BLACK BOX®
NETWORK SERVICES

2-Wire Modular Campus Driver

FEDERAL COMMUNICATIONS COMMISSION
AND
INDUSTRY CANADA
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 la classe A prescrites dans le Règlement sur le brouillage radioélectrique publié par Industrie 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 USED IN THIS MANUAL

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CE NOTICE

The CE symbol on your equipment indicates that it is in compliance with the Electromagnetic Compatibility (EMC) directive and the Low Voltage Directive (LVD) of the Union European (EU).

Contents

1. Specifications

Transmission Format —	Synchronous or asynchronous
Transmission Line —	Single unconditioned twisted pair
Clocking —	Internal, external, or receive loopback
Distance —	Distance, max., all data rates: 10.1 miles (16.4 km) on 19 AWG (0.9 mm) wire; 7.2 miles (11.5 km) on 22 AWG (0.64 mm) wire; 5 miles (8 km) on 24 AWG (0.5 mm) wire; 3.4 miles (5.5 km) on 26 AWG (0.4 mm) wire
Data Rates —	Synchronous: 32, 56, 64, and 128 Kbps; Asynchronous: 0 to 38.4 Kbps
Diagnostics —	V.52-compliant bit error rate pattern (511/511E pattern) generator and detector with error-injection mode; Local Line Loopback and Remote Digital Loopback, activated by front-panel switch or via serial interface
LED Status Indicators—	TD, RD, CTS, CD, DTR, NS (no signal), ER (error), and TM (test mode)
Interface Cards—	EIA RS-232/CCITT V.24, RS-232/530, CCITT V.35 and CCITT X.21
Connectors —	RJ-45 on line side; DB25 female, M/34 female or DB15 female on serial interface side, depending upon which interface card is installed
Temperature Range —	32 to 113°F (0 to 45°C)
Altitude —	Up to 15,000 feet (4570 m)
Humidity —	5 to 95% noncondensing

2-WIRE MODULAR CAMPUS DRIVER

Power —   ME485A: 115 VAC, 60 Hz; ME485AE: 230 VAC, 50 Hz; ME485A-D48: 48 VDC, 5 watts

Size —   7.3" x 6.6" x 1.6" (18.5 x 16.8 x 4.1 cm)

Weight —   2 lb. (1 kg)

2. Introduction

The 2-Wire Modular Campus Driver is a high-speed, AC-powered short-range modem that is able to operate synchronously or asynchronously—full duplex—over a single twisted pair. Supporting data rates to 128 Kbps (synchronous) or 38.4 Kbps (asynchronous), the Campus Driver is capable of point-to-point distances up to 5 miles using 24-AWG wire.

The Campus Driver supports internal, external, or receive loopback clocking in synchronous mode. Data rates and asynchronous data format may be configured locally using DIP switches.

The Campus Driver features replaceable DCE-DTE interface cards. Several different modules are available. Line connection is made by RJ-45C jack. Internal AC power-supply options include 120 or 230 VAC, or 48 VDC.

Some of the Campus Driver's features include:

• Synchronous data rates of 32, 56, 64, and 128 Kbps in all clock modes.

• Asynchronous data rates of 0 to 38.4 Kbps.

• Full-duplex operation over a single twisted pair (2-wire).

• Point-to-point distances up to 5 miles (all data rates) on 24-AWG twisted pair.

• Internal, external, or receive recovered clocking options.

• LED indicators for TD, RD, CTS, CD, DTR, TM, ER, and NS.

• Remote digital loopback, local line loopback diagnostic modes.

• Field-replaceable DTE-DCE interface cards.

3. Configuration

The Campus Driver is equipped with two sets of eight DIP switches, which allow configuration of the unit to a wide variety of applications.

3.1 External Configuration Switches

The Campus Driver uses a unique set of 16 external mini DIP switches that allow configuration to a wide range of applications. The 16 external switches are grouped into two eight-switch sets, and are externally accessible from the underside of the Campus Driver (See Figure 3-1).
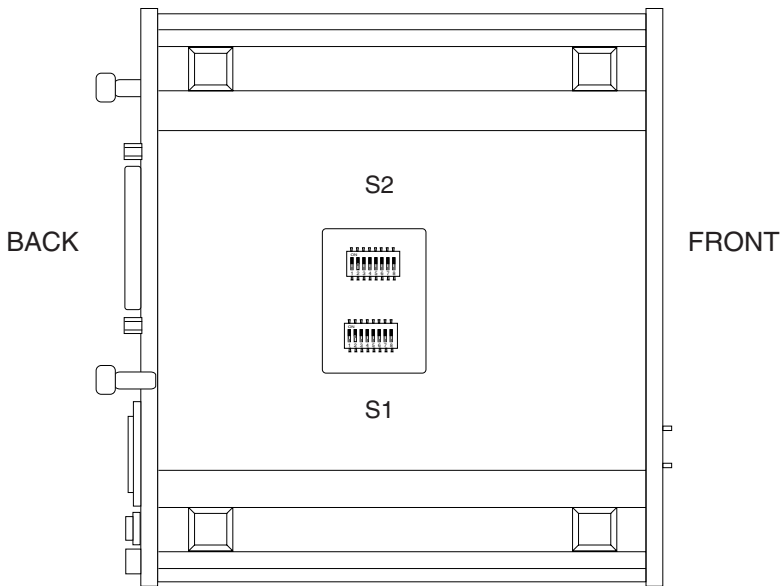
Figure 3-1. External DIP-Switch Locations.

The two sets of DIP switches on the underside of the Campus Driver will be referred to as S1 and S2. As Figure 3-2 shows, the orientation of all DIP switches is the same with respect to "ON" and "OFF" positions.

ON

```
ON
1 2 3 4 5 6 7 8
```

OFF
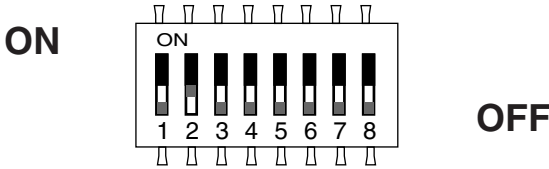
**Figure 3-2. Close-Up of the Switches.
(Both sets are identical in appearance.)**

3.1.1 CONFIGURATION SWITCH SET "S1"

The configuration switches on S1 set data rate, asynchronous or synchronous data format, transmit clock source, and response to RDL request. The default settings and detailed descriptions for each switch are shown below.

S1 SUMMARY TABLE		
Position	**Function**	**Factory Default**
S1-1	Data Rate	On ⎫ 64K Sync
S1-2	Data Rate	Off ⎭
S1-3	DSR during Local Line Loop	On DSR On
S1-4	Async/Sync Data Format	Off ⎫ Async/Sync
S1-5	Async/Sync Data Format	Off ⎭
S1-6	Tx Clock Source*	On ⎫ Internal Clock
S1-7	Tx Clock Source*	On ⎭
S1-8	Response to RDL Request	On Enable

Switches S1-1 and S1-2: Data Rate

Switches S1-1 and S1-2 are set in combination to determine the data rate of the Campus Driver. Each setting represents one synchronous data rate and one asynchronous data rate.

S1-1	S1-2	Sync Data Rate	Async Data Rate
On	On	32 Kbps	Reserved
Off	On	56 Kbps	Reserved
On	Off	64 Kbps	Reserved
Off	Off	128 Kbps	0 to 38.4 Kbps

Switch S1-3: Data Set Ready During Line Loopback Test

Switch S1-3 controls the behavior of the DSR signal at the EIA interface during the line loopback test.

S-3	Setting
On	DSR is on during local line loop
Off	DSR is off during local line loop

Switches S1-4 and S1-5: Async/Sync Operation

Switches S1-4 and S1-5 set the Campus Driver for async/sync operation. Both switches must be set in the "Off" position. There is no other valid setting.

S1-4	S1-5	Setting
Off	Off	Async/Sync
On	Off	Reserved
Off	On	Reserved
On	On	Reserved

Switches S1-6 and S1-7: System Clock Mode

The setting for switches S1-6 and S1-7 determines the clocking method between Campus Drivers.

S1-6	S1-7	Clock Mode	Description
On	On	Internal	System clock generated internally
Off	On	External (DTE)	System clock derived from terminal interface
On	Off	Receive Recover	System clock derived from the received line signal
Off	Off	Hardware Reset	

NOTE

Because communication between two Campus Drivers is always synchronous, *you must set these switches whether your application is async or sync*. For X.21 or async applications, please configure the local unit for internal clock mode and the remote unit for receive recover clock mode.

Switch S1-8: Response to RDL Request

The setting for switch S1-8 determines whether the Campus Driver responds to a request from the remote Campus Driver to go into Digital Loopback mode. For example, if the Campus Driver is set to "Response to RDL Request Disabled," it will not go into RDL mode when requested to do so by the remote Campus Driver.

S1-8	Setting
On	Response to RDL Request Enabled
Off	Response to RDL Request Disabled

3.1.2 CONFIGURATION SET "S2"

The switches on Switch S2 set the loopback modes and the speed of the control port. Default settings and detailed descriptions for each switch are shown below.

S2 SUMMARY TABLE		
Position	**Function**	**Factory Default**
S2-1	Not Assigned	Off
S2-2	Not Assigned	Off
S2-3	Response to LAL from DTE	Off Disabled
S2-4	Not Assigned	Off
S2-5	Not Assigned	Off
S2-6	Response to RDL from DTE	On Enabled
S2-7	Control Port Data Rate	On ⎫ 9600 bps
S2-8	Control Port Data Rate	On ⎭

Switches S2-1 and S2-2: Not Assigned

Switch S2-3: Response to Local Line Loop Requests from DTE

The setting for switch S2-3 determines whether the local Campus Driver responds to Local Line Loop requests from the DTE Interface.

S2-3	Activation	Description
Off	Disabled	Ignore Line Loopback request from DTE interface
On	Enabled	Respond to Line Loopback request from DTE interface

Switches S2-4 and S2-5: Not Assigned

Switch S2-6: Response to RDL Request from DTE

The setting for Switch S2-6 determines the Campus Driver's response to RDL requests from the local DTE. In the enabled setting, the Campus Driver responds to RDL requests from the local DTE by sending an RDL loop request to the remote Campus Driver.

S2-3	Activation	Description
Off	Disabled	Ignore Remote Digital Loopback request from DTE interface
On	Enabled	Respond to Remote Digital Loopback request from DTE interface

Switches S2-7 and S2-8: Control Port Data Rate

Switches S2-7 and S2-8 are set in combination to determine the control-port data rate for the Campus Driver.

S2-7	S2-8	Setting
On	On	9600 bps (default)
Off	On	19,2000 bps
On	Off	38,400 bps
Off	Off	57,600 bps

3.2 Software Control Port Switches

The 8-position RJ-45 (EIA/TIA-561) Control Port on the front of the Campus Driver is used to configure the unit and initiate diagnostic tests. To use the control port, connect a VT100™ terminal or similar RS-232 DTE with terminal emulation as follows:

1) Connect the serial RS-232 port of the terminal to the EIA/TIA-561 port of the Campus Driver. To construct an RS-232-to-EIA-561 patch cable, refer to the control port pinout diagram in **Appendix B**.

2) Power up the terminal and set its RS-232 port as follows:

> 9600 bps
> 8 data bits, 1 stop bit, no parity
> Local echo
> CR-CR/LF on inbound data
> ANSI, VT100 emulation

3) Verify that switches S2-8 and S2-7 are set to ON.

4) Power up the Campus Driver.

3.2.1 USING THE SOFTWARE MENU SYSTEM

The software switches on the Campus Driver are set using a menu-driven command system. To make a selection from any menu, enter the option number. To exit any menu without making a selection, press the [ESC] key or the [SPACE] key.

After the Campus Driver is powered on, the control port will send out this message:

```
ver x.x
```

Press [ESC] on the terminal.

The Campus Driver will then display the following MAIN MENU screen:

```
*************************************************
*                 MAIN MENU                     *
*                                               *
* 1. Display Active Configuration               *
* 2. Display Hardware Configuration             *
* 3. Display Software Configuration             *
* 4. Setup Software Configuration               *
* 5. Select Hardware/Software Control           *
* 6. Display Modem Status                       *
* 7. Test Modes                                 *
*************************************************
Enter your selection(1-7)>
```

Select an item from the MAIN MENU to proceed.

NOTE

The [ESC] key and the Space bar are functionally equivalent. You may respond to any menu with either an [ESC] or [SPACE]. This returns you to the previous menu.

3.2.2 MAIN MENU OPTION 1: DISPLAY ACTIVE CONFIGURATION

Option 1 displays the active configuration (below). The Campus Driver uses the active configuration for its operation.

```
*************************************************************
*        ACTIVE CONFIGURATION - Esc to MAIN MENU            *
*                                                           *
* Configuration Control:             Hardware              *
* DTE Rate:                          64 Kbps               *
* Data Format:                       Synchronous           *
* Clock Mode:                        Internal              *
* DSR during Local Line Loop:        Enabled               *
* Response to Remote Digital Loop:   Enabled               *
* DTE controlled Local Line Loop:    Disabled              *
* DTE controlled Remote Digital Loop: Disabled             *
*************************************************************
```

3.2.3 MAIN MENU OPTION 2: DISPLAY HARDWARE CONFIGURATION

Option 2 displays the configuration set by the hardware DIP switches. To use the Hardware Configuration for the Active Configuration, select Main Menu Option 5, then select "Use Hardware DIP-Switches" (below).

```
**********************************************************
*      HARDWARE CONFIGURATION - Esc to MAIN MENU        *
*                                                        *
* Configuration Control:              Hardware          *
* DTE Rate:                           64 Kbps           *
* Data Format:                        Synchronous       *
* Clock Mode:                         Internal          *
* DSR during Local Line Loop:         Enabled           *
* Response to Remote Digital Loop:    Enabled           *
* DTE controlled Local Line Loop:     Disabled          *
* DTE controlled Remote Digital Loop: Disabled          *
**********************************************************
```

3.2.4 MAIN MENU OPTION 3: DISPLAY SOFTWARE CONFIGURATION

Option 3 displays the configuration of the software switches (below). To use the software configuration for the Active Configuration, select Main Menu Option 5, then select "Use Software Switches."

```
**********************************************************
* SOFTWARE CONFIGURATION MENU - Esc to MAIN MENU *
*                                                *
* 1. DTE Rate                                    *
* 2. Data Format (Async/Sync)                    *
* 3. Clock Mode                                  *
* 4. DSR during Local Line Loop                  *
* 5. Response to Remote Digital Loop             *
* 6. DTE controlled Local Line Loop              *
* 7. DTE controlled Remote Digital Loop          *
**********************************************************
Enter your selection(1-7)>>
```

3.2.5 MAIN MENU OPTION 4: SETUP SOFTWARE CONFIGURATION

Option 4 allows you to select the software configuration of the Campus Driver. After making any changes to the software configuration, you must choose MAIN MENU Option 5 and then MAIN MENU Option 2 to implement changes in software configuration.

```
************************************************
* SOFTWARE CONFIGURATION MENU - Esc to MAIN MENU *
*                                              *
* 1. DTE Rate                                  *
* 2. Data Format (Async/Sync)                  *
* 3. Clock Mode                                *
* 4. DSR during Local Line Loop                *
* 5. Response to Remote Digital Loop           *
* 6. DTE controlled Local Line Loop            *
* 7. DTE controlled Remote Digital Loop        *
************************************************
Enter your selection(1-7)>>
```

DTE Rate
Option 1 in the Setup Software Configuration menu takes you to the DTE Rate Menu (below). The selection screen that appears depends upon whether the data format is synchronous or asynchronous.

The selections are shown below.

a) This menu is displayed when the data format is synchronous:

```
************************************************
* DTE RATE - Esc to SOFTWARE CONFIG MENU    *
*                                           *
* 1. 32 Kbps          3. 64 Kbps (Default) *
* 2. 56 Kbps          4. 128 Kbps          *
************************************************
Enter your selection(1-4)>>
```

b) This menu is displayed when the data format is asynchronous:

```
************************************************
* DTE RATE - Esc to SOFTWARE CONFIG MENU    *
*                                           *
* 1. 0-38,400 bps (default)   3. Reserved  *
* 2. Reserved                 4. Reserved  *
************************************************
Enter your selection(1-4)>>
```

Data Format
Option 2 in the Setup Software Configuration Menu allows you to select the async or sync data format (below).

```
************************************************
* DATA FORMAT - Esc to SOFTWARE CONFIG MENU  *
*                                            *
* 1. Asynchronous, 8 bits + no parity        *
* 2. Asynchronous, 7 bits + parity           *
* 3. Asynchronous, 7 bits, no parity         *
* 4. Synchronous                             *
************************************************
Enter your selection(1-4)>
```

Clock Mode
Option 3 in the Setup Software Configuration Menu allows you to select the sync clock mode (below).

```
************************************************
* CLOCK MODE - Esc to SOFTWARE CONFIG MENU *
*                                          *
* 1. Master Clock - Internal (default)     *
* 2. Master Clock - External (DTE provided)*
* 3. Slaved to Receive Clock               *
************************************************
Enter your selection(1-3)>
```

NOTE

One Campus Driver must be a Master Clock (either internal or external) and the other must be Slaved to the Receive Clock.

Set this option as follows:

Master Clock—Internal: Selection 1 allows the Campus Driver to generate an internal clock as the timing source.

Master Clock—External: Selection 2 allows the Campus Driver to derive the system clock from the locally connected DTE.

Slaved to Receive Clock: Selection 3 to allows the Campus Driver to derive the timing source from the incoming data stream from the remote Campus Driver.

DSR During Local Line Loop

Option 4 in the Setup Software Configuration Menu allows you to configure the behavior of the local Data Set Ready (DSR) signal during the Local Line Loop test mode (below).

```
**************************************************
*           DSR DURING LOCAL LINE LOOP          *
*           Esc to SOFTWARE CONFIG MENU         *
*                                               *
* 1. DSR ON during Local Line Loop (default)  *
* 2. DSR OFF during Local Line Loop             *
**************************************************
Enter your selection(1-2)>>
```

Response to Remote Digital Loop

Option 5 in the Software Configuration Menu allows you to instruct the Campus Driver to either respond or ignore the Remote Digital Loop request from the remote Campus Driver.

```
****************************************
*  RESPONSE TO REMOTE DIGITAL LOOP    *
*     Esc to SOFTWARE CONFIG MENU     *
*                                     *
* 1. ENABLE (default)    2. DISABLE  *
****************************************
Enter your selection(1-2)>>
```

DTE-Controlled Local Line Loop

Option 6 in the Software Configuration Menu allows you to instruct the Campus Driver to either respond or ignore Local Line Loop requests from the DTE. To instruct the Campus Driver to respond to Local Line Loop requests from the DTE, select Enable (Option 1). To instruct the Campus Driver to ignore Local Line Loop requests from the DTE interface, select Disable (Option 2).

```
****************************************
*    DTE CONTROLLED LOCAL LINE LOOP   *
*     Esc to SOFTWARE CONFIG MENU     *
*                                     *
* 1. ENABLE (default)    2. DISABLE  *
****************************************
Enter your selection(1-2)>>
```

DTE-Controlled Remote Digital Loop

Option 6 in the Software Configuration Menu takes you to the DTE-Controlled Remote Digital Loop Menu (below). The Remote Digital Loop on the Campus Driver can be controlled from the DTE interface by selecting Enable (Option 1). To instruct the Campus Driver to ignore this request from the DTE interface, select Disable (Option 2).

```
*****************************************
* DTE CONTROLLED REMOTE DIGITAL LOOP *
*    Esc to SOFTWARE CONFIG MENU       *
*                                      *
* 1. ENABLE (default)     2. DISABLE *
*****************************************
Enter your selection(1-2)>>
```

3.2.6 MAIN MENU OPTION 5: SELECT HARDWARE/SOFTWARE CONTROL

The setting of Option 5 from the Main Menu selects whether the Campus Driver will use the hardware switch settings or the software switch settings for its active configuration.

```
**************************************************
*    HARDWARE/SOFTWARE CONFIGURATION CONTROL   *
*              Esc to MAIN MENU                 *
*                                              *
* 1. Use Hardware Dip-switches (default)       *
* 2. Use Software Switches                     *
**************************************************
Enter your selection(1-2)>>
```

3.2.7 MAIN MENU OPTION 6: DISPLAY MODEM STATUS

Option 6 from the Main Menu displays the Modem Status (below). Pressing RETURN on the keyboard updates and redisplays the screen.

```
***********************************************************
*              MODEM STATUS - Esc to MAIN MENU           *
*                                                        *
* Handshake status:     HANDSHAKING                      *
* Data Terminal Ready:  OFF                              *
* Request To Send:      OFF                              *
* Carrier Detect:       OFF                              *
* Data Set Ready:       OFF                              *
* Clear To Send:        OFF                              *
* Test Mode:            OFF                              *
***********************************************************
```

NOTE

Valid Campus Driver Handshake Statuses are listed below:

1) Handshaking—This status occurs when the Campus Driver is in the process of establishing a link with another Campus Driver.

2) Data Mode—This status occurs when the Campus Driver successfully establishes a link with another Campus Driver allowing the data to flow.

3.2.8 MAIN MENU OPTION 7: TEST MODES

Option 7 from the Main Menu allows you to select the test-mode status of the Campus Driver, (below). The Campus Driver Test Mode settings help to verify the integrity of the data link and isolate communication difficulties.

```
TEST MODE MENU - Esc to MAIN MENU
1. OFF
2. 511
3. 511 w/errors
4. Local Line Loop
5. Local Line Loop and 511
6. Local Line Loop and 511 w/errors
7.Remote Digital Loop
8.Remote Digital Loop and 511
9.Remote Digital Loop and 511 w/errors

Enter your selection<1-9>>
```

NOTE

An error counter is displayed when the unit is in one of the above test modes except LLB and RDL.

To run or terminate a particular test, key in the option to get to that screen menu. If a particular test cannot be invoked, the unit displays the message: "Attempt unsuccessful!"

Test Mode options 2, 3, 7, 8, and 9 require the Campus Driver to be in Data Mode with the remote Campus Driver. The Campus Driver Test Modes are described below:

OFF Terminates all tests.

511 Initiates the built-in test pattern generator and detector.

511 with Errors Initiates the built-in test pattern generator and detector. The test-pattern generator also injects intentional errors approximately once per second.

Local Line Loop and 511 Initiates the Local Line Loop test and starts the internal 511 generator and detector.

Local Line Loop and 511 with errors Initiates the Local Line Loop test and starts the internal 511 generator and detector. In this test, the 511 pattern generator injects intentional errors into the data stream.

Remote Digital Loop Initiates the Remote Digital Loopback test. Any data sent to the remote Campus Driver is returned to the originating device.

Remote Digital Loop and 511 Initiates the Remote Digital Loopback test and starts the internal 511 generator and detectors.

Remote Digital Loop and 511 with errors Initiates the Remote Digital Loopback test and starts the 511 test patterns. In this test, the 511 pattern generator will inject initial errors into the data stream.

The Modem Status Screen is displayed upon initiating a test. A 511 error counter is displayed to indicate errors. Press the "C" key to clear the counter and redisplay the Modem Status Screen. Pressing "ESC" returns you to the Test Mode Menu.

Pressing "C" will clear the error count and redisplay the modem status screen. Pressing Return will update and redisplay the status.

4. Installation

Once the Campus Driver is properly configured, it is ready to connect to the twisted-pair interface, to the serial port, and to the power source.

4.1 Connection to the Twisted-Pair Interface

The Campus Driver supports communication between two DTE devices at distances to 5 miles (24 AWG) and data rates to 128 Kbps (sync) or 38.4 Kbps (asynchronous). There are two essential requirements for installing the Campus Driver:

1. These units work in pairs. Therefore, you must have one Campus Driver (or a compatible model) at each end of a two twisted-pair interface.

2. To function properly, the Campus Driver needs one twisted pair of metallic wire. This twisted pair must be unconditioned, dry, metallic wire, between 19 and 26 AWG (the higher number gauges may limit distance somewhat). Standard dial-up telephone circuits, or leased circuits that run through signal-equalization equipment, or standard, flat modular telephone cable, are not acceptable.

The RJ-45 connector on the Campus Driver's twisted-pair interface is pre-wired for a standard telco wiring environment. The signal/pin relationships are shown below:

RJ-45	SIGNAL
1	N/C
2	N/C
3	N/C
4	Tip
5	Ring
6	N/C
7	N/C
8	N/C
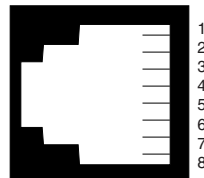
4.2 Connection to the Serial Port

The serial-port interface on the Campus Driver uses interchangeable Interface Cards. Each Card has a 50-pin card-edge connector on one side and a serial-port interface on the other. Figure 4-1 (below) shows how a Card plugs into the back of the Campus Driver.
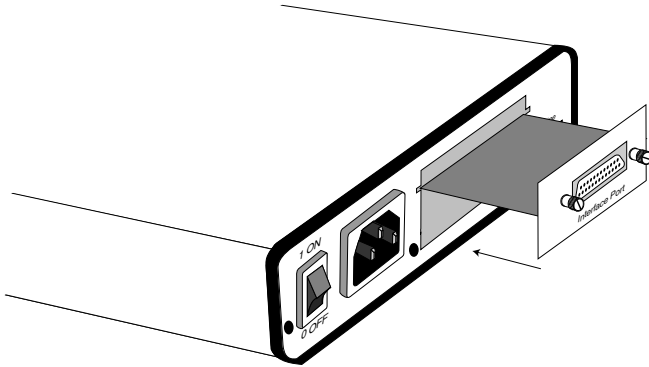

Figure 4-1. Installing the Interface Card.

4.2.1 CHANGING INTERFACE CARDS

Removing a Card

1. Turn the power switch off. Leave the power cord plugged into a grounded outlet to keep the unit grounded.

2. Loosen the two thumbscrews on the Card by turning them counterclockwise.

3. Grasp the two thumbscrews and gently pull the Card from the unit. Apply equal force to the thumbscrews to keep the Card straight during the removal process.

Installing a New Card

1. Make sure the power switch is off. Leave the power cord plugged into a grounded outlet to keep the unit grounded.

2. Hold the Card with the faceplate toward you and align the Card with the guide slots in the rear panel of the Campus Driver.

3. While keeping the Card's faceplate parallel with the Campus Driver's rear panel, slide the Card straight in—so that the card-edge contacts line up with the socket inside the chassis.

NOTE

The card-edge connector should meet the socket when it is almost all the way into the chassis. If you encounter a lot of resistance, remove the Card and repeat Steps 2 and 3.

4. With the card-edge contacts aligned with the socket, firmly seat the Card by using your thumbs to apply pressure directly to the right and left edges of the Card's faceplate. Applying moderate and even pressure should be sufficient to seat the Card. You should hear it snap into place.

5. To secure the Card in place, push the thumbscrews into the chassis and turn the screws clockwise to tighten.

4.2.2 CONNECTION TO A DTE DEVICE

The serial port on the interface cards (all except the X.21 card) is hard-wired as a DCE. Therefore these cards "want" to plug into a DTE such as a terminal, PC, or host. When making the connection to your DTE device, use a straight-through cable of the shortest possible length—we recommend 6 feet or less. When purchasing or constructing an interface cable, please refer to the pin diagrams in **Appendix B** as a guide.

4.2.3 CONNECTION TO A DCE DEVICE

If the Campus Driver's interface card is hard-wired as a DCE (all except the X.21 card), you must use a null-modem cable when connecting to a printer, modem, multiplexer, or other DCE device. This cable should be of the shortest possible length—we recommend 6 feet or less. When purchasing or constructing a null-modem interface cable, use the pin diagrams in **Appendix B** as a guide.

NOTE

Pinout requirements for null-modem applications vary widely between manufacturers. If you have any questions about a specific application, contact Technical Support.

4.2.4 RECONFIGURING THE X.21 INTERFACE CARD

The serial port on the X.21 card is default wired as a DCE, but may be switched to a DTE. This is done by reversing the orientation of the DCE/DTE strap, as described below:

To reverse DCE/DTE orientation, remove the card according to the instructions in **Section 4.2.1**. The DCE/DTE strap is located on the bottom side of the Card's PC board. The arrows on the top of the strap indicate the configuration of the X.21 port (for example, if the DCE arrows are pointing toward the DB15 connector, the X.21 port is wired as a DCE). Reverse the DCE/DTE orientation by pulling the strap out of its socket, rotating it 180°, then plugging the strap back into the socket. You will see that the DCE/DTE arrows now point in the opposite directions, showing the new configuration of the X.21 port. Reinstall the card according to the instructions in **Section 4.2.1**.

4.3 Connection to the Power Source

The Campus Driver is available with three power-supply options:

The **Standard** power-supply option is available in 115 (ME485A) or 230 (ME485AE) VAC.

The **DC** power-supply option (ME485A-D48) operates in 48-VDC environments and is equipped with a 3-pin terminal-strip-type connector. The DC power source used with this product must be with a Selv source of supply.

The two AC power-supply options are equipped with a male IEC-320 power connection. A domestic (U.S.) power-supply cord is supplied with the unit. To connect the standard power supply, follow these steps:

1. Attach the power cord (supplied) to the shrouded male IEC-320 connector on the rear of the Campus Driver.

2. Plug the power cord into a nearby AC power outlet.

3. Turn the rear power switch ON.

WARNING! There are no user-serviceable parts in the power-supply section of the Campus Driver. Voltage-setting changes and fuse replacement should only be performed by qualified service personnel. Any questions may be answered by contacting Technical Support at (412) 746-5500.

5. Operation

Once the Campus Driver is properly configured and installed, it should operate transparently. This sections describes power-up, reading the LED status monitors, and using the built-in loopback test modes.

5.1 Power-Up

Before applying power to the Campus Driver, first be sure that you have read **Section 4.3**, and that the unit is connected to the appropriate power source. Then power up the unit using the rear power switch.

5.2 LED Status Monitors

The Campus Driver features eight front-panel LEDs that monitor power, the DTE signals, network connection, and test modes. Figure 5-1 shows the front-panel location of each LED. Following Figure 5-1 is a description of each LED's function.
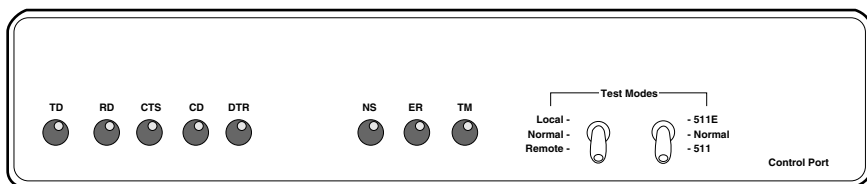

Figure 5-1. Front Panel.

TD and RD	Will glow red to indicate an idle condition of Binary 1 data on the respective terminal interface signals. Green indicates Binary 0 data.
CTS	Will glow green to indicate that the Clear to Send signal from the modem is active.
CD	Will glow red if no carrier signal is being received from the remote modem. Green indicates that the remote modem's carrier is being received.
DTR	Will glow green to indicate that the Data Terminal Ready signal from the terminal is active.
ER	Will glow red to indicate the likelihood of a Bit Error in the received signal. During the 511 or 511/E test, ER will flash to indicate that the Test Pattern Detector has detected a bit error.
TM	Will glow red to indicate that the Campus Driver has been placed in Test Mode. The unit can be placed in test mode by the local user or by the remote user.
NS	Will glow red to indicate that the local Campus Driver has not yet connected with the remote.

5.3 Test Modes

The Campus Driver offers two proprietary loopback test modes, plus a built-in V.52 BER test pattern generator, to evaluate the condition of the modems and the communication link. These tests can be activated physically from the front panel, or via the interface.

5.3.1 USING LOCAL LINE LOOPBACK (LLB)

The Local Line Loopback (LLB) test checks the operation of the local Campus Driver, and is performed separately on each unit. Any data sent to the local Campus Driver in this test mode will be echoed (returned) back to the user device. For example, characters typed on the keyboard of a terminal will appear on the terminal screen (see Figure 5-2).
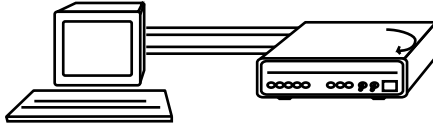
Figure 5-2. LLB.

To perform an LLB test, follow these steps:

A. Activate LLB. This may be done in one of two ways: first, by moving the front-panel toggle switch UP to Local, or second, by raising pin 18 on the interface. Once LLB is activated, the Campus Driver transmitter output is connected to its own receiver. The TM LED should be lit.

B. Verify that the data terminal equipment is operating properly and can be used for a test. If a fault is indicated, call a technician or replace the unit.

C. Perform a V.52 BER (bit error rate) test as described in **Section 5.3.3**. If the BER test equipment indicates no faults but the data terminal indicates a fault, follow the manufacturer's checkout procedures for the data terminal. Also, check the interface cable between the terminal and the Campus Driver.

5.3.2 REMOTE DIGITAL LOOPBACK (RDL)

The Remote Digital Loopback (RDL) test checks the performance of both the local and remote Campus Drivers, and the communication link between them. Any characters sent to the remote Campus Driver in this test mode will be returned back to the originating device. For example, characters typed on the keyboard of the local terminal will appear on the local terminal screen after having been passed to the remote Campus Driver and looped back.
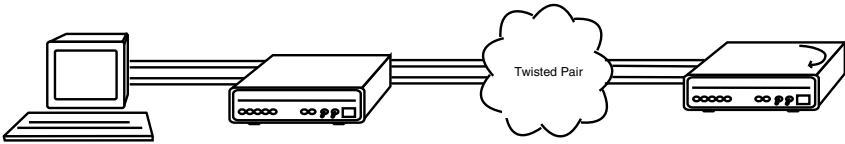

Figure 5-3. RDL.

To perform an RDL test, follow these steps:

A. Activate RDL. This may be done in one of two ways: First, by moving the front-panel toggle switch DOWN to "Remote." Or, second, by raising pin 21 on the interface.

NOTE

Switch S1-8 (Response to RDL Request) on the remote Campus Driver must be enabled.

B. Perform a BER (bit error rate) test as described in **Section 5.3.3**. If the BER test equipment indicates a fault and the Local Line Loopback test was successful for both Campus Drivers, you may have a problem with the twisted-pair line between the modems. You should inspect the twisted-pair line for proper connections and continuity.

5.3.3 V.52 BER Test Generator

To use the V.52 BER test in conjunction with the Remote Digital Loopback tests (or with Local Line Loopback tests), follow these steps.

A.   Locate the 511/511E toggle switch on the front panel of the Campus Driver and move it UP. This activates the V.52 BER test mode and transmits a 511 test pattern into the loop. If any errors are present, the local Campus Driver's red ER LED will blink sporadically.

B.   If the above test indicates no errors are present, move the V.52 toggle switch DOWN, activating the 511/E test with errors present. If the test is working properly, the local Campus Driver's red ER LED will glow. A successful 511/E test will confirm that the link is in place, and that the Campus Driver's built-in 511 generator and detector are working properly.

NOTE

The above V.52 BER tests can be used independently of the Remote Digital Loopback tests. This requires two operators: one to initiate and monitor the tests at the local Campus Driver, and one to do the same at the remote Campus Driver. In this case, the test pattern sent by each Campus Driver will not be looped back, but will be transmitted down the line to the other Campus Driver. While one operator initiates the test, the other monitors for errors.

Appendix A. Replacing the Fuse

WARNING! Only Service Personnel are to access the area inside the plastic shield marked with the electric shock symbol. (See A.1 below.)

Service Personnel are defined as persons who have the appropriate technical training and experience necessary to (a) perform tasks in the SERVICE ACCESS AREA of the equipment, and (b) be aware of hazards to which they are exposed in performing a task, and of measures to minimize the danger to themselves or other persons.

This section describes the procedures for replacing the fuse.

A.   Switch the unit OFF.

B.   Remove the power plug from the AC wall outlet.

C.   Remove the power plug out of the rear of the unit.

D.   Switch the unit ON and verify that none of the front-panel status indicators are lit. Switch the unit OFF.

E.   Remove the metal screws located on the rear-panel bottom left and bottom right. *Do not discard the screws.* Gently slide the PC board and rear panel out from the metal enclosure.

F.   Remove the nylon screws that hold the clear plastic shield in place. Lift off the plastic shield. *Do not discard the screws or the plastic shield.*

G.   With a flat-blade screwdriver, gently pry off the fuse cover. *Do not discard this cover!* Pull out the fuse. Replace the fuse and reinstall the fuse cover.

> **WARNING!** Replace the fuse only with one that has the correct voltage and current rating for the voltage setting of the unit (the proper fuse rating is marked on the board near the fuse holder). Replacing the fuse with one having an incorrect rating can result in a fire!

H.) *Before connecting the power cord,* verify that the line voltage is within the voltage range specified for the unit. This rating is stated on the label on the bottom of the unit. *An improper line-voltage connection may result in damage, improper functioning, or both.* Install the circuit power cord according to the instructions in **Section 4.3**.

I.) Reinstall the plastic shield so that all of the holes line up with the stand-offs. Reinstall the nylon screws. *Do not overtighten the nylon screws.*

J.) Line up the PC board with the two slots located on the rear-panel bottom left and bottom right. Gently slide the PC board/rear-panel assembly back into the enclosure. It is properly installed when the all of the indicators and switches are aligned at the front-panel and the rear-panel bezel is fully mated into the enclosure. Do not force the unit into the enclosure. If it sticks, it's usually because the PC board was not inserted into the two slots properly.

K.) Reinstall the two metal screws that were removed as instructed in Step E.

L.) Reinstall the power cord according to the operator's manual instructions.

Replacement Fuses

ME485A, ME485AE........................Fuse 5x20mm, 100mA, 250V, Time-lag
Little Fuse P/N 218.100

ME485A-D48......................Fuse 5x20mm, 200mA, 250V, Time-lag
Little Fuse P/N 239.200

Appendix B. Pinouts

DB25F Connector—DCE
(ME481C-232, ME481C-422)

Pin #	Signal
1	FG (Frame Ground)
2	TD (Transmit Data)
3	RD (Receive Data)
4	RTS (Request to Send)
5	CTS (Clear to Send)
6	DSR (Data Set Ready)
7	SGND (Signal Ground)
8	CD (Carrier Detect)
9	RC/ (Receive Timing-B)
10	CD/ (Carrier Detect-B)
11	XTC/ (External Transmit Clock-B)
12	TC/ (Test Control-B)
13	CTS/ (Clear to Send-B)
14	TD/ (Transmit Data-B)
15	TC (Test Control-A)
16	RD (Receive Data)
17	RC (Receive Timing)
18	LLB (Local Line Loop)
19	RTS/ (Request to Send-B)
20	DTR (Data Transfer Rate)
21	RDL (Remote Digital Loop)
22	DSR/ (Data Set Ready-B)
23	DTR/ (Data Transfer Rate-B)
24	XTC (External Transmit Clock)
25	TM (Test Mode)

M/34F Connector—DCE
(V.35 Interface)
(ME481C-35)

Pin #	Signal
B	SGND (Signal Ground)
C	RTS (Request to Send)
D	CTS (Clear to Send)
E	DSR (Data Set Ready)
F	CD (Carrier Detect)
H	DTR (Data Transfer Ready)
L	LLB (Local Line Loop)
M	TM (Test Mode)
N	RDL (Remote Digital Loop)
P	TD (Transmit Data)
R	RD (Receive Data)
S	TD/ (Transmit Data-B)
T	RD/ (Receive Data-B)
U	XTC (External Transmit Clock)
V	RC (Receive Timing)
W	XTC/ (External Transmit Clock-B)
X	RC/ (Receive Timing-B)
Y	TC (Test Control-A)
AA	TC/ (Test Control-B)

DB15F Connector—DCE Setting
(X.21 Interface)
(ME481C-X21)

Pin #   Signal
  1 . . . . Frame Ground
  2 . . . . T (Transmit Data-A)
  3 . . . . C (Control-A)
  4 . . . . R (Receive Data-A)
  5 . . . . I (Indication-A)
  6 . . . . S (Signal Element Timing-A)
  7 . . . . BT (Byte Timing-A)
  8 . . . . SGND (Signal Ground)
  9 . . . . T/ (Transmit Data-B)
 10 . . . . C/ (Control-B)
 11 . . . . R/ (Receive Data-B)
 12 . . . . I/ (Indication-B)
 13 . . . . S/ (Signal Element Timing-B)
 14 . . . . BT/ (Byte Timing-B)

Note: X.21 uses balanced data and control signals.

2-Wire Modular Campus Driver Pinout Control Port

The 2-Wire Modular Campus Driver control port is an 8-position connector, compliant with EIA/TIA-561.

Pin Function	RJ-45 Pin No.
Ground	4
Receive data (to DTE)	5
Transmit data (from DTE)	6

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