



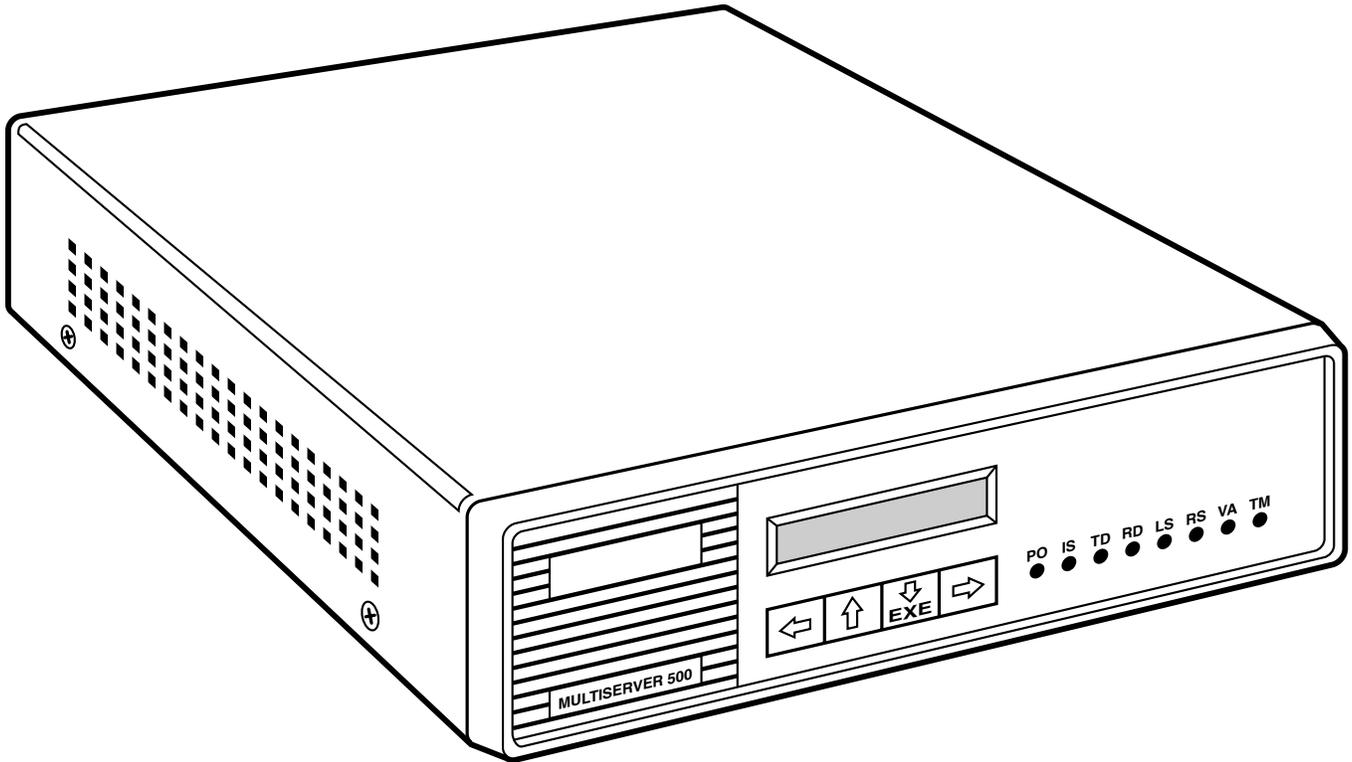
BLACK BOX[®]
NETWORK SERVICES



MARCH 1996

MX400A	MX404C
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Multiserver 500



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Contents

Chapter 1: Specifications.....	7
Chapter 2: Introduction	10
2.1 Multiplexing and the Multiserver 500.....	10
2.2 Description of the Multiserver 500.....	10
2.3 Block Diagram	12
2.3.1 Voice/Fax Interface Module.....	13
2.3.2 Digital Processing Module.....	13
2.3.3 Serial Interface Module.....	13
2.3.4 LCD	13
2.3.5 Power Supply.....	13
2.4 Interfaces.....	13
2.4.1 Data Channel	13
2.4.2 Voice/Fax Channel.....	13
2.4.3 Composite Channel	13
2.4.4 Command Port.....	13
2.5 Options.....	14
2.6 Modules Covered in This Manual	14
Chapter 3: Installation.....	15
3.1 Unpacking the Multiserver 500	15
3.2 Installing the Multiserver	16
3.2.1 Selecting an Installation Site.....	16
3.2.2 Cable and Power Connections	16
3.3 Setting the Composite Transmit Clock	17
3.4 Installing the Voice/Fax Interface Module	18
3.5 Setting the Time and Date	19
Chapter 4: Using the LCD and Keypad.....	21
Chapter 5: Using the Command Port.....	28
5.1 Factory Defaults	28
5.2 Connecting Asynchronous Terminals	30
5.2.1 Connecting a Single Multiserver 500.....	30
5.2.2 Connecting Multiple Multiserver 500s	31
5.3 Impedance Strapping.....	32
5.4 CMD IN and CMD OUT Connectors.....	33
5.5 Accessing the Command Port.....	34
Chapter 6: Operation	41
6.1 LED Indicators.....	41
6.2 The LCD and the Keypad	43
6.3 Default Configuration Settings.....	43

6.4	Operating the Multiserver 500	44
6.4.1	Establish a Data Connection	44
6.4.2	To Make a Telephone Call.....	44
6.4.3	To Send a Fax Message	47
Chapter 7: Diagnostics and Troubleshooting		48
7.1	Automatic Self-Test.....	48
7.2	User-Initiated Tests	48
7.2.1	Suggested Test Sequence.....	50
7.2.2	EEPROM Test.....	50
7.2.3	Self-Test.....	50
7.2.4	Local Data Loopback Test	50
7.2.5	Local Composite Loopback Test.....	51
7.2.6	Remote Composite Loopback Test	54
7.2.7	Remote Data Loopback.....	57
Appendix A: FXS Voice/Fax Interface Module.....		58
A.1	Connectors on the Back Panel	59
A.2	Strapping.....	61
A.3	Removing or Replacing the Module	61
A.4	Specifications	61
Appendix B: FXO Voice/Fax Interface Module.....		63
B.1	Connectors on the Back Panel	64
B.2	Strapping.....	66
B.3	Removing or Replacing the Module	67
B.4	Specifications	67
Appendix C: E&M Voice/Fax Interface Module		68
C.1	Differences Between Models.....	68
C.2	Telephone-Interface Connectors.....	69
C.3	Connecting the Telephone-Interface Cable	69
C.4	E&M Lead States.....	71
C.5	Connection Diagrams.....	71
C.6	Strapping.....	75
C.7	Removing or Replacing the Module	76
C.8	Specifications	76
Appendix D: Changing the Data Interface Types.....		77
D.1	Removing the Top Cover	78
D.2	Configuring the Interfaces.....	78
D.3	Replacing the Top Cover.....	80
Appendix E: Agency and Telephone-Company Requirements		82
E.1	Requirements for Operation with the Telephone Company.....	82
E.2	Equipment Attachment Limitations for Operation in Canada	82
Appendix F: Cabling and Pin Assignments.....		84
F.1	Cables for the Composite Interface	84
F.2	Data-Channel Interface Cables.....	92

Glossary97

Index.....102

Figures

2-1 Typical Multiserver 500 Application10

2-2 Multiserver 500, Front and Rear Views11

2-3 Multiserver 500 Block Diagram12

3-1 Cable and Power Connectors.....16

3-2 Clocking with Multiserver 500 Connected to a DCE Device17

3-3 Installing or Removing the Voice/Fax Interface Module18

3-4 Setting the Time and Date20

5-1 Reconfiguring the Command-Port Parameters29

5-2 Connecting the Asynchronous Terminal30

5-3 Typical Three-Multiserver Daisychain Topology.....31

5-4 Setting the Data Rate and Device Number31

5-5 Location of Command Port Impedance Header E5-on the Serial Interface Module32

5-6 CMD IN CMD OUT Connector Pin Assignments (RS-422 Interface)33

5-7 Flowchart for Accessing the Command Port34

6-1 The Front Panel of the Multiserver 50041

6-2 Telephone Calls from Local FXS Interfaces45

6-3 Telephone Calls from Local FXO or E&M Interfaces.....46

7-1 Clocking, with Multiserver 500s Connected in a Back-to-Back Hookup.....48

7-2 Tests in the Diagnostics Menu49

7-3 Local Data Loopback Test.....51

7-4 Local Composite Loopback Test.....52

7-5 FXO and E&M Voice/Fax Connections.....52

7-6 Setting Up a Remote Composite Loopback Test.....55

7-7 Setting Up a Remote Data Loopback Test56

A-1 A Typical FXS Application58

A-2 Connectors on the Back Panel of the FXS Interface Module59

A-3 Wiring of the Connectors on the Back Panel59

A-4 Cable Connections60

B-1 A Typical FXO Application63

B-2 Back Panel of the FXO Analog Interface Module.....64

B-3 Wiring of the Connectors on the Back Panel64

B-4 Cable Connections65

B-5 Locations of the Straps on the FXO Interface Module.....66

C-1 Connections for the E&M Voice/Fax Interface Module68

C-2 Connectors on the Back Panel69

C-3 Connecting the E&M Cable70

C-4 Type I Interface Connection.....72

C-5 E&M Type II Interface Connection.....73

C-6 E&M Type V Interface Connection Diagram.....74

C-7 Where the Straps Are on the E&M Module75

D-1 Removing the Top Cover77

D-2 Configuring the Composite Interface79

D-3 Configuring the Data-Channel Interface81

F-1 Pin Assignments for the RS-232 COMPOSITE and DATA CHANNEL Connectors84

F-2	RS-232-to-RS-232 DCE Crossover Cable (EZ423-0015)	85
F-3	Pin Assignments for the V.35 COMPOSITE and DATA CHANNEL Connectors.....	86
F-4	V.35-to-DCE Crossover Cable (EHN070-005M)	87
F-5	Pin Assignments for the RS-530 COMPOSITE and DATA CHANNEL Connectors	88
F-6	RS-530-to-RS-530 DCE Crossover Cable	89
F-7	RS-530-to-RS-449 DCE Crossover Cable	90
F-8	RS-530-to-X.21 DCE Crossover Cable	91
F-9	RS-232-to-DTE Straight Cable (EDN16C-xxxx-MF)	92
F-10	V.35-to-DTE Straight Cable (EHN071-005M)	93
F-11	RS-530-to-RS-530 DTE Straight Cable	94
F-12	RS-530-to-RS-449 DTE Straight Cable	95
F-13	RS-530-to-X.21 DTE Straight Cable	96

Tables

1-1	Allowable Rate Combinations.....	8
5-1	Impedance-Strapping Requirements	32
6-1	LED Indicators.....	42
C-1	E&M Lead States.....	71
D-1	List of Configuration Items for the Composite Interface	78
D-2	List of Configuration Items for the Data Channel Interface	80

1. Specifications

Composite Interface

Type — RS-232 (CCITT V.24/V.28) serial synchronous, internal/external clocking; full-duplex interfaces to support optional V.35, RS-530, RS-449, and X.21 standards

Connector — DB25 female

Configured as — DCE

Speeds (bps) — 7200, 9600, 14,400, 19,200, 38,400, 56,000, 64,000, 72,000

NOTE: The Multiserver 500 will not operate with clock rates, internal or external, other than those specified above.

Data-Channel Interface

Number of Channels — 1

Type — RS-232 (CCITT V.24/V.28) serial synchronous/asynchronous, full-duplex interfaces to support optional V.35, RS-530, RS-449 and X.21 standards.

Connector — DB25 female connector

Configured as — DCE

Sync Channel Data Rates — 1200 bps to 72,000 bps

Sync-Channel Bandwidth Allocation — Fixed rate or dynamic rate

Fixed Rate: Always operates at guaranteed rate

Dynamic Rate: Operates at either a maximum configured rate or guaranteed configured rate, depending on voice/fax activity and DBA configuration

Dynamic Rate

Switching Status — On-hook/off-hook, or idle/active voice/fax traffic

Maximum Rate — Composite rate minus overhead

Async Channel

Data Rates — 1200 bps to 57,600 bps

Data Bits — 7 or 8 data bits plus 1 parity bit

Parity — Space, mark, even, odd, none

Stop Bits — 1, 1.5, and 2 per character

Flow Control — RTS/CTS and X-ON/X-OFF; must be configured the same way at each end

EIA Controls: — 4 full-duplex control signals supported

Voice/Fax Channel

Interface Types — E&M, FXS, or FXO, depending on the type of voice/fax interface card installed

Digitizing Rates — Fixed rates of 4000, 4800, 6400, 7200, 8000, 9600, 12,000, 12,800, 14,400, and 16,000. The voice/fax channel is automatically assigned the highest fixed rate within the available bandwidth. Available bandwidth equals composite rate minus guaranteed sync channel rate minus overhead. Overhead is 400 bps for composite rates of less than 56 Kbps, and 800 bps for composite rates of 56 Kbps and above.

Specifications for Voice/Fax Modules — See Appendixes A, B, and C

Command Port Interface

Type — RS-232 (CCITT V.24/V.28) serial asynchronous

Connector — 8-position modular jack wired as RJ-1D DCE

Speeds — 1200 bps to 19,200 bps

Data Bits — 7 or 8 data bits plus 1 parity bit

Parity — Space, mark, even, odd, none

Stop Bits — 1, 1.5, and 2 per character

Flow Control — X-ON/X-OFF

Allowable Rate Combinations

Table 1-1 shows the allowable combinations of composite and data channel rates.

Table 1-1. Allowable Rate Combinations

Composite Rate	Sync Data Rate	DBA Max Sync Rate	Maximum Async Rate
7200	1200	6800	3600
	2400	6800	
	3600	6800	
9600	1200	9200	4800
	2400	9200	
	3600	9200	
	4800	9200	
14400	1200	14400	9600
	2400	14000	
	3600	14000	
	4800	14000	
	7200	14000	
	9600	14000	
19200	1200	14000	14000
	2400	14000	
	3600	19200	
	4800	19200	
	7200	19200	
	9600	19200	
	12000	19200	
	14400	19200	

Composite Rate	Sync Data Rate	DBA Max Sync Rate	Maximum Async Rate
38400	1200	14400	28800
	2400	14400	
	3600	19200	
	4800	19200	
	7200	19200	
	9600	19200	
	12000	28800	
	14400	28800	
	19200	33600	
	28800	38000	
	33600	38000	
56000	1200	14400	38400
	2400	14400	
	3600	19200	
	4800	19200	
	7200	19200	
	9600	19200	
	12000	28800	
	14400	28800	
	19200	33600	
	28800	38400	
	33600	48000	
38400	55200		
46400	55200		
48000	55200		
51200	55200		

Composite Rate	Sync Data Rate	DBA Max Sync Rate	Maximum Async Rate
64000	1200	14400	38400
	2400	14400	
	3600	19200	
	4800	19200	
	7200	19200	
	9600	19200	
	12000	28800	
	14400	28800	
	19200	33600	
	28800	38400	
	33600	48000	
	38400	56000	
	46400	56000	
	48000	63200	
	51200	63200	
	56000	63200	
	57600	63200	
72000	1200	14400	38400
	2400	14400	with 8-bit data
	3600	19200	
	4800	19200	
	7200	19200	
	9600	19200	57600
	12000	28800	with 7-bit data
	14400	28800	
	19200	33600	
	28800	38400	
	33600	48000	
	38400	56000	
	46400	56000	
	48000	64000	
	51200	64000	
	56000	71200	
	57600	71200	
	64000	71200	

Indicators — Self-test, EEPROM test, local and remote data loopback tests, and local and remote composite loopback tests

Power Requirements — 100-250 VAC, @ 0.9A, 50-60Hz

Power Supply — External, provided with the Multiserver

Size — 11.25”L × 8.5”W × 3”H (29 × 22 × 8 cm)

Weight — 3.4 lb. (1.5 kg)

Operating Environment —

Temperature: 32 to 114° F (0 to 45.5° C) operating; -40 to 158° F (-40 to 70° C) storage

Relative Humidity: 25% to 75%

Atmospheric Pressure: 12.47 to 15.37 psi (86 KPA to 106 KPA)

Agency Compliance

FCC Part 15, Class A

FCC Part 68

C.R.C., C. 13744

VDE 0871 Level B

CSA Standard C.22.2 No. 950 M-89

UL 1950

BABT 340, Issue 6

TÜV/GS-EN 60950/VDE 0805

DOC CS-03

2. Introduction

2.1 Multiplexing and the Multiserver 500

The Multiserver 500 is a standalone voice/fax/data multiplexor. It converts analog voice into low-bit-rate digital format, and multiplexes the digitized voice with data into a composite digital stream. The composite stream is transmitted over a leased line to a remote site.

At the remote site, another Multiserver 500 demultiplexes the composite stream into data and digitized voice, and reconverts the digitized voice into analog form.

It's the low bit rates that allow voice signals to share a leased line with data. When you add digitized voice to an already existing data link, you don't pay anything more than your existing leasing costs; the voice gets a free ride.

In addition to accepting analog voice signals for digital conversion, the Multiserver 500 can also process analog signals from a fax machine. When the mux detects fax signals, the firmware switches into fax mode. In this mode, signals are demodulated into fax symbols and passed as data to

the remote end. At the remote end the symbols are remodulated to the correct standards.

A typical Multiserver 500 application is shown in Figure 2-1.

2.2 Description of the Multiserver 500

Physically, the Multiserver 500 is an assembly of printed circuit boards—one data channel/composite channel and one voice/fax module—housed in a rectangular enclosure (see Figure 2-2). The front of the unit includes an LED display, an LCD display, and a keypad.

The LED display monitors power status, self-test results, link conditions, and voice and data channel activities.

The LCD display provides status, events, and messages, and together with the keypad is used for configuration, diagnostics, and administration functions.

The physical ports for connecting the Multiserver 500 to the various interfaces are on the back of the unit.

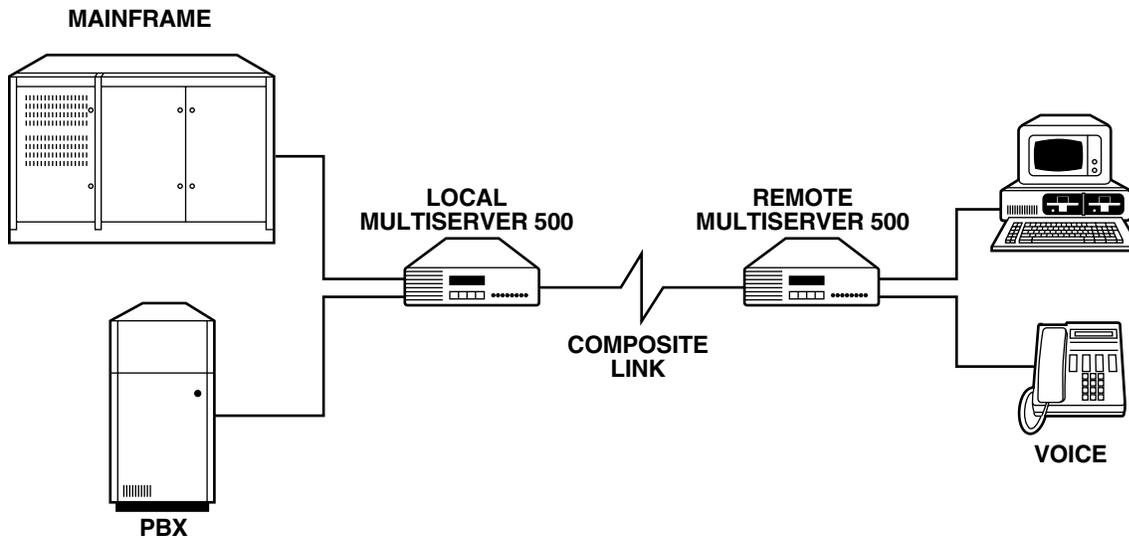


Figure 2-1. Typical Multiserver 500 Application.

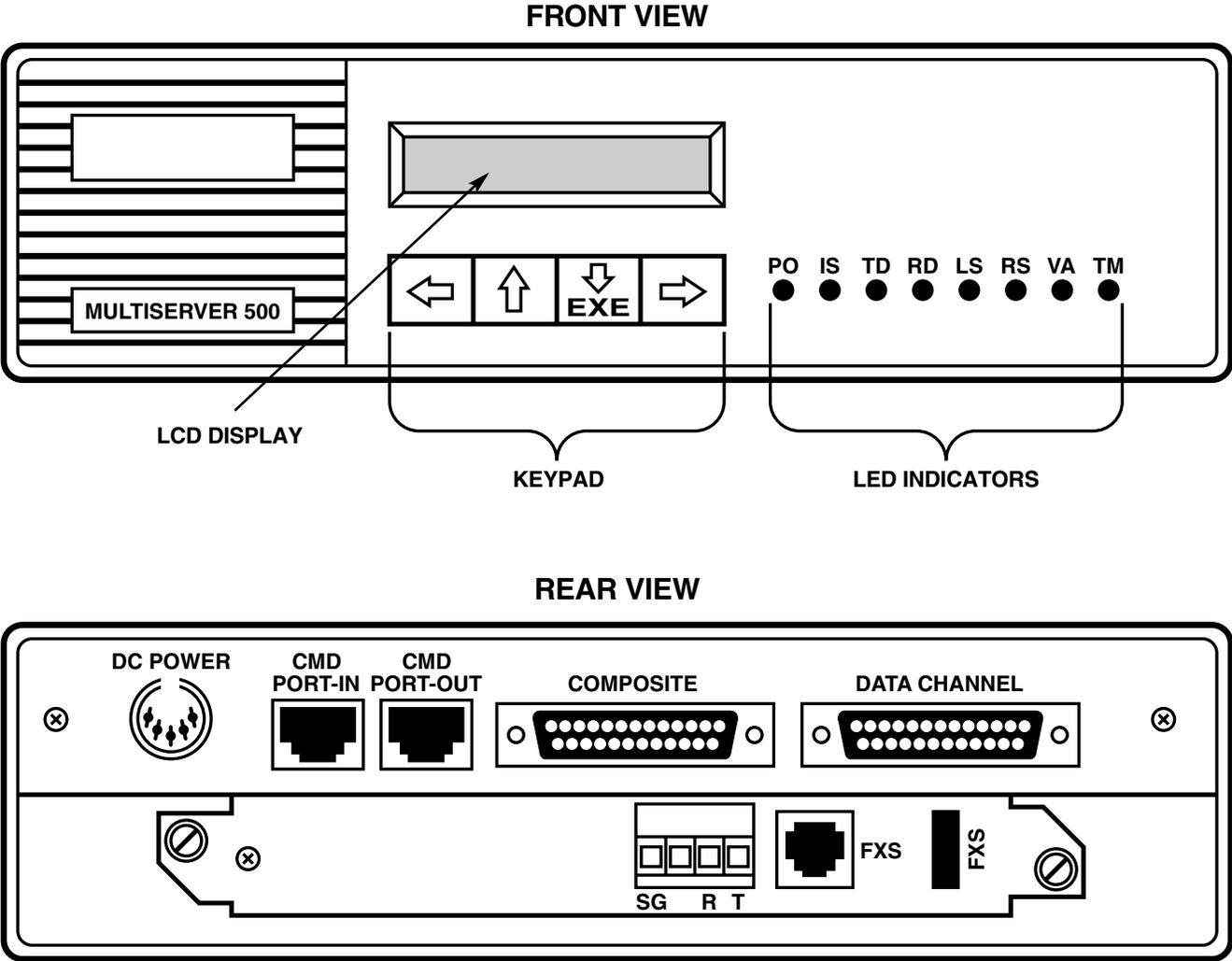


Figure 2-2. Multiserver 500, Front and Rear Views.

2.3 Block Diagram

Figure 2-3 is a diagram of the basic building blocks that make up the Multiserver 500: the digital processing module, the voice/fax interface module,

and the serial interface module. Attached to the basic building blocks are the LCD display and power-supply unit.

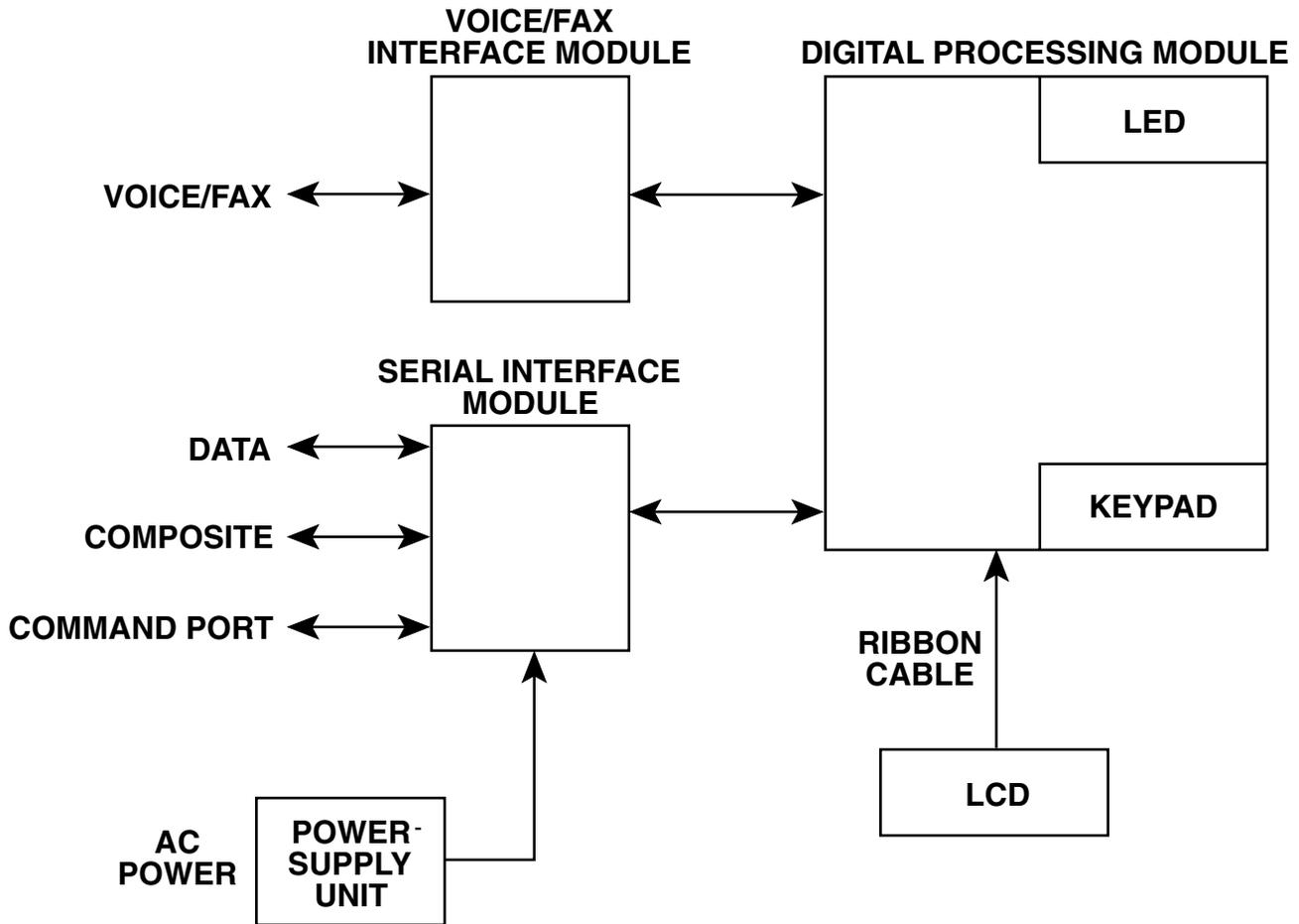


Figure 2-3. Multiserver 500 Block Diagram.

2.3.1 VOICE/FAX INTERFACE MODULE

The main function of the voice/fax interface module is to convert the analog signals from the fax machine or telephone equipment into digital form, so they can be used by the digital processing module. In addition, the voice/fax interface module supplies impedance matching and signaling conversion between the analog interface and the Multiserver 500.

2.3.2 DIGITAL PROCESSING MODULE

The digital processing module is the main processing unit of the Multiserver 500. Its functions include voice compression and multiplexing. In addition, the LCD display and the keypad form part of the digital processing module.

2.3.3 SERIAL INTERFACE MODULE

The serial interface module provides physical connections for the data, composite, and Command Port interfaces. It also contains the clock-generating circuits derived either from internal or external sources.

2.3.4 LCD

With the keypad, the LCD lets you configure and monitor the Multiserver 500. It physically connects to the digital processing module by a ribbon cable.

2.3.5 POWER SUPPLY

Power is supplied from a detachable power supply through a connector at the back of the Multiserver 500.

2.4 Interfaces

There are four interfaces that connect to the Multiserver 500: data channel, voice/fax channel, Command Port, and composite interface.

2.4.1 DATA CHANNEL

The data channel interface is an RS-232 interface terminated in a DB25 connector wired as DCE. Support for V.35, RS-449/RS-530, and X.21 physical levels is available on an optional basis, implemented by daughterboards that plug into the serial interface module.

The mux can accept both synchronous data ranging from 1200 bps to 72,000 bps, and

asynchronous data ranging from 1200 bps to 57,600 bps.

2.4.2 VOICE/FAX CHANNEL

Depending on the type of telephone equipment (or other analog equipment) interfacing with the voice/fax channel, the voice/fax channel conforms with one of three common types of signaling conventions:

- FXS (Foreign Exchange Station)—Loop Start
- FXO (Foreign Exchange Office)—Loop Start
- E&M (E-lead and M-lead)—Tie Line Trunk

You can easily match the Multiserver 500 with the correct telephone interface with a set of three optional analog interface modules: FXS, FXO, and E&M.

For more detailed information on the analog interface modules, refer to **Appendixes A, B, and C**.

2.4.3 COMPOSITE CHANNEL

The composite is a synchronous channel ranging from 7200 bps to 72,000 bps. Physically, the composite channel is an RS-232 port terminated in a DB25 connector wired as DCE. Support for V.35 RS-449/RS-530, and X.21 physical levels is also available, implemented by daughterboards that plug into the serial interface module.

2.4.4 COMMAND PORT

The Command Port is one way to access the command facility of the Multiserver 500. Use the command facility to issue commands and to monitor status.

Physically, the Command Port is a set of two RJ-45 connectors at the back panel. It's used to connect an external asynchronous terminal to the Multiserver 500.

In a single Multiserver 500 application, the CMD PORT-IN connector is used for connection to the terminal.

When several muxes are controlled by a single terminal, the CMD PORT-IN connector connects to the previous Multiserver 500 (or terminal, if it is the first unit in line) and the CMD PORT-OUT connector connects to the next Multiserver 500 in

line.

2.5 Options

As described earlier, the composite port and data channel interface connectors are wired, as standard, for interfacing with RS-232 type devices. You can change the interface with a conversion kit. See the next section for the part numbers.

For additional information, refer to **Appendixes D** and **F**.

2.6 Models Covered in This Manual

The basic Multiserver 500 is part number MX400A-232/232. You might also have ordered it in any of the optional configurations:

MX400A-35/35: V.35 composite interface, V.35 data interface

- Base unit (MX400A-232/232)
- Two MX410C-35 Interface Cards

MX400A-422/422: RS-422 (X.21) composite interface, RS-422 (X.21) data interface

- Base unit (MX400A-232/232)
- Two MX410C-422 Interface Cards

MX400A-422/35: RS-422 (X.21) composite interface, V.35 data interface

- Base unit (MX400A-232/232)
- MX410C-422 Interface Card
- MX410C-35 Interface Card

MX400A-35/232: V.35 composite interface, RS-232 data interface

- Base unit (MX400A-232/232)
- MX410C-35 Interface Card

MX400A-422/232: RS-422 composite interface, RS-232 data interface

- Base unit (MX400A-232/232)
- MX410C-422 Interface Card

In addition to the Multiserver 500 (MX400), this manual covers the following voice/fax interface card models:

- MX401C: Standard E&M Interface Module
- MX402C: Enhanced E&M Interface Module
- MX403C: Standard FXO Interface Card
- MX404C: Enhanced FXO Interface Module
- MX406C: Standard FXS Interface Card
- MX407C: Enhanced FXS Interface Module

3. Installation

Use the following procedures as a setup guide.

3.1 Unpacking the Multiserver 500

Unpack and inspect the equipment. Report any physical damage to the shipping carrier. Save the packing material. You may need it if you need to return the unit for repair.

Check the contents of the equipment against the packing slip. Verify that you have received the following:

- The Multiserver 500

- If applicable, one modular cable for connecting your FXS or FXO interface module to telephone equipment
- One RJ-45-to-DB25 adapter
- One 8-conductor modular cable for use with the adapter
- One power supply

Appendix F contains wiring diagrams for the above cables. You may use them to construct your own interface cables. Refer to **Appendixes A, B, and C** for telephone interface cabling details.

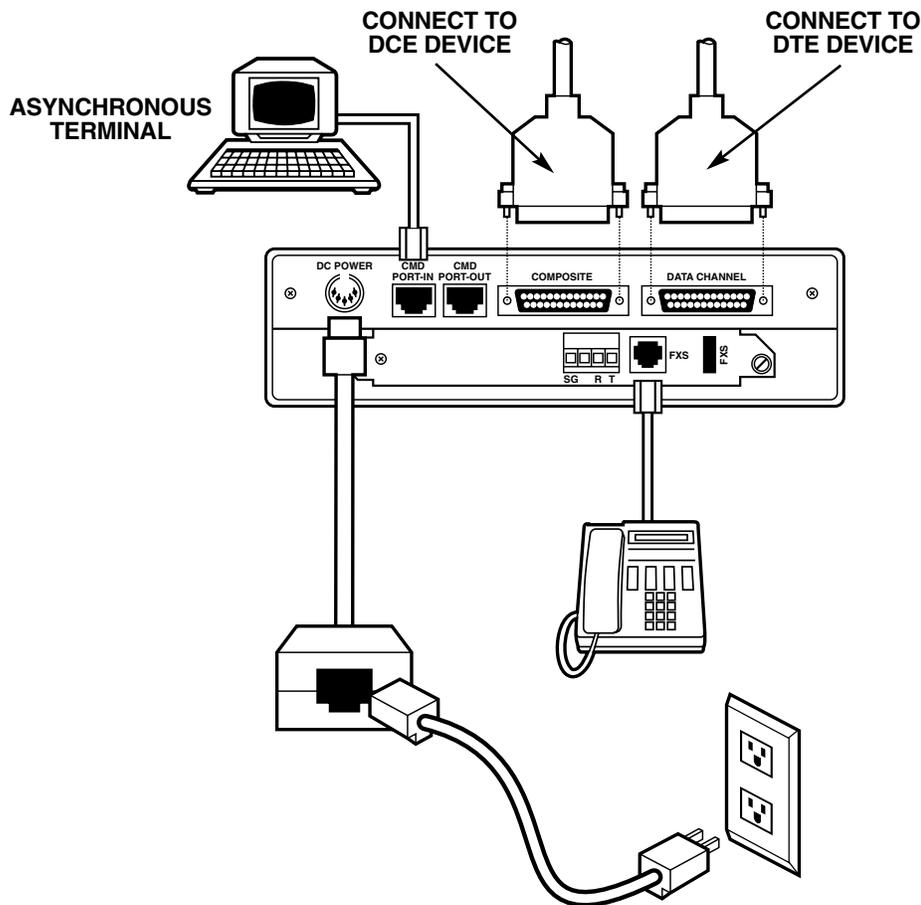


Figure 3-1 Cable and Power Connectors.

3.2 Installing the Multiserver

3.2.1 SELECTING AN INSTALLATION SITE

You can place the unit on a tabletop or shelf large enough to accommodate it. Allow enough space to get to the cables easily and remove the cover, and make sure there is unobstructed air flow from the sides of the unit.

3.2.2 CABLE AND POWER CONNECTIONS

Figure 3-1 shows the rear panel of the Multiserver 500.

1. Composite Interface

Use a crossover cable appropriate for your installation. (See **Section F.1** in **Appendix F**.) Connect one end to the COMPOSITE connector and the other end to the DCE device.

2. Data Channel Interface

Use a straight cable appropriate for your installation. (See **Section F.2**.) Connect one end to the DATA CHANNEL connector and the other end to the DTE device.

3. Telephone Interface

Requirements vary with the type of telephone equipment you're connecting to—and with the type of voice/fax interface module installed in the Multiserver 500. Refer to **Appendixes A** through **C** for details.

4. Power Connection

Connect the power supply output directly into the DC POWER connector of the Multiserver 500. Connect the other end to an AC wall outlet.

WARNING!

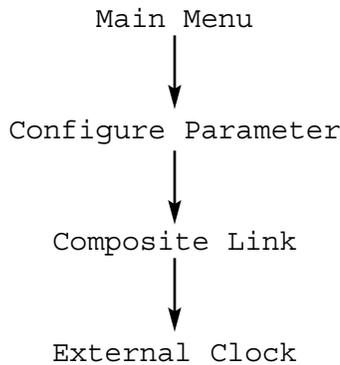
Do not use any power supply other than the one provided with your Multiserver 500, as illustrated in Figure 3-1. Any other power supply could damage the Multiserver 500.

5. *Connecting a Terminal to the Command Port*

See Chapter 6 for information on setting up and using your terminal.

3.3 Setting the Composite Transmit Clock

If your composite interface is connected to a DCE device as in Figure 3-2, verify that the composite clock is set to external. You can do that from the LCD/keypad:



NOTE: As shown in Figure 3-2, the Multiserver 500 provides transmit and receive clocks to the synchronous data interface.

CAUTION!

Once a pair of Multiserver 500s, configured for external clocking, have established communications, the clocking rate provided from the link DCE device cannot be changed. If the DCE rate is changed you must either cycle the power off and on on the Multiserver 500 or disconnect the link cable and then reconnect.

You can use two Multiserver 500s as a diagnostics tool. Simply connect two Multiserver 500s back to back and bench-test them. To do this, set both muxes to internal clock and select a composite clock rate.

Once you've selected a composite clock rate, you must set both the local and remote muxes to the same rate. The procedure is as follows (see Figure 3-3):

2. Set the clock rate (9600) of the local unit to external:

```
>COM C=EX R=9600 <cr>
```

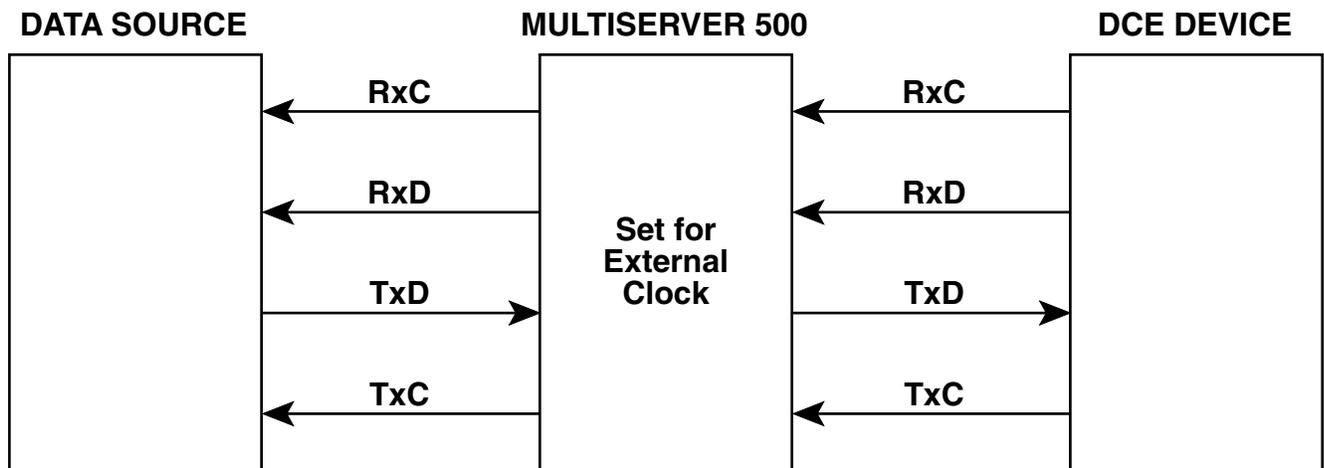


Figure 3-2. Clocking with Multiserver 500 Connected to a DCE Device

3. Save the clock rate:

>SA

4. At the remote unit, repeat steps 2 and 3.

NOTE: Both the local and the remote Multiserver 500s must be set to the same composite clock rate. Otherwise, the system will lock up.

3.4 Installing the Voice/Fax Interface Module

Normally, the Multiserver 500 is shipped with the voice/fax interface module already installed. If it was shipped separately, or if you need to change the existing module, see Figure 3-3 and proceed as follows:

Tool Required: Medium-sized flat-head screwdriver.

To install:

1. Facing the rear of the Multiserver 500, place the voice/fax interface module in the card guides, then slide it toward the rear until it is firmly seated in its mating connector in the digital module.

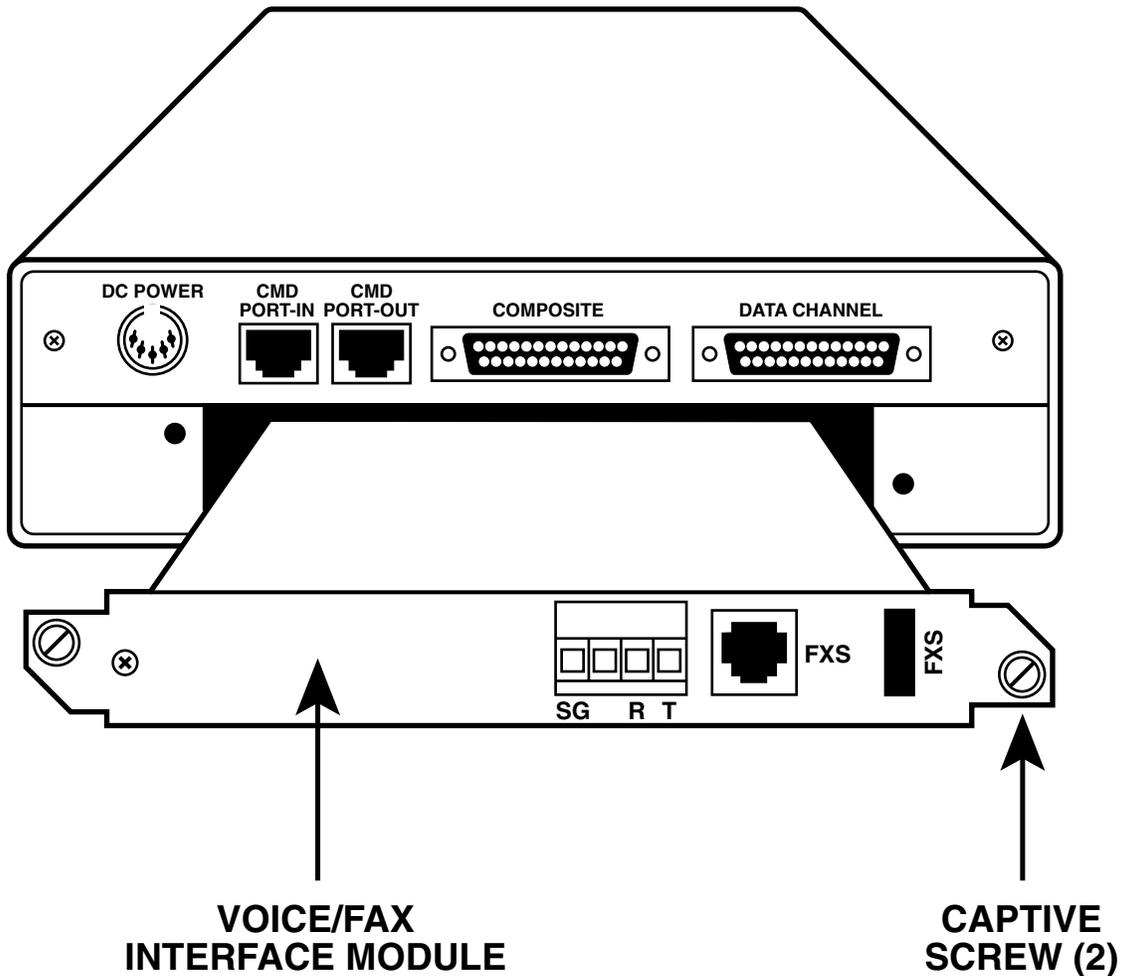


Figure 3-3. Installing or Removing the Voice/Fax Interface Module.

2. Secure the module with the two spring-loaded captive screws. For further information, including cable installation, refer to **Appendix A, B, or C**.

To remove:

1. Using a medium-sized flat-head screwdriver, unscrew the two spring-loaded captive screws.
2. Grasp the interface module firmly and slide it slowly toward you until it's free of its mating connector, then slide it out of the Multiserver 500.

3.5 Setting the Time and Date

To set the time of day and date from the Command Port terminal, enter:

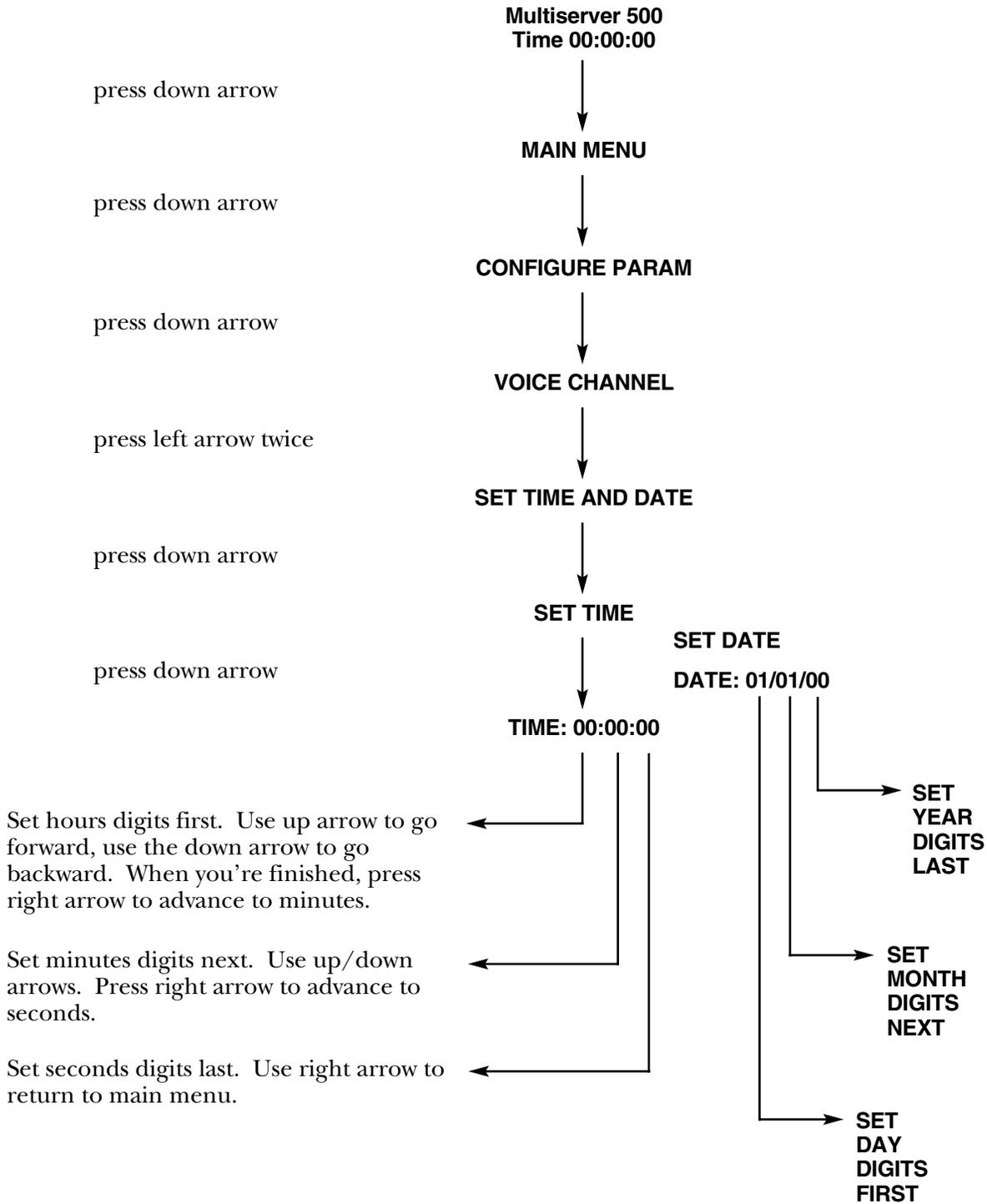
```
>U T=hh:mm:ss (set)
```

```
>U D=dd/mm/yy (set)
```

Note that time and date are not stored in EEPROM (non-volatile memory), and must be set again each time the Multiserver is powered up.

See **Chapter 6** for additional Command Port details.

To set the time of day and date from the LCD/keypad, follow the diagram in Figure 3-4.

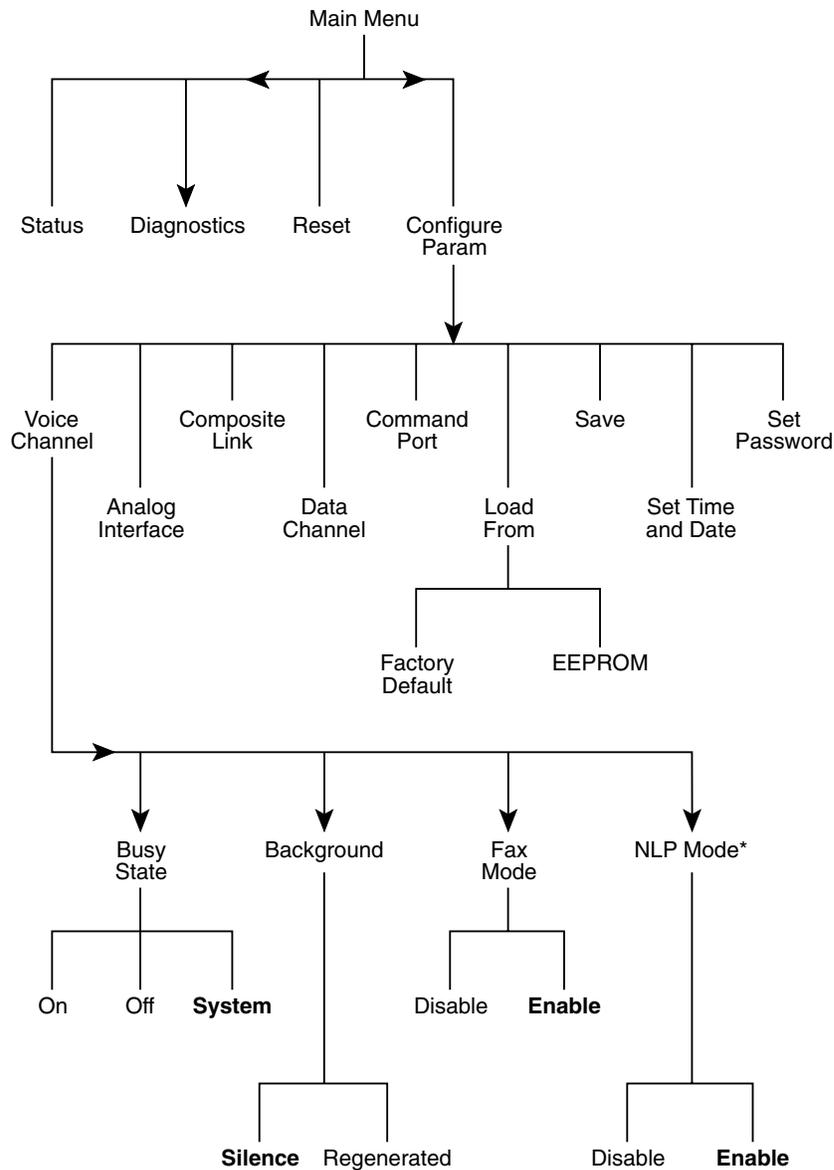


Refer to Chapter 4 for additional LCD/keypad details.

Figure. 3-4. Setting the Time and Date.

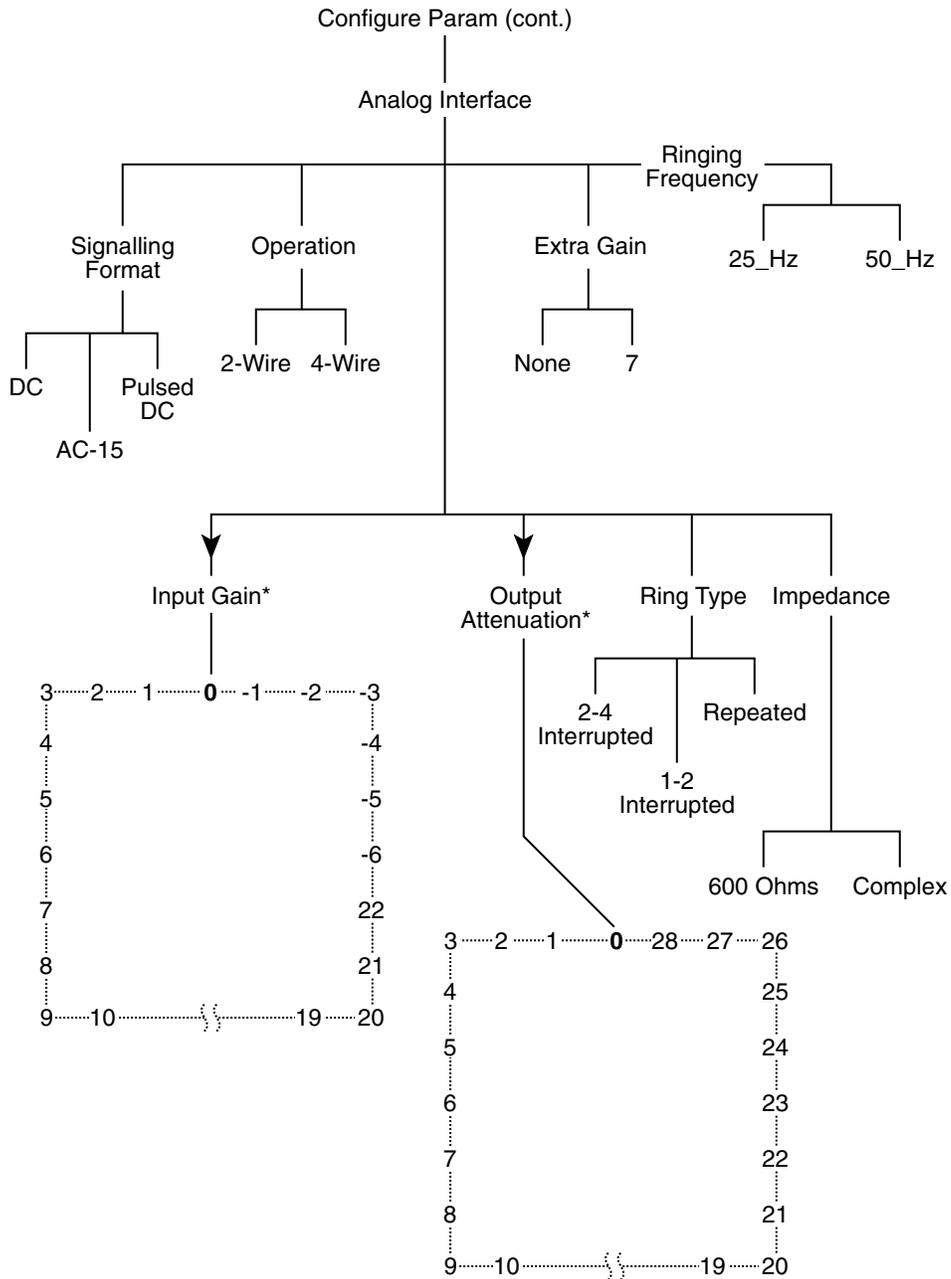
4. Using the LCD and Keypad

One of the ways to configure and monitor the Multiserver 500 is to use the LCD/keypad. For the Command Port method, see **Chapter 5**.



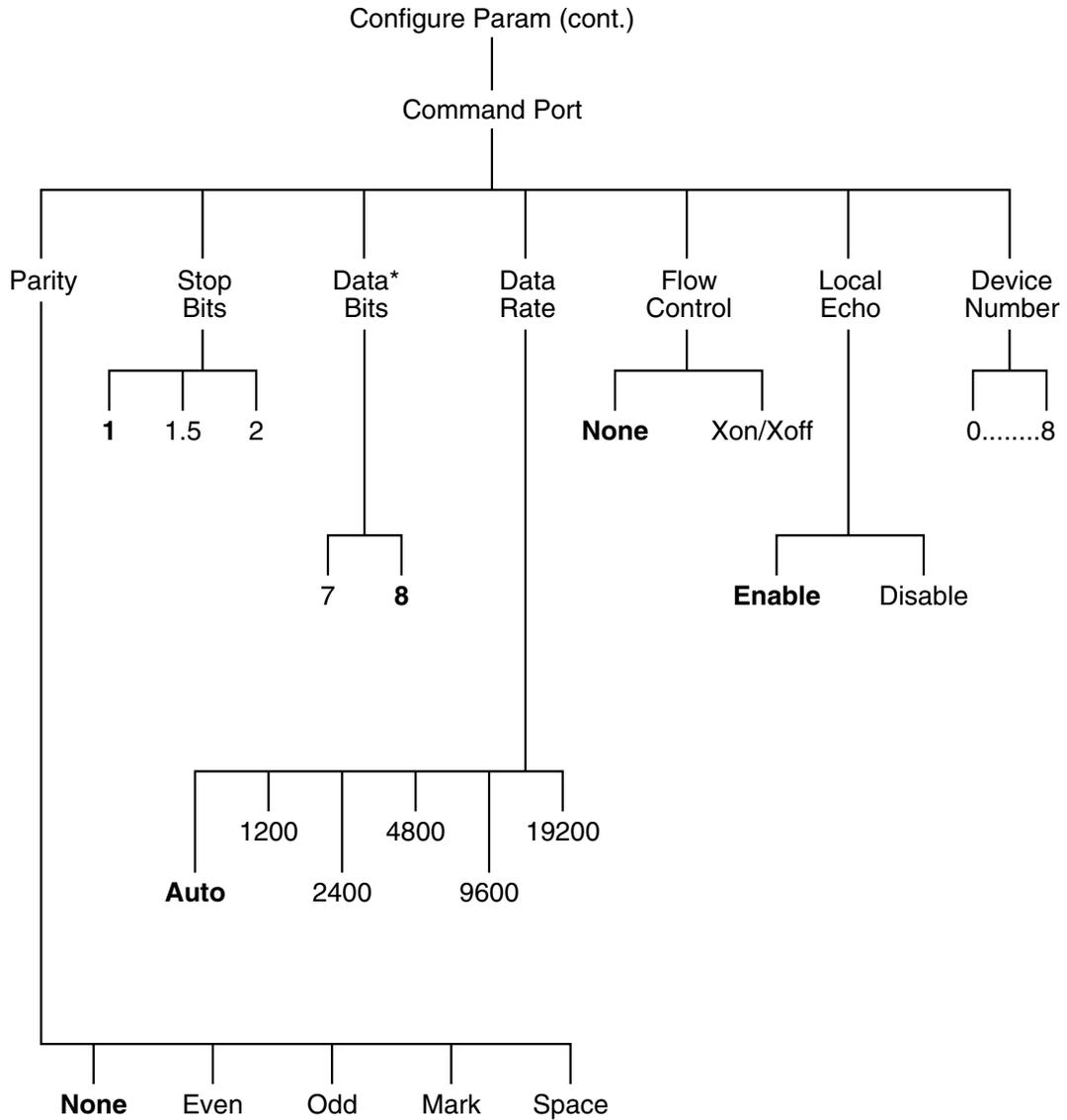
* NLP = Non-linear processing, which suppresses residual echo. In E&M 4-wire applications, voice quality may be improved by disabling NLP.

Parameters shown in **bold** are default values.



* If you operate your equipment in the U.S.A. or Canada, input gain and output attenuation levels must be set to 0 dB. In other countries, follow the standards of the country where the equipment is being used. If there are no specific standards, set the input and output levels of your equipment to match the interfacing telephone equipment.

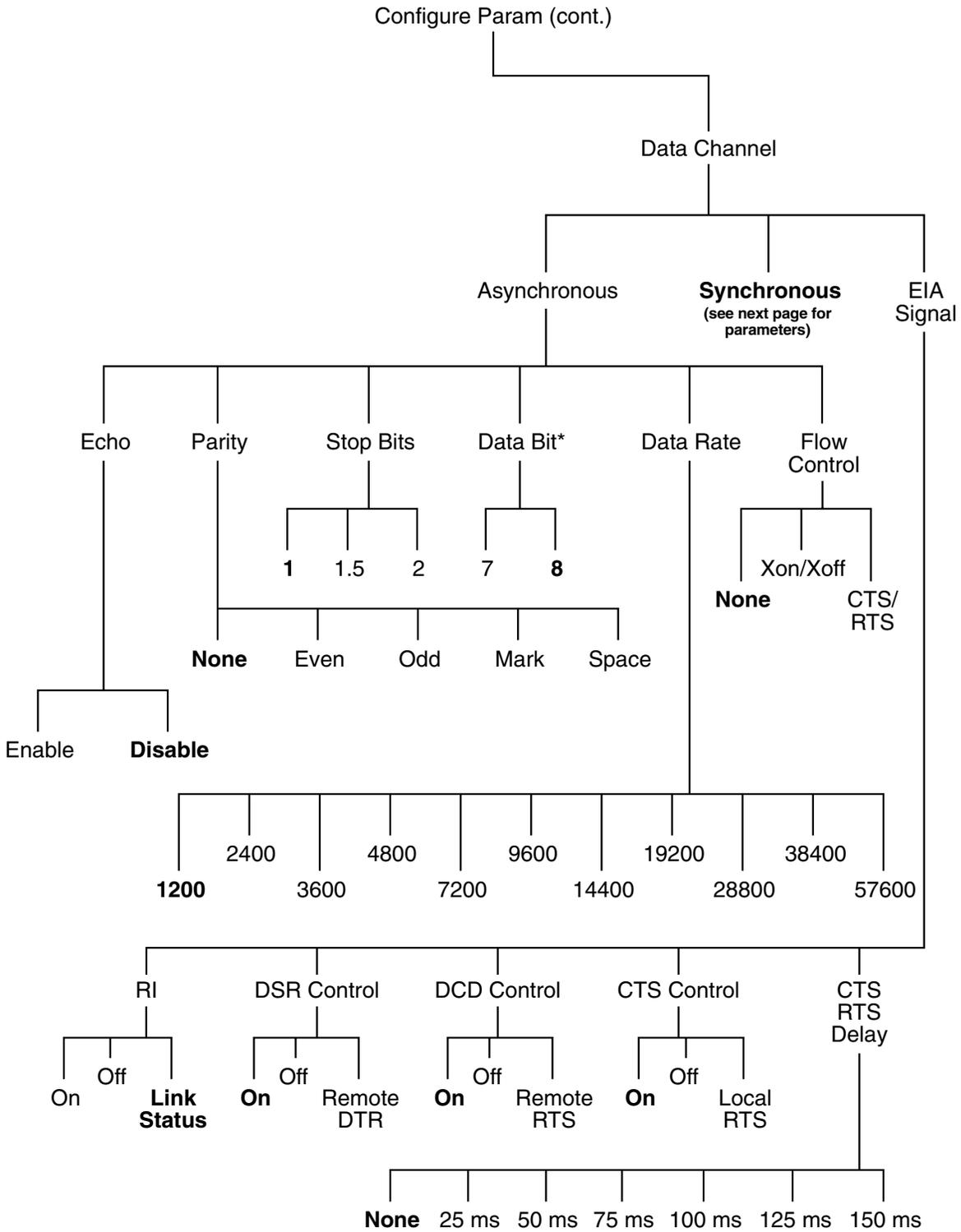
Parameters shown in **bold** are default values.



NOTE: When you change these Command Port parameters, they become effective after you select a Save and then a Reset.

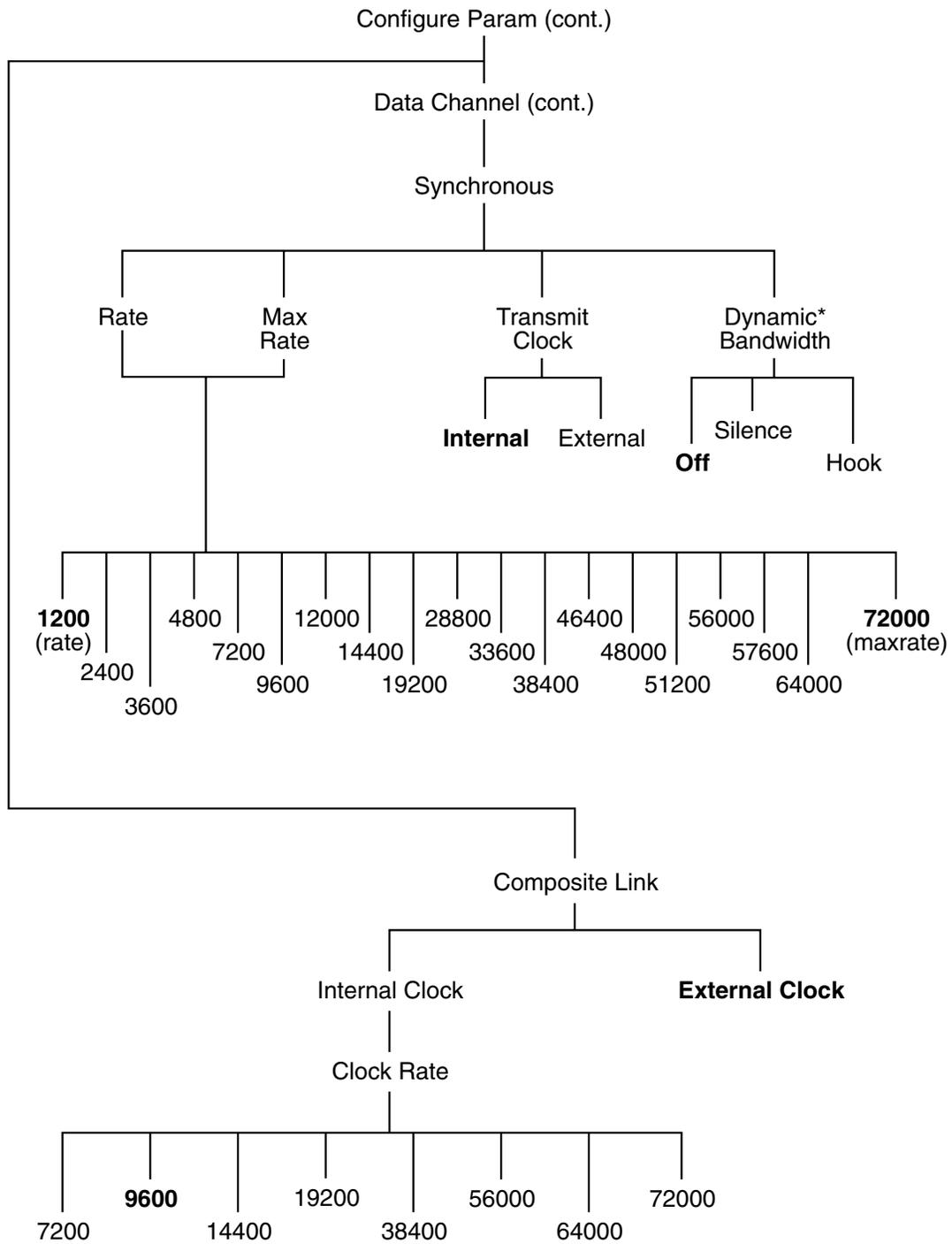
* Does not include parity bit.

Parameters shown in **bold** are default values.



* Does not include parity bit.

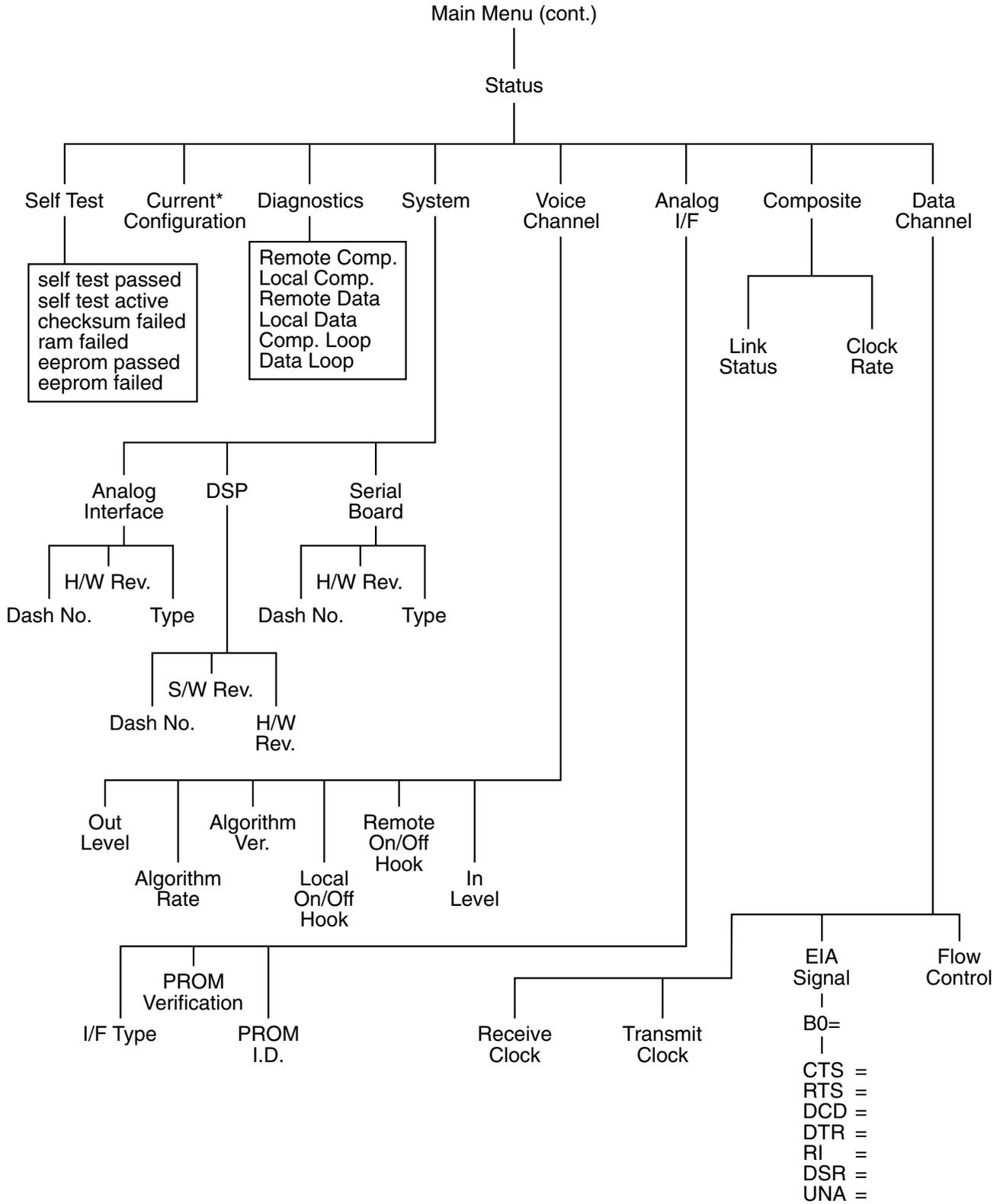
Parameters shown in **bold** are default values.



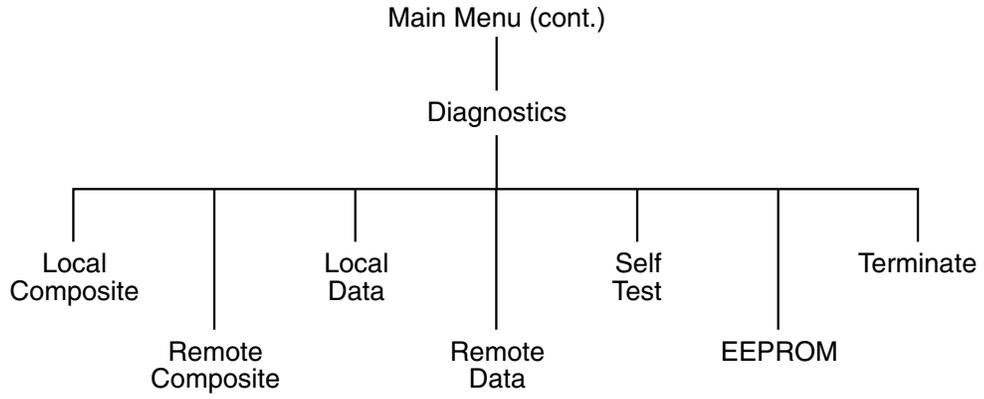
NOTE: The Multiserver 500 will not operate with clock rates, internal or external, other than those specified above.

* Refer to **Section 6.4.1** for a definition of Dynamic Bandwidth Allocation.

Parameters shown in **bold** are default values.



* Shows status of all configuration parameters, as selected.



5. Using the Command Port

In addition to performing all of the functions from the LCD/keypad, you can also do the same thing with an asynchronous terminal connected to the Command Port (with the exception of setting the device number). This section describes how to configure and strap the Command Port and how to connect the asynchronous terminal to the Command Port.

Once you've configured the Command Port and connected the asynchronous terminal, you can use the Command Port to configure and monitor the Multiserver 500. See **Section 6.3** for default details.

5.1 Factory Defaults

The factory defaults of the Command Port are as follows:

Data Rate: Automatic Baud Rate

	(ABR)
Number of Data Bits:	8
Parity:	None
Number of Stop Bits:	1
Flow Control:	None
Device Number:	0
Local Echo:	Enabled

If your terminal meets all of the above parameters (with the exception of device number), including any of the compatible ABR rates, your Command Port is ready for operation. ABR is compatible with 1200, 2400, 4800, 9600, and 19,200 bps.

Otherwise, the Command-Port parameters must be reconfigured from the LCD/keypad, as shown in Figure 5-1.

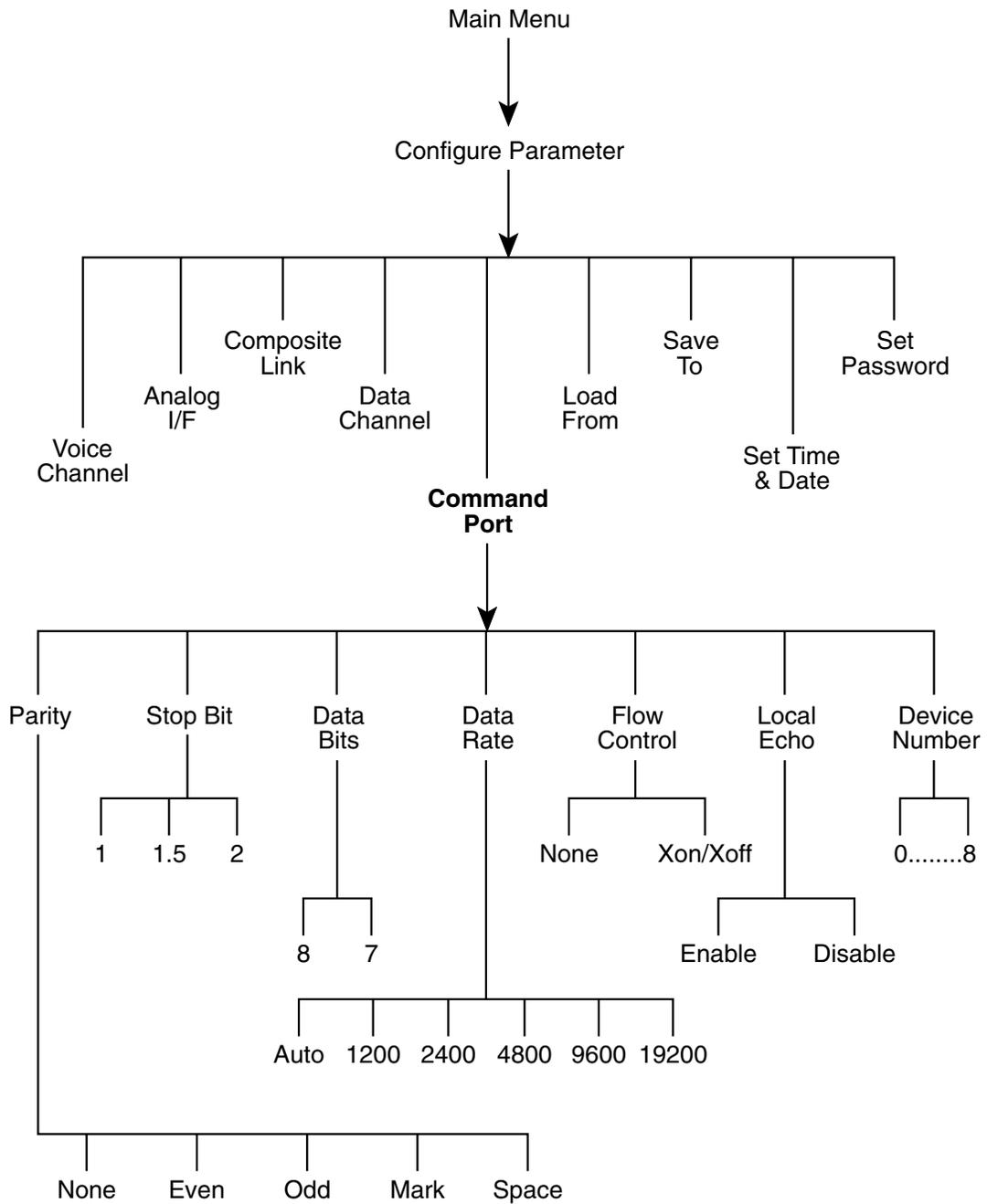


Figure 5-1. Reconfiguring the Command-Port Parameters.

5.2 Connecting Asynchronous Terminals

The Command Port includes an interface connector, so you can connect an asynchronous terminal. The interface connector also lets you control multiple Multiserver 500s from a single terminal in a daisychain fashion.

5.2.1 CONNECTING A SINGLE MULTISERVER 500

As shown in Figure 5-2, there are two RJ-45-type Command Port connectors located on the rear panel of the Multiserver 500: CMD IN and CMD OUT. Cable requirements and pinouts are detailed

in Section 5.4. If your installation includes a single Multiserver 500, connect the asynchronous terminal to CMD IN. You will need an RJ-45 to DB25 adapter to connect the cable to the asynchronous terminal.

NOTE: In a single-unit installation, the device number must be left at its default value of 0, and you must strap the Multiserver 500 for the low-impedance position. Strapping details are covered in Section 5.3.

5.2.2 CONNECTING MULTIPLE MULTISERVER 500s

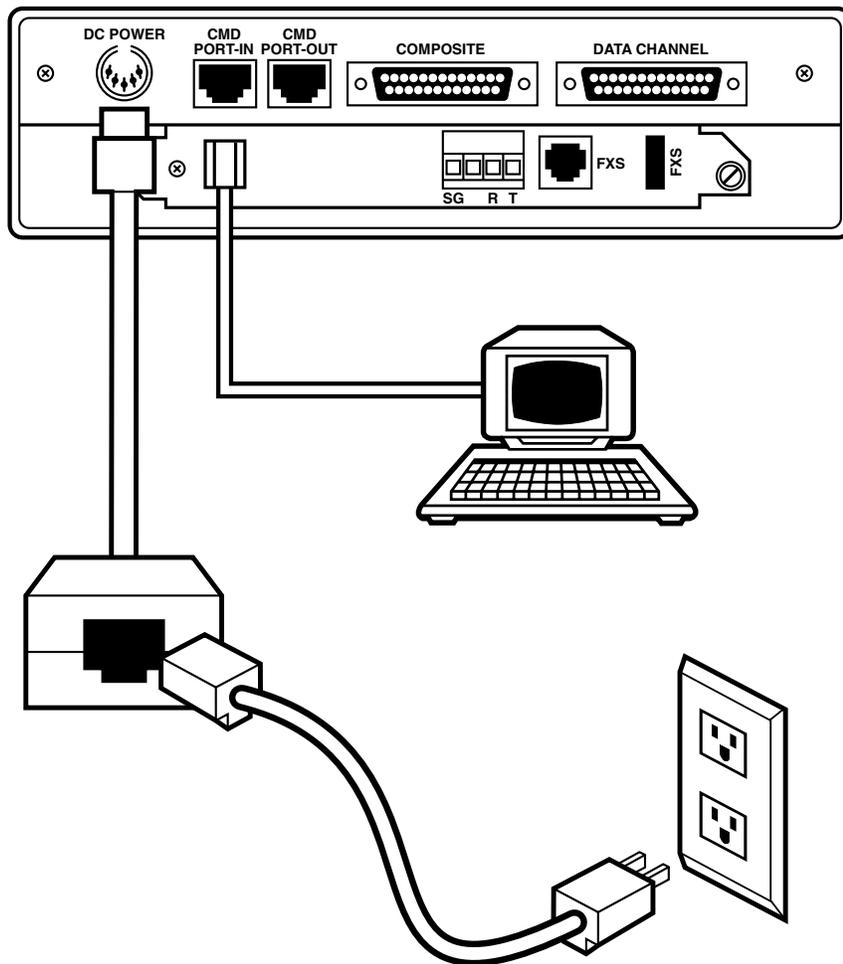


Figure 5-2. Connecting the Asynchronous Terminal.

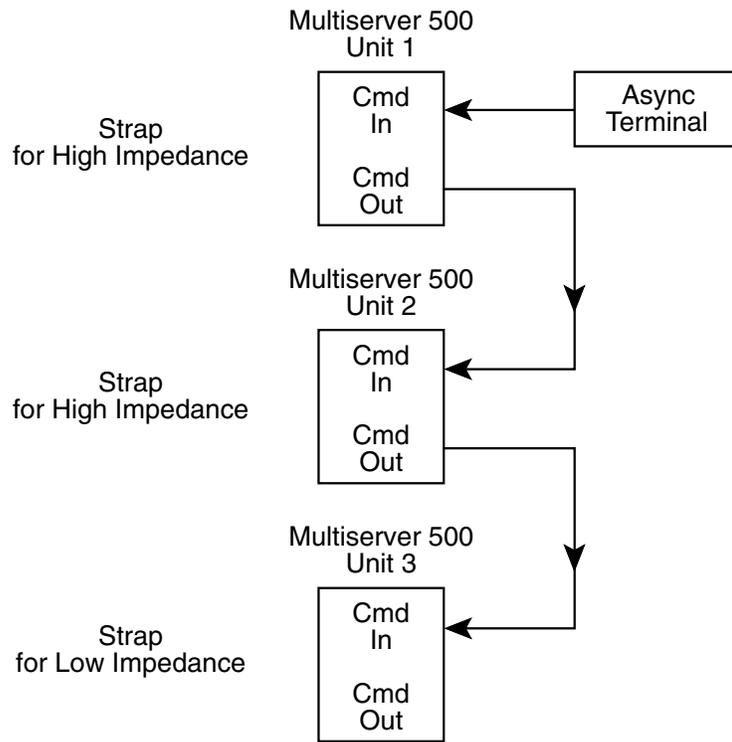


Figure 5-3. Typical Three-Multiserver Daisychain Topology.

You can connect up to eight Multiserver 500s in a daisychain and control the chain from a single asynchronous terminal. Figure 5-3 shows the topology for a typical three-Multiserver 500 local installation. Before connecting them, you must configure each Multiserver 500 with a fixed data rate and then with a device number from the LCD and keypad. (See Figure 5-4.) The default values are

8 data bits, 1 stop bit, no parity, autobaud, no flow control, and local echo enabled.

At least one unit must be set to 1; each of the other units may be set randomly to any number in the range of 2 through 8, as long as no two units have the same number.

5.3 Impedance Strapping

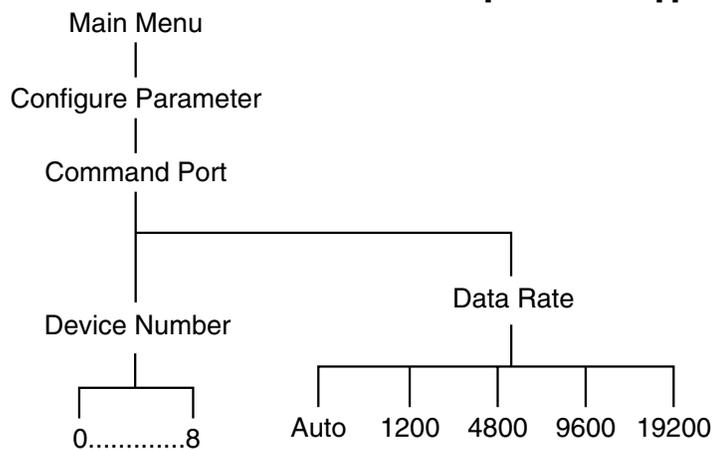


Figure 5-4. Setting the Data Rate and Device Number.

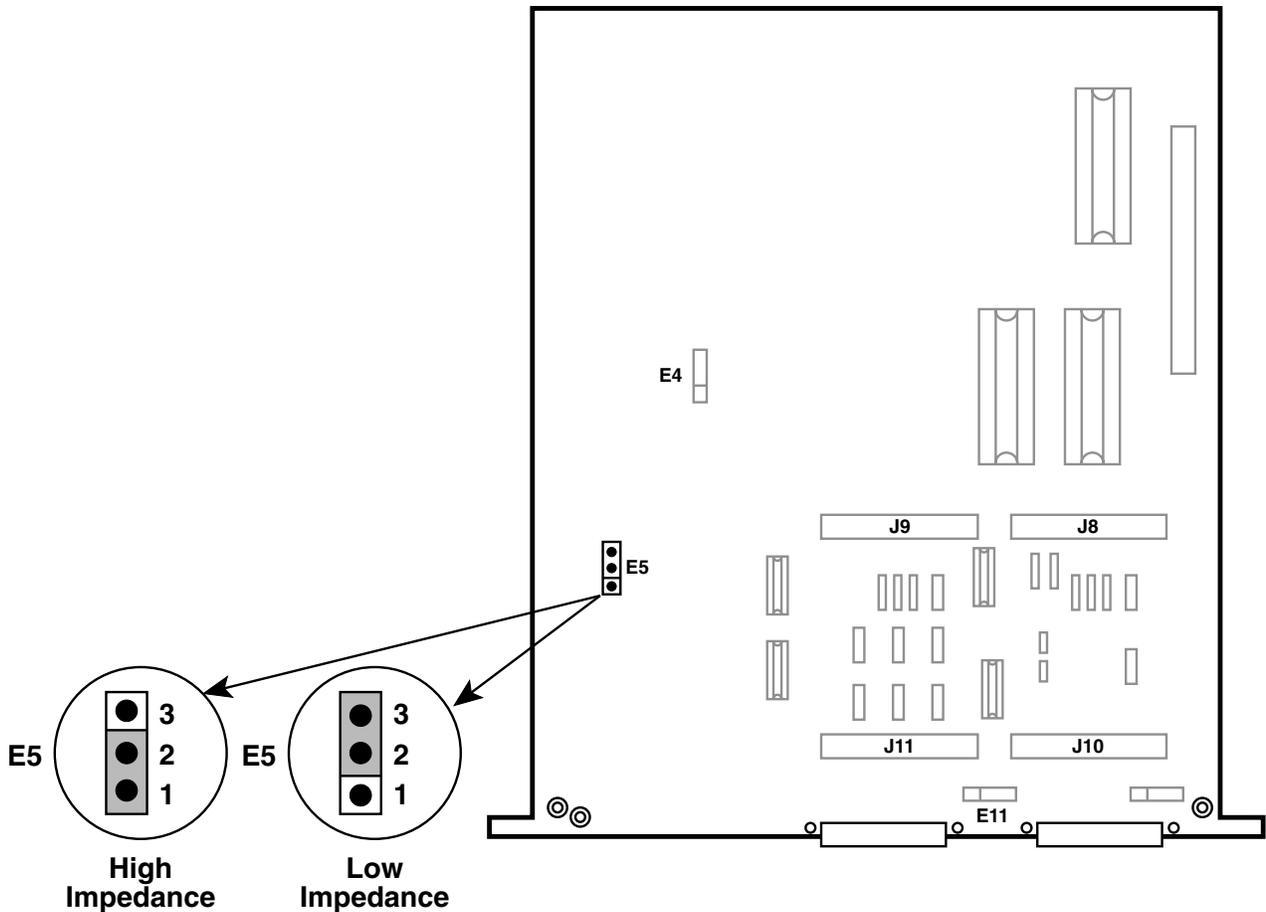


Figure 5-5. Location of Command-Port Impedance Header E5 on the Serial Interface Module.

You can strap the Command Port receiver for either high-impedance (30K Ω) or low-impedance (5K Ω) termination, implemented by a three-position header E5 and a 2-position jumper. Figure 5-5 shows the location E5 on the serial interface module. See **Section D.1** for accessing the serial interface module.

- To strap for low-impedance termination,

position the jumper over pins 2 and 3.

- To strap for high-impedance termination, position the jumper over pins 1 and 2.

Impedance requirements are as listed in Table 5.1.

Table 5-1. Impedance-Strapping Requirements

Number of Multiserver 500s	Strapping Requirements
1	Strap E5 for low impedance.
2 through 4	Strap E5 on end unit for low impedance. Strap E5 on all other units for high impedance.
5 through 8	Strap E5 on all units for high impedance.

5.4 CMD IN and CMD OUT Connectors

Figure 5-6 shows the pin assignments for the CMD IN and CMD OUT connectors.

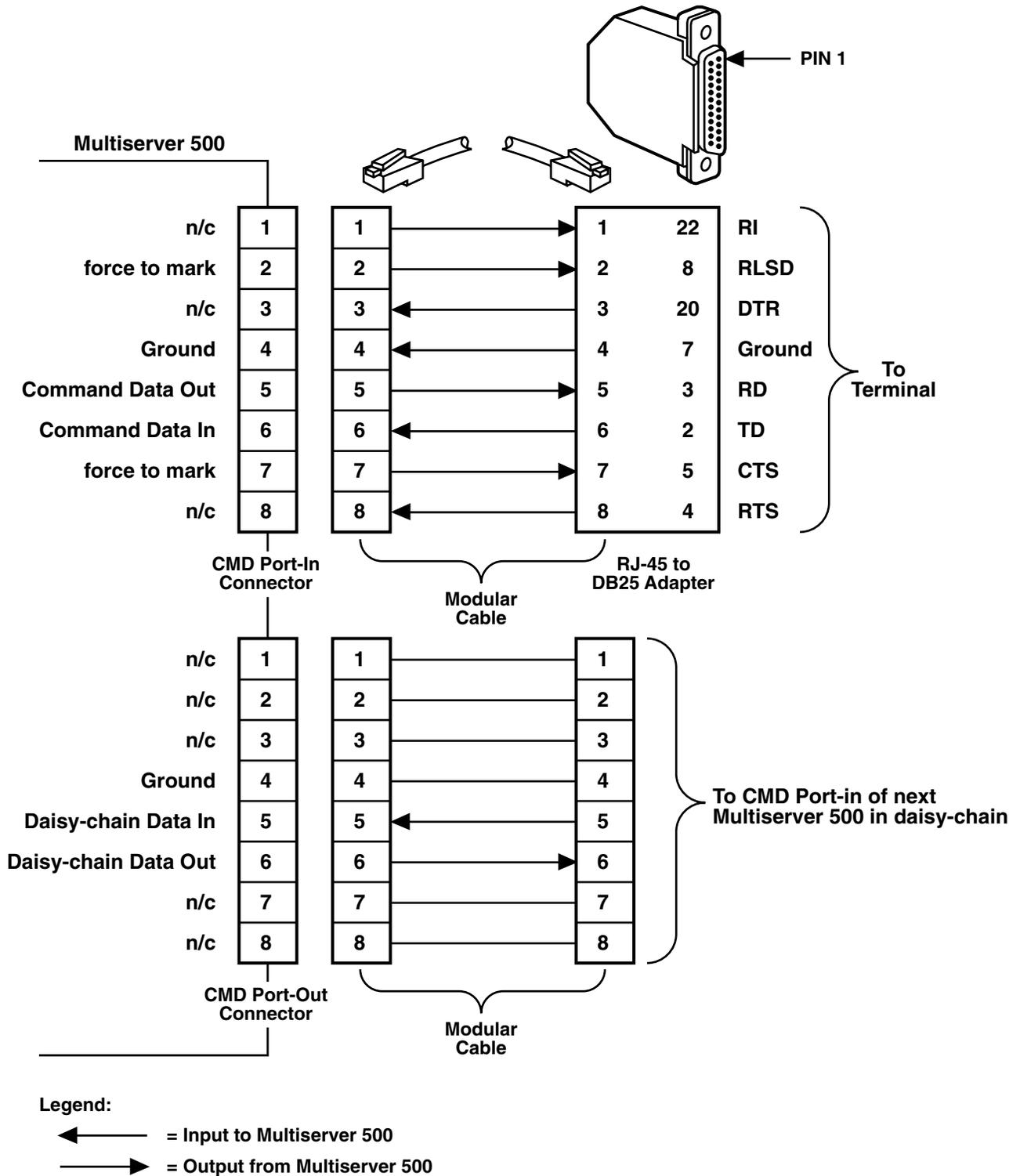


Figure 5-6. CMD IN and CMD OUT Connector Pin Assignments (RS-422 Interface).

5.5 Accessing the Command Port

To access the Command Port from the asynchronous terminal, follow the flowchart in Figure 5-7.

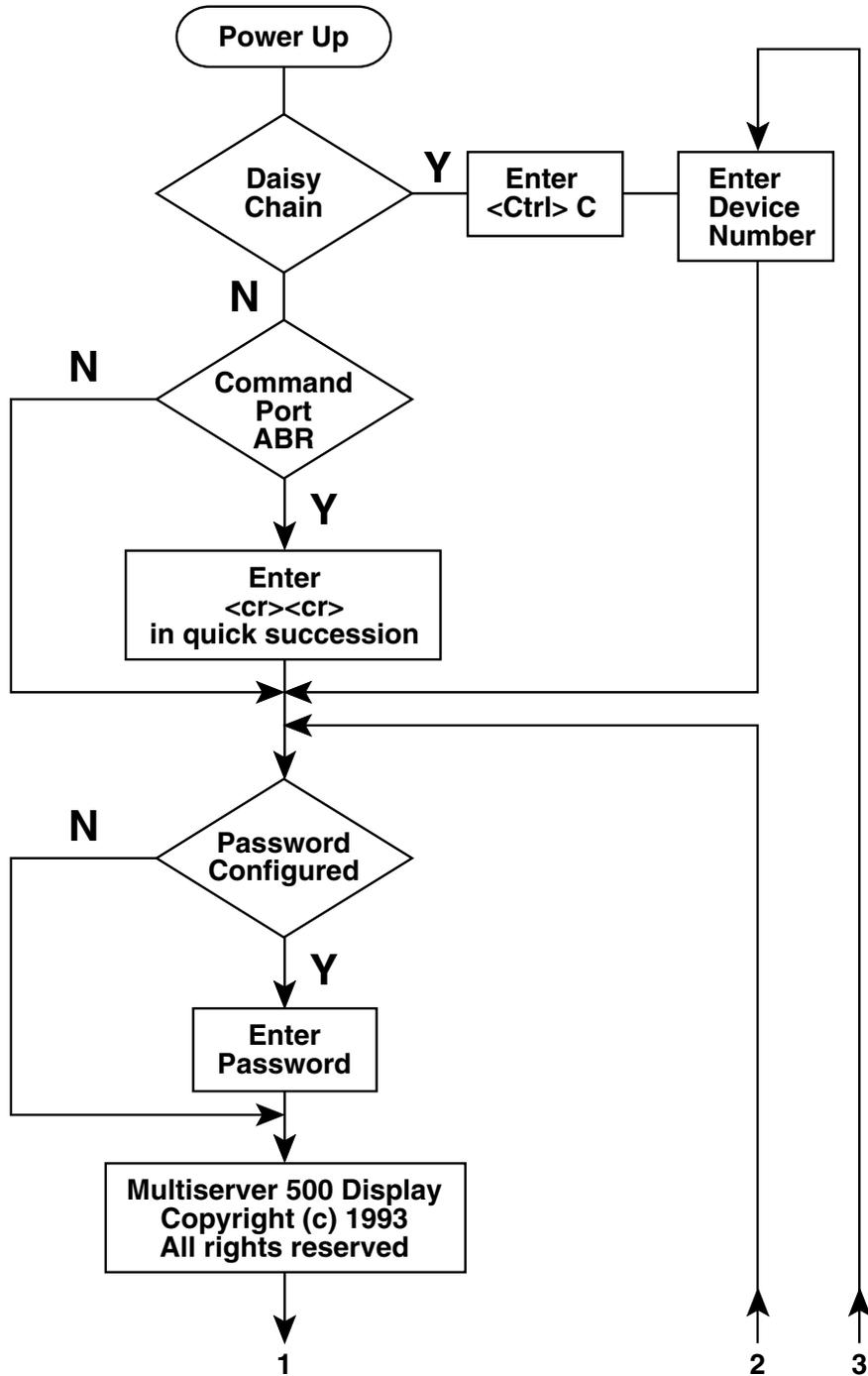
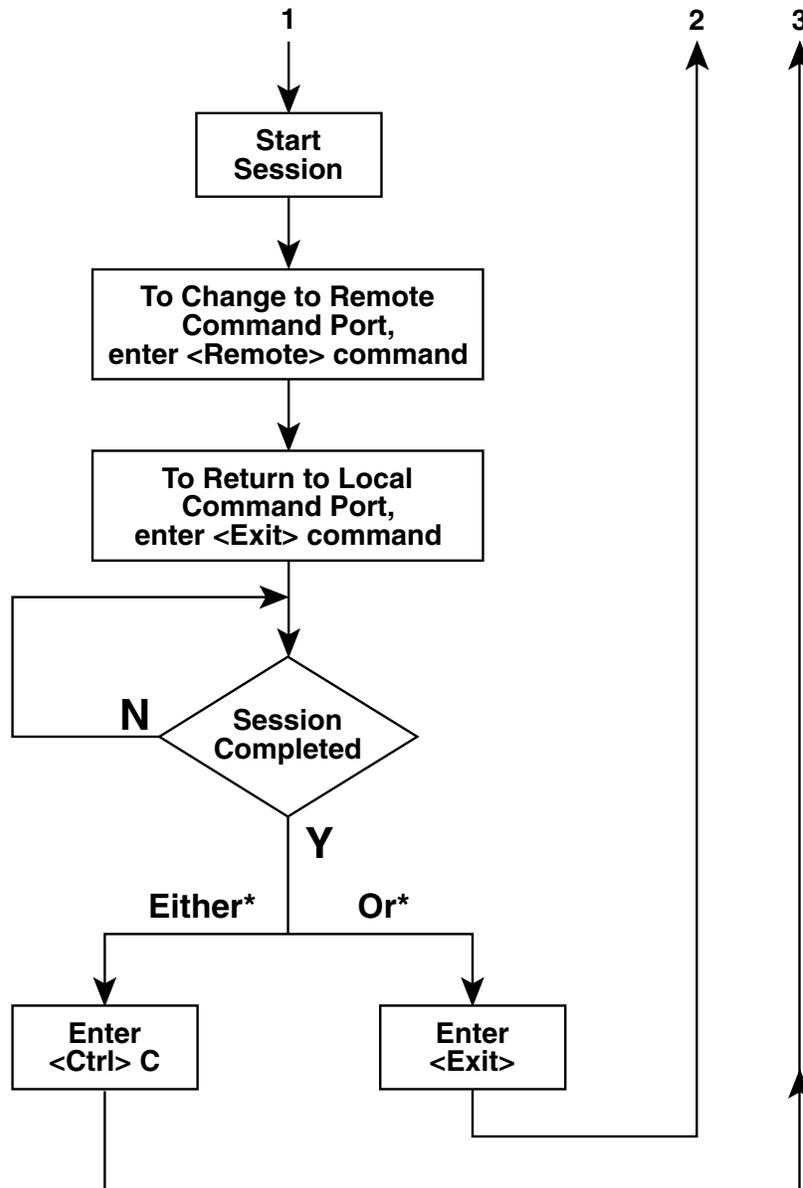


Figure 5-7. Flowchart for Accessing the Command Port.



* If daisy chaining or reconfiguring Command Port, enter <Ctrl> C to end session. Otherwise, enter <exit>.

Figure 5-7. Flowchart for Accessing the Command Port (continued).

When you type a command, you need only type the first few unique letters. In the lists of commands in this manual, the capitalized part of a command is the minimum you must type for the Multiserver to recognize it.

Configuring the Prompt

When you first turn on the Multiserver 500, the following prompt will appear on the terminal screen: `>`.

You can change the prompt to whatever you like. To change it to “Multiserver 500>,” enter:

```
UNit PRompt = Multiserver 500 <CR>
```

The prompt will change to:

```
Multiserver 500>
```

The prompt thus configured becomes automatically active for the duration of the session. You can make this permanent by issuing a `SAve` command.

List of Commands

To get a list of commands, enter a question mark (?) followed by a `<cr>`.

```
Multiserver 500>?<cr>
```

The following list will appear:

Command	Function
<code>Alnterface*</code>	Configures the analog interface portion of the voice/fax parameters.
<code>ASyncport*</code>	Configures the async data port parameters.
<code>CMDport*</code>	Configures the Command Port's parameters.
<code>COMPositelink*</code>	Configures the composite link parameters.
<code><Ctrl>C</code>	Terminates all command sessions.
<code>DAtaport*</code>	Configures the data port type and controls.

Command	Function
---------	----------

<code>Dlagnostics*</code>	Performs diagnostic tests.
<code>Exit</code>	Terminates the current command session.
<code>LOAd</code>	Sets parameters to factory-default values or last saved configuration values.
<code>Remote</code>	Accesses remote Command Port.
<code>SAve</code>	Command to save modified configuration in EEPROM (non-volatile memory), replacing the default parameters. Command will take effect after unit is reset.
<code>SHow*</code>	Displays selected information such as status and statistics.
<code>SYncport*</code>	Configures parameters for the sync data port.
<code>Unit*</code>	Changes system-level parameters.
<code>Voicport*</code>	Configures the digital portion of the voice/fax parameters.

How to Enter Commands and Set Parameters

There are no menus when you use the command port. Instead, you enter a command or a string of commands that are specific to the parameter (or parameters) you intend to set or change, bypassing all intermediate steps.

- Commands are not case-sensitive.
 - The upper-case letters shown in the list of commands are for your information only. They indicate the minimum number of characters required to execute that command.
 - Commands that require parameters are followed by an asterisk (*). For more information about a specific command's parameters, type the command name, followed by a space, followed by a ?.
- Example: `>DA ? (Data port)`.
- A command without an asterisk will not display

* For these commands, you must enter parameters. To get a display of parameters available under each command, type in the command name, followed by a space, followed by a question mark (?), followed by `<cr>`. For example, to get the sync port parameters, type `SY ?<cr>`.

more information, but will be executed when entered.

- Parameters of the same command may be chained together as a single entry, with each parameter separated by a space. The chain cannot exceed 80 characters, including spaces.

Example: to configure CTS and DSR in the data port async channel, you could enter the following string: `data=as cts=on dsr=on`. (NOTE: The equal sign = may be replaced by a space.)

List of Parameters

Following is a list of parameters associated with each of the commands marked with an asterisk in the list of commands.

AInterface

INput_gain (dB)	-6 through 22
Output_Attn (dB)	0 through 28
OPeration (E&M)	2_wire, 4_wire
Signalling_format (E&M)	DC, AC-15, Pulsed_DC
IMpedance	600 ohms, Complex
RINGTYPE (FXS)	2-4_interrupted, 1-2_interrupted
RINGFreq (FXS)	25_Hz, 50_Hz
Extra_gain (E&M 4-wire)	None, 7 dB

Example: `>AI IN=-6 OUT=4 RING T=2-4 IMP=600<cr>` will set the FXS input gain to -6 dB, the output attenuation to 4, the ringing type to 2-4, and the line impedance to 600 Ω

NOTE: If your equipment is operated in the U.S.A. or Canada, input and output levels must be set to 0 dB. In other countries, follow the standards of the country wherein the equipment is used. If there are no specific standards, set the input and output levels of your equipment to match the interfacing telephone equipment.

Be sure to separate each command in the string by

a space.

The parameters above become effective immediately when entered, but are not stored in EEPROM (nonvolatile memory) until saved. To save the newly set parameters in EEPROM, type `>SA <cr>`.

ASyncport

Rate (bps)	1200, 2400, 3600, 4800, 7200, 9600, 14400, 19200, 28800, 38400, 57600
Data_bit	8, 7
Stop	1, 1.5, 2
Parity	None, Even, Odd, Mark, Space
Flow_control	None, Xon/Xoff, CTS/RTS
Echo	Disable/Enable

Example: `>AS RA=7200 D=7 P=O <cr>` will set the async channel rate to 7200 bps, the number of data bits 7, and parity to odd.

Be sure to separate each command in the string with a space.

To save the newly set parameters in EEPROM, type `>SA <cr>`.

CMD port

Rate (bps)	AUTO*, 1200, 2400, 4800, 9600, 19200
Data_bit	8, 7 (Does not include parity bit)
Stop	1, 1.5, 2
Parity	None, Even, Odd, Mark, Space
Flow_control	None, Xon/Xoff
Echo	Enable, Disable

* The Automatic baud rate option is available only to terminals that use an 8-bit, no parity, 1 stop bit format.

Device Number: 0 through 8

Example: >CMD RA=9600 will set the Command Port rate to 9600.

Be sure to separate each command in the string by a space. To save the newly set parameters in EEPROM, type >SA <cr>.

COMpositelink

Clock External, Internal

Rate (bps) 7200, 9600, 14400, 19200, 38400, 56000, 64000, 72000

Example: >COM CL=EX RA=56000 <cr>, will set the composite port clock to external, and the rate to 56,000 bps. Rate selection applies to internal clock only.

Be sure to separate each command in the string by a space. To save the newly set parameters in EEPROM, type >SA <cr>

DAtaport

Use this command to select the data port type and parameters that are common to both the synchronous and asynchronous data channels. Parameters that are unique to the synchronous and asynchronous channels are set by separate commands for each type.

Type	Asynchronous, Synchronous
CTS	ON, OFF, Local (Follows local RTS)
CTSDelay	None, 25, 75, 100, 125, 150 in msec
DCD	ON, OFF, Remote (follows remote RTS)
DSR	ON, OFF, Remote (follows remote DTR)
RI	ON, OFF, Link (follows link status)

Example: >DA TY=SY RI=OFF will set the data port type to synchronous, and the ring indicator to off.

Be sure to separate each command in the string

by a space. To save the newly set parameters in EEPROM, type >SA <cr>.

DIagnostics

SElftest	Initiates a self-test
EEprom	Initiates a nonvolatile RAM check
LOCComp	Initiates a local composite loopback
REMCComp	Initiates a remote composite loopback
LOCDat	Initiates a local data channel loopback
REMDat	Initiates a remote data channel loopback
TErminate	Terminates test in progress, such as self- test or loopback

Example: To initiate a remote-data-channel loopback test, type: >DI REMD <cr>.

SHow

DATE Displays today's date

Example: >SH DATE 03/11/94

Status Displays Multiserver 500's current general status, including self-test, loopback, and hardware type and revision.

Example: >SH S

System Status: 20 MHz DSP, 64K RAM,
no download capability

Main module 001 Voice & Data

Revision Level: B

Voice/Fax Interface Module: 002

Revision Level: 03

Interface Type: Enhanced FXS, Loop
start.

Serial Module 001 Voice & Data

Revision Level: B

Serial Module Type: Standard

Self-Test passed, EEPROM passed, No active loopback

COMposite Displays the current status of the composite link, including rate, clock, and link.

Example: >SH COMP

COMPOSITE LINK STATUS

Link Up, External Clock Rate = 19200

VOice Displays the current status of the voice/fax channel, including rate, on-hook/off-hook, input/output levels, etc.

Example: >SH VO

Voice Channel Status

Local = on-hook, Remote = on-hook,

Level In = 0, Level Out = 0

Algorithm rate = 16000,

Algorithm ver. = 0,

Analog interface Status:

Interface Type = Enhanced FXS,

PROM version = 2A, PROM I.D. = 2196

DATA Displays the current EIA status of the data channel, including type, rate, flow control and EIA signal status.

Example: >SH DATA

Data Channel Status:

EIA SIGNAL

Input:

UNA = OFF, B0 = OFF, RTS = OFF,

DTR = OFF

Output:

DCD = OFF, RI = OFF, CTS = ON

DSR = OFF, for Synchronous Data:

Synchronous Tx Data Rate = 56000,

Rx Data Rate = 56000 for Asynchronous Data:

Asynchronous data rate = 9600, flow control = OFF

Time Displays current time

Example: >SH T

02:59:37

VErsion Displays the current software revision.

Example: >SH VE

Software Revision: 907-2200-0

CONfiguration Displays the current configuration of the data channel, Command Port, composite link, voice/fax channel, and the analog interface portion of the voice/fax channel. See the explanation below.

Example: >SH CON

Data Channel configuration

Type = Asynchronous, CTS = ON, CTSDelay = None, DCD = Remote rts, DSR = Remote dtr, RI = Link status, Rate = 9600, Data_bit = 8, Stop = 1, Parity = None, Flow_control = None, Echo = Disable

Command port configuration

device number = 1, Rate = 9600, Data_bit = 8, Stop = 1, Parity = None, Flow_control = None, Echo =

Enable

Voice Channel configuration

BUSYstate = SYStem,

BACKground = Silence, FAX = Disable,
NLP = Enable

Composite Link configuration

Clock = External, Rate = 9600

Analog Interface configuration

INput_gain(dB) = 0, Output_attn

(dB) = 0, RINGType =
2-4_interrupted,

RINGFreq = 25_Hz,

IMpedance = 600 Ohms

Unlike SHow CONfiguration, SHow DATA always displays the parameters currently stored in EEPROM (nonvolatile memory).

To activate the newly set configuration, type >U R <cr> (unit reset).

This message might appear:

Data and composite parameters effective after unit reset.

When that message appears, the data and composite parameters displayed have been recently modified but not made effective. After you use the save command and reset the unit, the modified parameters will be stored in EEPROM (nonvolatile memory) and the message above will disappear. Unlike data and composite parameters, voice and analog parameters take effect immediately when you enter them.

SYnc port

Rate* or Maxrate (bps): 1200, 2400, 3600, 4800,
7200, 9600, 12000,
14400, 19200, 28800,
33600, 38400, 46400,
48000, 51200, 56000,
57600, 64000, 72000

Tx clock Internal/External

*Guaranteed rate.

DBA

OFF, SILENCE, HOOK

Example: >SY RA=38400 MAX=56000
DBA=HOOK <cr> will set the sync channel minimum rate to 38,400 bps, maximum rate to 56,000 bps, and DBA (dynamic bandwidth allocation) will follow the on-hook/off-hook state of the voice/fax channel.

Be sure to separate each command in the string by a space.

To save the newly set parameters in EEPROM, type >SA <cr>. To activate the newly set parameters, type: >U R <cr> (unit reset).

Unit

Available parameters are:

Date, Reset, Time, PAssword, PRompt

When you enter the parameters listed above, they take effect immediately. Date and time cannot be saved and will be lost when power is disconnected. You must save password and prompt in order for them to remain in effect after a power off/on cycle.

VOice Port

BUsy State OFF, ON, SYstem

BACKground Silence, Regenerated

Fax Disable, Enable

NLP† Disable, Enable

Example: >BUSy SY will set the busy state to system-controlled.

Be sure to separate each command in the string by a space. The above parameters become effective immediately when entered, but are not stored in EEPROM (nonvolatile memory) until saved. To save the newly set parameters in EEPROM, type >SA <cr>.

†NLP = Non-Linear Processing.

6. Operation

This section describes how the Multiserver 500 works. Indicators are described first, followed by procedures for transmitting data, making telephone calls, and sending fax messages.

6.1 LED Indicators

LED indicators are on the front panel of the Multiserver 500, as shown in Figure 6-1. Their functions are summarized in Table 6-1.

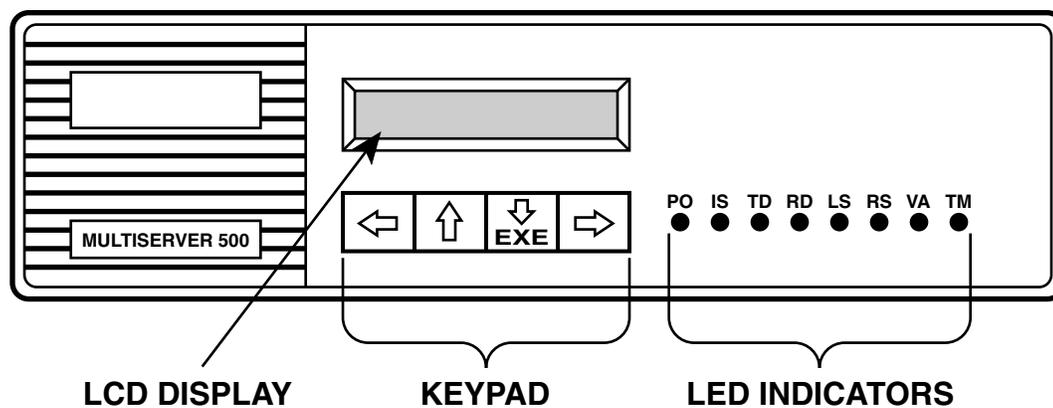


Figure 6-1. The Front Panel of the Multiserver 500.

Table 6-1. LED Indicators

Indicator	State	Meaning
PO (Power On)	On	Unit is powered up and has passed the self-test.
	Off	Power is off.
	Flashing	Self-test failed.
IS (In Sync)	On	The local Multiserver 500 is in sync with the remote Multiserver 500.
	Off	The local and remote Multiserver 500s are out of sync.
TD (Transmit Data)	Flickering	Data channel is transmitting data.
	Off	Data channel is not transmitting.
RD (Receive Data)	Flickering	Data channel is receiving data.
	Off	Data channel is not receiving data.
LS (Local Speech)	On	Speech signal from local telephone interface present.
	Off	No local speech present.
RS (Remote Speech)	On	Speech signal from remote telephone interface present.
	Off	No remote speech present.
VA (Voice Active)	On	Voice channel is active.
	Off	Voice channel is idle.
	Flashing	Voice channel is busy.
TM (Test Mode)	On	Multiserver 500 is in test mode.
	Off	Multiserver 500 is not in test mode.
	Flashing	Test failure.

6.2 The LCD and the Keypad

The two-line LCD (Liquid-Crystal Display) shows configuration menus, diagnostic test menus and results, time of day, and system status. A keypad lets you cycle through the LCD menu and make configuration selections. **Chapter 5** explains how to use the LCD and keypad.

6.3 Default Configuration Settings

When the Multiserver 500 is first turned on, the interfaces are configured with the following default values:

Analog Interface

Input Gain:	0 dB*
Output Attenuation:	0 dB*
Operation (E&M):	4-wire
Signaling Format (E&M)	DC
Impedance:	600 Ohms
Ringing Type (FXS)	2-4 interrupted
Ringing Frequency (FXS):	25 Hz
Extra Gain (E&M 4-wire):	None

CMDport

Rate	AUTO
Data bit	8
Stop	1
Parity	None
Flow control	None
Echo	Enable

COMpositelink

Clock	External
Rate	9600

DAtaport

Type:	Synchronous
CTS:	ON
CTSDelay:	None
DCD:	ON
DSR:	ON
RI:	Link status

ASyncport

Rate:	1200 bps
Data bit:	8
Stop:	1
Parity:	None
Flow control:	None
Echo:	Disable

SYncport

Rate:	1200 bps
Maxrate:	72,000 bps
Txclock	Internal
DBA	OFF

* If you operate your equipment in the U.S.A. or Canada, input gain and output attenuation levels must be set to 0 dB. In other countries, follow the standards of the country where the equipment is used. If there are no specific standards, set the input and output levels of your equipment to match the interfacing telephone equipment.

Voiceport

BUSYstate	SYStem
BACKground	Silence
FAX	Enable
NLP	Enable

You can change the default values either from the LCD/keypad (refer to **Chapter 5**) or from the Command Port (refer to **Chapter 6**).

6.4 Operating the Multiserver 500

NOTE: If link rate is less than the configured maximum rate, the maximum rate need not be reconfigured.

6.4.1 ESTABLISH A DATA CONNECTION

1. Connect a synchronous or asynchronous terminal, as applicable, to the DATA CHANNEL connector at the rear of the Multiserver 500. Use the appropriate straight cable as described in **Section F.2** in **Appendix F**.
2. Make sure that the Multiserver 500 is configured to meet the requirements of the data source. If not, reconfigure from either the LCD/keypad (refer to **Chapter 5**) or the Command Port (refer to **Chapter 6**). You can check the current configuration values with a SHOW CONFIGURATION command from the Command Port terminal, or by entering the STATUS CONFIGURATION menu from the LCD/keypad.
3. Enter data from the keypad on the data terminal.

Notes About the Data Channel

When the data channel is synchronous, you may configure it for either fixed or dynamic bandwidth allocation.

Fixed bandwidth allocation means that the channel always operates at a fixed rate as specified by the configured “rate” parameter.

In *dynamic bandwidth allocation*, two rate parameters are specified: “rate” and “maximum rate.” “Maximum rate” is the amount of link bandwidth allocated to the synchronous data channel when the voice channel is not in use. When the voice channel is in use, the synchronous data channel automatically drops down to the “rate” value, a guaranteed value of bandwidth allocation. Once the voice channel is no longer in use, data-channel bandwidth allocation returns to the maximum value.

There are two ways to define when the voice channel is in use: silence and hook.

When you select *hook*, the voice channel is considered to be in use as soon as a voice (or fax) connection is established, and will continue to be in use until both sides hang up.

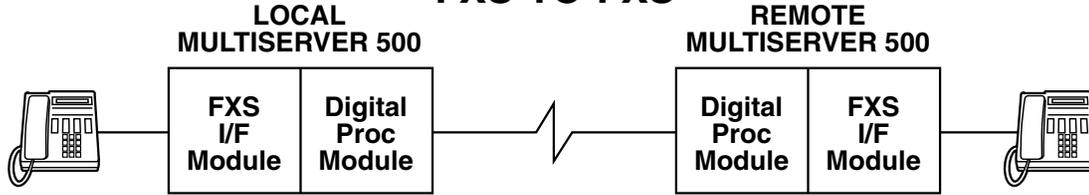
When you select *silence*, the voice channel is considered to be in use only while voice or fax traffic is in progress, and only in the direction of the traffic. In that direction the bandwidth of the synchronous data channel will drop from the “maximum rate” to the guaranteed “rate” speed.

6.4.2 TO MAKE A TELEPHONE CALL

Your Multiserver 500 voice/fax channel is dedicated for operation with a compatible voice/fax channel installed at the remote Multiserver 500. Making a telephone call depends on the type of voice/fax interface module installed at each end. It may be as simple as lifting the telephone off-hook (FXS-to-FXS) and waiting until the other party answers, or lifting the telephone and dialing if either end is fitted with an FXO or E&M voice/fax interface module.

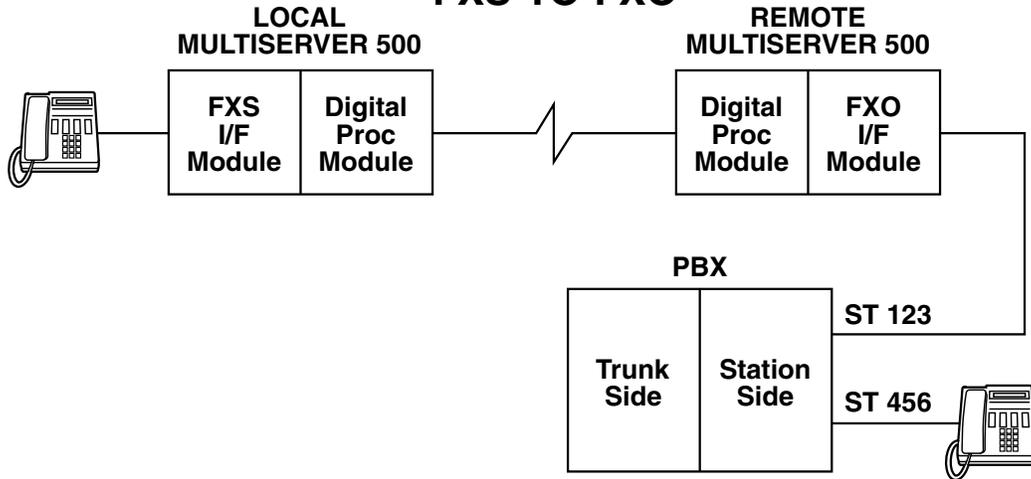
Figure 6-2 shows the steps involved in making a telephone call when the Multiserver 500 at the local end is fitted with an FXS voice/fax interface module. Figure 6-3 shows the steps involved when the Multiserver 500 at the local end is fitted with either an FXO or E&M interface module.

FXS-TO-FXS



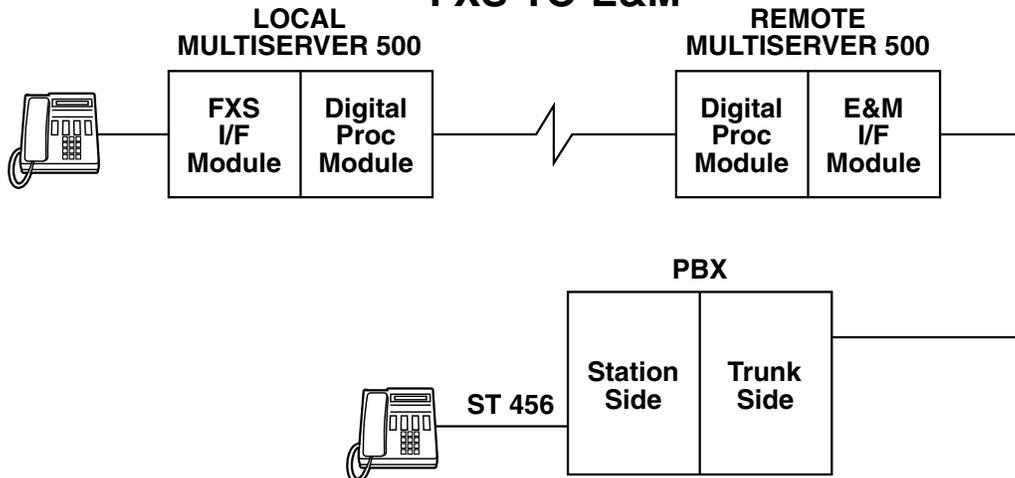
Lift telephone and speak when other party answers.

FXS-TO-FXO



Lift telephone. Wait for dial tone from PBX. Dial 456, speak when other party answers.

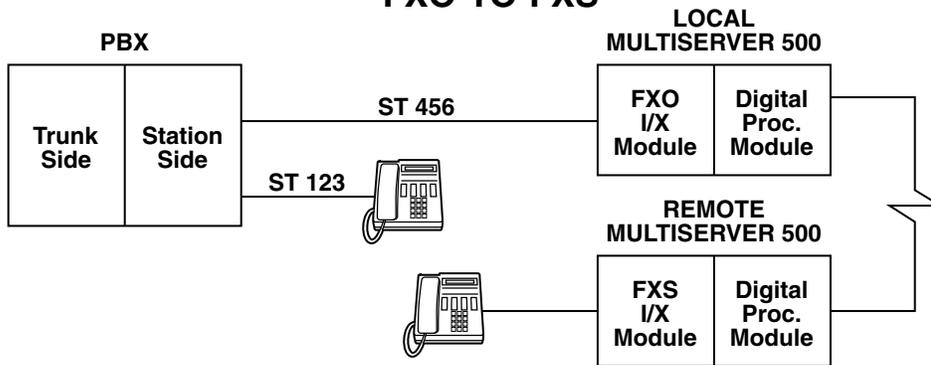
FXS-TO-E&M



Lift telephone. Wait for dial tone from PBX. Dial 456. Speak when other party answers.

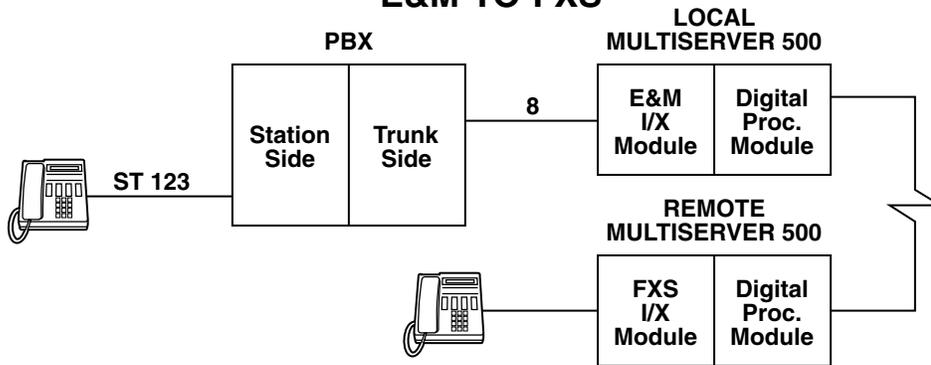
Figure 6-2. Telephone Calls from Local FXS Interfaces.

FXO-TO-FXS



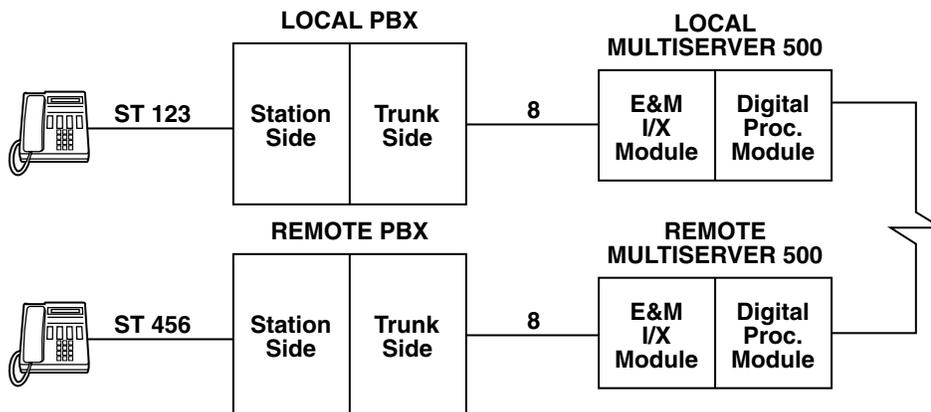
Lift telephone at local station 123. Wait for dial tone from PBX. Dial 456. Speak when other party answers.

E&M-TO-FXS



Lift telephone at local station 123. Wait for dial tone. Dial access code 8. Speak when other party answers.

E&M-TO-E&M



Lift telephone at local station 123. Wait for dial tone from local PBX. Dial access code 8. Wait for dial tone from remote PBX. Dial station 456. Speak when the other party answers.

Figure 6-3. Telephone Calls from Local FXO or E&M Interfaces.

Notes About Voice/Fax Channel Parameters

- Voice/fax channel parameters are configured using two separate commands (from the Command Port) or two separate menus (from the LCD/keypad): Voice Channel and Analog Interface.
- The voice/fax channel digitization rate is determined by the setting of the data channel rate. It is assigned the highest fixed rate within the available bandwidth. Available bandwidth equals composite rate minus guaranteed sync channel rate minus overhead. Overhead is 400 bps for composite rates of less than 56 Kbps, and 800 bps for composite rates of 56 Kbps and above.

6.4.3 TO SEND A FAX MESSAGE

Any voice application shown in Figures 6-1 and 6-2 works for fax transmission simply by replacing the telephone sets with fax machines. Make sure both fax machines are powered up and programmed for auto-answer. Then:

1. At the end from where you intend to initiate the fax message, insert the paper, place the fax machine off-hook, dial the number of the remote fax machine (if applicable), and press the START (or SEND) button on the fax machine. Send the fax as you normally would.
2. At the completion of the fax transmission, the voice/fax channel will return to the voice mode.

7. Diagnostics and Troubleshooting

You can use two Multiserver 500s as a diagnostics tool. Simply connect two Multiserver 500s back to back and bench-test them. To do this, set both muxes to internal clock and select a composite clock rate. Once you've selected a composite clock rate, you must set both the local and remote muxes to the same rate. The procedure is as follows (see Figure 7-1):

1. Connect a crossover cable between the COMPOSITE connectors of the two units.
2. Set the clock rate (9600) of the local unit:


```
>COM C=I R=9600 <cr>
```
3. Save the clock rate.


```
>SA
```
4. At the remote unit, repeat steps 2 and 3.

NOTE: Both Multiserver 500s must be set to the same composite clock rate. Otherwise, the system will lock up.

Other diagnostic tests are built into the Multiserver. In addition to the user-initiated tests, the Multiserver 500 undergoes an automatic self-test during power-up.

7.1 Automatic Self-Test

This is a series of tests performed in the following sequence:

- DSP Test
- Checksum Test
- RAM Test
- Composite Loopback Test
- Data Channel Loopback Test

If the DSP test fails, all LEDs will turn on and the unit will remain in this loop. If any other test fails, the TM indicator will flash, and the nature of the problem will be displayed on the LCD.

7.2 User-Initiated Tests

As an aid to installation and fault isolation, the Multiserver 500 incorporates a set of user-initiated diagnostic tests: self-test, local and remote data loopback, local and remote voice/fax loopback, and local and remote composite loopback. You can start these tests either from the LCD/keypad or from an asynchronous terminal connected to the CMD IN (Command Port) connector.

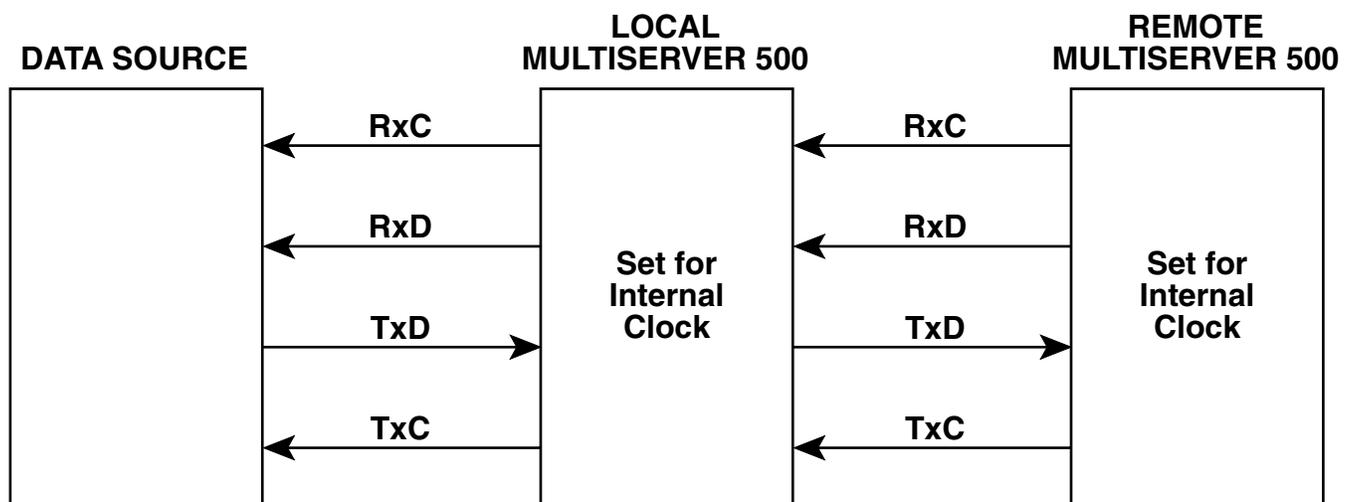


Figure 7-1. Clocking, with Multiserver 500s Connected in a Back-to-Back Hookup.

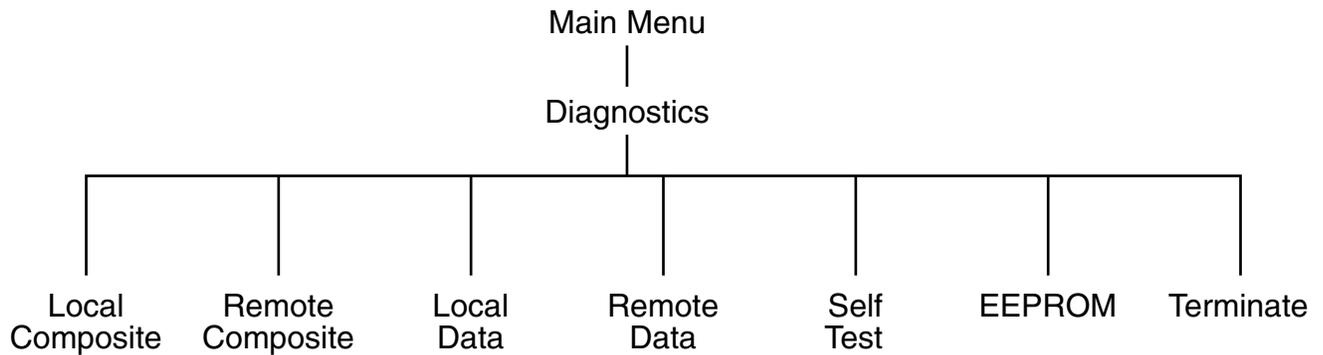


Figure 7-2. Tests in the Diagnostics Menu.

From the LCD/keypad, follow the path in Figure 7-2 to get the available options and select the appropriate test:

From the Command Port terminal, enter:

```
>DI=? <cr>
```

A help screen will appear:

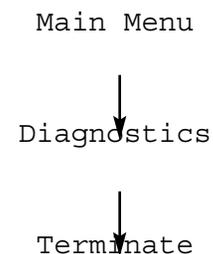
SElftest	Perform built in self test.
EEprom	Check NV RAM (active parameters are saved)
LOCComp	Set up for Local Composite Loopback test.
REMCComp	Set up for Remote Composite Loopback test.
LOCDat	Set up for Local Data Loopback test.
REMDat	Set up for Remote Data Loopback test.
TErminate	Terminate current test.

NOTE: If you have selected the self-test, local and remote data loopback tests, or local composite loopback test, the test will stay on until you terminate it. EEPROM and remote composite loopback are timer-controlled tests, and will terminate automatically when the time expires. You cannot initiate another test while the present test is in progress.

To terminate a test from the Command Port, enter:

```
>DI TErminate.
```

To terminate a test from the LCD/keypad, follow this path:



7.2.1 SUGGESTED TEST SEQUENCE

This is a suggested sequence for testing the Multiserver 500.

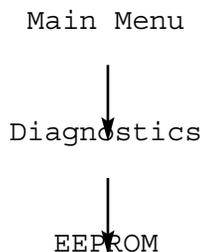
1. Perform the EEPROM test. If it passes, it verifies that the Multiserver 500 can store and retrieve data from the EEPROM.
2. Perform the Self-Test. If this test passes, the internal circuits of the local Multiserver 500 are operating properly.
3. Perform the Local Data Loopback Test. If this test passes, the data portion of the local serial interface module is operating properly.
4. Perform the Local Composite Loopback Test. This test verifies that the Multiserver 500 can digitize voice as well as multiplex data and voice.
5. Perform the Remote Composite Loopback Test. If this test passes, it verifies that the link is operational, that the local and remote Multiserver 500s can sync up, and that the remote Multiserver 500 responds to commands issued by the local Multiserver 500.
6. Perform the Remote Data Loopback Test. With the link up and running, this test can be used any time if a problem is encountered along the data channel. Since this test does not interfere with normal voice traffic, the voice/fax channel may be used by the operators at each end to compare test results.

7.2.2 EEPROM TEST

To perform the EEPROM test from the asynchronous terminal connected to the Command Port connector, enter:

```
>DI EE <cr>.
```

To perform the EEPROM test from the LCD/keypad, follow this path.



NOTE: Do not invoke any commands until the EEPROM test is completed.

The test will last approximately 5 seconds, and the TM LED will be on for the duration of the test.

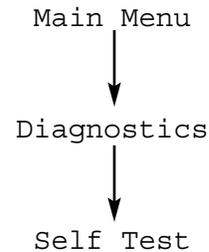
7.2.3 SELF-TEST

You can initiate the self-test from the Command Port menu. Its structure is similar to the automatic self-test, except that it runs in the background.

To perform the self-test from the asynchronous terminal connected to the Command Port, enter:

```
>DI SELftest <cr>.
```

To perform the self-test from the LCD/keypad, follow this path.



Test results are evaluated as follows:

If the DSP test fails, the TM LED will flash. For other test results, access the self-test portion of the STATUS menu from the LCD/keypad, or enter the command SH S from the Command Port terminal.

7.2.4 LOCAL DATA LOOPBACK TEST

The local data loopback verifies that the serial interface module circuits are capable of bidirectionally processing user data. There is no internal data source included and the remote data channel is not operational during this test.

To run the test, see Figure 7-3 and proceed as follows:

1. Connect an asynchronous terminal to the DATA CHANNEL connector of the Multiserver 500.

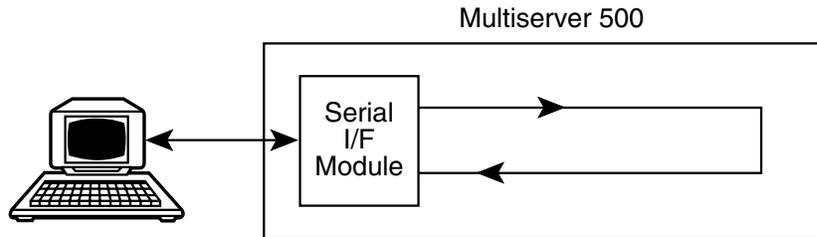


Figure 7-3. Local Data Loopback Test.

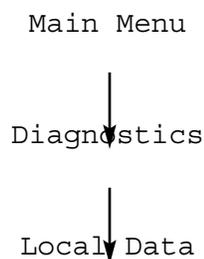
2. Configure the asynchronous channel to match your terminal equipment. Refer to **Chapter 4** or **Chapter 5** for configuration details.
3. Put the Multiserver 500 into local data loopback:

- a. From the Command Port, enter:

>DI LOCD <cr>

or

- b. From the LCD/keypad, select from the diagnostic menu:



4. Verify that the TM indicator light goes on.
5. Type any data on the terminal connected in step 1, and verify that the data is echoed back as typed.
6. Terminate the local data loopback test as described in **Section 7.2**. Verify that the TM indicator light goes off.

7.2.5 LOCAL COMPOSITE LOOPBACK TEST

The main purpose of the local composite loopback test is to verify that the Multiserver 500 is capable of multiplexing voice and data—and to produce a composite stream for transmission to the remote end.

In addition, the local composite loopback test verifies the proper operation of the local voice/fax digitizer.

Test Setup and Signal Flow

Depending on the voice/fax interface module type installed in your Multiserver 500, the local composite loopback test may involve three different setups: FXS, E&M, and FXO. Figure 7-4 shows the test setup and signal flow in a local composite loopback test for a Multiserver 500 fitted with an FXS type voice/fax interface module. See “Notes on FXO and E&M Interfaces” (page 53).

Procedure

1. Connect an asynchronous terminal to the DATA CHANNEL connector of the Multiserver 500.
2. Configure the data channel for asynchronous. Configure the asynchronous channel to match your terminal equipment. Refer to **Chapter 4** or **Chapter 5** for configuration details.
3. Connect a telephone set to the FXS connector on the voice/fax interface module.
4. Put the Multiserver 500 into local composite loopback:

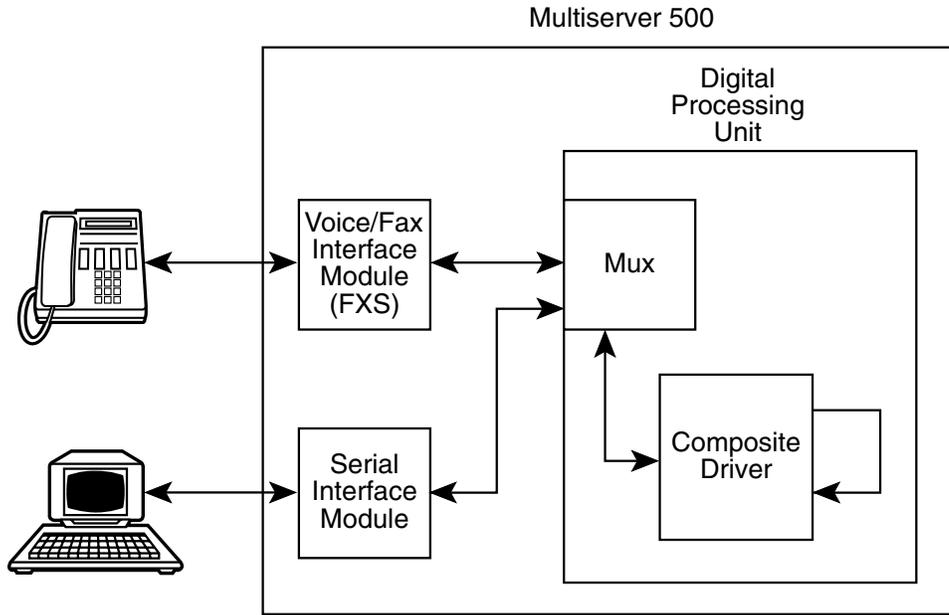


Figure 7-4. Local Composite Loopback Test.

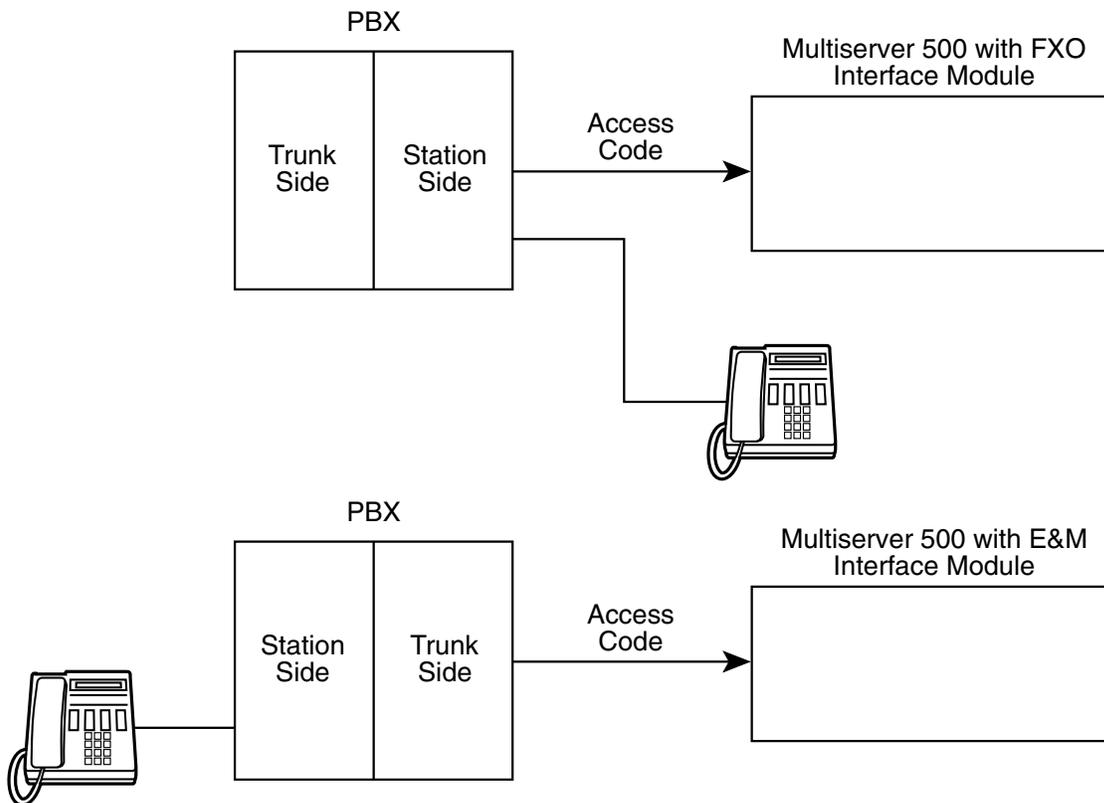


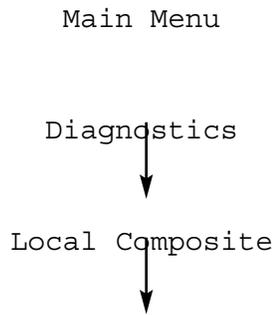
Figure 7-5. FXO and E&M Voice/Fax Connections

a. From the Command Port, enter:

```
>DI LOCComp <cr>
```

or

b. From the LCD/keypad, select from the diagnostic menu as shown below:



5. Verify that the TM indicator light goes on.

6. Type any data on the terminal connected in step 1, and verify that the data is echoed back as typed.

7. Speak into the telephone. You should hear your own voice echoed back.

8. Terminate the local composite loopback test as described in **Section 7.2**. Verify that the TM indicator light goes off.

Notes on FXO and E&M Interfaces

Figure 7-5 shows the voice/fax connections for FXO and E&M type voice/fax interface modules; data connections are not repeated. If your Multiserver 500 is fitted with an FXO type voice/fax interface module, you must first dial the station number that connects to the Multiserver 500 in order to perform a voice test.

Similarly, if your Multiserver 500 is fitted with an E&M type voice/fax interface module, you must first dial the access code assigned to the Multiserver 500 in order to perform a voice test.

7.2.6 REMOTE COMPOSITE LOOPBACK TEST

The main purpose of the Remote Composite Loopback Test is to verify that the link is up and that the local and remote Multiserver 500s can synchronize and communicate. It is a timer-controlled test and will terminate automatically after approximately 30 seconds.

Test Setup and Signal Flow

Figure 7-6 shows the test setup and signal flow for Multiserver 500s with FXS interface in a Remote Composite Loopback Test. See Figure 7-5 for FXO and E&M voice/fax circuit details.

Procedure

1. Connect an asynchronous terminal to the DATA CHANNEL connector of the local Multiserver 500.
2. Configure the data channel for asynchronous. Configure the asynchronous channel to match your terminal equipment. Refer to **Chapter 4** or **Chapter 5** for configuration details.
3. Connect a telephone set to the FXS connector on the voice/fax interface module.

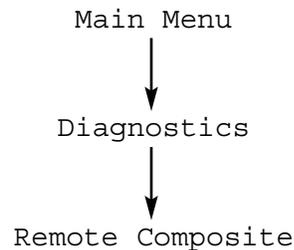
4. Put the Multiserver 500 into remote composite loopback. To do that,

- a. From the Command Port, enter:

```
>DI REMComp <cr>
```

or

- b. From the LCD/keypad, select from the Diagnostics menu as shown below:



5. Verify that the TM indicator light goes on.
6. Type any data on the terminal connected in step 1. Verify that the data is echoed back as typed.
7. Speak into the telephone. You should hear your own voice echoed back.
8. The test will expire in approximately 30 seconds and the TM indicator light will go off. If you need additional time to test the voice/fax and or the data channel, repeat step 4.

7.2.7 REMOTE DATA LOOPBACK

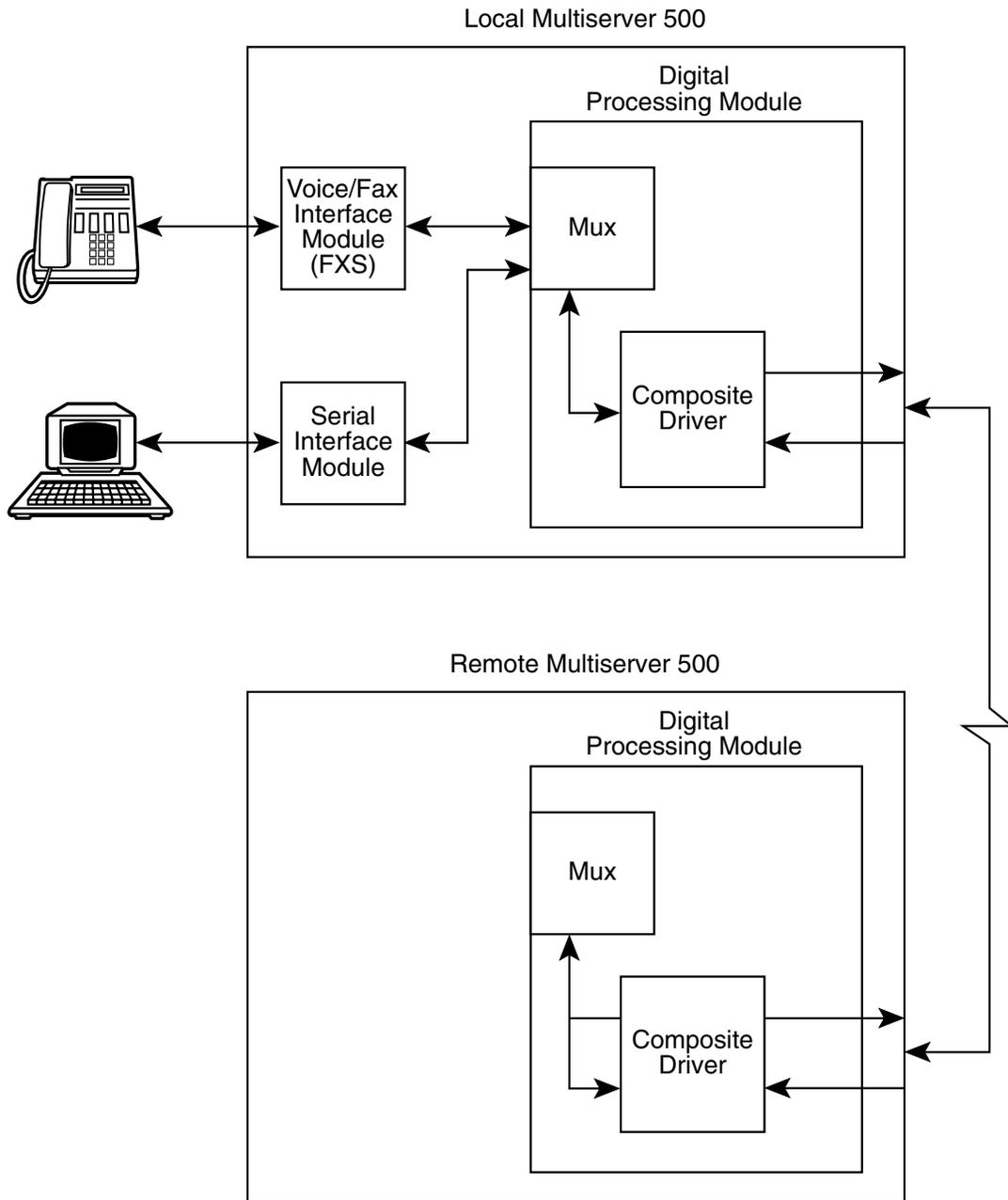


Figure 7-6. Setting Up a Remote Composite Loopback Test.

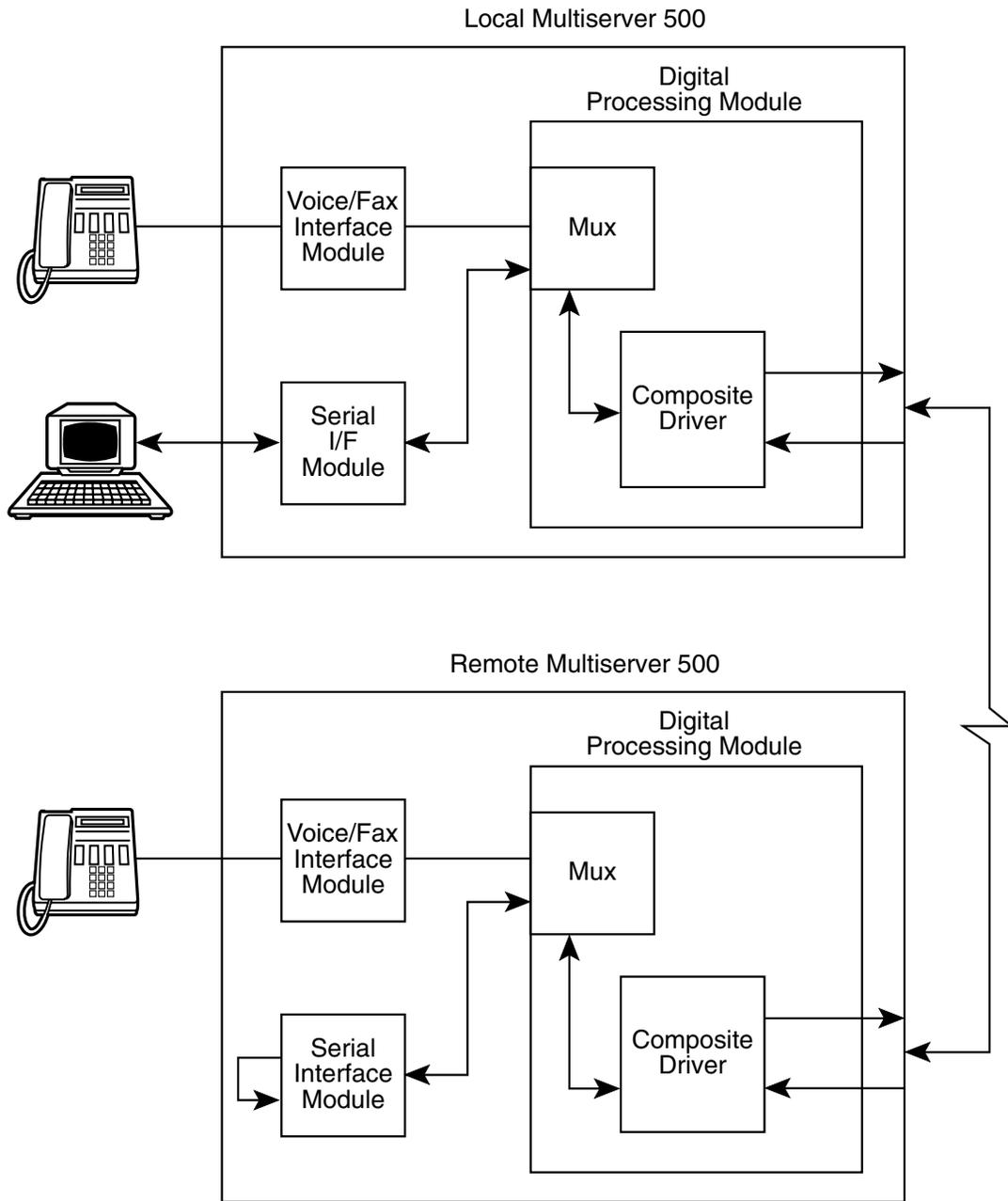


Figure 7-7. Setting Up a Remote Data Loopback Test.

The remote data loopback test examines the integrity of the data channel across the link. While this test is in progress, it does not affect the normal operation of the voice/fax channel, so you can use the voice/fax channel to talk about the quality of the data channel with someone at the other end. To run the test, see Figure 7-7 and proceed as follows:

1. Connect an asynchronous terminal to the DATA CHANNEL connector of the local Multiserver 500.
2. Configure the local data channel for asynchronous, and configure the asynchronous channel to match your terminal equipment. Refer to **Chapter 4** or **Chapter 5** for configuration details.
3. Have the remote operator configure his data channel and asynchronous channel.

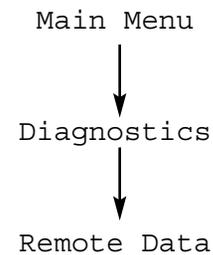
4. Put the Multiserver 500 into remote data loopback. To do this,

- a. From the Command Port, enter

```
>DI REMD <cr>
```

or

- b. From the LCD/keypad, enter through the Diagnostics menu as shown below:



5. Type any data on the terminal connected in step 1 and verify that the data is echoed back as typed.
6. Terminate the remote data loopback test as described in **Section 7.2**. Verify that the TM indicator light goes off.

Appendix A: FXS Voice/Fax Interface Module

The FXS Voice/Fax Interface Module provides ringing voltage and battery to the attached telephone equipment. It is normally used to connect the voice/fax channel directly to a telephone instrument or to the line side of a Key Telephone System or fax machine.

NOTE: The FXS voice/fax interface card is not registered with the FCC, so it cannot be connected to a public network.

Figure A-1 shows a typical FXS application. For clarity, the Multiserver 500 is represented by the FXS voice/fax interface cards.

There are two versions of the FXS Interface Card:

- **MX406C—FXS Standard Loop Start.** This model meets the safety requirements of North American regulatory agencies.
- **MX407C—Enhanced FXS Loop Start.** This model meets the safety requirements of all European and North American regulatory agencies.

A.1 Connectors on the Back Panel

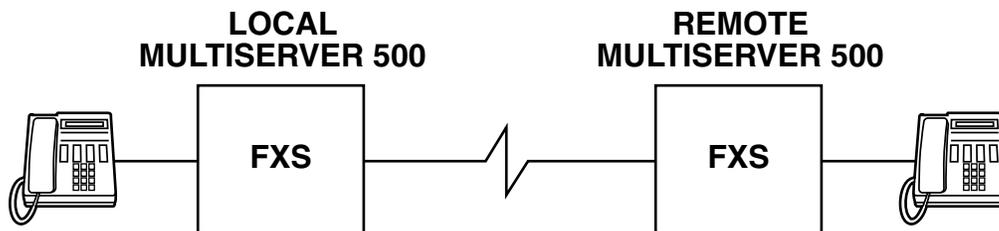


Figure A-1. A Typical FXS Application.

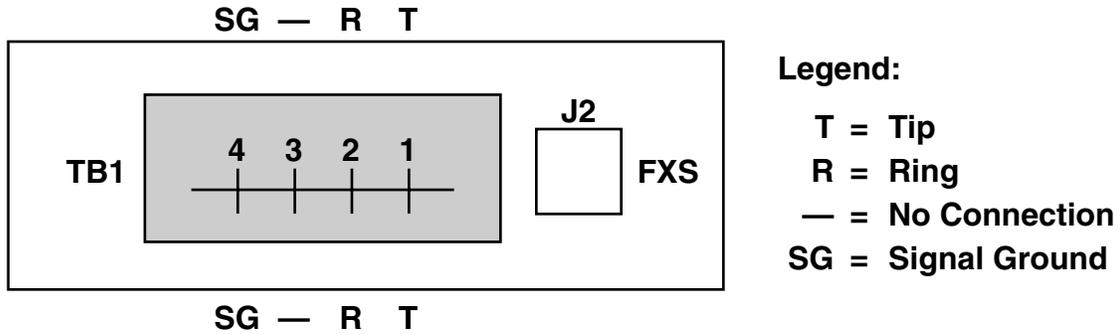


Figure A-2. Connectors on the Back Panel of the FXS Interface Module.

There are two connectors on the back panel of the FXS interface card: J2 and TB1 (see Figure A-2). J2, labeled “FXS,” is an RJ-11 modular connector used in most FXS-type applications. TB1 is an 4-pin terminal block that connects to a punch block. Both J2 and TB1 are shielded by a protective cover.

Connectors J2 and TB1 terminate the Tip (T) and Ring (R) leads in parallel, so that pins 2 and 3 of J2 are connected, respectively, to pins 1 and 2 of TB1 (see Figure A-3).

In most applications, use a modular cable (supplied) to connect the voice/fax channel to

telephone equipment. Connect one end of the cable to the FXS connector on the voice/fax interface card. Connect the other end to the telephone equipment.

If you are connecting to a punch block, use the terminal block (TB1). Use a cable with bare-wire leads (not included) to connect the terminal block and the punch block. The terminal block is fitted with a female plug that serves as a receptacle for the individual cable leads.

CAUTION!

Wiring to the trunk terminal block must

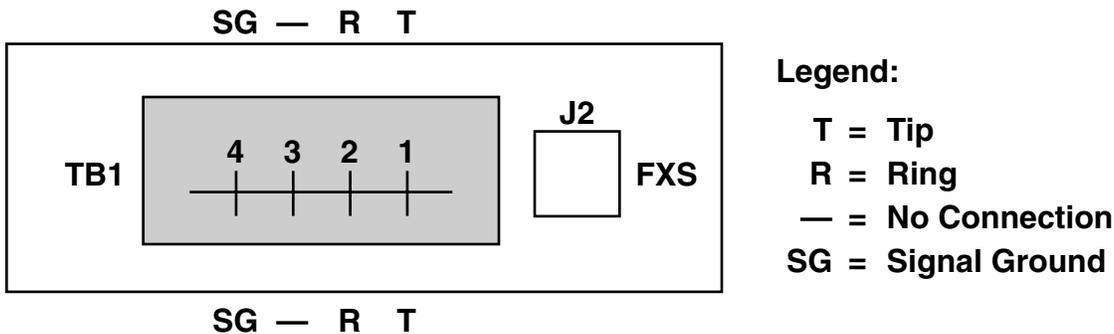


Figure A-3. Wiring of the Connectors on the Back Panel.

be carried out by a qualified technician. Wires used for this purpose must be UL® type CM, 22/24 AWG, 4-conductor.

Insert each cable lead into the cutout at the front of the plug and secure it at the top with a small flat-head screwdriver. We recommend that you color-code the cable leads for easy identification.

To make the connection, first remove the female plug. Then insert each cable lead into the cutout on the opening at the front of the plug, and secure it at the top with a screwdriver (see Figure A-4). Finally, reinsert the plug in the terminal block.

After you make the connection, install the connector cover: Insert the right tab of the cover in the retaining slot of the voice/fax interface card's

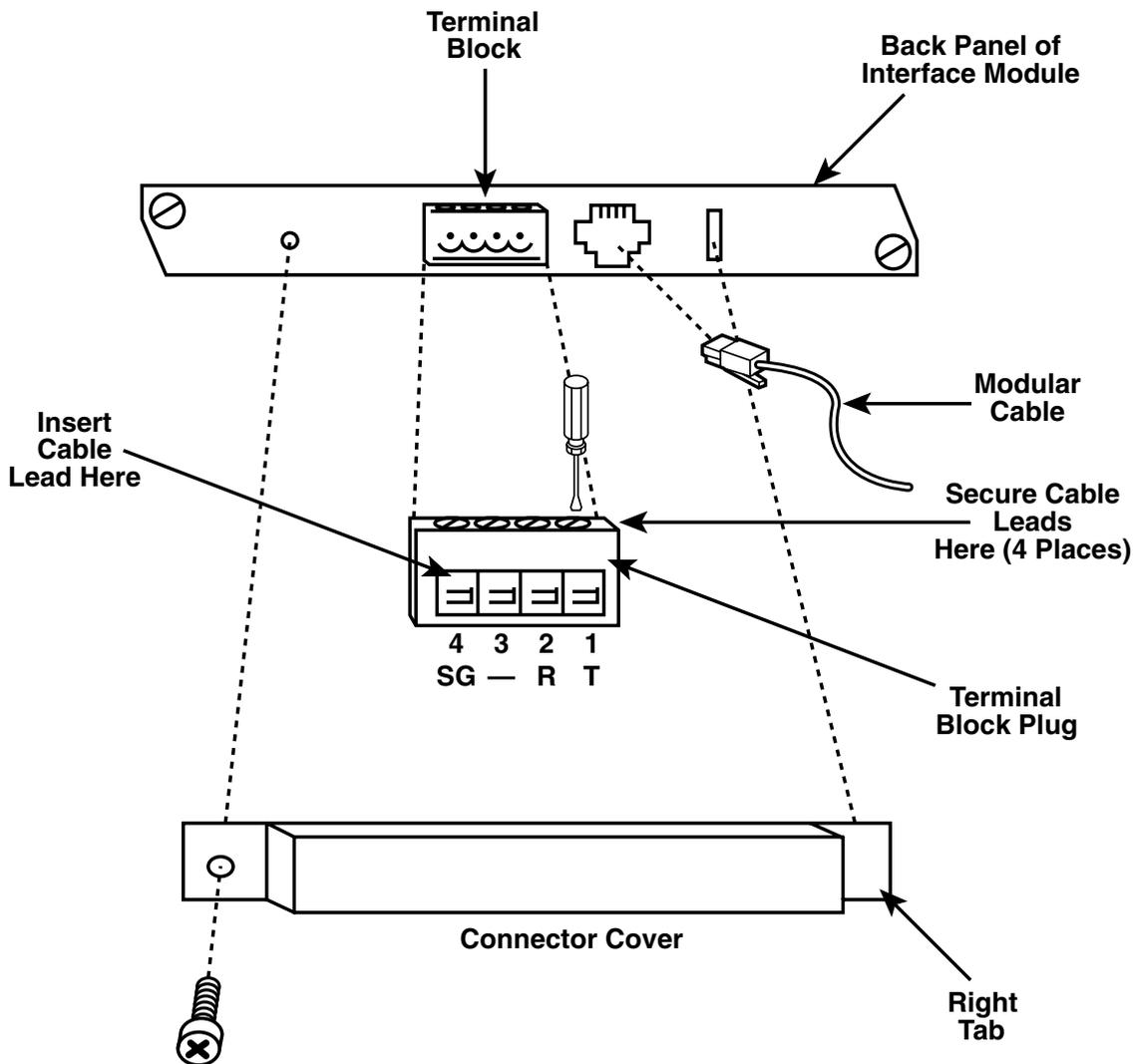


Figure A-4. Cable Connections.

back panel, then secure it on the left side with a Phillips-head screw.

A.2 Strapping

Do not alter any of the movable straps on the FXS Interface Module. They are set at the factory to match the type of memory installed, and changing the configuration could easily cause the Card to stop working altogether.

A.3 Removing or Replacing the Module

See **Section 3.4** for removal/replacement of the Multiserver 500 interface modules, including the FXS interface card.

A.4 Specifications

Signals Supported — Analog voice and Group 3 facsimile (fax)

Fax Signal Types: — V.21 channel 2, V.27 ter 2400, V.27 ter 4800, V.29 7200, and V.29 9600

Port Impedance —

Enhanced Model (software-selectable):

600 Ω (Default): Matches line impedance of 600 Ω in series with a 2.15- μ f capacitor

Complex: Matches line impedance of 370 Ω in series with a parallel network of a 0.31- μ f capacitor and a 620- Ω resistor

or

220 Ω in series with a parallel network of a 0.12- μ f capacitor and an 820- Ω resistor

Standard Model:

Fixed at 600 Ω in series with a 2.15- μ f capacitor

Insertion Loss — 2 dB nominal @ 1000 Hz (End-to-End) between Transmit and Receive of Port 1 and Transmit and Receive of Port 2. Example: Port 1 is FXS LS port and Port 2 is FXO LS port.

Port Return Loss — Echo: ≥ 22 dB; Singing: ≥ 18 dB; 200 to 3400 Hz: ≥ 16 dB

Longitudinal Balance — 200 to 1000 Hz: ≥ 58 dB; 1000 to 3400 Hz: ≥ 48 dB

Input and Output Level Adjustments — If you operate your equipment in the U.S.A. or

Canada, input gain and output attenuation are set at the factory to 0/0 dBm, and must not be changed. In other countries, follow the standards of the country where the equipment is used.

Maximum Input and Output Levels — 0 dBm

Frequency Response Over the Range of 300 Hz to 3400 Hz — +1 dB/-2 dB with respect to 1000 Hz

Idle Channel Noise — Inband, "C" Message: ≥ 20 dBrc; Psofometric: ≥ 60 dBmpo; Out of band, 10 KHz to 10 MHz Transverse or Longitudinal Noise: ≤ -70 dBm (enhanced models only)

Non-Linear Distortion (Multitone Signal) — Second Harmonic: ≥ 40 dB below signal; Third Harmonic: ≥ 40 dB below signal

Signal-to-Noise Ratio — ≥ 37 dB @ 1000 Hz

Echo Suppression — ≥ 35 dB

Echo Canceling — ≤ 16 ms (≤ 1000 km or 600 miles)

Crosstalk (near/far end) Between Channels — ≤ 75 dB

Signaling — Battery current into 130-W load: ≥ 36 milliamperes; Battery current into 900-W total loop: 20 milliamperes minimum

DC Loop Range — ≤ 900 Ω

DTMF Distortion (AC) — ≤ 1.5 %

DP Distortion — ≤ 2 %

Ring Tone (Software Selectable) — 20 Hz, 25 Hz (default), or 50 Hz

Ring Voltage (AC load of 2 ringers [4000 W] and zero line) — 25-Hz Tone: ≥ 54 Vrms ; 20- and 50-Hz Tones: ≥ 50 Vrms

Ring Current — ≤ 15 milliamperes into 5000- Ω load

Ring Cadence — Repeated ring (matches ringing cadence from remote voice/fax channel), interrupted ring 2/4 (2 seconds on, 4 seconds off), or interrupted ring 2/5 (ring two times for 0.4 separated by 0.2 second, then off for two seconds)

MULTISERVER 500

Size — 6.5"W × 6"D (16.5 × 15.2 cm)

Appendix B: FXO Voice/Fax Interface Module

The FXO Voice/Fax Interface Module normally attaches to the station side of a PBX or Central Office loop start equipment. It lets the PBX station or central office extend over the Multiserver 500 network to a remote site. Figure B-1 shows a typical FXO application. For clarity, the Multiserver 500 equipment is represented by the interface modules.

There are two versions of the FXO Voice/Fax

Interface Module:

- **MX403C—FXO Standard Loop Start.** This model meets North American regulatory agency safety requirements.
- **MX404C—Enhanced FXO Loop Start.** This model meets all European and North American regulatory agency safety requirements.

B.1 Connectors on the Back Panel

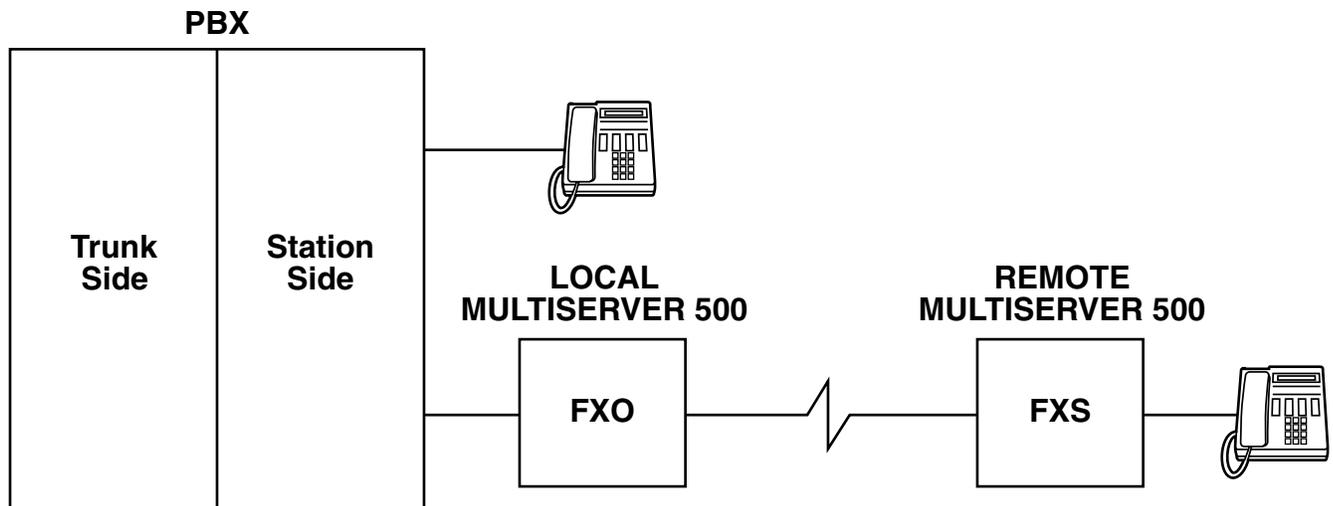


Figure B-1. A Typical FXO Application.

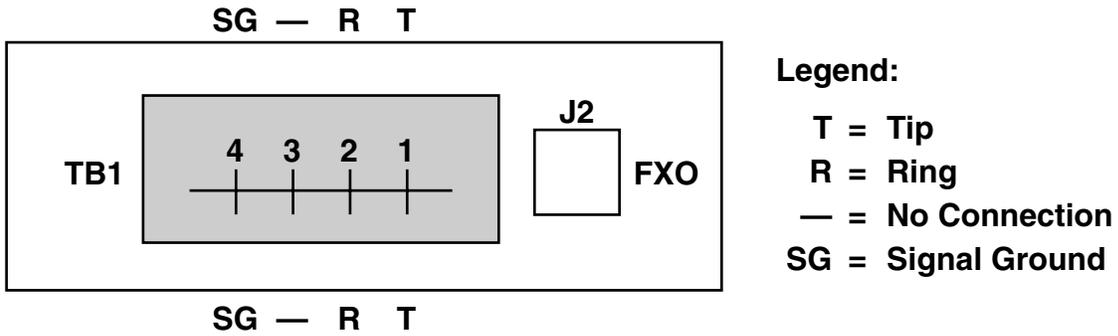


Figure B-2. Back Panel of the FXO Analog Interface Module.

There are two connectors located on the back panel of the FXO: J2 and TB1 (see Figure B-2). J2, labeled FXO, is an RJ-11 modular connector used in most FXO-type applications. TB1 is a 4-pin terminal block used to connect to a punch block. Both J2 and TB1 are shielded by a protective cover.

Connectors J2 and TB1 terminate the Tip (T) and Ring (R) leads in parallel, so that pins 2 and 3

of J2 are connected, respectively, to pins 1 and 2 of TB1 (see Figure B-3).

In most applications, use a modular cable (included) to connect the voice/fax channel to telephone equipment (see Figure B-4). Connect one end of the cable to the FXO connector on the voice/fax interface module. Connect the other end to your telephone equipment.

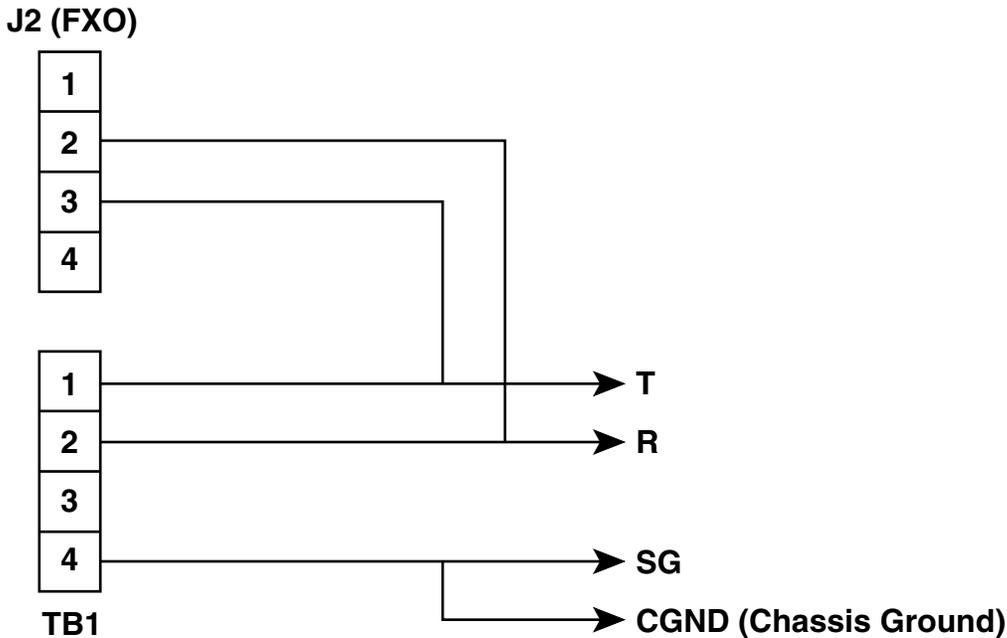


Figure B-3. Wiring of the Connectors on the Back Panel.

If you are connecting to a punch block, use the terminal block (TB1). Use a cable with bare-wire leads (not included) to connect the terminal block and the punch block. The terminal block is fitted with a female plug that serves as a receptacle for the individual cable leads.

CAUTION!

Wiring to the terminal block must be carried out by a qualified technician. Wires used for this purpose must be UL type CM, 22/24 AWG, 4-conductor.

Insert each cable lead into the cutout at the front of the plug and secure it at the top with a small flat-

head screwdriver. We recommend that you color code the cable leads for easy identification.

Make the connection by first removing the female plug, inserting each cable lead into the cutout on the opening at the front of the plug, and securing it at the top with a screwdriver (see Figure B-4). Finally, reinsert the plug in the terminal block.

After you make the connection, install the connector cover. To do this, simply insert the right tab of the cover in the retaining slot of the voice/fax interface module back panel. Then secure on the left side with a Phillips-head screw.

B.2 Strapping

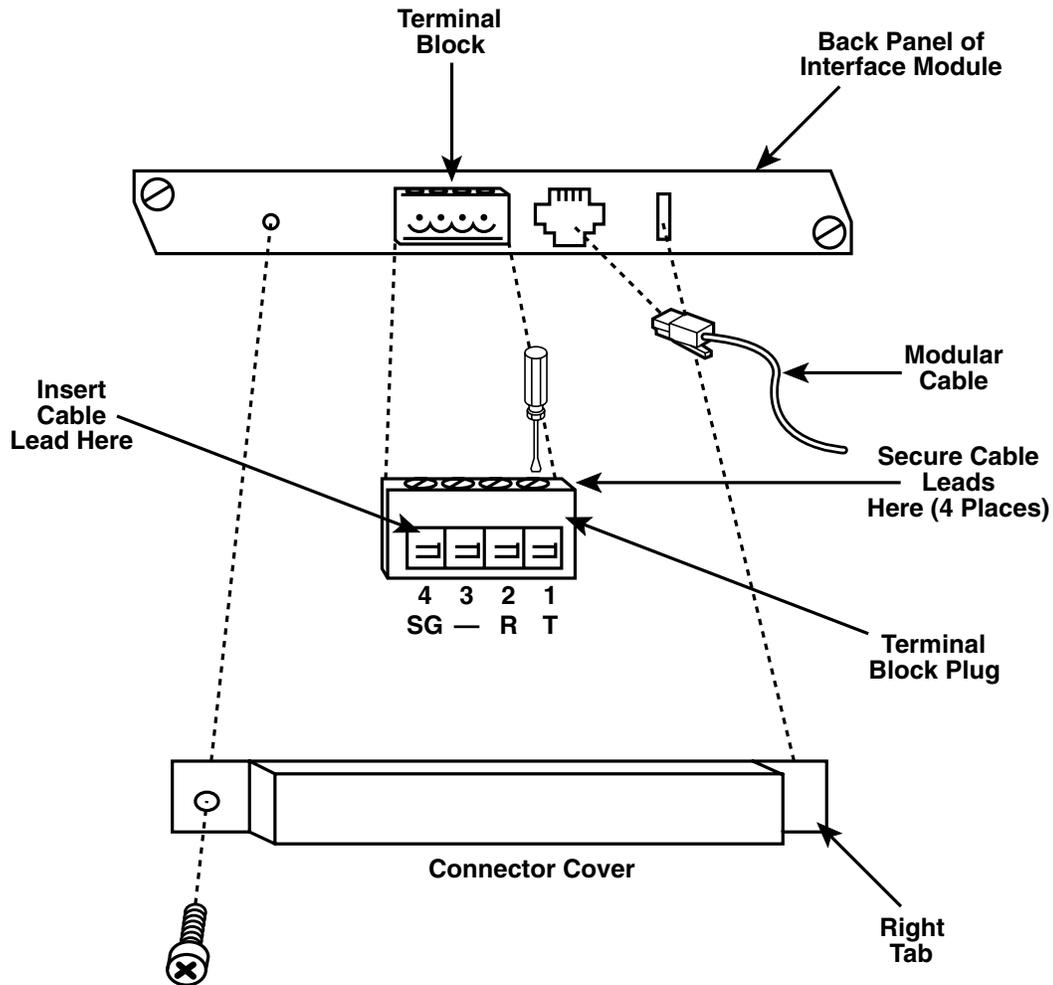


Figure B-4. Cable Connections.

Enhanced FXO Interface Module

There are 12 movable straps located on the enhanced FXO interface module: E1 through E5 and E7 through E13 (see Figure B-5). Their functions are as follows:

1. E1 through E5. These straps are reserved for internal use and are preset at the factory to match the type of memory installed. You must not alter them.
2. Dial Pulse Shaping. Dial pulse shaping is

implemented by an RC network connected across the dial pulse relay U9. To disconnect the RC network, remove strap E7.

3. Dial Pulse Series Resistance. This option selects one of two values of the series resistance in the dial pulse circuit: 150 Ω or 50 Ω (nominal). The default value is 50 Ω . To select the 150- Ω value, move the strap from E9 to E8.
4. Line Impedance Selection. This option selects one of two line-impedance values: 600- Ω resistive and 600- Ω in series with a 2.15- μf

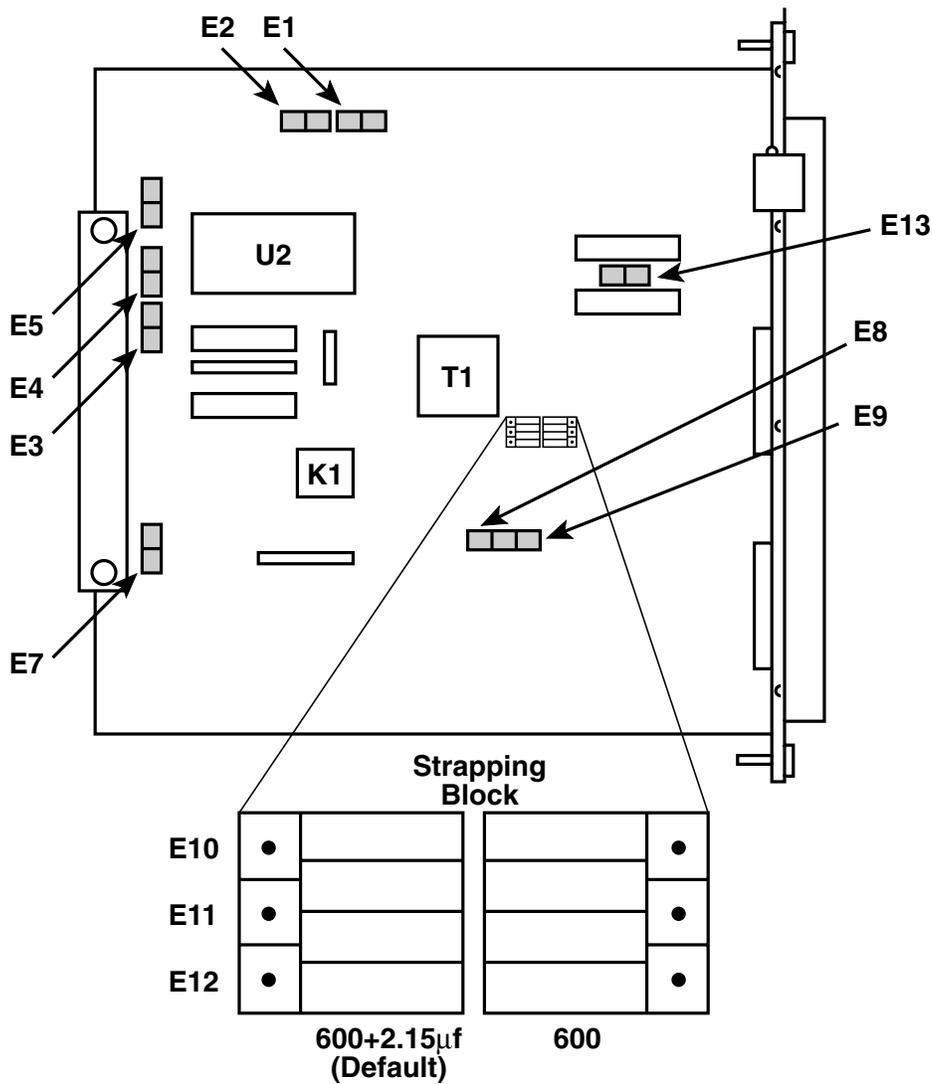


Figure B-5. Locations of the Straps on the FXO Interface Module.

capacitor (default). To select 600 Ω resistive, place the strapping block over the right two-thirds of E10, E11, and E12 as shown in Figure B-5. To select 600 Ω in series with a 2.15 μf capacitor, place the strapping block over the left two-thirds.

5. E13. This strap is reserved for use in internal tests. *Do not alter it.*

Standard FXO Interface Card

Do not alter any of the straps on the standard FXO interface module. E1 through E5 have the same function as E1 through E5 in the enhanced model. E11 has the same function as E13 in the enhanced model.

B.3 Removing or Replacing the Module

See **Section 3.4** for removing or replacing the Multiserver 500 interface modules, including the FXO interface module.

B.4 Specifications

Signals Supported — Analog voice, Group 3 facsimile (fax), and modem

Fax Signal Types — V.21 channel 2, V.27 ter 2400, V.27 ter 4800, V.29 7200, and V.29 9600

Port Impedance —

Enhanced Model (Software-selectable)

600 Ω (Default); may be strapped one of two ways: 1. Matches line impedance of 600 Ω resistive; 2. Matches line impedance of 600 Ω in series with a 2.15-μf capacitor (default)

Complex: Matches line impedance of 370 Ω in series with a parallel network of a 0.3-μf capacitor and a 620-Ω resistor

or

220 Ω in series with a parallel network of a 0.12-μf capacitor and an 820-Ω resistor

Standard Model

Fixed at 600 Ω in series with a 2.15-μf capacitor

Insertion Loss — 2 dB nominal @ 1000 Hz (End-to-End) between Transmit and Receive of Port 1 and Transmit and Receive of Port 2.

Example: Port 1 is FXO LS port and Port 2 is FXS LS port.

Port Return Loss — Echo Return Loss: ≥22 dB; Singing Return Loss: ≥18 dB 200 to 3400 Hz; ≥16 dB

Longitudinal Balance — 200 Hz to 1000 Hz: ≥58 dB; 1000 Hz to 3400 Hz: ≥48 dB

Input and Output Levels: — If you operate your equipment in the U.S.A or Canada, input gain and output attenuation are set at the factory to 0/0 dBm, and must not be changed. In other countries, follow the standards of the country where the equipment is used.

Maximum Input and Output Levels — 0 dBm

Idle Channel Noise — Inband, “C” Message: ≥20 dBnc; Psometric: ≥60 dBmpo; Out of band, 10 KHz to 10 MHz, Transverse or Longitudinal Noise: ≤70 dBm (enhanced models only)

Non-Linear Distortion, Second and Third Harmonics (Multitone Signal) — ≥40 dB below signal level

Signal-to-Noise Ratio — ≥37 dB @ 1000 Hz

Echo Suppression — ≥35 dB

Echo Canceling — ≤16 ms (≤1000 Km or 600 miles)

Crosstalk (near/far end) Between Channels — ≤75 dB

Signaling — DC Pulse Distortion Make/Break: ≤3%; AC DTMF, Transparently Passed: ≤1.5%

DC Loop Range — 48 V Battery: ≤1750 W; 42.5 V Battery: ≤1500 W

Off-Hook DC V/I Characteristics at Tip-Ring — ≤300 W

Ring Voltage Input 18 to 53 Hz — Detect: ≥25 Vrms; Not Detect: ≤ 20 Vrms

Ring Cadence Repeat Distortion — ≤2 %

Size — 6.5"W × 6"D (16.5 × 15.2 cm)

Appendix C: E&M Voice/Fax Interface Module

The E&M Voice/Fax Interface Card interfaces the voice/fax section of the Multiserver 500 with the trunk side of a Private Branch Exchange (PBX) as shown in Figure C-1. This type of telephone interface breaks out the audio signal and status control (or signaling) on separate wires.

Audio is transmitted on either a single pair (2-wire operation) of wires labeled T/R, or on two pairs (4-wire operation) of wires labeled T/R and T1/R1, as configured. When configured for 2-wire operation, the T/R pair transmits and receives communications. When configured for 4-wire operation, the T/R pair transmits and the T1/R1 pair receives.

Signaling consists of an M lead and an E lead. In the E&M interface module the M lead is defined as the input or receive lead and the E lead is defined as the output or transmit lead. In some cases added return leads termed SB and SG are used.

There are five E&M signaling formats defined: Types I, II, III, IV, and V. However, only three formats are in common use today: Types I, II, and V.

Type I is the most common type used in the United States, while Type V is common throughout the rest of the world. Type II was designed for compatibility with some AT&T® PBX types.

C.1 Differences Between Models

There are two versions of the E&M Voice/Fax Interface Card:

- **MX401C—E&M Standard.** This model meets all North American regulatory-agency safety requirements. It uses the Type I signaling convention.
- **MX402C—E&M Enhanced.** This model meets all European and North American regulatory-agency safety requirements. You may strap it one of three ways to match the signaling convention of the interfacing PBX equipment: Type I, II, or V.

Unless specified otherwise, information in this appendix applies to both models.

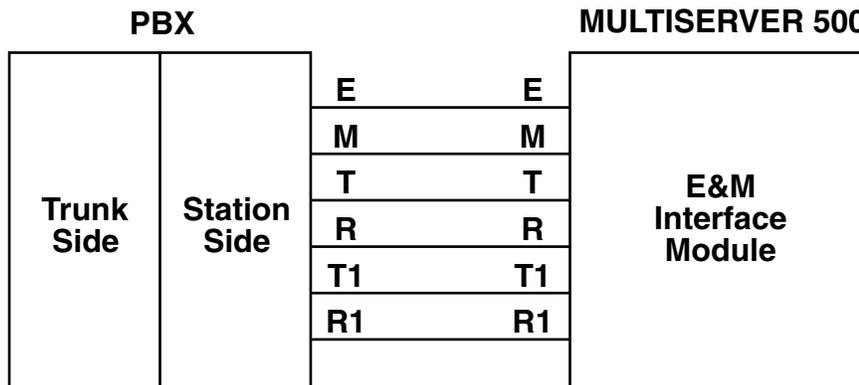


Figure C-1. Connections for the E&M Voice/Fax Interface Module.

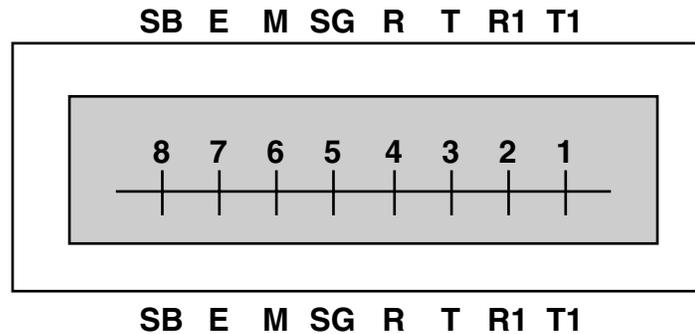


Figure C-2. Connectors on the Back Panel.

C.2 Telephone-Interface Connectors

The telephone interface signals are terminated in an 8-pin tie trunk terminal block on the back panel (see Figure C-2). This connector is fitted with a female plug.

C.3 Connecting the Telephone-Interface Cable

To connect to the telephone interface (PBX), see Figure C-3 (page 70) and proceed as follows:

WARNING!

Remove the power plug from the power socket **BEFORE** you make any connections to the telephone interface.

CAUTION!

Wiring to the tie trunk terminal block must be carried out by a qualified technician. Wires used for this purpose must be UL type CM, 22/24 AWG, 8-conductor.

1. Remove the plug from the 8-pin terminal block.
2. Use a cable with bare-wire leads (not included). Insert each cable lead into the cutout at the front of the plug and secure it with a small flat-head screwdriver at the top. We recommend that you color-code the cable leads for easy identification.
3. Insert the plug, which now includes the cable leads, in the terminal block.
4. After you make the connection, install the connector cover: Insert the right tab of the cover in the retaining slot of the voice/fax interface module back panel; then secure it on the left side with a Phillips-head screw.

C.4 E&M Lead States

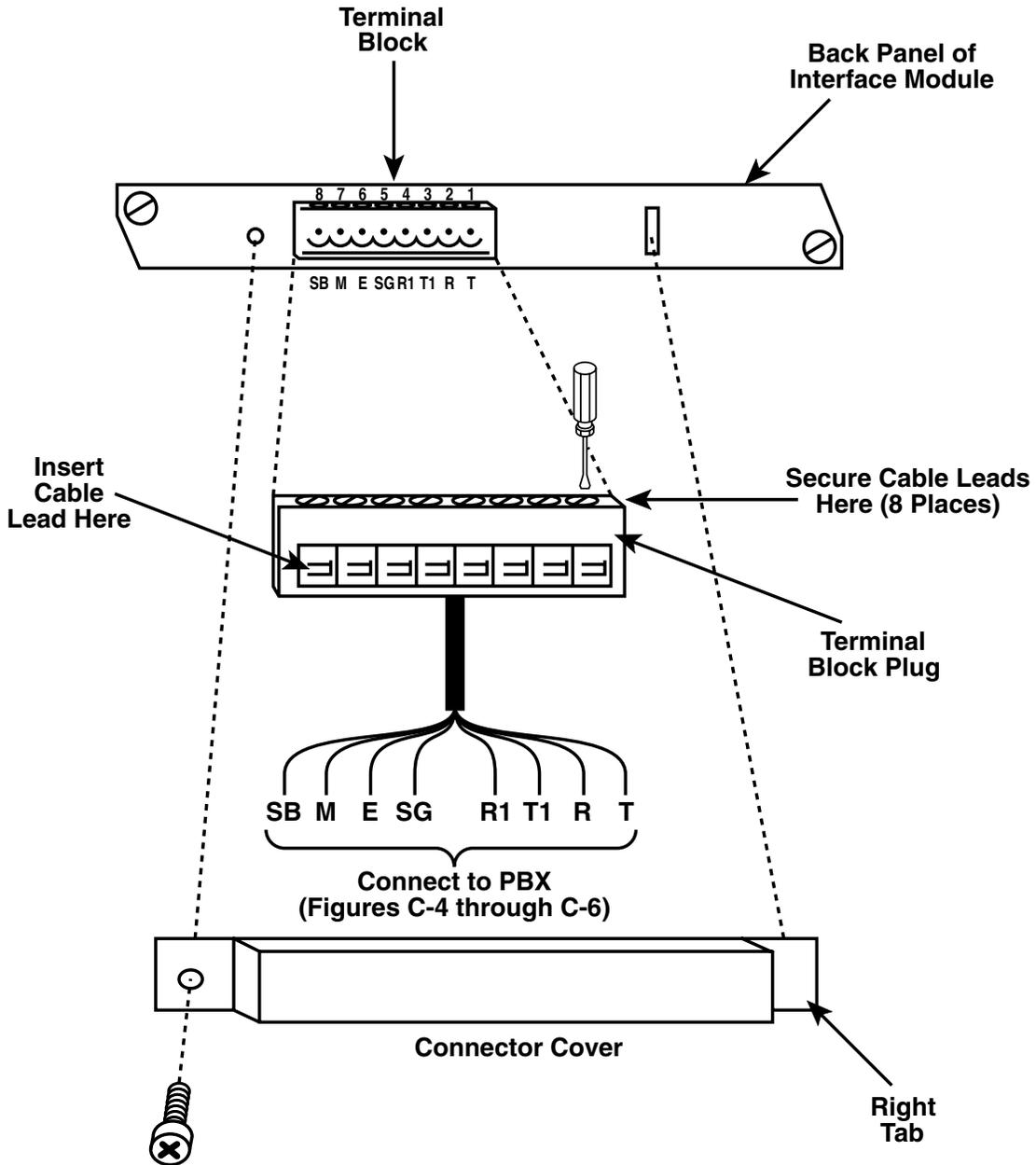


Figure C-3. Connecting the E&M Cable.

Table C-1. E&M Lead States

Lead	State	Type I	Type II	Type V
E (output)	Idle Active	Open SG	Open Close (SG)	Open SG
M (input)	Idle Active	SG -48 V	Open Close (SB)	Open SG

SG = Signal Ground

SB = Signal Battery

Table C-1 is a summary of the E and M idle and active lead states for signaling Types I, II, and V.

C.5 Connection Diagrams

Figures C-4 through C-6 are simplified connection diagrams between the E&M voice/fax interface module and the PBX for signaling types I, II, and V. As discussed earlier, Types II and V are supported only by the MX402C.

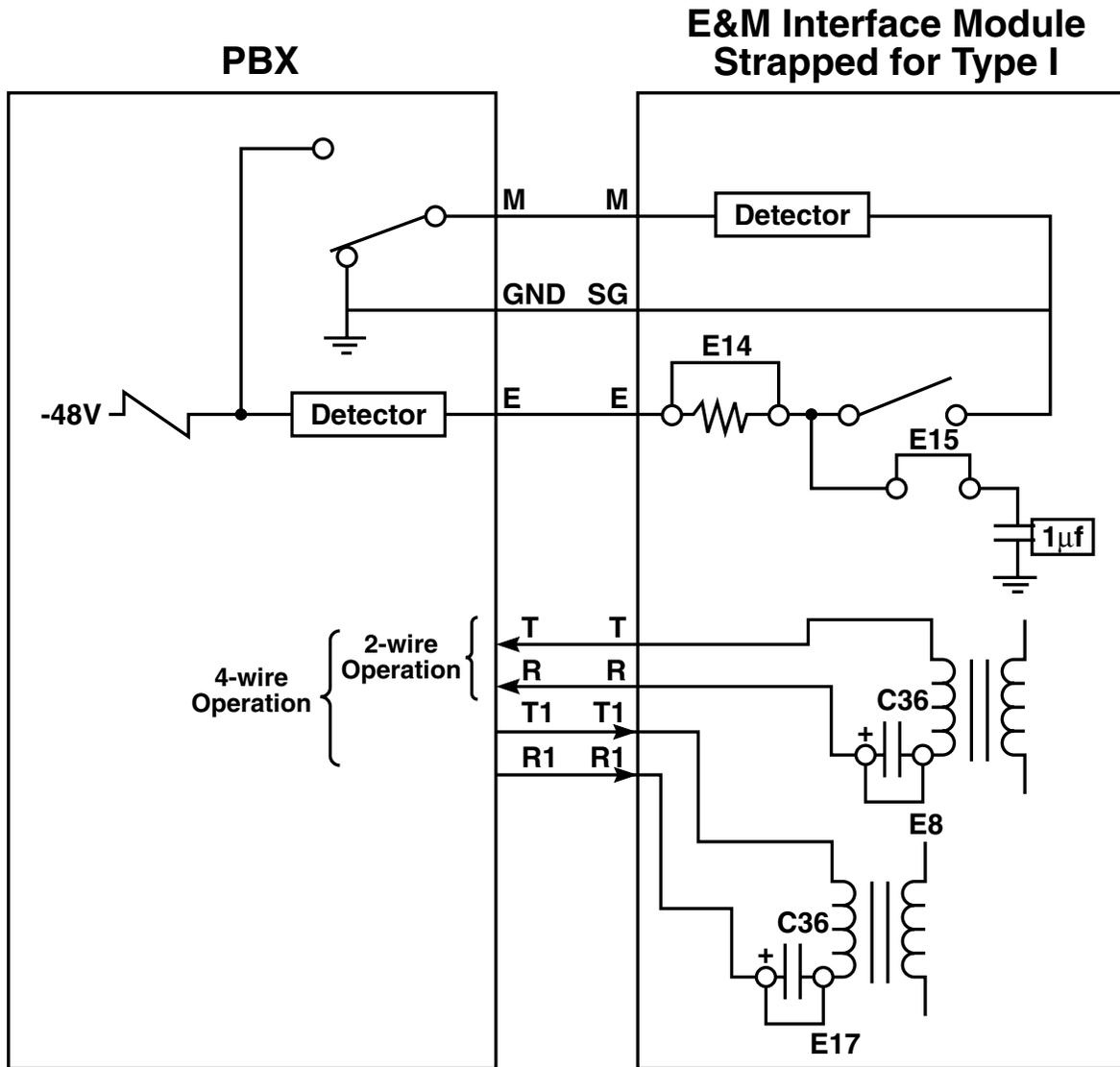


Figure C-4. Type I Interface Connection.

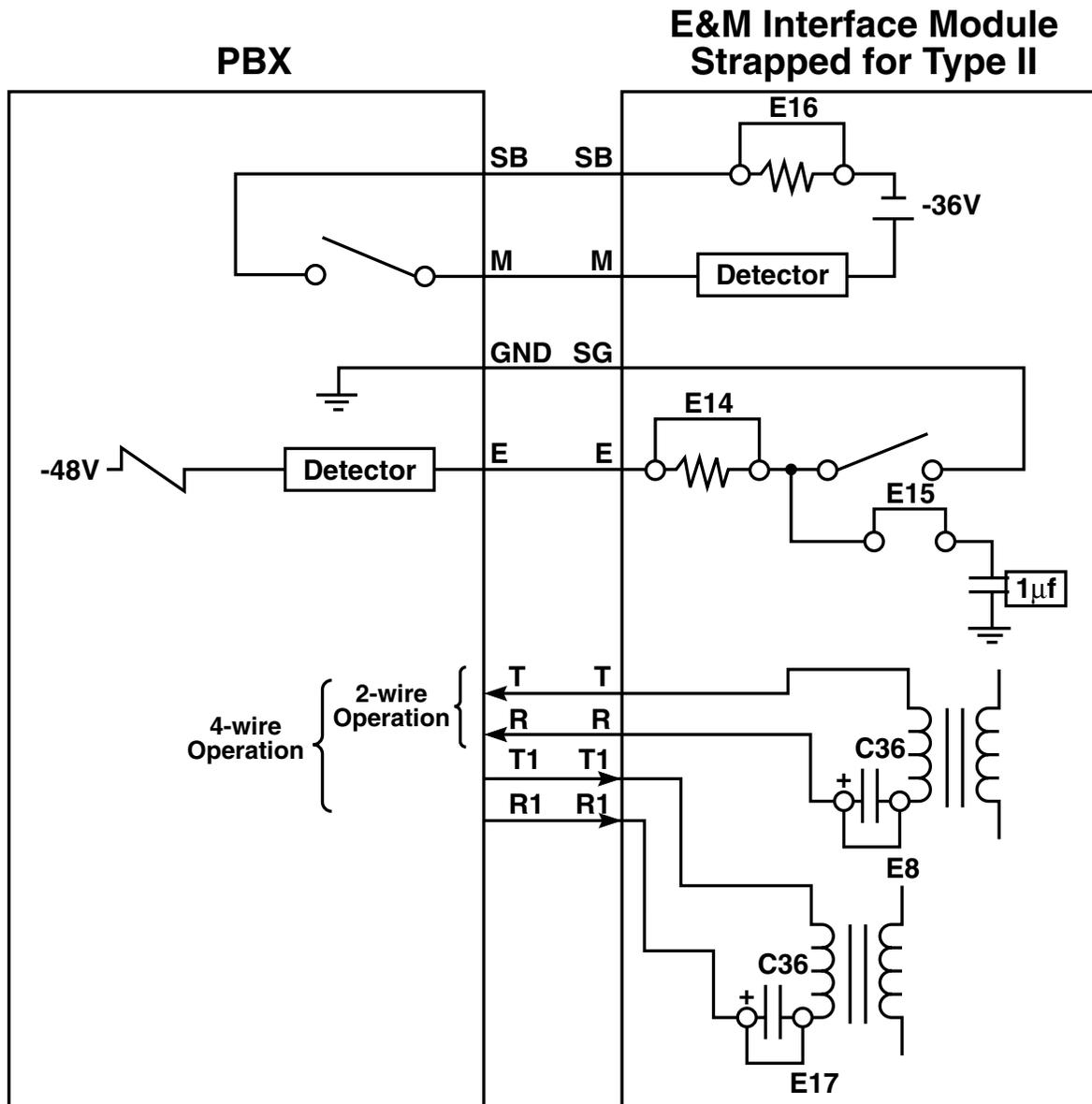


Figure C-5. E&M Type II Interface Connection.

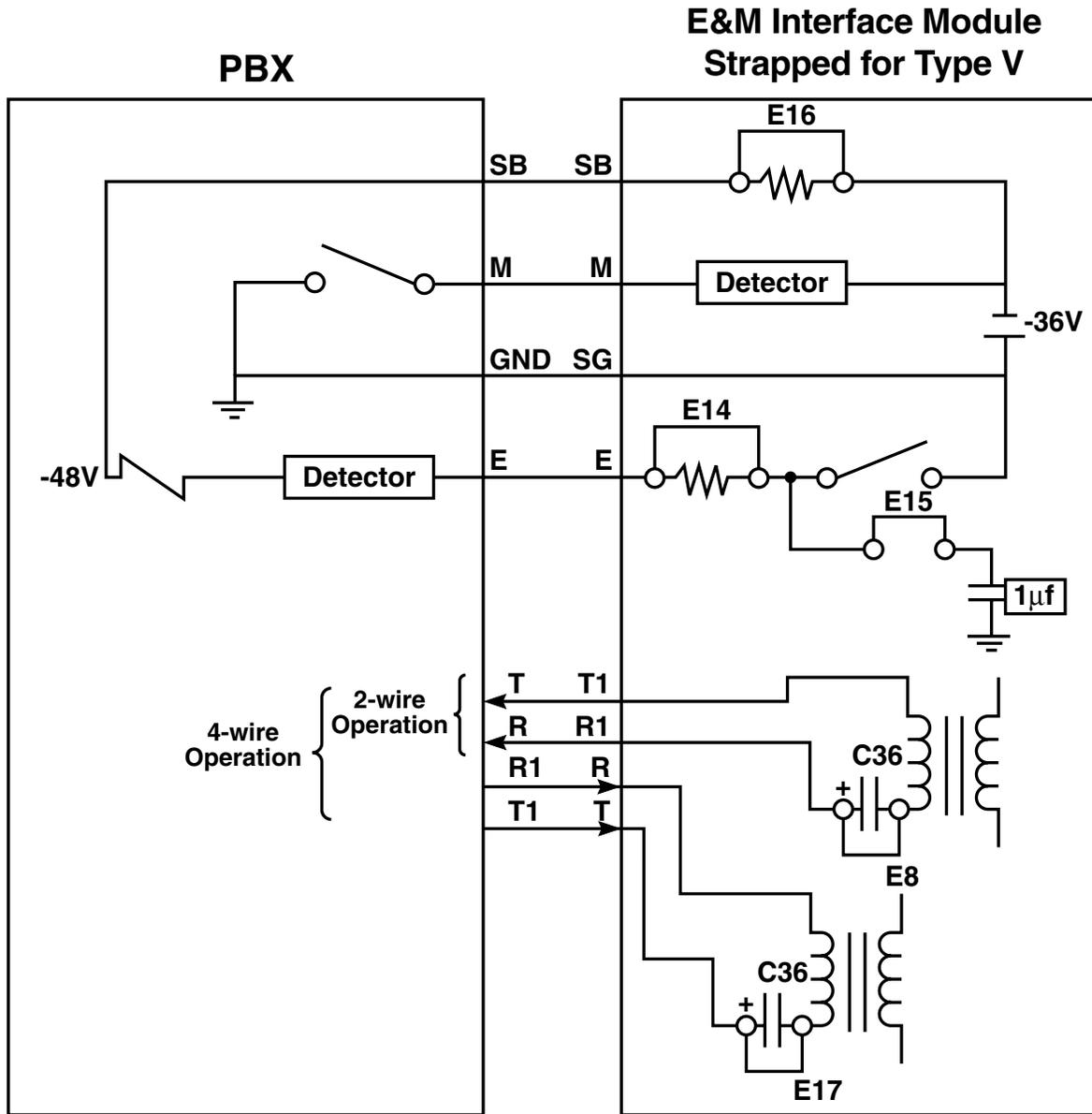


Figure C-6. E&M Type V Interface Connection.

C.7 Strapping

Enhanced E&M Voice/Fax Interface Card

The functions of straps E1 through E22 on the enhanced E&M interface card (see Figure C-7) are as follows:

1. E1 through E5. These straps are preset at the factory to match the type of memory installed. Do not alter them.
2. E6, E7, and E9 through E13. These straps are used to select signaling types I, II, and V (MX402C only).
3. Straps E8 and E17 are normally installed to shunt out DC blocking capacitors C36 and C38. Remove them if there are DC voltages present in the R and R1 leads.
4. Strap E14 is used to shunt out the series resistor in the E lead in case the loop resistance is too high to trip the detector inside the PBX.
5. Strap E15 is used for dial-pulse correction; it connects a 1- μ F filter capacitor between the SG lead and ground.
6. Strap E16 is used to shunt out the series resistor in the SB lead in case the loop resistance is too high to trip the detector inside the interface module.
7. Straps E18 and E19 are reserved for use in internal tests. Do not alter them.
8. Straps E20, E21, and E22 are spares.

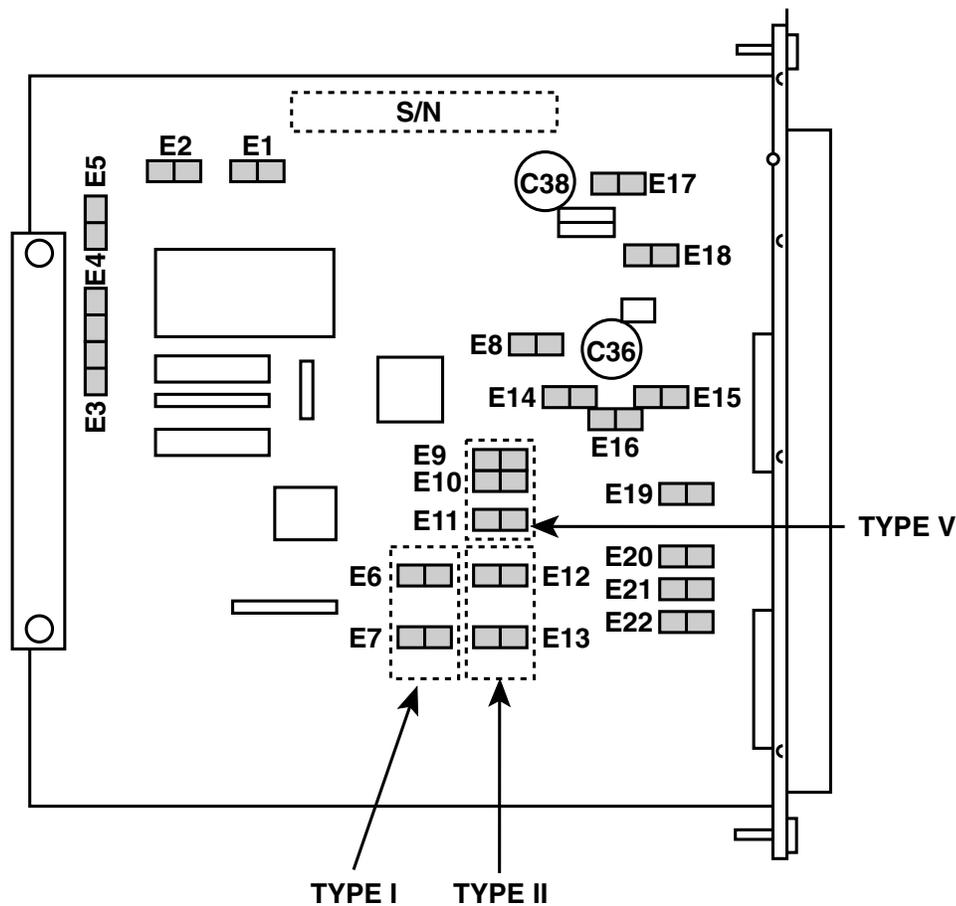


Figure C-7. Where the Straps Are on the E&M Module.

Standard E&M Voice/Fax Interface Card

The functions of the straps on the standard E&M voice/fax interface module are as follows:

1. E1 through E-5 have the same functions as E1 through E5 in the enhanced model.
2. E9 has the same function as E14 in the enhanced model.
3. E6 and E7 have the same functions as E18 and E19 in the enhanced model.
4. E8 is a spare in the standard model.

C.7 Removing or Replacing the Module

See **Section 3.4** for removal/replacement of the Multiserver 500 interface modules, including the E&M interface module.

C.8 Specifications

Signals supported — Analog voice and Group 3 facsimile (fax)

Fax Signal Types — V.21 channel 2, V.27 ter 2400, V.27 ter 4800, V.29 7200, and V.29 9600

Port Impedance —

4-wire, and 2-wire Standard Models: Matches line impedance of 600 Ω resistive.

2-wire (Enhanced model only, software selectable: 600 Ohms (Default): Matches line impedance of 600 Ω resistive; Complex: Matches line impedance of 370 Ω in series with a parallel network of a 0.31- μ f capacitor and a 620 Ω resistor, or 220 Ω in series with a parallel network of a 0.12- μ f capacitor and a 620 Ω resistor

Port Return Loss — Echo Return Loss: ≥ 22 dB; Singing Return Loss: ≥ 18 dB; 200 to 3400 Hz: 16 dB

Longitudinal Balance — Up to 1000 Hz: ≥ 58 dB; 1000 Hz to 3400 Hz: ≥ 48 dB

Input and Output Level Adjustments — If you operate your equipment in the U.S.A. or Canada, input gain and output attenuation are

set at the factory to 0/0 dBm, and must not be changed. In other countries, follow the standards of the country where the equipment is used.

Maximum Input Level — 0 dBm

Maximum Output Level (Enhanced Model) — 4-wire: +7 dBm; All others: 0 dBm

Insertion Loss at 1000 Hz — 2-wire T/R of Port 1 to 2-wire T/R of Port 2: 2 dB nominal; 4-wire T/R of Port 1 to 4-wire T1/R1 of Port 2: 2 dB nominal

Frequency Response Over the Range of 304 Hz to 3404 Hz — +1 dB/-2 dB with respect to 1004 Hz

Idle Channel Noise — Inband "C" Message: ≤ 20 dBnc/65 dBmpo; Psofometric: ≤ 65 dBnc/65 dBmpo; Out of band, 10 KHz to 10 MHz

Transverse or Longitudinal Noise — ≤ 70 dBm (enhanced models only)

Non-Linear Distortion (Multitone Signal), Second and Third Harmonics — ≥ 40 dB below signal level

Signal-to-Noise Ratio at 1004 Hz — ≥ 37 dB

Echo Suppression (2-wire) — ≥ 35 dB

Echo Canceling (2-wire) — ≤ 16 ms (≤ 1000 km or 600 miles)

Loop Range Including Instrument — ≤ 900 ohms; 1372 m (4500 feet) on 24 AWG wire pair

Signaling — E-Lead Current Limit: ≤ 25 ma; M-Lead Sensitivity: ≤ 1400 ohms DC Pulse Distortion: $\leq 2\%$

Signaling Formats — AC: DTMF @ 2280 Hz (AC15, 4-wire); DC: Steady or Pulsed

Types — Enhanced Model: Types I, II, and V; Standard Model: Type I only

Size — 6.5"W \times 6"D (16.5 \times 15.2 cm)

Appendix D: Changing the Data Interface Types

You can configure the DATA CHANNEL and COMPOSITE interface connectors to give one of three types of signal levels: RS-232, V.35, or RS-530. Configuration is implemented by a set of daughterboards and jumper blocks.

A fourth interface type, RS-449, can be derived from an RS-530 interface type using special converter cables. A fifth composite interface type, X.21, may be derived from an RS-530 type using X.21 special converter cables. Refer to **Appendix F** for cabling details.

Both interface connectors are configured at the factory to signal-level types specified with the order. If you need to change the interface type of either or both connectors, read the rest of this appendix.

WARNING!

To change interface types, you must remove the top cover in order to gain access to the interior of the Multiserver 500. Do NOT attempt to remove the top cover while the Multiserver 500 is connected to the power source.

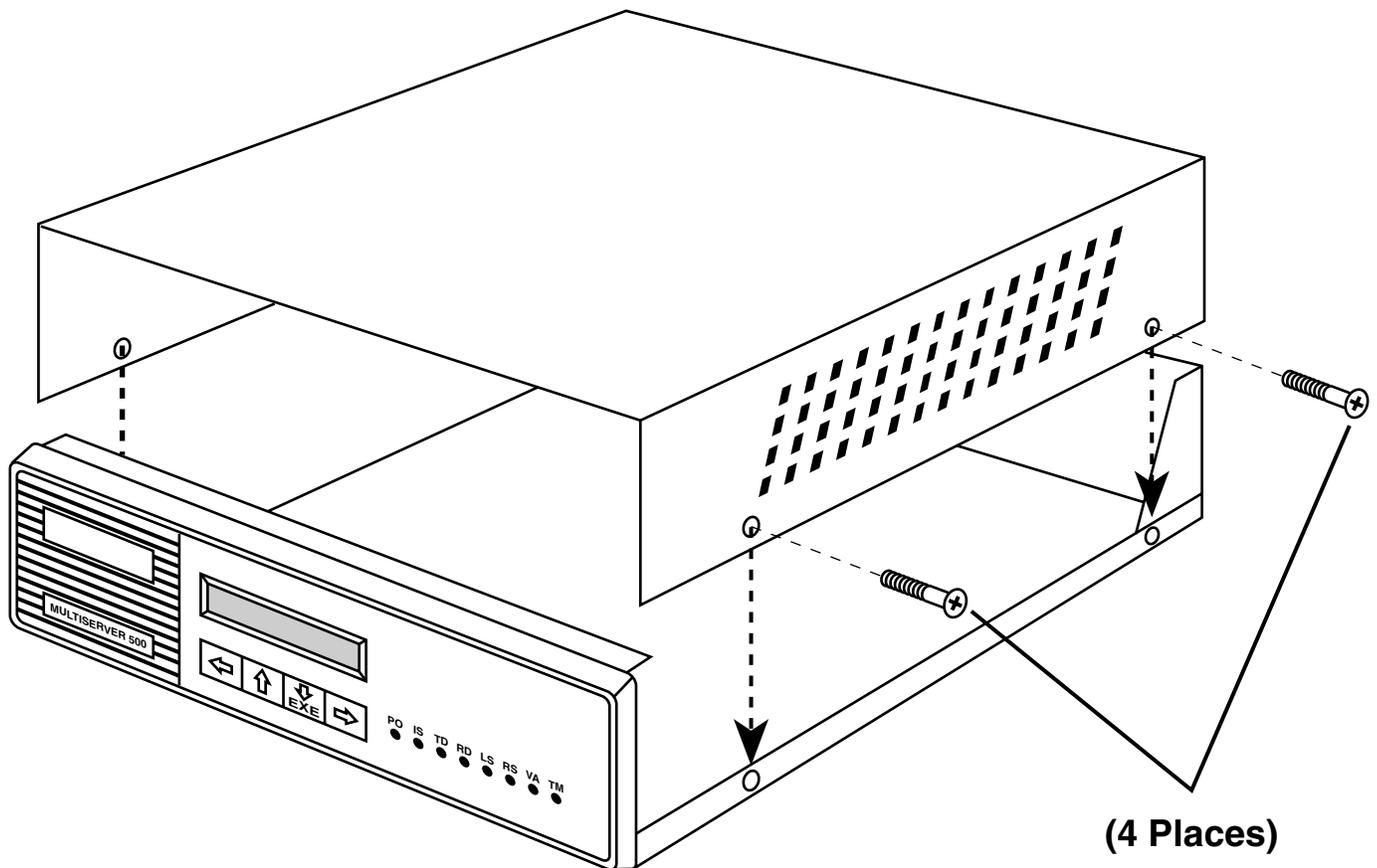


Figure D-1. Removing the Top Cover.

CAUTION!

Observe standard industry practices concerning the handling of static-sensitive electronic components. Use suitable grounding for the unit, in your work area, and on your person.

D.1 Removing the Top Cover

Items used to configure the interface types are located on the top module and are accessible when the top cover is removed. The top cover is fastened by four screws, two on each side. Remove and save the four screws, using a number 1 or number 2 Phillips-head screwdriver; then lift off the cover. See Figure D-1.

D.2 Configuring the Interfaces

Composite Interface

Table D-1 is a configuration matrix for the composite interface. The column headings in Table D-1 relate to items highlighted in Figure D-2. To configure an interface type, first consult Table D-1 to determine the requirements for that interface. Then, find the locations of the items associated with that interface and install (or remove) as necessary.

For example, to configure the composite interface for V.35, move down the Interface Type column in Table D-1 to V.35, and check all columns along that row. You will note that the Model MX410C-V.35 daughterboard must be installed, headers X3 and X4 must be removed, and jumper E11 and E4 must be installed on pins 1-2. You will also find that the interface cable number required for this interface is EHN070.

Finally, install or remove the applicable items, using Figure D-1 as a guide.

Data Channel Interface

Table D-1. List of Configuration Items for the Composite Interface

Interface Type	Daughterboard A	Cable B	Headers X3 and X4	Jumper E11	Jumper E4
RS-232	None	EZ423 crossover	Installed	Installed on pins 2-3	Installed on pins 1-2
V.35	Model MX410C-V.35	EHN070 crossover	Removed	Installed on pins 1-2	Installed on pins 1-2
RS-530	Model MX410C-422	EHN077-005M crossover	Removed	Installed on pins 2-3	Installed on pins 1-2
RS-449	Model MX410C-422	EHN075-005M crossover	Removed	Installed on pins 2-3	Installed on pins 1-2
X.21	Model MX410C-422	EHN073-005M crossover	Removed	Installed on pins 2-3	Installed on pins 2-3

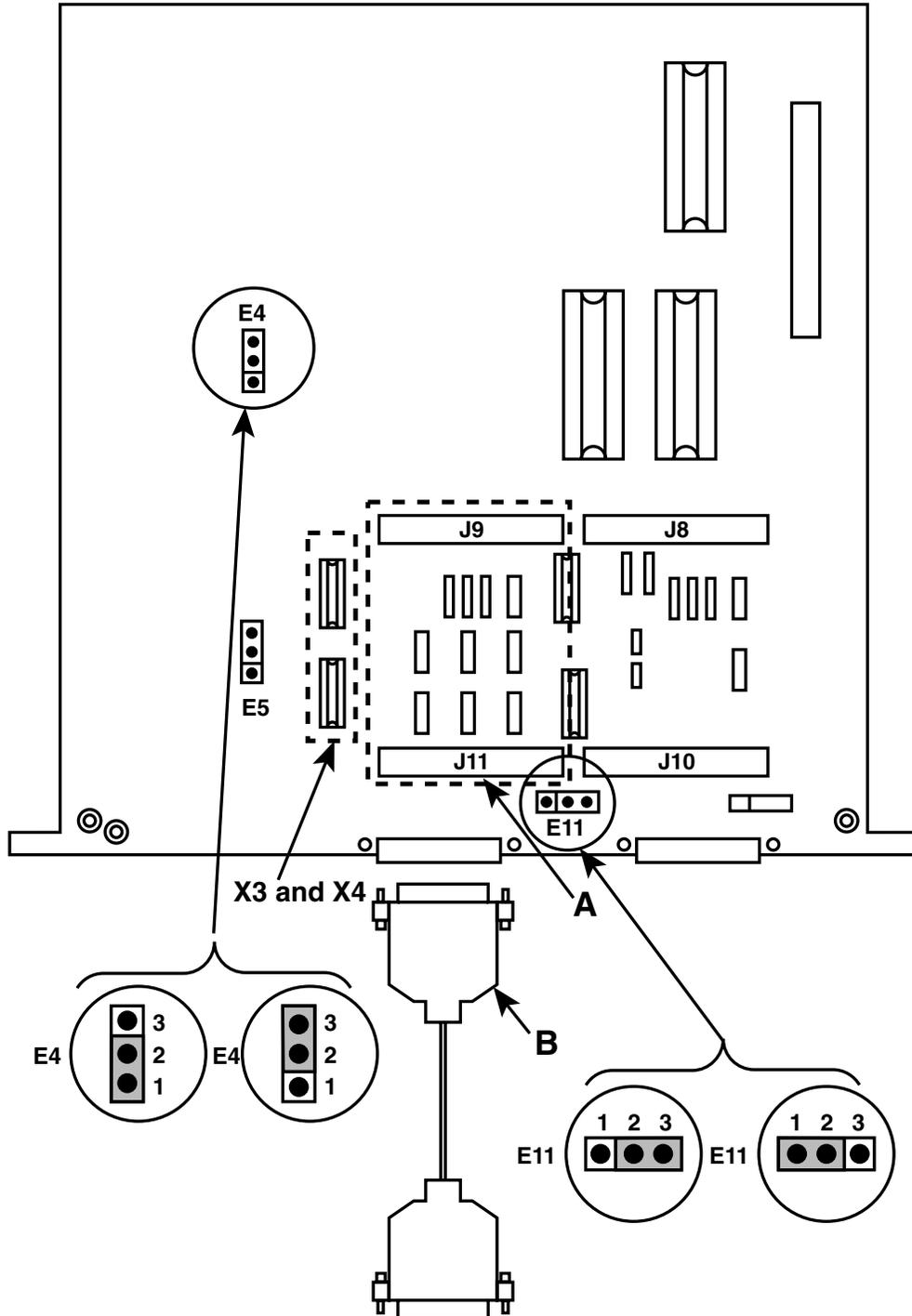


Figure D-2. Configuring the Composite Interface.

To configure the data channel interface, consult Table D-2 and Figure D-3 and follow the guidelines given for the composite interface.

Table D-2. List of Configuration Items for the Data Channel Interface

Interface Type	Daughterboard C	Cable D	Headers X2 and X5	Jumper E10
RS-232	None	EDN16C straight	Installed	Installed on pins 2-3
V.35	Model MX410C-V.35	EHN071 straight	Removed	Installed on pins 1-2
RS-530	Model MX410C-422	EHN076-005M straight	Removed	Installed on pins 2-3
RS-449	Model MX410C-422	EHN074-005M straight	Removed	Installed on pins 2-3
X.21	Model MX410C-422	EHN072-005M straight	Removed	Installed on pins 2-3

D.3 Replacing the Top Cover

After you configure the interface connectors, replace the top cover and secure it with the four screws removed in **Section D.1**.

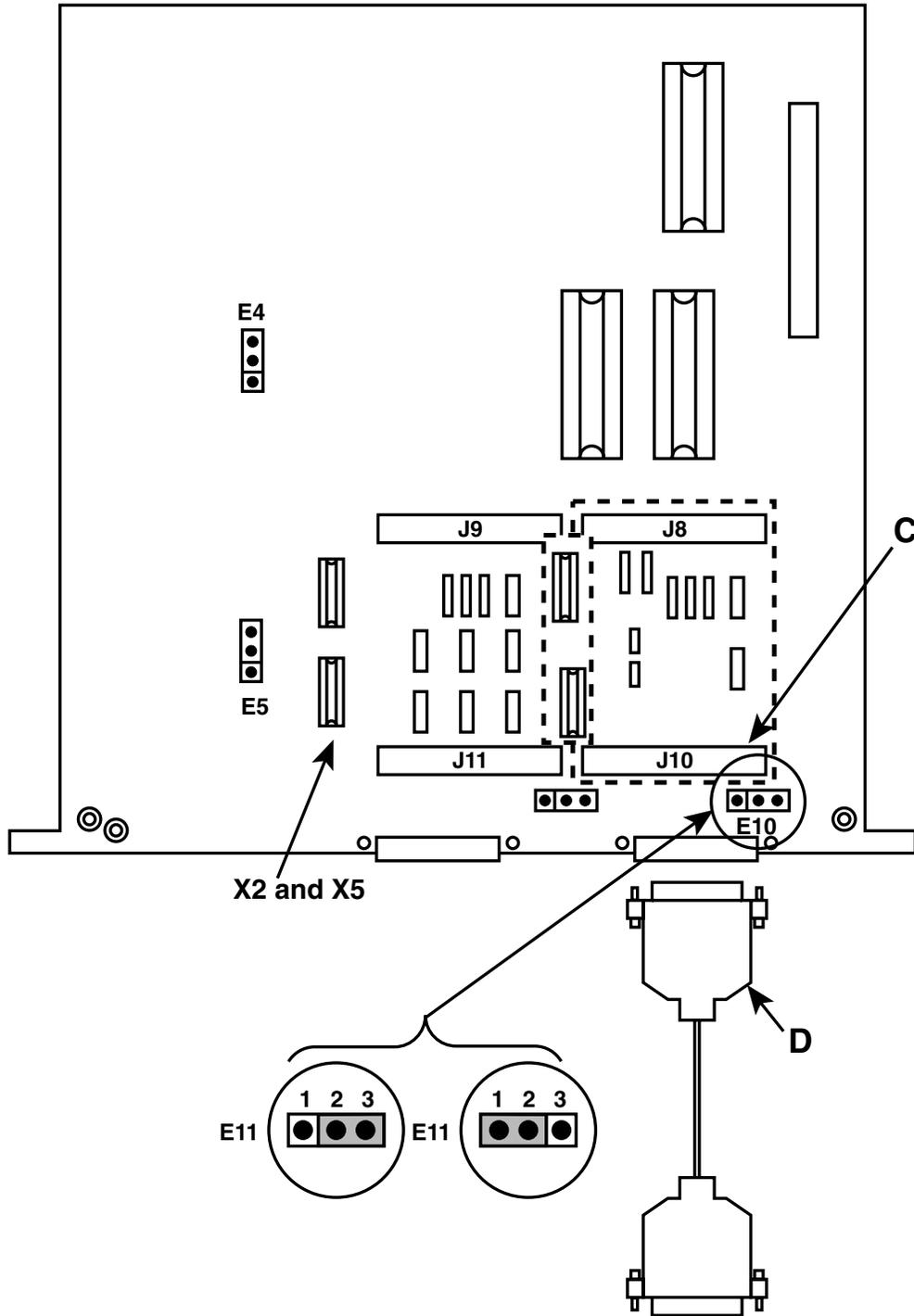


Figure D-3. Configuring the Data-Channel Interface.

Appendix E: Agency and Telephone-Company Requirements

Information provided in the following paragraphs is applicable only to Multiserver 500 units installed in the U.S.A. and Canada. If your installation is located outside of the U.S.A. and Canada, you must meet the requirements of the country where the equipment is operated.

E.1 Requirements for Operation with the Telephone Company

If your equipment causes harm to the telephone network, the telephone company may temporarily discontinue your service. If possible, the company will notify you in advance. But if advance notice is not practical, you will be notified as soon as possible. You will be given the opportunity to correct the situation and you will be informed of your right to file a complaint with the FCC.

Your telephone company may make changes in its facilities, equipment, operation, or procedures that could affect the proper functioning of your equipment. If it does, you will be notified in advance to give you an opportunity to maintain uninterrupted service.

If you experience any operational problems while you're using your equipment, determine whether the problem is due to a malfunction in your equipment or in the telephone interface.

WARNING!

Do not attempt to repair the Multiserver 500. Attempts to repair the Multiserver 500 may cause injury, and may also damage equipment on the telephone network.

Attempts to repair the Multiserver 500 are violations of FCC rules. Repair to the Multiserver 500 can only be made by the manufacturer, its authorized agents, and by others who may be authorized by the FCC. Please contact our Technical Support Staff for further information.

1. The problem may be in the telephone interface. If the Multiserver 500 works in some interfaces

but not in others, the problem is due to the telephone interface.

2. The problem may be in your equipment. If the Multiserver 500 does not work with any telephone interface, then it is most likely that the problem is in your Multiserver 500. To check your Multiserver 500, follow the test procedures outlined in Chapter 7.

E.2 Equipment Attachment Limitations for Operation in Canada

CP-01, Part I

Section 10.1

Notice: The Canadian Department of Communications label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational and safety requirements. The Department does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, the user should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This

precaution may be particularly important in rural areas.

CAUTION!

You should NOT attempt to make such connections yourself, but should contact the electric inspection authority or electrician, as appropriate.

CP-01, Part I,

Section 10.2

Notice: The Load Number (LN) assigned to each terminal device denotes the percentage of the total load to be connected to a telephone loop which is used by the device, to prevent overloading. The termination on a loop may consist of any combination of devices subject only to the requirement that the total of the Load Numbers of all the devices does not exceed 100.

Appendix F: Cabling and Pin Assignments

IMPORTANT!

The composite and data channel connectors require shielded cables in order to maintain compliance with Title 47 of the Code of Federal Regulations, Federal Communications Commission's Rules and Regulations, Part 15, Subpart J.

This Appendix contains cabling diagrams and pin assignments for the COMPOSITE, DATA CHANNEL, and CMD PORT interface connectors. Refer to the diagrams if you intend to construct your own cables. Cable length must not exceed 50 feet (15 meters).

Cabling for the voice/fax channel depends on the type of interface module installed in the Multiserver 500, and is given in **Appendixes A, B, and C.**

F.1 Cables for the Composite Interface

RS-232-to-RS-232 DCE

Pin assignments for the COMPOSITE and DATA CHANNEL connectors configured for RS-232 signal levels are shown in Figure F-1. Use a crossover cable (order code **EZ423-0015**), with male terminations at each end, for connection to a DCE device. See Figure F-2.

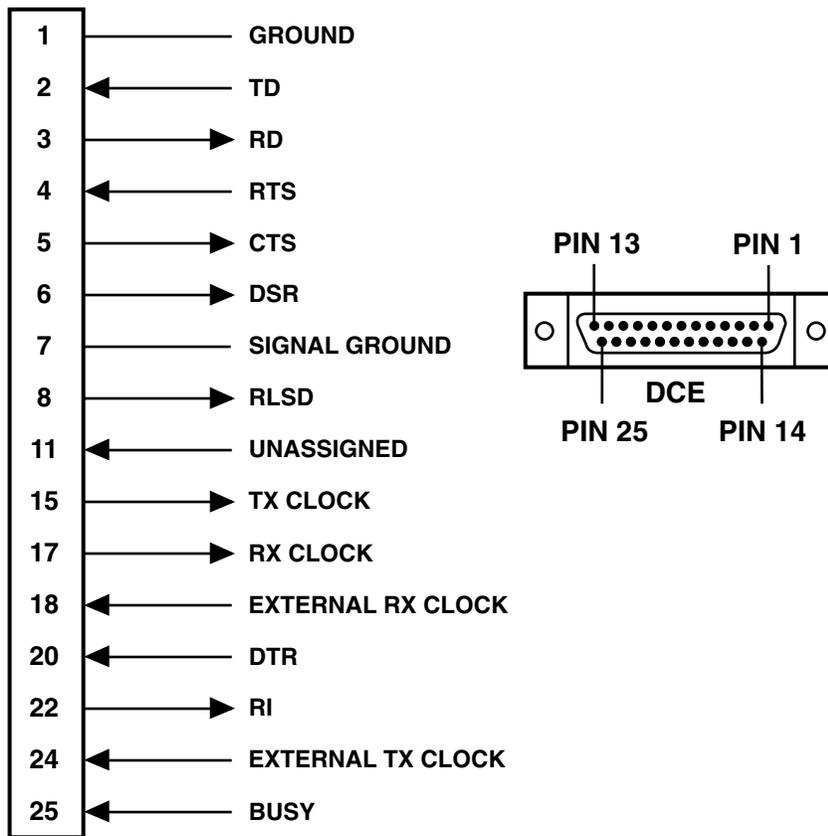


Figure F-1. Pin Assignments for the RS-232 COMPOSITE and DATA CHANNEL Connectors.

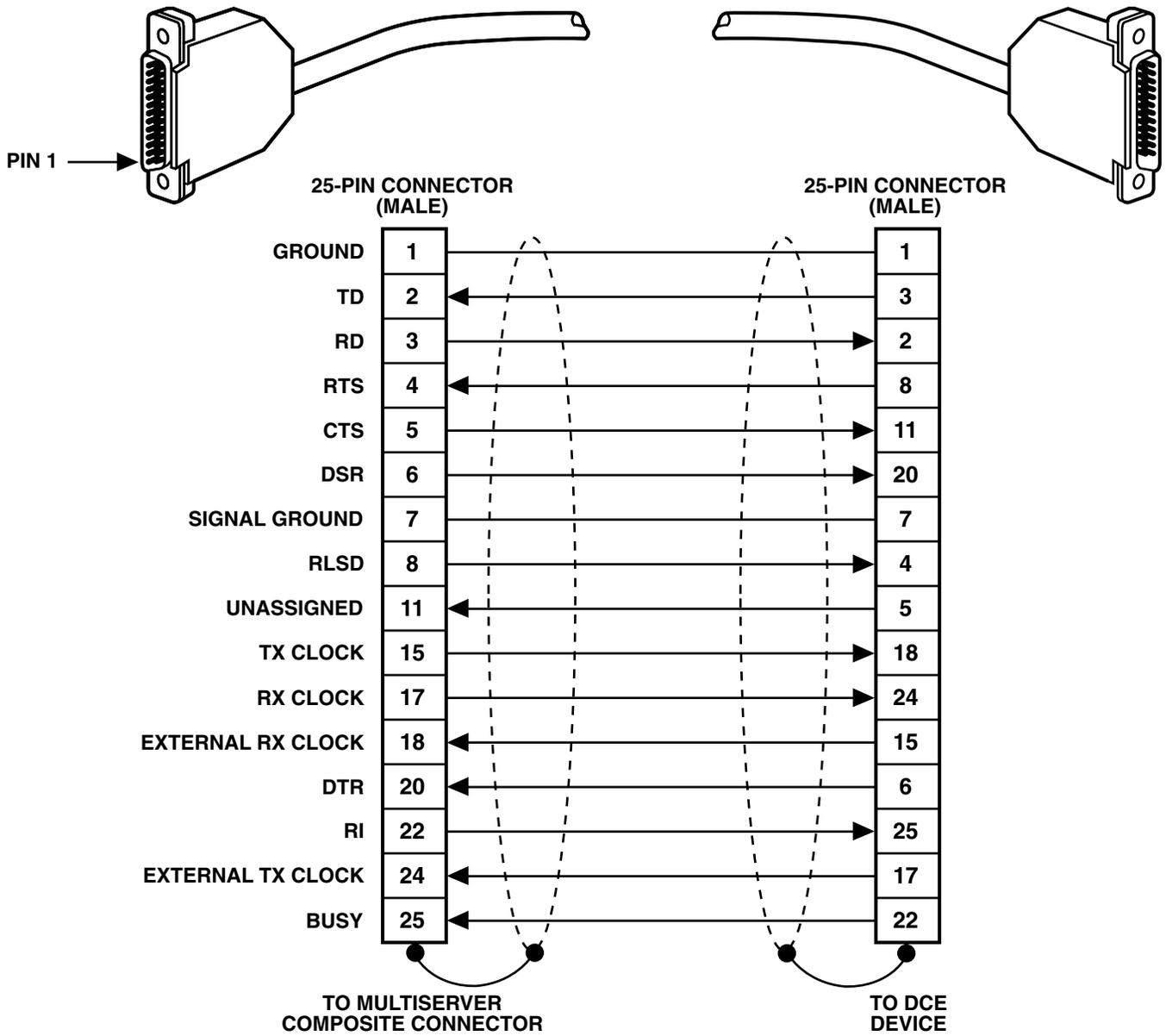


Figure F-2. RS-232-to-RS-232 DCE Crossover Cable (EZ423-0015).

V.35-to-DCE

Pin assignments for the COMPOSITE and DATA CHANNEL connector configured for V.35 signal levels are shown in Figure F-3. Use a crossover cable with male terminations at each end. See Figure F-4.

RS-530-to-RS-530 DCE

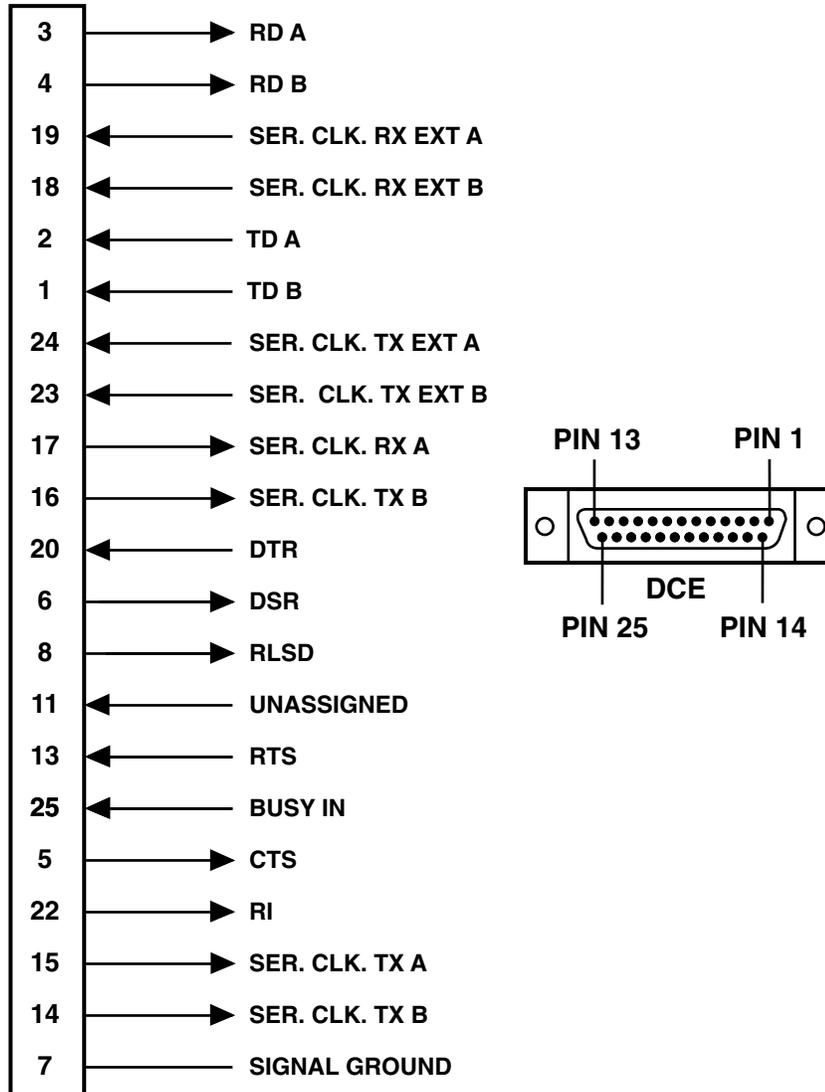


Figure F-3. Pin Assignments for the V.35 COMPOSITE and DATA CHANNEL Connectors.

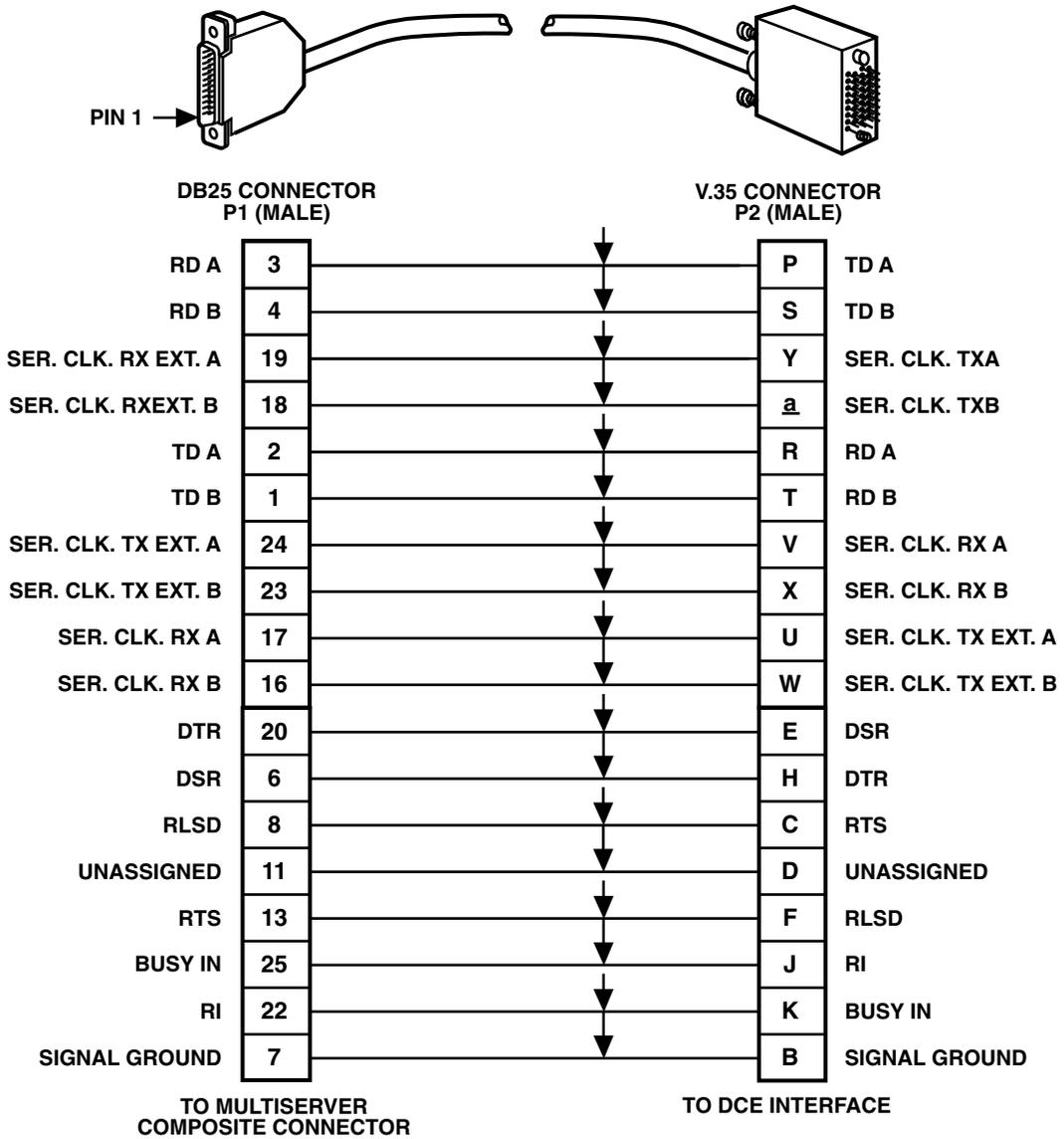


Figure F-4. V.35-to-DCE Crossover Cable (EHN070-005M).

Pin assignments for the COMPOSITE and DATA CHANNEL connectors configured for RS-530 signal levels are shown in Figure F-5. Use a crossover cable (order code TC) with male terminations at each end to connect to an RS-530 DCE device. See Figure F-6.

RS-530-to-RS-449 DCE Crossover Cable

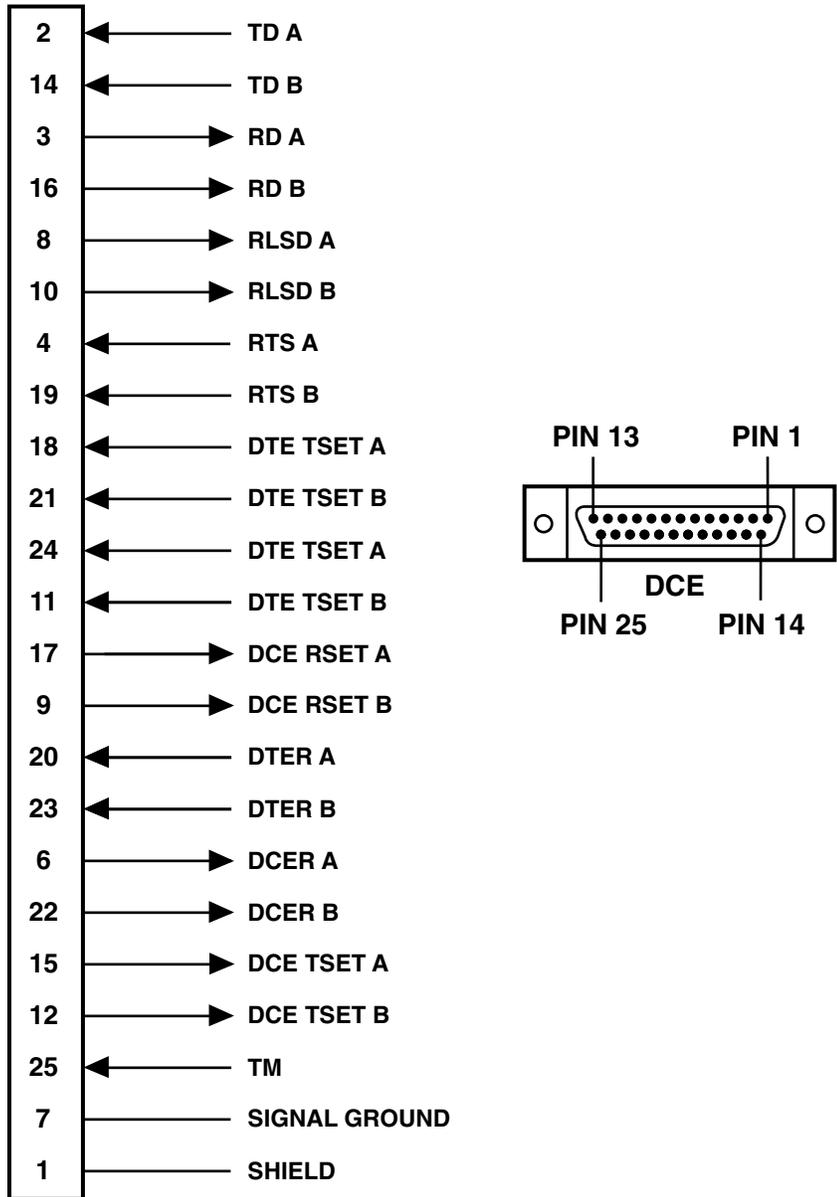


Figure F-5. Pin Assignments for the RS-530 COMPOSITE and DATA CHANNEL Connectors.

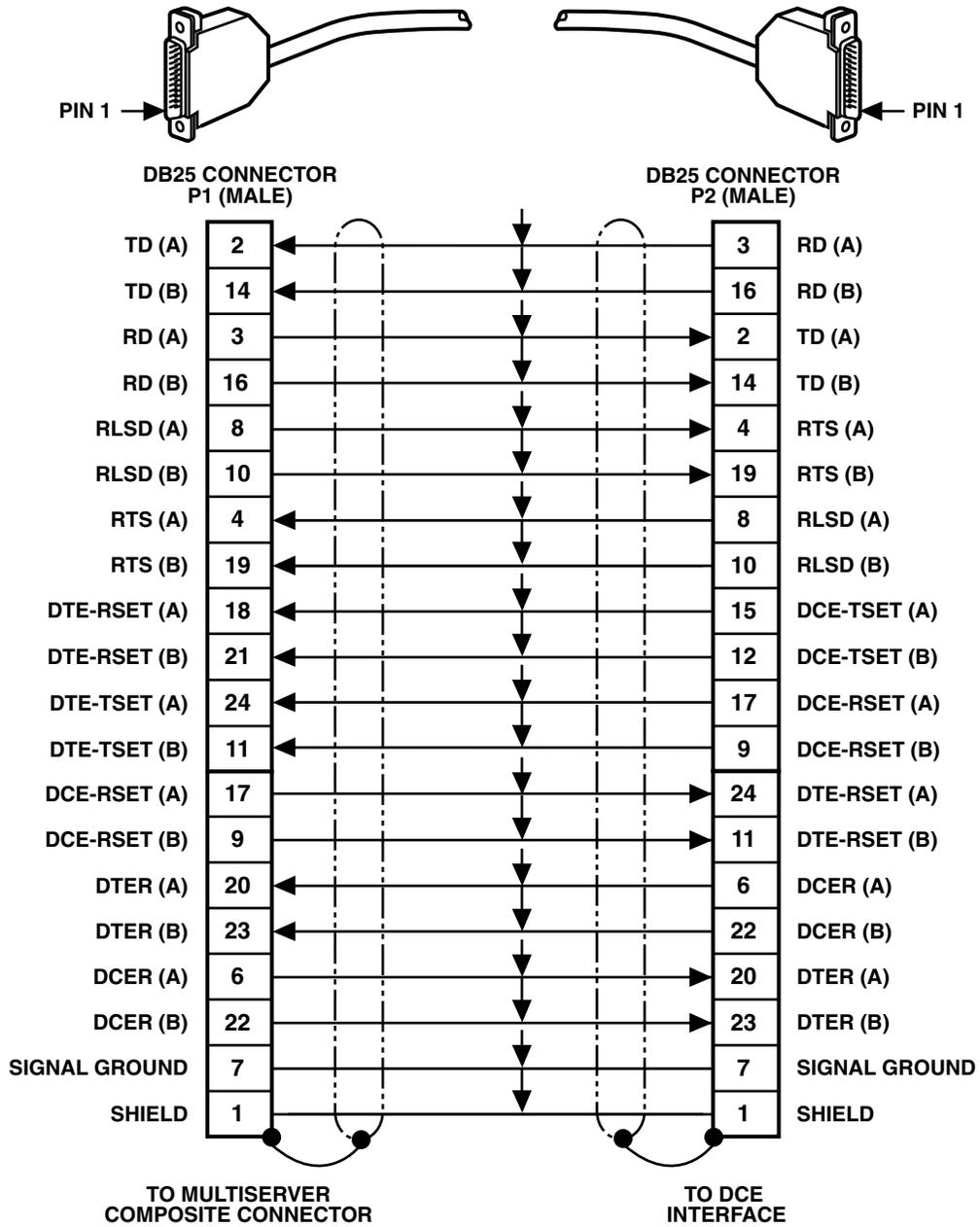


Figure F-6. RS-530-to-RS-530 DCE Crossover Cable.

Pin assignments for the COMPOSITE and DATA CHANNEL connectors configured for RS-530 signal levels are shown in Figure F-5. Use a crossover cable (order number EHN075-005M) with male

terminations at each end to connect to an RS-449 DCE device. See Figure F-7.

RS-530-to-X.21 DCE Crossover Cable

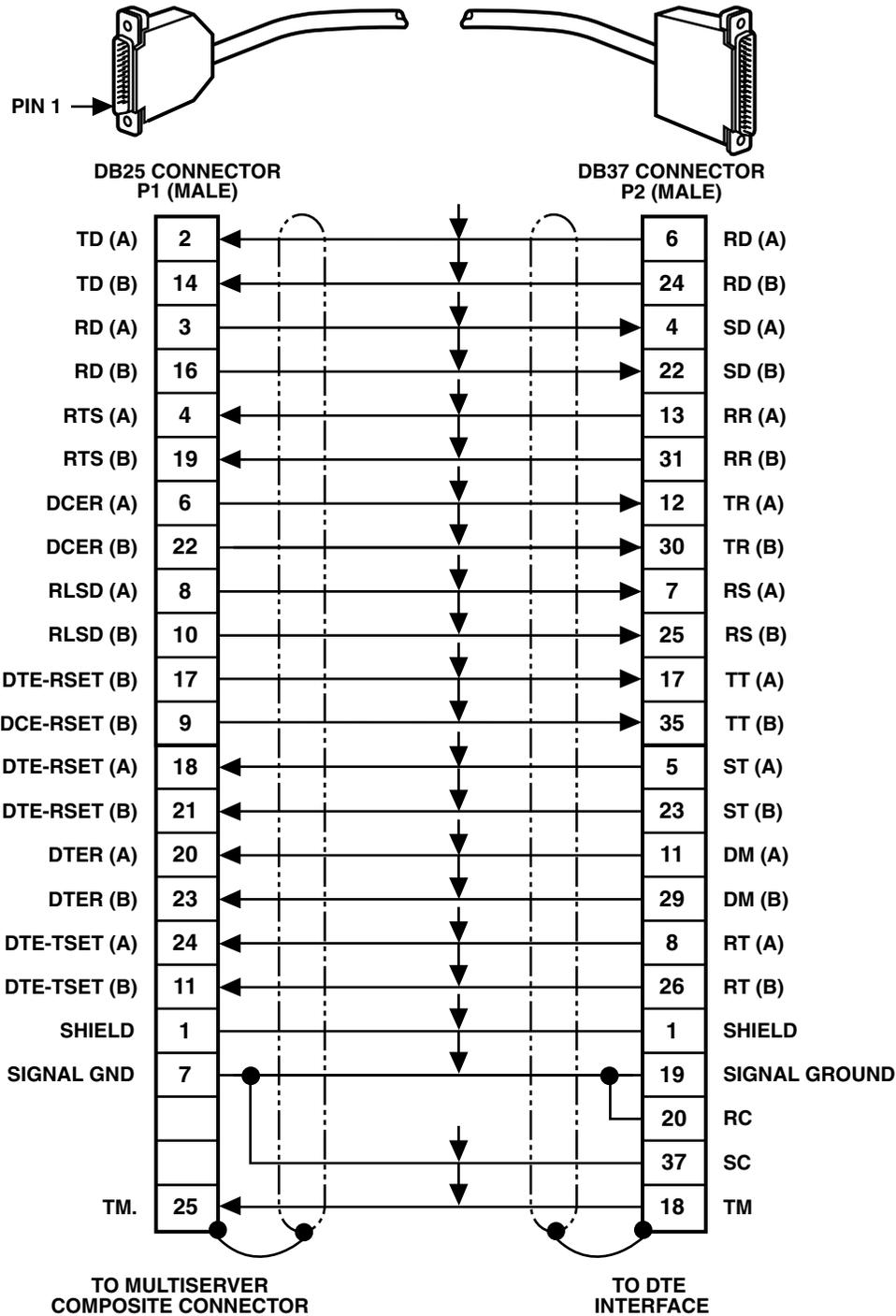


Figure F-7. RS-530-to-RS-449 DCE Crossover Cable.

Pin assignments for the COMPOSITE connector configured for RS-530 signal levels are shown in Figure F-5. Use a crossover cable (order code EHN073-005M) with male terminations at each end to connect to an X.21 DCE device. See Figure F-8.

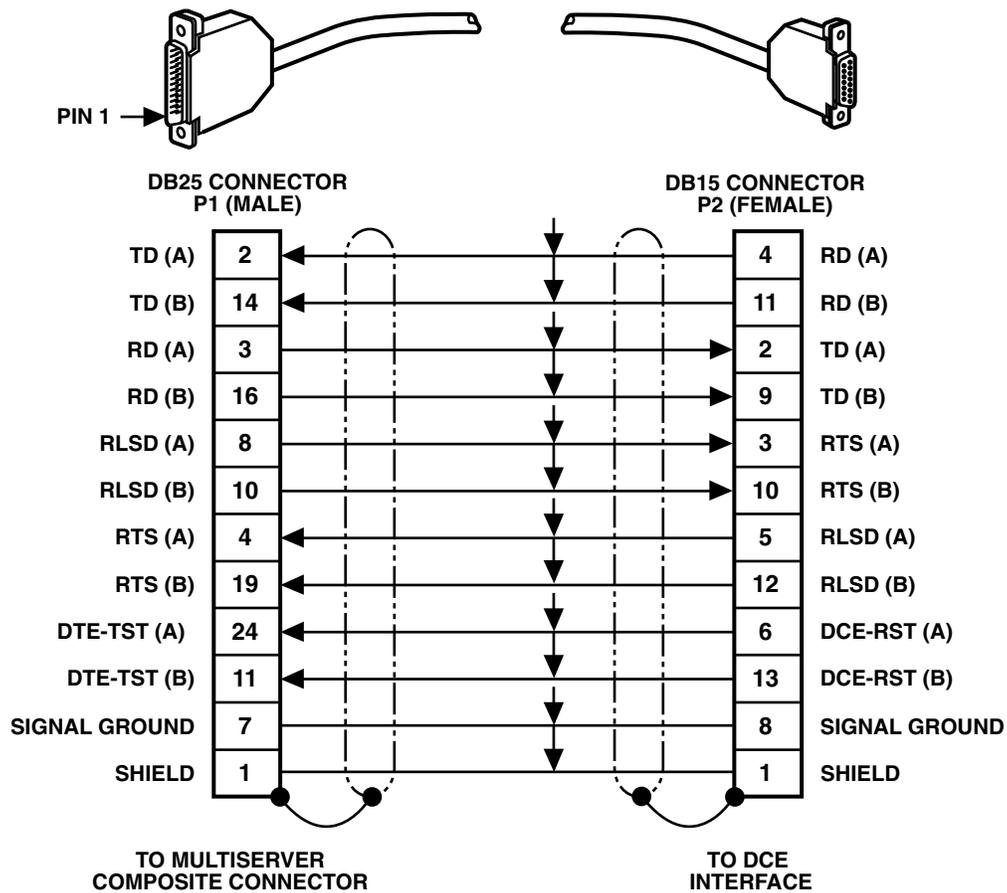


Figure F-8. RS-530-to-X.21 DCE Crossover Cable.

F.2 Data-Channel Interface Cables

RS-232 to DTE

Pin assignments for the DATA CHANNEL connector configured for RS-232 signal levels are shown in Figure F-1. Use a straight cable (order code EDN16C-xxxx-MF) with male-to-female terminations. See Figure F-9.

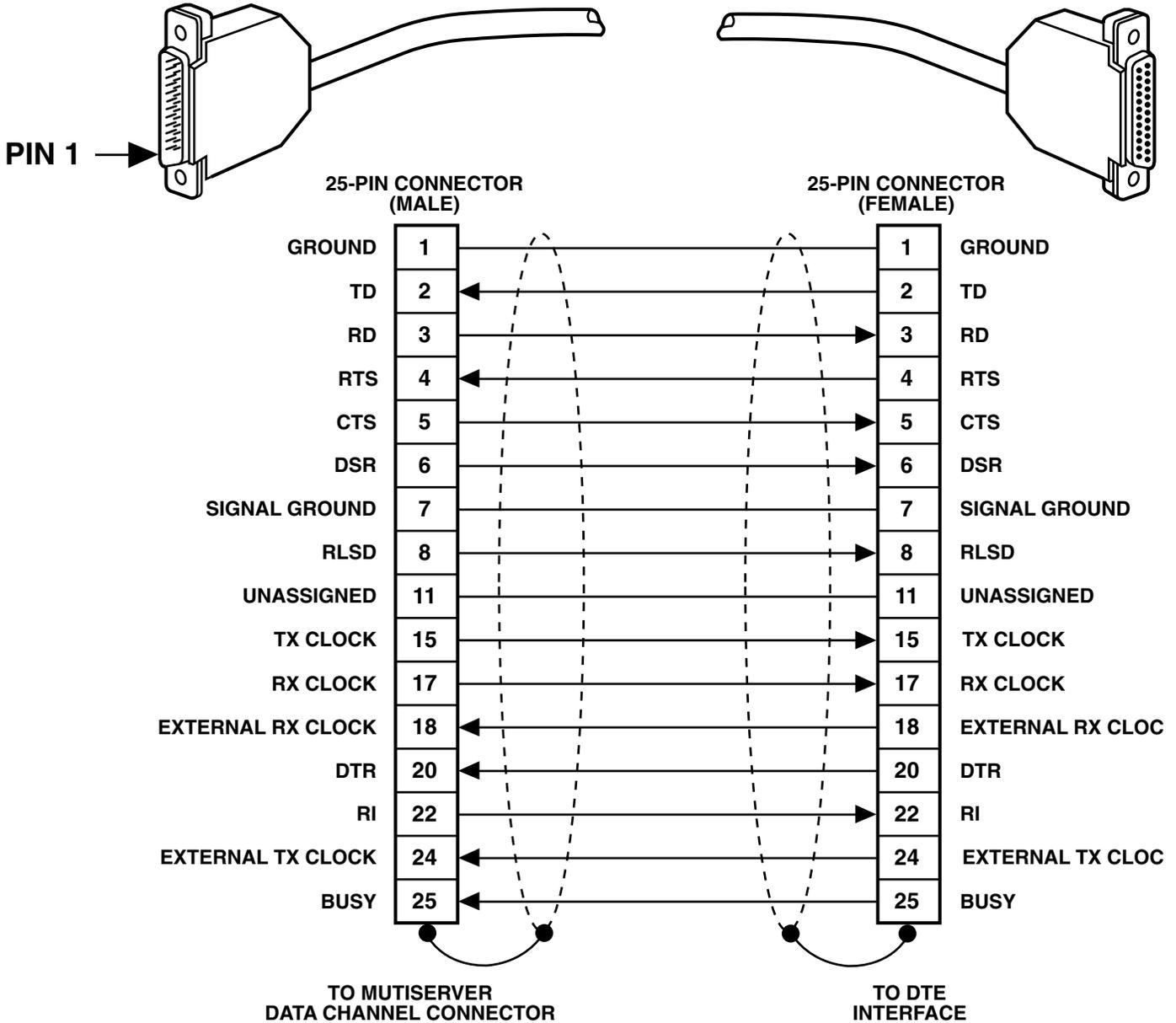


Figure F-9. RS-232-to-DTE Straight Cable (EDN16C-xxxx-MF).

V.35 to DTE

Pin assignments for the DATA CHANNEL connector configured for V.35 signal levels are shown in Figure F-3. Use a straight cable (order code EHN071-005M) with male-to-female terminations. See Figure F-10.

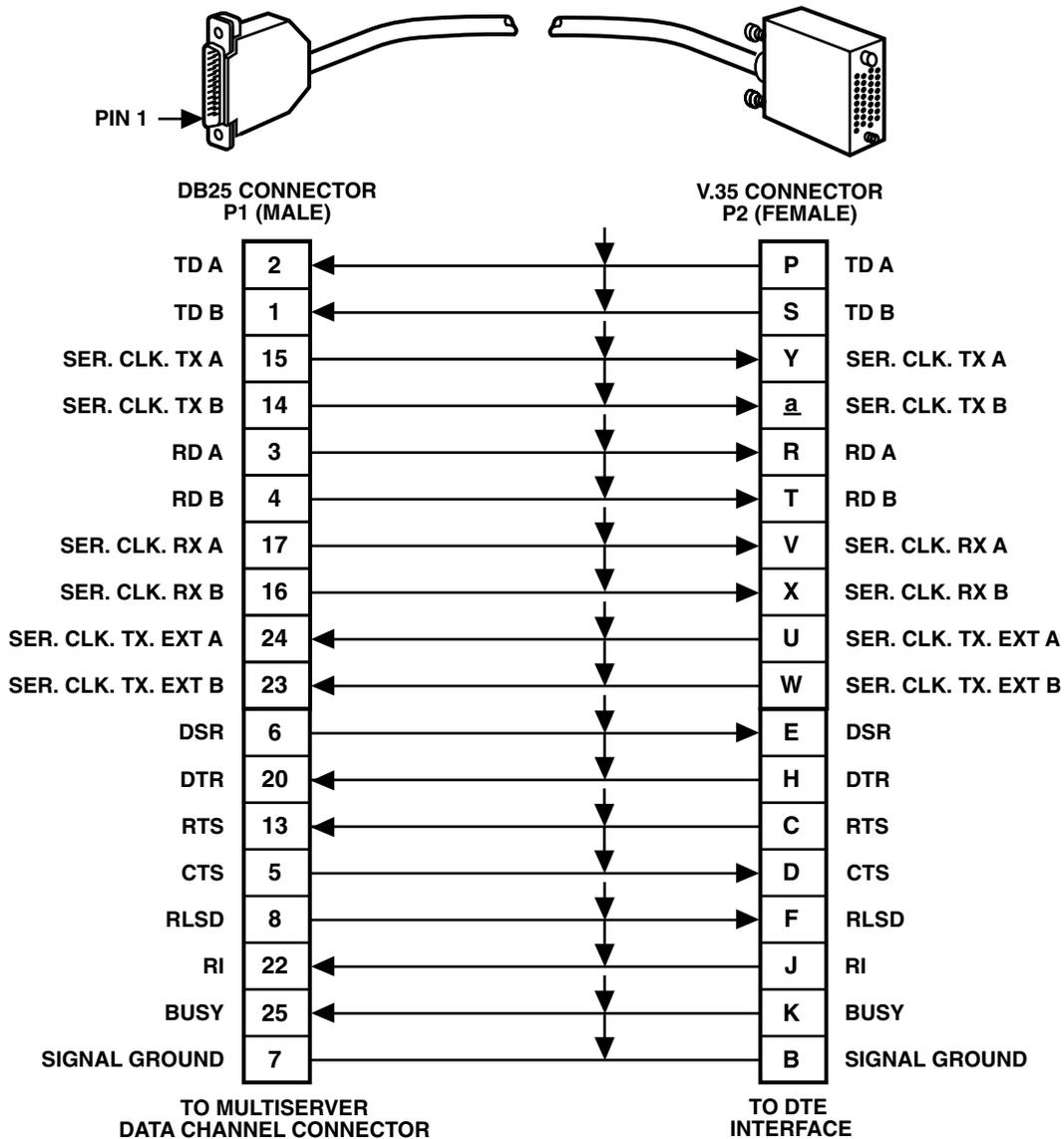


Figure F-10. V.35-to-DTE Straight Cable (EHN071-005M)

RS-530-to-RS-530 DTE

Pin assignments for the DATA CHANNEL connector configured for RS-530 signal levels are shown in

Figure F-5. Use a straight cable (order code EHN076-005M) with male-to-female terminations, to connect to an RS-530 DTE device. See Figure F-11.

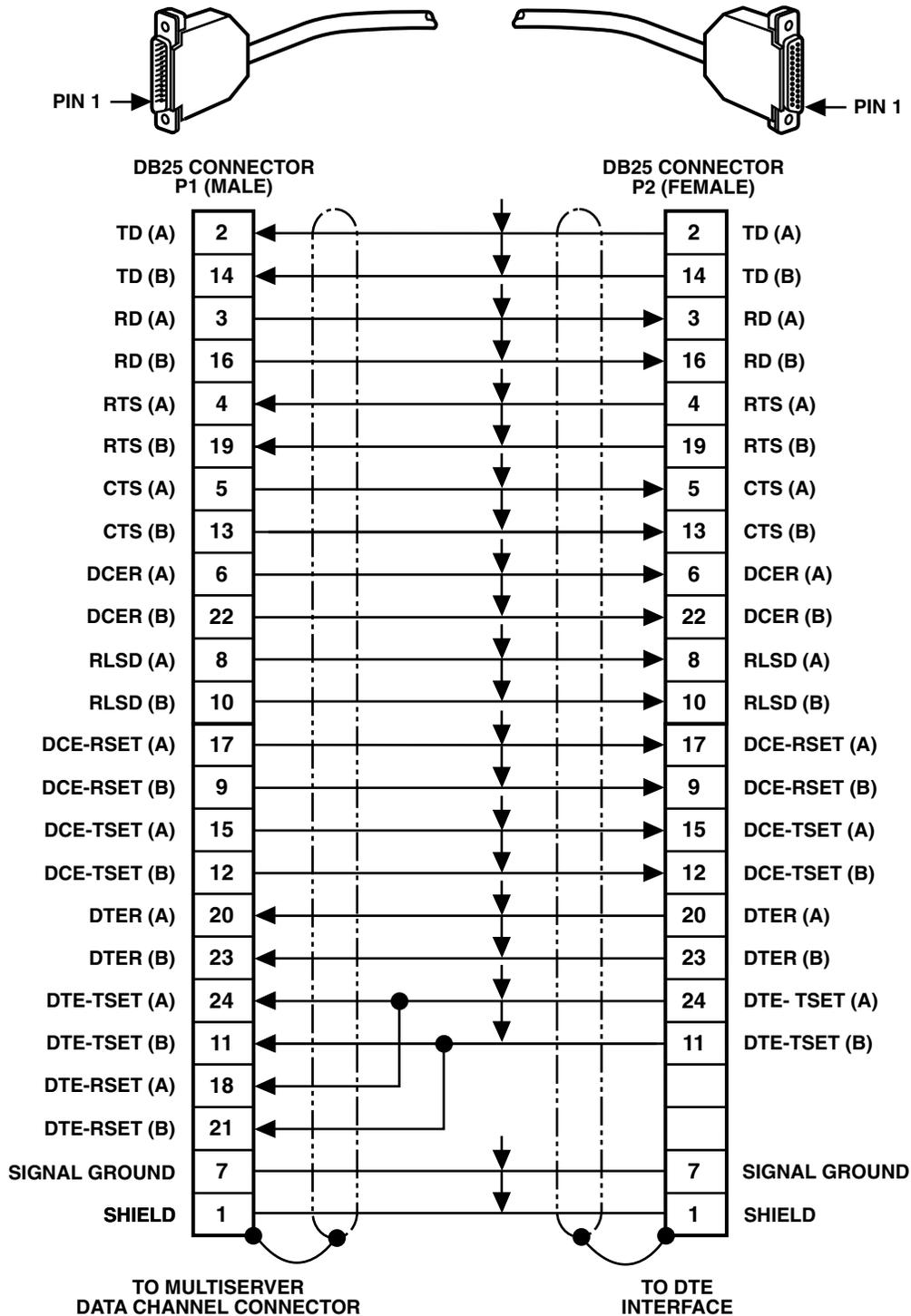


Figure F-11. RS-530-to-RS-530 DTE Straight Cable.

RS-530-to-RS-449 DTE

Pin assignments for the DATA CHANNEL connector configured for RS-530 signal levels are

shown in Figure F-5. Use a straight cable (order code EHN074-005M) with male-to-female terminations, to connect to an RS-449 DTE device. See Figure F-12.

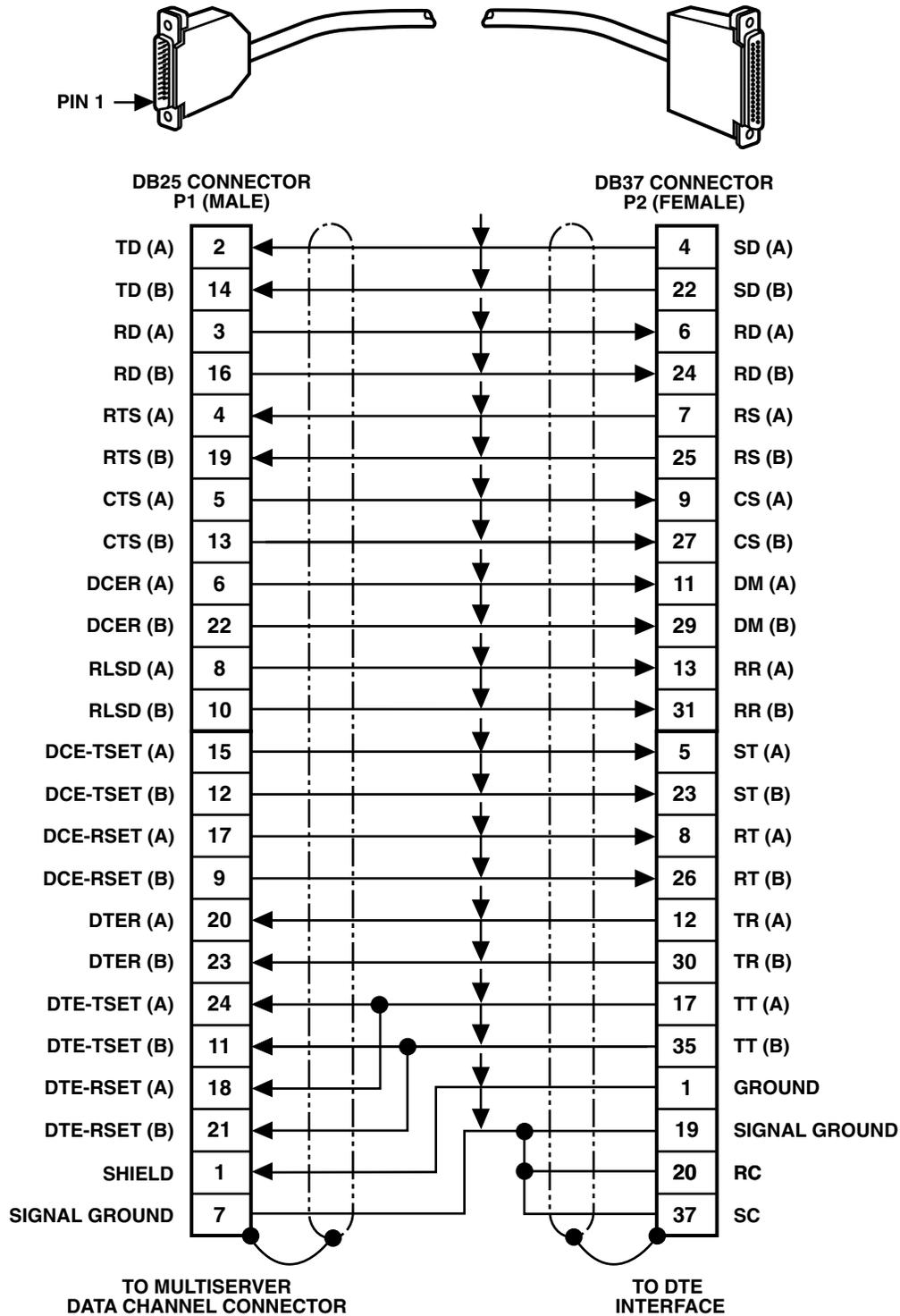


Figure F-12. RS-530-to-RS-449 DTE Straight Cable.

RS-530-to-X.21 DCE Straight Cable

Pin assignments for the DATA CHANNEL connector configured for RS-530 signal levels are shown in Figure F-5. Use a straight cable (order code EHN072-005M) with male/female terminations to connect to an X.21 DTE device. See Figure F-13.

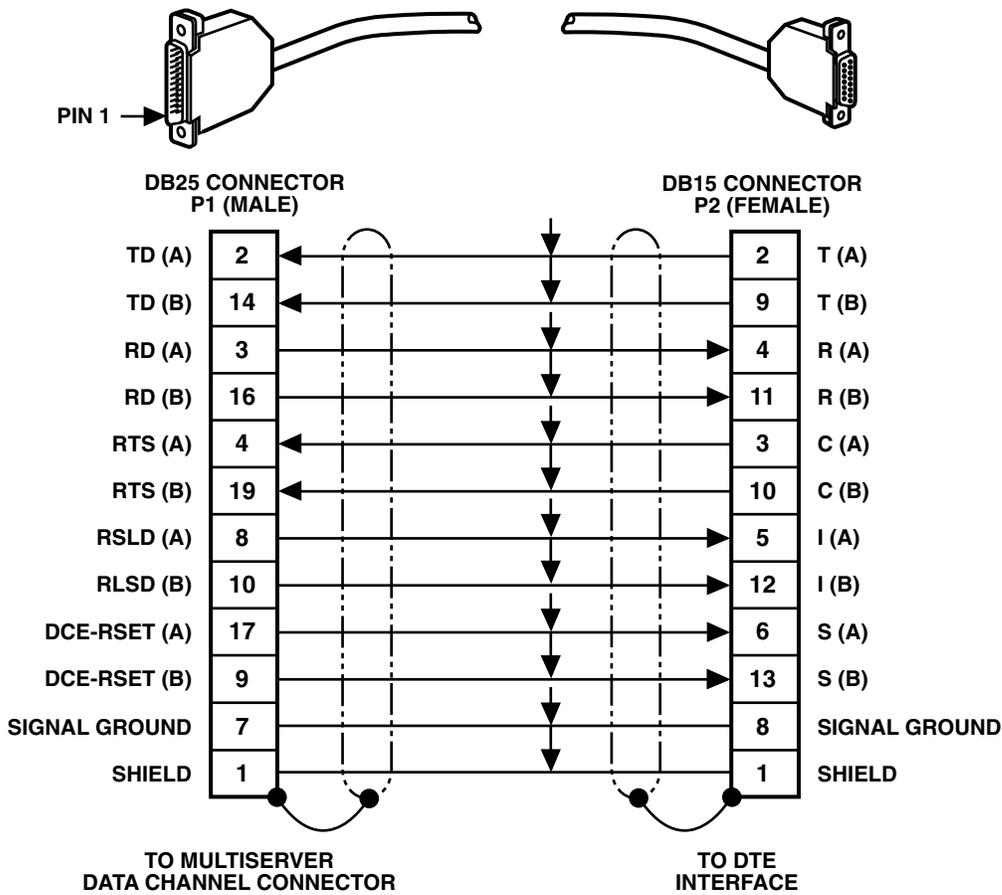


Figure F-13. RS-530-to-X.21 DTE Straight Cable.

Glossary

AC-15

A variation of the E&M signaling format used in Great Britain. See definition under **tone signaling**. For other options, see **DC signaling** and **pulsed DC**.

Attenuation

Decrease or deterioration of signal strength. Within the Multiserver 500, attenuation is a configurable option for output signal levels in 1-dB increments. See also **maximum output level**.

Bit

Contraction of binary digit. The smallest unit of information and the basic unit in digital data communications. A bit can have a zero or a one value (mark or space in data communications terminology).

Buffer

A temporary storage area to absorb the difference in either the rate of data flow or the time of occurrence of events in transmissions from one device to another.

Busy state

One of three configuration options that selects the way the Multiserver 500 controls the busy state of the voice/fax channel: always off, always on, or system-controlled.

Composite

The multiplexed output of the Multiserver 500 that includes voice or fax and synchronous or asynchronous data.

Composite loopback

A diagnostic test that loops back the composite data. May be local or remote.

Daisy chaining

A topology for connecting Multiserver 500 Command Ports together. It allows multiple local Multiserver 500s to be controlled from a single asynchronous terminal.

Data loopback

A diagnostic test that loops back the data portion of the signal but does not affect voice/fax operation. May be local or remote.

dB, decibel

A relative measure (logarithmic) of change in signal power.

DBA

Dynamic Bandwidth Allocation, a method used to allocate additional bandwidth to the synchronous data channel when the voice/fax channel is not in use.

dBm

An absolute measure of signal power, where 0 dBm equals 1 milliwatt into 600 ohms.

DC signaling

A configurable option in the Multiserver 500 fitted with an E&M-strapped voice/fax interface module. With this option, the channel senses the idle/active status by the DC condition of the M-lead, and indicates the idle/active status to the remote end by the DC condition on the E-lead. See **AC-15** and **pulsed DC**.

Decoding pulsing

See **pulse dialing**.

DID

Direct Inward Dialing, a service offered by the telephone company. It lets you dial an internal extension without passing through the operator. Billing does not start until the extension answers.

DISA

Direct Inward System Access, a service offered by a PBX. It lets incoming calls to the PBX have dialing access within the private network. May often be protected by a dialed password. Billing starts at the time when the PBX provides the dial tone.

DIT

Direct In Termination, a service offered by a PBX. It lets incoming calls to the PBX be routed directly to a selected telephone or group of telephones without operator intervention. Billing does not start until the telephone answers.

DSP

Digital Signal Processor, a microprocessor incorporated in the Multiserver 500 and used for voice compression and fax demodulation.

DTMF

Dual Tone Multifrequency, used for call addressing in pushbutton telephones. Also known as Multifrequency Push-Button (MFPB) in Europe.

Dynamic bandwidth allocation

See **DBA**.

E&M

In industry usage, a signaling convention between voice PBXs. As related to the Multiserver 500, an interface module compatible with the tie-trunk side of a voice PBX.

Extra gain

See **maximum output level**.

Fax, facsimile

Transmission of hardcopy images (written, typed, or drawn material) through the voice/fax channel.

FX, foreign exchange service

A telephone service provided to a subscriber from a central office which is located outside the subscriber's exchange area.

FXO, foreign exchange office

A voice/fax interface module that connects to the station side of the local PBX or central office.

FXS, foreign exchange station

A voice/fax interface module that connects to the telephone equipment at the subscriber's foreign exchange station.

Guaranteed rate

A Multiserver 500 configuration option ("rate" in the configuration menus) that specifies the amount of link bandwidth allocated to the synchronous data channel when the voice/fax channel is in use.

Header

Pins on a circuit board onto which a jumper can be installed for purposes of hardware configuration.

Hook

One of the Multiserver 500 options controlling Dynamic Bandwidth Allocation (DBA). When selected, it provides indication when the voice/fax channel is in use.

Host

The central computer (or computer systems) that provides primary data processing functions or data base access.

Hz, Hertz

A measure of frequency or bandwidth equal to one cycle per second.

Indicator lights

The light-emitting diodes (LEDs) on the front of the Multiserver 500.

Input level

A level of relative analog signal strength obtained from the attached telephone equipment.

Interrupted ring

A configuration option for the Multiserver 500 voice/fax channel fitted with an FXS interface module. When the channel is configured for interrupted ring, it rings the attached telephone set in a fixed cadence. See **repeated ring**.

Jumper

A miniature connector or wire that fits over, and electrically connects, two pins. A jumper either opens or shorts the electrical connection between the two pins.

Key telephone system

A telephone system in which the telephones have multiple pushbuttons to allow call out directly, without dialing an access number such as 9, and select incoming calls by pushing a button. Generally, a key telephone system has limited internal telephone-to-telephone capacity.

Link

A communications circuit or transmission path connecting two Multiserver 500s.

Loopback

A diagnostic feature used to test Multiserver 500s and related equipment either locally or from end to end over the link and back.

Maximum bandwidth

The amount of bandwidth allocated to the asynchronous data channel when the voice channel is not in use.

Maximum output level

A configuration option for an E&M 4-wire voice/fax channel. Allows for a maximum output level of +7 dBm.

NLP

Nonlinear processing, a method used to suppress residual echo.

Off-hook

A line condition caused when a telephone handset is removed from its cradle.

On-hook

A line condition that exists when a telephone handset is resting in its cradle.

PBX, private branch exchange

A privately owned phone system installed within the premises of an organization. It allows communication among users within the organization, as well as between those users and the outside world. It differs from a key telephone system, in that the user must dial an access number such as 9 to get an outside line.

Pulse dialing

Method used for call addressing in rotary telephones by short pulses of on-hook/off-hook. Also known as decadic pulsing in Europe.

Pulsed DC

A variation on the E&M signaling format, also known as Ron-Tron, used in France. A call connect request is made by sending a pulse of a medium duration on the transmit or "Tron" lead, and the call request is acknowledged by a return pulse of the same duration on the receive or "Ron" lead. See **DC** and **AC-15**.

RAM

Random access memory. A storage device into which data can be entered or read from.

Repeated ring

A configuration option for a Multiserver 500 voice/fax channel fitted with an FXS interface module. When so configured, causes the local

voice/fax channel to ring the attached telephone set in response to a remote PBX ringing signal. See **interrupted ring**.

Ring-down

A configurable option for a Multiserver 500 voice/fax channel fitted with an FXS interface module. Causes the local telephone to ring when the remote telephone is lifted off-hook, or vice versa.

Ron-Tron

See **pulsed DC**.

Self-test

A diagnostic feature used to test the Multiserver 500. Self-test is performed automatically during power up, but may be invoked manually by the user at any time.

Signaling

A handshaking protocol used between telephone equipment. Includes supervising (on/off hook line status), alerting (ringing), and call addressing (dialing) for switched services.

Signaling options

Options related to signaling that are configurable in the Multiserver 500. When fitted with an FXS interface module, the options include repeated ringing, interrupted 2/4 ringing, and interrupted 2-ring 1/2. When fitted with an E&M interface module, the options include DC, pulsed DC, and 2280 tone.

Silence

One of the Multiserver 500 options controlling Dynamic Bandwidth Allocation (DBA).

Single frequency

See **tone signaling**.

Strapping

A method used to configure a module; changing the positions of the straps changes the electrical connections between pairs of leads.

Telco

An Americanism; short for telephone company.

Telephone interface

The external equipment connecting to the voice/fax interface module of the Multiserver 500.

Telephone interface connector

A termination on the voice/fax interface module that connects the analog side of the voice/fax channel to the telephone equipment such as a telephone set, key telephone system, or voice PBX. There are three types of telephone interface connectors:

- RJ-11 registered modular jack, used for connecting to FXS and FXO type telephone interface equipment. Requires a 2-conductor modular cable.
- 4-pin terminal block, an alternate method used for connecting to FXS and FXO type telephone interface equipment. Requires a cable made up of 4 color-coded wires.
- 8-pin terminal block, used for connecting to E&M type telephone interface equipment. Requires a cable made up of 8 color-coded wires.

Tone signaling

A configurable option in the Multiserver 500 fitted with an E&M interface module, also known as AC-15. When so configured, the local channel senses the idle condition of the remote channel when a 2280-Hz tone is present on the T1-R1 pair. When the local channel is in an idle state, it informs the remote channel by placing a 2280-Hz tone on the T-R pair.

See also **DC signaling**.

Types I, II, and V

Strapping options in the enhanced E&M voice/fax interface module. It is used to match the E&M-strapped voice/fax channel with one of three PBX trunk types. See **Appendix C** for details.

2-wire/4-wire

A configuration option that matches the E&M voice/fax interface module with the PBX tie trunk. In a 4-wire system, the audio signal is transmitted over one pair of wires and received over the other pair. In a 2-wire system, the same pair of wires is used for both transmit and receive.

Index

Cables	16, 82	Interfaces	13-14
Cabling diagrams.....	82	Key Telephone System	58
Canadian Department of Communications	83	Keypad.....	21, 43
Clocking.....	17	LCD	13, 21, 43
CMD IN and CMD OUT Connectors	33	LED Indicators	41
Command Port.....	13, 28	Local Composite Loopback Test	51
Command port, accessing.....	34	Local Data Loopback Test.....	50
Commands, list of.....	36	Loopback tests	50
Composite Channel	13	Models available	14
Composite interface, configuring	78	Options	14
Composite Transmit Clock	17	Parameters	37
Data Channel.....	13, 44	Part numbers	14
DATA CHANNEL and COMPOSITE interface connectors.....	77	Power Supply	13
Data Connection	44	Prompt, configuring.....	36
Date, setting	18	Registration.....	82
Daughterboards.....	15, 77	Remote Composite Loopback Test	54
Default Configuration Settings.....	43	Remote Data Loopback	57
Defaults of the Command Port	28	Repair Instructions.....	82
Diagnostic tests	48	Self-Test	48, 50
Digital Processing Module	13	Serial Interface Module	13
E&M signaling formats.....	68	Site, selecting	16
E&M Voice/Fax Interface Card	68	Telephone Call	44
EEPROM Test	50	Telephone company.....	82
Fax machine	58	Terminals, connecting	30
Fax transmission	47	Time and Date	18
FXO Voice/Fax Interface Module	63	Tip (T) and Ring (R) leads	59, 64
FXS Voice/Fax Interface Module	58	Trasmit clock, composite	17
Impedance requirements	32	Troubleshooting	48
Impedance Strapping.....	32	Unpacking	15
Installing	16	Voice/Fax Channel	13
Interface modules	13	Voice/Fax Channel Parameters	47
		Voice/Fax Module, installing	20



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