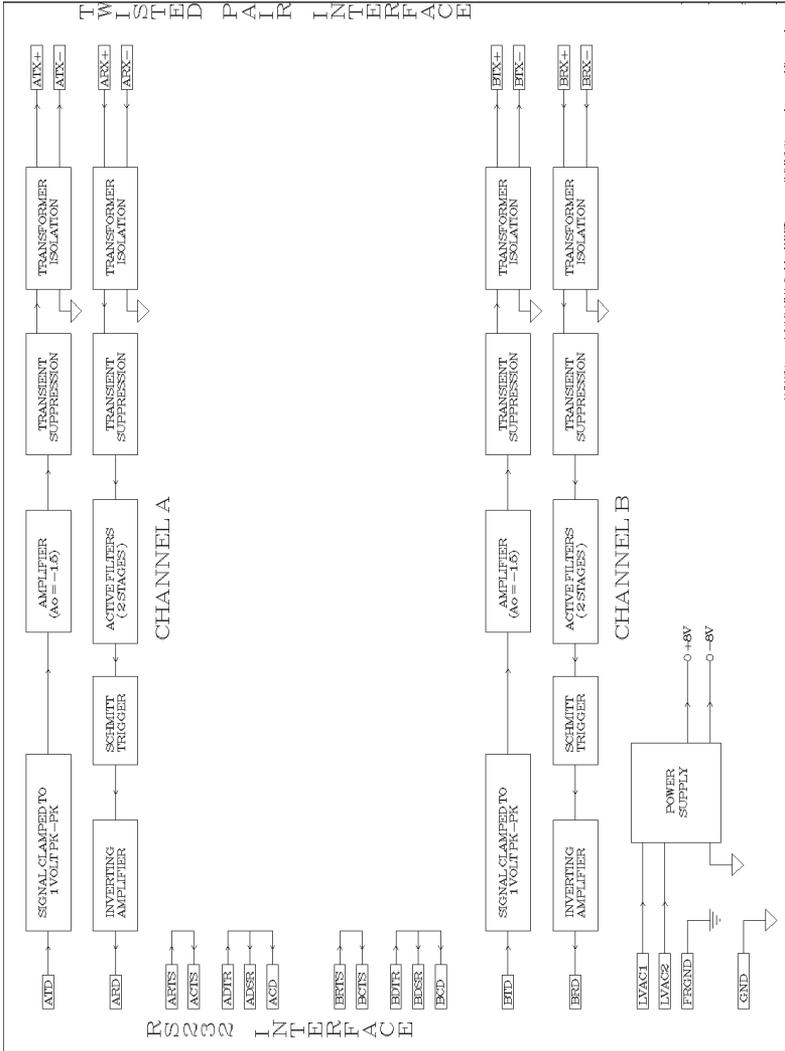Bench tests yield the following data rate/maximum distance results:

Data Rate in bps	Maximum Distance in miles (km)		
	19 AWG	22 AWG	24 AWG
19,200	2.5 (4)	2.1 (3.4)	1.3 (2.1)
9,600	3.7 (6)	2.3 (3.7)	1.7 (2.7)
4,800	4.9 (7.9)	4.9 (7.9)	2.5 (4)
2,400	8.2 (13.2)	5.8 (9.3)	4.6 (7.4)
1,200	10 (16.1)	8.3 (13.4)	6.8 (10.9)

Many environmental factors can affect the maximum distances obtainable at a particular site. Use this table as a general guideline only.

To gain optimum performance from the Mini Driver Card, 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.

Appendix B: Block Diagram

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