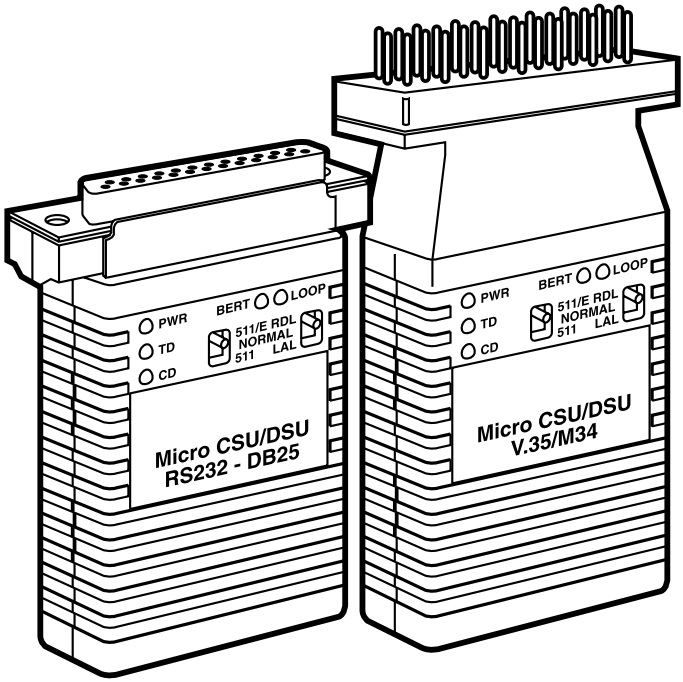
BLACK BOX
NETWORK SERVICES

SEPTEMBER 2003
MT165A
MT165AE
MT166A
MT166AE

Micro CSU/DSUs



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FEDERAL COMMUNICATIONS COMMISSION
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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 B 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.

CE Notice

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

FCC Information

The Micro CSU/DSU has been tested and registered in compliance with the specifications in Part 68 of the FCC rules. A label on the equipment bears the FCC registration number. You may be requested to provide this information to your telephone company.

Your telephone company may make changes in its facilities, equipment, operations, or procedures that could affect the Micro CSU/DSU's proper operation. If this happens, the telephone company should give you advance notice to prevent the interruption of your service.

The telephone company may decide to temporarily discontinue your service if they believe your Micro CSU/DSU may cause harm to the telephone network. Whenever possible, they will contact you in advance. If you elect to do so, you have the right to file a complaint with the FCC. The telephone company may ask you to disconnect the equipment from the telephone network until the problem has been corrected or until you are certain that the Micro CSU/DSU is not malfunctioning.

The following information may be required when applying to your local telephone company for leased-line facilities.

Service Type	Digital Facility Interface Code	Service Order Code	Network Jacks
56 kbps	04DU5-56	6.0F	RJ-48 female
64 kbps	04DU5-64	6.0F	RJ-48 female

Radio and TV Interference

The Micro CSU/DSU generates and uses 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 and television reception. The Micro CSU/DSU has been tested and found to comply with the limits for a Class A computing device in accordance with the specifications in Subpart B of Part 15 of FCC rules, which are designed to provide reasonable protection from such interference in a commercial installation. However, there is no guarantee that interference will not occur in a particular installation. If the Micro CSU/DSU does cause interference to radio or television reception, which can be determined by disconnecting the RS-232 interface, the user is encouraged to try to correct the interference by one or more of the following measures: moving the computing equipment away from the receiver, re-orienting the receiving antenna and/or plugging the receiving equipment into a different AC outlet (such that the computing equipment and receiver are on different branches). In the event the user detects intermittent or continuous product malfunction due to nearby high-power transmitting radio-frequency equipment, the user is strongly advised to only use data cables with an external outer shield bonded to a metal or metalized connector.

Trademarks Used in this Manual

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

Contents

1. Specifications

DDS Type:	Dedicated
Transmission Format:	Synchronous, full duplex
Maximum Operating Distance:	3.4 miles (5.5 km) over 26 AWG (0.4-mm) twisted pair
DTE Interface:	RS-232 (DB25 female or DB25 male), or V.35 (M/34 male)
Standards:	AT&T® 62310 compliant
DTE Rates:	56 and 64 kbps
Transmission Line:	4-wire
Diagnostics:	V.54-compliant local and remote loopback tests; V.52-compliant 511/511E BER test
Applications:	DDS, point-to-point or multipoint; ClearChannel, point-to-point; campus-area point-to-point
User Controls:	(2) 3-position front-panel switches: (1) for 511E/Normal/511, (1) for RDL/Normal/LAL
Connectors:	MT165A/E: (1) DB25 female, (1) RJ-48C female for DDS line; MT166A/E: (1) M/34 male, (1) RJ-48C female for DDS line
Indicators:	PWR, TD, CD, BERT, LOOP
Power Supply:	MT165A, MT166A: 120 VAC, 60 Hz to 5 VDC 200-mA wallmount transformer; MT165AE, MT166AE: 100–240 VAC, 50 Hz to 5 VDC, 2A wallmount transformer
Size:	MT165A: 0.8"H x 2.1"W x 3.5"L (2 x 5.3 x 8.9 cm); MT166A: 0.9"H x 2"W x 4.9"L (2.3 x 5.1 x 12.4 cm)

2. Introduction

2.1 Overview

The Micro CSU/DSU is a miniature CSU/DSU designed for 56-kbps DDS or 64-kbps ClearChannel communications over a synchronous DDS circuit—or over dedicated twisted pair. The Micro CSU/DSU also supports distances up to 3.4 miles (5.5 km) over a dedicated twisted-pair circuit.

The Micro CSU/DSU provides switch-selectable timing options of internal, external, and network receive-recovered clock. Because it connects directly to the RS-232/V.24 (MT165A) or V.35 (MT166A) port, the ultra-compact Micro CSU/DSU doesn't require additional cables.

The Micro CSU/DSU's built-in V.54 loopback test modes and V.52 BER test patterns are accessed by two front-panel switches. Seven LEDs (five on the front of the unit and two on the back) monitor power, test modes, and communication status. Twisted-pair line connections are made with a modular RJ-48 female jack on the bottom of the unit.

2.2 Features

- Works with 56-kbps DDS, 64-kbps ClearChannel, or private twisted-pair circuits.
- Switchable circuit assurance feature.
- Full-duplex communication over two dedicated twisted pairs.

3. Configuration

The Micro CSU/DSU is easy to install and is designed for reliability. The instructions in this chapter will help you set up and install the Micro CSU/DSU properly.

3.1 Opening the Case

Before using the Micro CSU/DSU, you must configure it for your application. To do so, you'll need to open the case. Insert a flat head screwdriver into the open slot on either side of the case. (See Figure 3-1 to see how to open the MT165A.)

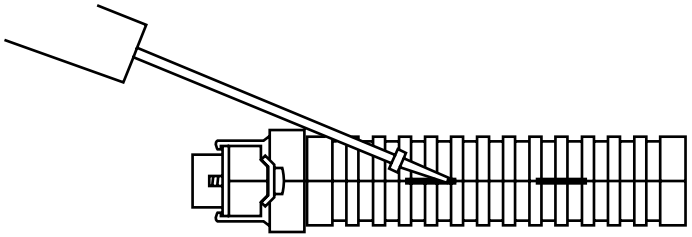

Figure 3-1. Using the screwdriver to pry open the MT165A's case.

Twist the screwdriver head slightly and the top half of the case will separate from the lower half. You now have access to the internal switches used to configure the unit. Figure 3-2 shows how the MT165A's case separates.

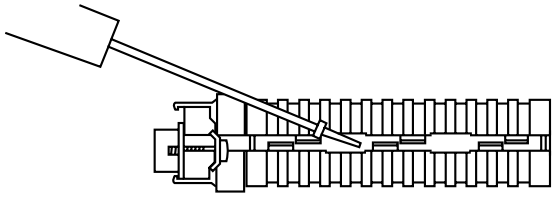

Figure 3-2. Using the screwdriver to completely open the MT165A's case.

For the MT166A, you'll first need to remove the screws (see Figure 3-3). Then use a screwdriver to open the MT166A's case as shown in Figures 3-4 and 3-5.

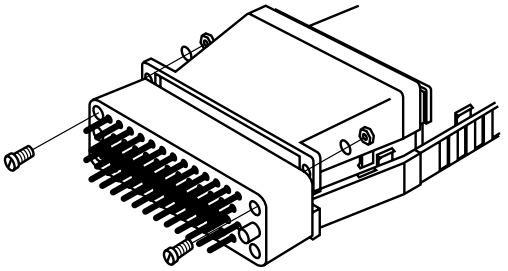

Figure 3-3. Removing the screws.

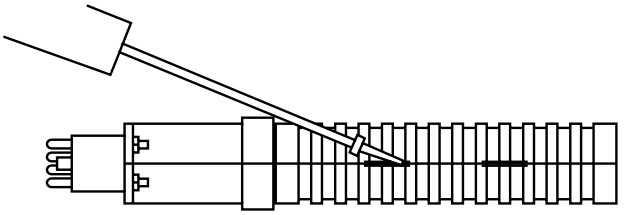

Figure 3-4. Using the screwdriver to pry open the MT166A's case.

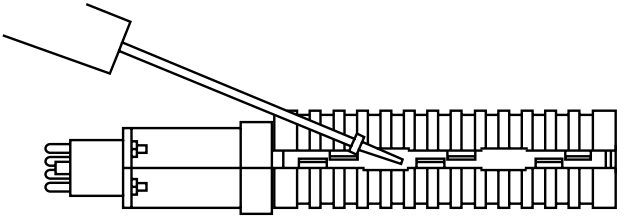

Figure 3-5. Using the screwdriver to open the main part of the MT166A's case.

After opening the case, refer to **Sections 3.2** and **3.3** to set the configuration switches and jumpers.

3.2 Configuration Switch Set "S1"

The Micro CSU/DSU uses a set of eight internal switches to set clocking mode, circuit assurance, RTS control, data rate, and loop control. Figures 3-6 and 3-7 show the switch and jumper locations with respect to the other components on the bottom of the PC board.

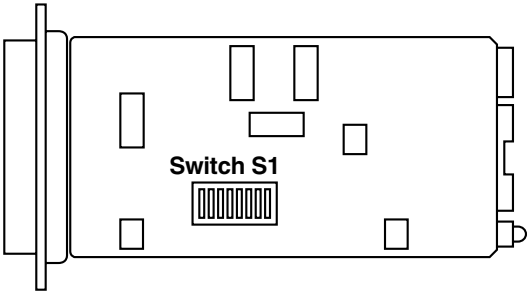

Figure 3-6. Switch S1 (on the bottom of the MT165A's PC board).

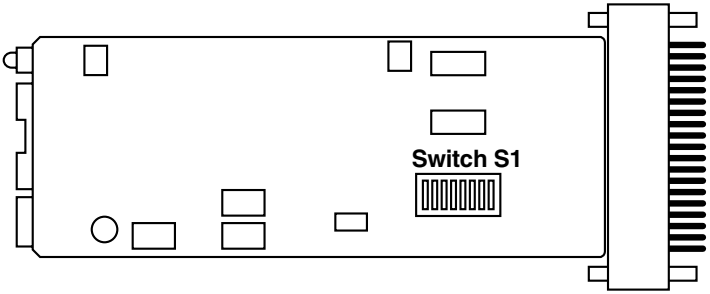

Figure 3-7. Switch S1 (on the bottom of the MT166A's PC board).

Figure 3-8 shows the switch settings on DIP-Switch S1 with respect to ON/OFF positions. The default settings for DIP-Switch S1 are shown in Table 3-1. Detailed descriptions of each switch follow the table.

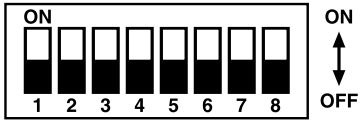

Figure 3-8. Closeup of the DIP switches.

Table 3-1. Switch S1.

Position	Function	Factory Default	
S1-1	Clock Mode	Off	Network
S1-2	Clock Mode	On	
S1-3	Circuit Assurance	Off	Disabled
S1-4	RTS	On	Forced On
S1-5	Data Rate	Off	56 kbps
S1-6	Front-Panel Switch Control	Off	Enable Front-Panel Switches
S1-7	DTE Loop Control	On	Loop Control from DTE Disabled
S1-8	Receive RDL	Off	Receive RDL Enabled

Switches S1-1 and S1-2: Clock Mode

The setting for switches S1-1 and S1-2 determines the transmitter clocking mode for the Micro CSU/DSU.

S1-1	S1-2	Clock Mode	Description
On	Off	External (DTE)	Transmit clock derived from terminal interface.
Off	On	Network (Looped)	Transmit clock derived from the received line signal; use this mode for Dedicated DDS operation.
Off	Off	Internal (Master)	Transmit clock derived internally.
On	On	Campus Clock	Transmit clock derived from received line signal. Allows *remote* device (in campus clock mode) to initiate V.54 loopback. For use only in campus short-haul configuration.

NOTE

***Opposite* device must be in internal clock mode.**

Switch S1-3: Circuit Assurance

On dedicated circuits, the transmitter and the CTS output can be configured to go on only when a working communication circuit is established. If Circuit Assurance is used, enable it on only one end of the communication link.

S1-3	Circuit Assurance	Description
On	Enabled	CTS will go low and the transmitter will be held off if the receiver is in the No Signal state or CD is low.
Off	Disabled	The transmitter and CTS will operate without regard to the receiver state.

Switch S1-4: RTS Control

The RTS input can be forced on, ignoring the terminal's RTS signal. RTS controls the transmitter by either sending the user's data or sending an idle code.

S1-4	Activation	Description
On	Forced On	Transmitter is always ON.
Off	DTE Signal	The RTS input controls the transmitter.

Switch S1-5: Data Rate

This switch controls the data rate on the line (RJ-48 female port) and should match the speed of your digital service.

S1-5	Setting
Off	56 kbps
On	64 kbps

NOTE

Power must be cycled off and then on to reset the Data Rate.

Switch S1-6: Front-Panel Switch Enable/Disable

Switch S1-6 determines whether the front-panel switches may be used to perform diagnostic functions.

S1-6	Activation	Description
Off	Enabled	Front-panel switches may be used to activate/ terminate diagnostics.
On	Disabled	Front-panel switches will have no effect on the operation of the unit.

Switch S1-7: DTE Loop Request Line Enable/Disable

The setting for switch S1-7 determines whether the front-panel switches (and DTE lines) can be used to activate/terminate the loopback diagnostic modes and BER test patterns.

S1-7	DTE Line Activation	Description
Off	Enabled	DTE loop request line switches may be used to activate/terminate diagnostics.
On	Disabled	DTE loop request lines will have no effect on the operation of the unit.

Switch S1-8: Receive RDL Enable/Disable

Switch S1-8 determines whether or not the unit will respond to loop requests from the remote device.

S1-8	Activation	Description
Off	Enabled	Unit will respond to loop requests from the remote device.
On	Disabled	Unit will ignore loop requests from the remote device.

3.3 Interface Power Option Jumpers

Both versions of the Micro CSU/DSU can be powered from the supplied AC power source, from DC power supplied to the power-supply jack, or directly from the local RS-232/V.24 (MT165A) or V.35 (MT166A) interface.

3.3.1 Interface Power Option (MT165A)

Two jumper straps (JP1 and JP2) are used in combination to set the MT165A to receive its power from the RS-232 interface. Figure 3-9 shows the position of JP1 and JP2 on the top side of the PC board.

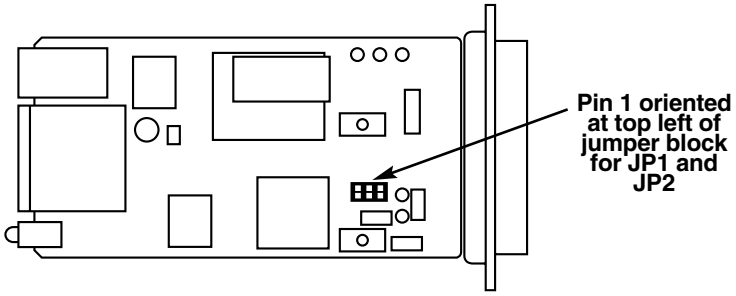

Figure 3-9. Position of the jumpers on the PC board.

Figure 3-10 shows the orientation of the pins on the six-pin jumper block and possible settings of jumper straps JP1 and JP2.

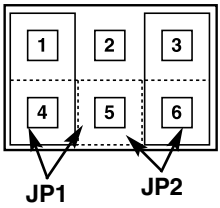

Figure 3-10. Possible settings for JP1 and JP2.

Table 3-2. MT165A's JP1 and JP2.

JP1	JP2	Function
1 & 4	5 & 6	DC Powered by Pin 9*
4 & 5	3 & 6	DC Powered by Pin 21

* Indicates factory-default setting

NOTE

Power must be +5 VDC ± 5% @ 200 mA.

DC Power Supplied by Pin 9

The MT165A may be configured to receive its operating power from pin 9 on the RS-232 interface. In the normal setting, pin 9 is not used for interface power.

JP1 Position 1 & 4 — Normal (default).

JP2 Position 5 & 6 — Pin 9 used for interface power. In this setting, the Micro CSU/DSU is powered from the DTE interface. Power should be applied to pin 9 at +5 VDC (± 5%), 200 mA. *The AC wallmount transformer must not be connected in this setting.*

NOTE

The only allowable positions for Jumper JP1 are as listed in Table 3-2.

DC Power Supplied by Pin 21

The Micro CSU/DSU may be configured to receive its operating power from pin 21 on the RS-232 interface. In the normal setting, pin 21 is used for its normal function.

JP1 Position 4 & 5	Pin 21 used for interface power. In this setting, the Micro CSU/DSU is powered from the DTE interface. Power should be applied to pin 21 at +5 VDC (± 5%), 200 mA. *The AC wallmount transformer must not be connected in this setting.*
JP2 Position 3 & 6	Normal (default).

NOTE

The only allowable positions for Jumper JP2 are as listed in Table 3-2.

3.3.2 Interface Power Option (MT166A)

One jumper strap (JP1) is used to set the Micro CSU/DSU to receive its power from the V.35 interface. Figure 3-11 shows the position of JP1 on the PC board.

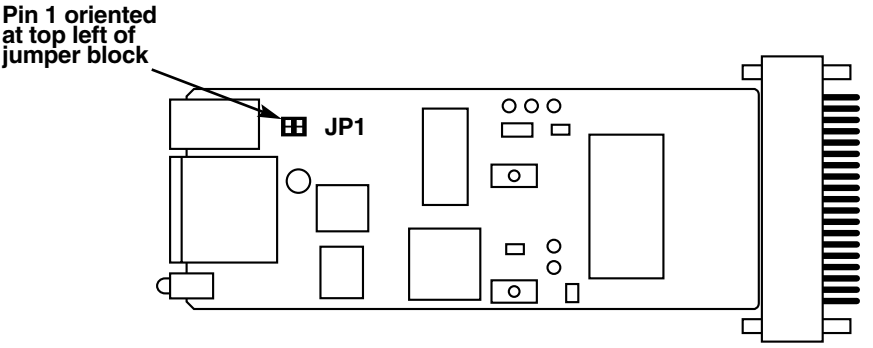

Figure 3-11. Position of the jumper on the PC board.

Figure 3-12 shows the possible settings of jumper strap JP1.

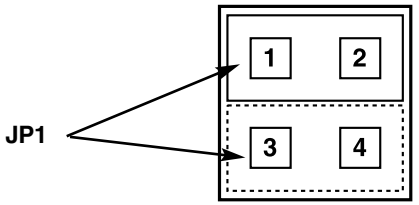

Figure 3-12. Possible settings for JP1.

DC Power Supplied by Pin KK

The MT166A may be configured to receive its operating power from pin KK on the V.35 interface. In the normal setting, pin KK is not used for interface power.

Position 1 & 2	Interface power option. In this setting, the Micro CSU/DSU is powered from the DTE interface. Power should be applied to pin KK at +5 VDC (± 5%), 200 mA. *The AC wallmount transformer must not be connected in this setting.*
Position 3 & 4	Normal (default).

4. Installation

The Micro CSU/DSU is designed for 4-wire, full-duplex communication over a DDS or ClearChannel carrier circuit or over a dedicated twisted pair. This chapter describes the proper connection of the line interface, the DTE (terminal) interface, and AC power supply.

4.1 Line (Network) Connection

The RJ-48 female port on a Micro CSU/DSU is pre-wired for a standard Telco wiring environment (as shown below). Connect this port to the RJ-48 female jack provided by your digital service carrier using a straight-through twisted-pair cable between 19 and 26 AWG. To be sure you have the right wiring, use Figure 4-1 below as a guide.

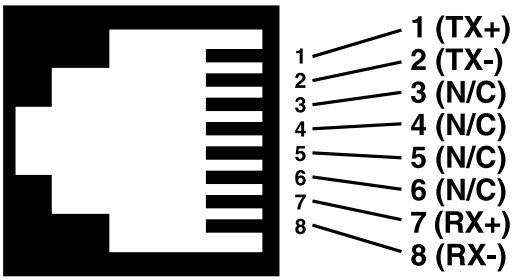

Figure 4-1. RJ-48 connector pinning.

4.2 Connecting Over Private Twisted Pair

If you are using a pair of Micro CSU/DSUs as short-range modems over private twisted pair, make the connection between them using a twisted-pair crossover cable pinned according to the pinout below.

RJ-48 Female Cable (4-Wire)

Signal	Pin #	Pin #	Signal
TX+	1	----------7	RX+
TX-	2	----------8	RX-
RX+	7	----------1	TX+
RX-	8	----------2	TX-

4.3 DTE (Terminal) Connection

The Micro CSU/DSU is designed for direct connection to the DTE without a cable and is available in two interface options—RS-232/V.24 and V.35. If you want to connect the CSU/DSU to a DCE (such as a multiplexor), you will need a crossover (null-modem) cable. To construct or purchase your interface cable, refer to the pinout diagrams in **Appendix B**.

4.4 Power Connection

The Micro CSU/DSU can be powered from the supplied AC power source, from DC power supplied to the power-supply jack, or directly from the local RS-232/V.24 (MT165A) or V.35 (MT166A) interface. This section describes the available power options.

120-VAC Power

The 120-VAC adapter supplied with the standard version of the Micro CSU/DSU is a wallmount type and may be plugged into any approved 120-VAC wall plug.

230-VAC Power (IEC)

The Universal Input Adapter supplied with the "International" version of the Micro CSU/DSU is equipped with an IEC-320 shrouded male connector. This connects with one of several available country-specific power cords. If you need to order one of these power cords, contact Technical Support.

DC Power Connection

You may bypass the AC wall adapters and supply DC power directly to the Micro CSU/DSU power-supply jack or via the DTE Supplemental Power Input pins. *The AC wallmount transformer must not be connected when the Micro CSU/DSU is powered by DC.*

DC Power Supplied to Power Jack

You may supply DC power directly to the power-supply jack. DC power supplied must be 5 VDC ± 5%, 200 mA, center positive, and can be supplied via a barrel-type plug with 2.1/5.5/10 mm I.D./O.D./Shaft Length dimensions.

Interface Power

The Micro CSU/DSU may also be powered by means of the RS-232/V.24 (MT165A) or V.35 (MT166A) interface signals. DC power supplied to the interface pins must be at +5 VDC ± 5%, 200 mA. See **Sections 3.3.1** (MT165A) and **3.3.2** (MT166A) to configure the unit to receive interface power.

NOTE

The DC power source must be SELV (Circuit, Safety Extra Low Voltage) specified. (See CENELEC EN609050, Section 1.2.8.5).

WARNING

The Micro CSU/DSU will be damaged if any other power-supply input than 5 VDC ± 5% is used with the Interface Power Option.

5. Operation

Once you have configured the Micro CSU/DSU properly (**Chapter 3**) and made line, DTE, and power connections correctly (**Chapter 4**), you are ready to operate the Micro CSU/DSU. The Micro CSU/DSU will operate automatically once it's powered.

This chapter describes the LEDs and the use of the built-in V.54 and V.52 test modes.

5.1 Front-Panel LEDs

The Micro CSU/DSU features five front-panel status LEDs that indicate the condition of the unit and communication link. Figure 5-1 shows the front-panel location of each LED. Following the illustration is a description of each LED.

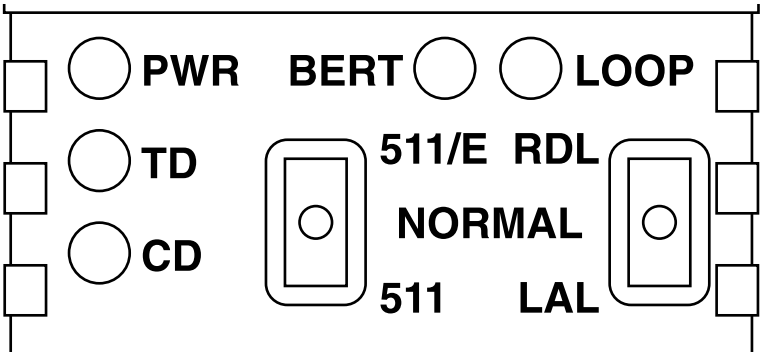

Figure 5-1. Front-panel LEDs.

PWR (Power). Glows green when power is supplied to the unit. The unit is operational as soon as power is applied—there is no power switch.

TD (Transmit Data). Off to indicate an Idle condition or Binary "1" data. Red indicates Binary 0 data.

CD (Carrier Detect). Glows red when carrier is active. In 64-kbps mode, CD is off if there is no carrier. In 56-kbps mode, CD is off if there is no carrier, if an Out-of-Service or Out-of-Frame violation occurs, or if idle code is detected.

BERT Glows red when errors are detected in test mode during the 511 and 511/E tests. This indicator also glows during normal operation to indicate framing errors and/or bipolar violations in 64-kbps mode or invalid bipolar violations in 56-kbps mode.

LOOP Glows red when the V.54 loopback tests or V.52 BER tests are initiated or when CO loopback is initiated by the service provider.

5.2 Back-Panel LEDs

The Micro CSU/DSU has two LEDs on the back panel (see Figure 5-2). Following Figure 5-2 is a description of each LED.

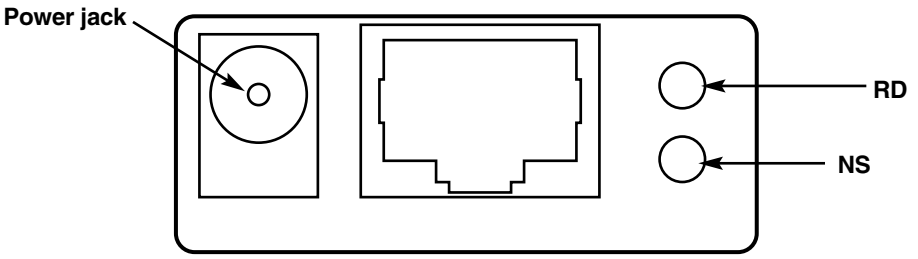

Figure 5-2. Back-panel LEDs.

RD (Receive Data). Off to indicate an Idle condition or Binary "1" data. Green indicates Binary 0 data.

NS (No Signal). Glows green when there is no valid carrier. This means the Micro CSU/DSU receiver does not detect a valid signal from the digital service provider or, in the case of short-haul operation, from the remote Micro CSU/DSU. If NS is lit, check for an unplugged cable, broken wire, or an incorrect Line Rate selection.

5.3 Test Modes

The Micro CSU/DSU offers two V.54 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 physically activated from the front panel or via the interface.

5.3.1 Using Local Analog Loopback (LAL)

The Local Analog Loopback (LAL) test checks the operation of the local Micro CSU/DSU and is performed separately on each unit. Any data sent to the local Micro CSU/DSU from the DTE in this test mode will be echoed (returned) back to the DTE. For example, characters typed on the keyboard of a terminal will appear on the terminal screen. To perform a LAL test:

1. Activate LAL. This may be done in one of two ways: first, by moving the front-panel toggle switch DOWN to "LAL"; second, by raising the appropriate pin on the terminal interface (pin 18 for the MT165A, pin L for MT166A). Make sure DIP switches S1-6 and S1-7 are OFF. Once LAL is activated, the Micro CSU/DSU transmitter output is connected to its own receiver. The test LED should be lit.

2. 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.

3. 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 Micro CSU/DSU.

5.3.2 Using Remote Digital Loopback (RDL)

The Remote Digital Loopback (RDL) test checks the performance of both the local and remote Micro CSU/DSUs and the communication link between them. Any characters sent to the remote Micro CSU/DSU 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 Micro CSU/DSU and looped back. To perform an RDL test:

1. Activate RDL. This may be done in two ways: first, by moving the front-panel toggle switch UP to "RDL"; second, by raising the appropriate pin on the terminal interface (pin 21 for MT165A, pin N for MT166A). Make sure S1-6 and S1-7 are OFF.

NOTE

To activate RDL by pin 21 on the MT165A, Jumper JP2 must be set in the "NORMAL" setting (see Section 3.3.1).

2. Perform a V.52 BER test as described in **Section 5.3.3**. If the BER test equipment indicates a fault, and the Local Analog Loopback test was successful for both Micro CSU/DSUs, you may have a problem with the twisted-pair line between the modems. You should then check the twisted-pair line for proper connections and continuity.

5.3.3 Using the V.52 BER Test

To use the V.52 BER test in conjunction with the V.54 loopback tests:

1. Locate the 511/511E toggle switch on the front panel of the Micro CSU/DSU and move it to 511. This activates the V.52 BER test mode and transmits a 511 test pattern into the loop. If any errors are present, the local modem's red "Error" LED will blink sporadically. Set the switch to Normal when the CSU/DSU is operating and sending data.

2. If the above test indicates no errors are present, move the V.52 toggle switch to 511/E, activating the "511/E" test with errors present. If the test is working properly, the local modem's red BERT LED will glow. A successful "511/E" test will confirm that the link is in place and that the Micro CSU/DSU's built-in 511 generator and detector are working properly. Set the switch to Normal when the CSU/DSU is operating and sending data.

NOTE

The above V.52 BER test can be used independently of the V.54 loopback tests. This requires two operators: one to initiate and monitor the tests at the local Micro CSU/DSU and one to do the same at the remote Micro CSU/DSU. In this case, the test pattern sent by each Micro CSU/DSU will not be looped back but will be transmitted down the line to the other Micro CSU/DSU. Both operators must initiate and monitor the tests simultaneously.

Appendix A. Cable Recommendations

The following statements apply when you use the Micro CSU/DSU as a short-range modem over private twisted pair.

These short-range modems are tested to the distances stated in this manual (**Chapter 1**, Specifications) on twisted-pair cable with these characteristics:

Wire Gauge	Capacitance	Resistance
19 AWG	83 nF/mi. or 15.72 pF/ft.	0.0163 Ω/ft.
22 AWG	83 nF/mi. or 15.72 pF/ft.	0.0326 Ω/ft.
24 AWG	83 nF/mi. or 15.72 pF/ft.	0.05165 Ω/ft.
26 AWG	83 nF/mi. or 15.72 pF/ft.	0.08235 Ω/ft.

We fully expect that these short-range modems will operate on lines with specifications different from those tested. As a precaution, though, make sure that the cable being used has similar or better characteristics (lower capacitance or lower resistance).

Wire with capacitance of 20 pF/ft. or less is suitable for our short-range modems; however, distances may vary from those stated in this manual. Resistance will also affect distance but not functionality. Wire should be 26 AWG or larger (the smaller the number, the larger the gauge size).

These products are designed to withstand normal environmental noise and conditions; however, other environmental factors too numerous to list may affect the product's proper operation.

Appendix B. Interface Pin Assignments

DDS/ClearChannel Interface

The DDS/ClearChannel interface is an RJ-48 female modular jack.

Pin #	Signal
1	TX+ (Line Transmit Positive)
2	TX- (Line Transmit Negative)
3	N/C (No Connection)
4	N/C (No Connection)
5	N/C (No Connection)
6	N/C (No Connection)
7	RX+ (Line Receive Positive)
8	RX- (Line Receive Negative)

M/34 Connector (V.35), Terminal Interface

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)
L	LAL (Local Analog 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 (Transmit Clock-A)
AA	TC/ (Transmit Clock-B)
KK	Supplemental Power Input

DB25 Connector (RS-232/V.24), Terminal Interface

Pin #	Signal
1	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	User Selectable: Supplemental Power Input or Not Used
15	TC (Transmit Clock)
17	RC (Receive Clock)
18	LL (Local Loop)
21	User Selectable: Supplemental Power Input or RL (Remote Loop)
24	XTC (External Transmit Clock)
25	TM (Test Mode)

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