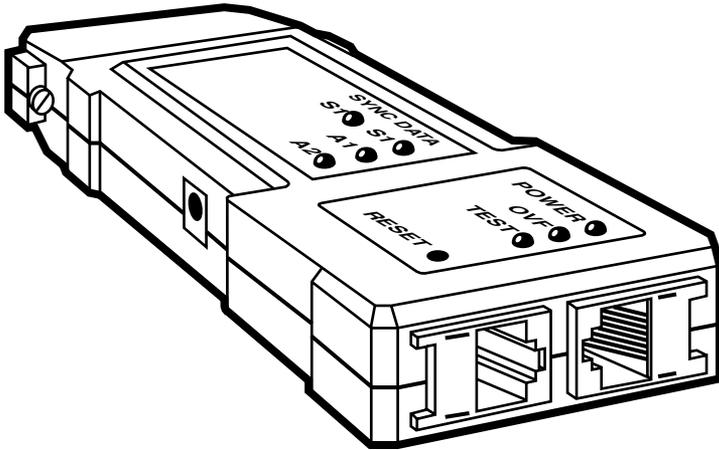




Miniature 2-Channel Statistical Multiplexor



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1. Todas las instrucciones de seguridad y operación deberán ser leídas antes de que el aparato eléctrico sea operado.
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8. Servicio—El usuario no debe intentar dar servicio al equipo eléctrico más allá a lo descrito en las instrucciones de operación. Todo otro servicio deberá ser referido a personal de servicio calificado.
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10. El equipo eléctrico deber ser situado fuera del alcance de fuentes de calor como radiadores, registros de calor, estufas u otros aparatos (incluyendo amplificadores) que producen calor.
11. El aparato eléctrico deberá ser conectado a una fuente de poder sólo del tipo descrito en el instructivo de operación, o como se indique en el aparato.

12. Precaución debe ser tomada de tal manera que la tierra física y la polarización del equipo no sea eliminada.
13. Los cables de la fuente de poder deben ser guiados de tal manera que no sean pisados ni pellizcados por objetos colocados sobre o contra ellos, poniendo particular atención a los contactos y receptáculos donde salen del aparato.
14. El equipo eléctrico debe ser limpiado únicamente de acuerdo a las recomendaciones del fabricante.
15. En caso de existir, una antena externa deberá ser localizada lejos de las líneas de energía.
16. El cable de corriente deberá ser desconectado del cuando el equipo no sea usado por un largo periodo de tiempo.
17. Cuidado debe ser tomado de tal manera que objetos líquidos no sean derramados sobre la cubierta u orificios de ventilación.
18. Servicio por personal calificado deberá ser provisto cuando:
 - A: El cable de poder o el contacto ha sido dañado; u
 - B: Objetos han caído o líquido ha sido derramado dentro del aparato; o
 - C: El aparato ha sido expuesto a la lluvia; o
 - D: El aparato parece no operar normalmente o muestra un cambio en su desempeño; o
 - E: El aparato ha sido tirado o su cubierta ha sido dañada.

MINIATURE 2-CHANNEL STATISTICAL MULTIPLEXOR

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1. Specifications

1.1 General

Test Modes—*Main Channel and Sub-Channels*: Local and remote loopback; *Main Channel Modem*: Local analog and remote digital loopback Control; *Command Port*: Any sub-channel port

Indicators (LEDs)—(1) SYNC for main channel, (2) DATA LEDs (one for each sub-channel), (1) POWER, (1) OVF, (1) TEST, (1) RESET

Power—*MX870A*: 115 VAC; *MX870AE*: 230 VAC; 47 to 63 Hz; 5 VDC, 700 mA, regulated

Temperature—32 to 122°F (0 to 50°C)

Humidity—Up to 95%, noncondensing

Size—0.9"H x 2.1"W x 4.3"D (2.2 x 5.3 x 11 cm)

Weight—3.3 oz. (90 g)

1.2 Sub-Channel

Configuration—DCE

Number of Sub-Channels—2

Data Rate—300 to 19200 bps, user-selectable

Interface—*Control Signals*: RTS, CTS, DTR, DCD; *Local Control Signal*: RTS to DCD

Transmitted End-to-End Character Code—5, 6, 7, or 8 data bits

Stop Bits—1, 1.5, or 2

Parity—Odd, even, none

Connectors—(2) RJ-45 female

Flow Control—*Hardware*: DTR/CTS for end-to-end (DTE-DTE) flow control, CTS flow control from sub-channel to DTE; *Software*: X-ON, X-OFF. X-ON, X-OFF characters are selectable from DCI (11H) to DC4 (14H) and 91H to 94H

1.3 Composite Channel

Configuration—DTE

Transmission Format—Synchronous, external timing

Data Rate—Up to 19.2 kbps

Connector—(1) DB25 female

Control Signals—RTS, CTS, DCD, DTE, analog loopback (pin 18), remote digital loopback or signal quality (pin 21)

Protocol—Proprietary variant of HDLC framing protocol as defined in CCITT X.25 level 2

2. Quick-Start Guide

2.1 Scope

This guide provides concise instructions for configuring your Miniature 2-Channel Statistical Multiplexor. Use it if you're already familiar with the Multiplexor, or if you're an experienced user and have a good basic understanding of data-communication principles and know the applications and characteristics of statistical multiplexors.

Use this guide together with Figure 4-6, Configuration Tree.

Whenever you want more details, refer to Tables 4-1 and 4-2 and to Sections 4.9 and 4.10.

Once you start the configuration program, the Multiplexor will guide you through any desired configuration.

2.2 What You Need

You configure the Multiplexor from a data terminal connected to one of the Multiplexor sub-channels. The terminal communication parameters must match the parameters of the selected sub-channel. If you do not know what these parameters are, or you just received a new Multiplexor, use the following default parameters:

Baud Rate:	9600 bps
Format of Data:	Character length 8 data bits
	No parity
	1 stop bit

The Multiplexor is shipped to you with these defaults. If you're re-installing an already-configured Multiplexor, you can reset it to factory defaults. Read **Sections 4.3 and 4.4**, then turn the Multiplexor off, set its internal INIT/NOR jumper to INIT, and turn the Multiplexor on again. Return the INIT/NOR jumper to NOR before starting the configuration.

Whenever the Multiplexor is already installed in a link, establish communication with the remote Multiplexor before starting. In this way, you will be able to configure the two units from the terminal connected to the local Multiplexor.

2.3 Configuration Instructions

Pay attention to use of capital letters whenever required.

1. If necessary, power up the Multiplexor and connect your terminal to one of the sub-channels. Check terminal communication parameters.
2. Allow an idle period of at least one second, type @ @ @, wait at least one second, and type S.
3. The Multiplexor enters the command mode. Enter the password.

NOTE

The default password is RD. If you do not know the password, initialize the Multiplexor via the INIT/NOR jumper.

4. The STM displays the Main Menu. Use Figure 4-6 to plan your configuration actions. Record the configuration on the form given at the end of the appendix. Keep the filled-up form for reference.

IMPORTANT

Each configuration change takes effect immediately. Each time you change one of the communication parameters of the sub-channel you use now, you must immediately change the corresponding communication parameter of your terminal to the same value. If you don't, you lose communication with the Multiplexor. If you make an error that you cannot correct, initialize again the Multiplexor with the INIT/NOR jumper and start again.

5. When the link to the remote Multiplexor operates, use Remote System Configuration to transfer local configuration to remote Multiplexor, and/or to configure the remote Multiplexor as required.
6. If you initialized the Multiplexor, modify the password as required. Record the password.
7. Exit the command mode by typing 6 on the Main Menu.

3. Introduction

3.1 Functional Description

The Miniature 2-Channel Statistical Multiplexor is an advanced, full function and compact statistical multiplexor.

The Multiplexor multiplexes two asynchronous data sub-channels, at data rates of 300 to 19,200 bps onto a single composite synchronous channel of up to 19.2 kbps. Composite channel rate is automatically determined by an external clock signal, whereas sub-channel characteristics and other system features are selected by the user, using a menu-driven configuration function.

The Multiplexor uses a dynamic data buffer management technique, to allocate available buffer capacity according to sub-channel activity. Error-free end-to-end data transmission is ensured by powerful and efficient error detection and automatic retransmission, completely transparent to the user.

The Multiplexor provides independent hardware and software flow control for each sub-channel (both end-to-end flow control (DTE to DTE), and terminal flow control (DCE to DTE). For compatibility with most applications, hardware flow control (DTR) and several software flow-control characters are available.

The Multiplexor provides for full system configuration (including configuration downloading from the local Multiplexor to the remote Multiplexor, and vice-versa) from any sub-channel port. Password protection is used, to prevent unauthorized configuration changes.

Configuration can be carried out using any standard CRT terminal, using a simple, menu-driven facility. Configuration parameters are stored in non-volatile memory and are immediately available upon power-up.

To facilitate initial system configuration, the Multiplexor stores, in addition to the user-selected configuration, a set of default configuration parameters (factory setting), that can be selected by means of a jumper (see **Section 4.3**).

The Multiplexor has comprehensive diagnostics functions, including automatic self-test upon power-on, local and remote sub-channel loopback, and local and remote composite channel loopback. Front-panel indicators show the condition of each sub-channel and the composite-link synchronization status. In addition, the Multiplexor can control the V.54 pins (pins 18 and 21) of the RS-232 interface serving the composite link. This provides control over the analog and remote digital loopback functions of the modem connected to the Multiplexor.

3.2 Typical Application

Figure 3-1 shows a typical Multiplexor application. In this application, the Multiplexor sub-channels receive data provided by the host computer via channels operating at various rates, and statistically multiplexes the sub-channel data to form a composite data stream having a rate much smaller than the arithmetical sum of the individual sub-channel rates. The required composite link rate depends on Multiplexor buffer capacity versus sub-channel traffic statistics and allowable delay. The composite data is sent via modems to the remote Multiplexor, where it is demultiplexed and distributed to the local users, at their nominal rate (that may differ from the nominal host transmission rate).

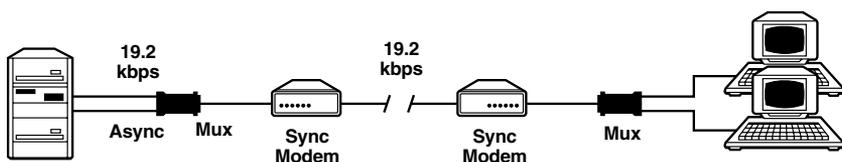


Figure 3-1. Typical Application.

Reliable operation of any statistical multiplexor requires the equipment connected to its sub-channels to use some form of flow control. However, an important feature of the Multiplexor is that the flow-control methods used at each of the two sub-channel ends can be different (hardware control at one end, software control at the other end), the conversion being transparently performed by the Multiplexor.

4. Installation

4.1 General

The Multiplexor is delivered completely assembled. It's designed for desktop use.

4.2 Site and Power Requirements

4.2.1 POWER

The Multiplexor is powered by an external power supply of 5 VDC/700 mA. A 115-VAC power supply is included with the MX870A model and a 230-VAC power supply is included with the MX870AE model.

The power supply is connected to the Multiplexor by a cable ending in a miniature phone jack (tip positive, sleeve-ground).

4.2.2 AMBIENT REQUIREMENTS

Both Multiplexor models will operate properly in any ambient conditions suitable for operation of electronic computer equipment and peripherals. Multiplexors, however, can operate without performance degradation over a wide range of temperatures, 32 to 22°F (0 to 50°C), at relative humidities (up to 95%, non-condensing).

4.3 Description of Internal Jumpers

The Multiplexor has three internal jumpers, used according to the following description:

(1) INIT - NOR jumper (JP1).

This jumper is used to select the default set of configuration parameters stored in the Multiplexor. The jumper has two positions:

NOR - Normal operation.

The Multiplexor uses parameters selected by the user during the last configuration session, and stored in the Multiplexor's non-volatile RAM.

INIT - Initialization.

The Multiplexor uses the default configuration (determined by the factory and common to all Multiplexor units). To select the default configuration, set the jumper to INIT, then apply power to Multiplexor. The default configuration is loaded upon power-up (factory setting is NOR).

When delivered, the non-volatile memory of the Multiplexor is already loaded with the default configuration, therefore the Multiplexor is configured in accordance with the factory settings.

You may have to select again the default configuration (INIT) in the following cases:

- After an error was made during the configuration session, which either prevents communication between the control terminal and the Multiplexor, or proves difficult to trace and correct.
- The description of the configuration loaded into the Multiplexor has been lost, and it is therefore not possible to enter the configuration mode in the NOR mode. To avoid this inconvenience, always keep a record of the last configuration parameters (a typical record form is shown in **Appendix B**).

After the default configuration is loaded by setting the jumper to INIT and powering up the Multiplexor, it becomes the current Multiplexor configuration and the jumper should be returned to the NOR position to allow configuration.

(2) PIN 21 ON-OFF jumper (JP3).

Pin 21 of the standard RS-232 interface can serve either as a signal-quality indication (SQ) line, or as a remote-loopback command line. The actual function of pin 21 depends on the specific model of modem in use, and a jumper allows adapting the Multiplexor to the modem connected to the composite (main) link connector.

The jumper has two positions:

PIN 21 ON

Set the jumper to this position when the modem uses pin 21 as a remote loopback command line. This connects the internal Multiplexor pin 21 driver to this pin, and allows the user to control this modem function using the diagnostics screen.

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PIN 21 OFF

Set the jumper to this position when the modem uses pin 21 as a signal- and quality-indication output. You should also use this position whenever in doubt about the actual function of the pin in the specific modem model you use. In this position, you no longer have control of the modem remote loopback function from the diagnostics screen.

Factory setting is OFF.

(3) TXCLK jumper (JP2)

This jumper enables checking of TXCLK (main channel).

The jumper has two positions:

- Connect - TXCLK sample connected
- Disconnect - TXCLK sample disabled

Factory setting is Connect.

WARNING

Disconnect the power supply from the mains before opening the Multiplexor. You might be shocked!

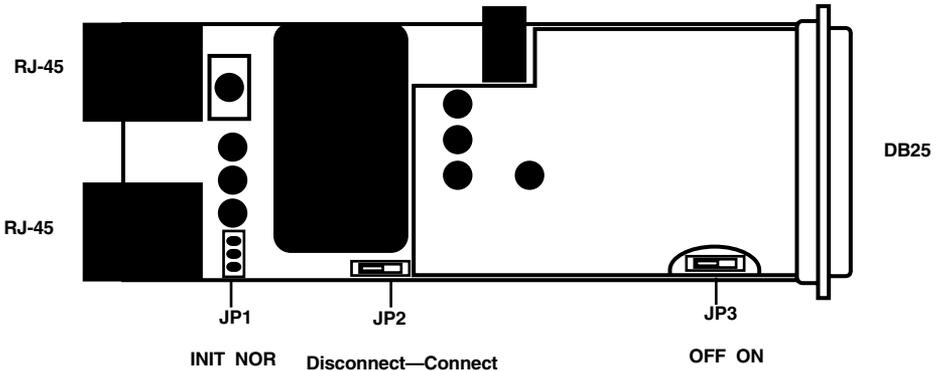


Figure 4-1. Location of the Jumpers.

4.4 Cable Connections

4.4.1 GENERAL

The Multiplexor has one standard DB25 connector, serving the main channel, and two RJ-45 connectors for the sub-channels.

4.4.2 SUB-CHANNEL CONNECTIONS

Multiplexor sub-channel interfaces are configured as data communication equipment (DCE) interfaces, thereby allowing direct connection, via RS-232 port cables, to data terminal equipment (DTE). When modems are used to extend range (tail-end circuits), crossover cables are required. Sub-channel interfaces are asynchronous; therefore, clock signals are not supported or required.

4.4.3 MAIN (COMPOSITE) CHANNEL CONNECTION

The Multiplexor composite channel interface is configured as a DTE interface, intended for connection to a synchronous modem, that is capable of providing the clock signal that determines the Multiplexor's composite-channel data rate.

Appendix A also lists the pin allocation for the main composite-channel connector.

4.5 Power-On Procedure

To turn the Multiplexor on, connect the power cable to the Multiplexor power supply, then plug the power supply unit into the mains. Plug the power supply into the Multiplexor. The POWER indicator should light.

Check that after a few seconds (during which the Multiplexor performs a self-test), the TEST indicator goes out. If the link to the far Multiplexor is not yet operational, the TEST indicator will flash.

4.6 Configuration Information

The Multiplexor can operate in three modes:

1. Normal operation mode (described in detail in **Chapter 5**)
2. Parameter configuration mode

Allows user to set-up parameters of local and remote Multiplexor units. This mode provides two types of functions:

- Parameter-selection functions.
- System management functions, used to save (store) selected parameters, transfer configurations between the local and remote units, activate new configurations, and select passwords.

3. Diagnostics mode

Multiplexor diagnostic functions include local and remote loops on each sub-channel and on the composite channel, and modem loops (analog and optionally remote digital loopback). Refer to **Chapter 6** for additional details.

The parameter-configuration mode and the diagnostics mode are activated by the user from the command terminal, using the Multiplexor configuration program. For those already familiar with the Multiplexor, there is a Quick-Start Guide in **Chapter 2**. This section provides an outline of the configuration parameters available to the user. **Section 4.7** provides step-by-step instructions on starting configuration and diagnostics sessions. **Section 4.8** provides in-depth information on each menu, and the purpose of each parameter or diagnostics screen.

The Multiplexor has two types of configuration parameters:

1. System parameters that affect both Multiplexor units connected in a link, and also affect all their sub-channels. System parameters are listed in Table 4-1.
2. Sub-channel parameters, that affect only the operation of a single sub-channel. Sub-channel parameters are listed in Table 4-2.

Table 4-1. System Parameters and Factory Settings.

No.	Parameter	Function	Available Selections	Factory Setting
1	PASSWORD	Controls access to configuration	Any two characters except those used as X-ON and X-OFF control characters	RD (capital letters)
2	X-ON CONTROL CHARACTER	When using software flow control, causes the receiving terminal to start data transfer	11H (DC1) 12H (DC2) 13H (DC3) 14H (DC4) 91H 92H 93H 94H	11H
3	X-OFF CONTROL CHARACTER	When using software flow control, causes the receiving terminal to stop transfer of data	Same range as for X-ON; however, selected character must be different from the X-ON character	13H

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Table 4-2. Sub-Channel Parameters and Factory Settings.

No.	Parameter	Function	Available Selections	Factory Setting
1	BAUD RATE	Sub-channel data rate	300, 600, 1200, 1800, 9600 2400, 4800, 7200, 9600, 14400, and 19200 bps	
2	DATA BITS	Number of data bits in sub-channel data frame	5, 6, 7, 8	8
3	PARITY	Type of parity used in sub-channel data frame	Odd Even None	None
4	STOP BITS	Number of stop bits in sub-channel data frame	1, 1.5, 2	1
5	MUX TO DTE SOFTWARE FLOW CONTROL	Controls software flow control function at the local end of the sub-channel. When on, see also Table 4-1, No. 2, 3.	On Off	On
6	END-TO-END SOFTWARE FLOW CONTROL	Activates end-to-end software flow control When on, see also Table 4-1, No. 2, 3.	On Off	On
7	END-TO-END DTR FLOW CONTROL	Activates end-to-end hardware flow control (via DTE line)	On Off	On
8	RTS CONTROL PASS	Enables the transfer of the RTS state to the remote DCD line	On	Off

4.7 Starting the Configuration Session

The rest of this chapter explains in detail how to configure the Multiplexor. If you are already acquainted with the Multiplexor, a Quick-Start Guide is given in **Chapter 2**.

4.7.1 USING THE CONFIGURATION PROGRAM

The Multiplexor configuration program can be run on any standard CRT terminal, connected to any sub-channel port. It is a simple menu-driven program that guides you through the various configuration steps:

1. At each step, you are presented with a screen that shows all available selections, and when applicable, also shows the current selections.
2. A standard selection procedure is used throughout: the available options are marked with numbers, and you indicate your selection by typing the option number.
3. To leave the current screen, you always type "Q". This returns you to the previous screen. When you are on the main menu of the Multiplexor, you must type 6 to exit.

The program checks your entries and does not accept invalid entries. For example, if the program expects a numerical entry in a certain range, and you press a key outside this range, the program ignores your entry and waits for a valid response. After a valid response is provided, it is immediately executed by the local Multiplexor. As you will see later, when you prepare the configuration for the remote Multiplexor, three different stages are used: preparation of configuration, transfer to remote Multiplexor, and activation of transferred configuration. When changing parameters related to the communications format of the sub-channel used to configure the Multiplexor, you must immediately change terminal communication format as well.

However, if you make a mistake and lose communication with the Multiplexor, you can always quit the configuration program and start again from the default configuration (see **Section 4.3** for instructions). You can always stop the configuration session at any point, by pressing the ESC key of the terminal; however, any changes made before pressing the ESC key remain in effect.

4.7.2 PREPARATION FOR CONFIGURATION SESSION

1. Power on the Multiplexor.

Wherever possible, establish communication with the remote Multiplexor.

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However, configuration can usually be done without connection to the remote Multiplexor. There is one exception to this rule: you must establish communication with the remote Multiplexor if you set the RTS-to-DCD control passing to ON (screen 14), and your command terminal requires DCD active in order to communicate.

2. Select one of the terminals connected to Multiplexor sub-channels as a command (configuration) terminal, or connect a CRT terminal to one of Multiplexor ports.
3. When a new terminal is connected to the Multiplexor sub-channel selected as the command port, program the communications parameters of this terminal according to those of the selected Multiplexor port (factory setting is 9600 bps, 8 data bits, 1 stop bit, no parity bit).

4.7.3 STARTING THE CONFIGURATION PROGRAM

The configuration program requires the user to enter a password before proceeding any further. If you enter an incorrect password, the Multiplexor immediately returns to start again the configuration session.

NOTES

1. The following examples assume that the command mode is activated via sub-channel 1.
 2. Multiplexor commands requiring alphanumeric inputs are case-sensitive. Observe use of lower-case and upper-case letters in the following examples.
1. To start the configuration session, allow an idle period of at least one second, type @ @ @, then wait at least one second and type S (typing any other character after the @ @ @ string returns the Multiplexor to the normal mode, and you will see the message: Multiplexor IN NORMAL MODE).
 2. After correctly typing the starting command, the Multiplexor stops data transfer through the sub-channel used as a command sub-channel, its TEST indicator lights, and the opening screen appears as follows:

COMMAND MODE IS ACTIVATED VIA CH1

Multiplexor COMMAND MODE

REV 0.0

ENTER MULTIPLEXOR PASSWORD

3. Enter the password, carefully observing the correct use of upper and lowercase characters. The password is not echoed to the screen. Factory setting is RD.
4. If the password is rejected, you will see the following screen appear :

```
COMMAND MODE IS ACTIVATED VIA CH1
      WRONG PASSWORD
MULTIPLEXOR IS IN NORMAL MODE
```

You must repeat step (1) again.

5. If the password is accepted, the Multiplexor sends the main menu:

```
MAIN MENU
0) SYSTEM CONFIGURATION
1) SUB-CHANNEL 1 CONFIGURATION
2) SUB-CHANNEL 2 CONFIGURATION
3) DIAGNOSTICS
4) EXIT TO NORMAL OPERATION
SELECT YOUR CHOICE (0 - 4)
```

You can now start the actual configuration session (**Section 4.8**).

From this point on, whenever you want to end the configuration session, press Q as many times as necessary to obtain the following message, or press ESC.

```
EXIT COMMAND MODE
MULTIPLEXOR IN NORMAL MODE
```

4.8 Configuration Procedure

The rest of this chapter presents the menus and the data-entry screens contained in the configuration program.

These paragraphs describe menu and screen purpose, explain how to fill the desired data, and present any supplementary information that may be required.

Table 4-3 lists the available menus and screens, their index numbers and the page on which you will find each screen.

Table 4-3. Multiplexor Configuration Program.

Index	Menu/Data Entry Screen	Page
	MULTIPLEXOR MAIN MENU	
	SYSTEM CONFIGURATION Menu	
	X-ON CONTROL CHARACTER Screen	
	X-OFF CONTROL CHARACTER Screen	
	MODIFY PASSWORD Screen	
	SUB-CHANNEL 1/2 CONFIGURATION Screens	
	BAUD RATE Screen	
	DATA BITS Screen	
	PARITY Screen	
	STOP BITS Screen	
	STM TO DTE SOFTWARE FLOW CONTROL Screen	
	END TO END SOFTWARE FLOW CONTROL Screen	
	END TO END DTR FLOW CONTROL Screen	
	RTS CONTROL PASS Screen	
	DIAGNOSTICS Menu	
	LOCAL LOOPS Screen	
	REMOTE LOOPS Screen	
	MODEM LOOPS Screen	
	LOOP CONTROL Screens	
	REMOTE Multiplexor CONFIGURATION Menu	
	TRANSFER CONFIGURATION FROM REMOTE TO LOCAL Screen	
	REMOTE Multiplexor CONFIGURATION Screen	
	EXAMINE Remote Multiplexor Configuration Screen	

Table 4-3 (continued). Multiplexor Configuration Program.

Index	Menu/Data Entry Screen	Page
	SAVE IN LOCAL MULTIPLEXOR Screen	
	TRANSFER CONFIGURATION FROM LOCAL TO REMOTE Screen	
	PREPARE REMOTE MULTIPLEXOR CONFIGURATION Menu	
	REMOTE Multiplexor SYSTEM CONFIGURATION Menu	
	REMOTE SUB-CHANNEL 1,2 SYSTEM CONFIGURATION Screens	
	ACTIVATE REMOTE Multiplexor CONFIGURATION Screen	

4.9 Main Menu

Purpose: Select the configuration task to be carried out.

Description: (see **Table 4-4**).

Table 4-4. Description of the Main Menu.

Code	Item	Description
0	SYSTEM CONFIGURATION	Used for selection of system-wide parameters (see Section 4.6) Select X-ON and X-OFF flow control characters Change password Prepare remote Mux configuration

Table 4-4 (continued). Description of the Main Menu.

Code	Item	Description
1	SUB-CHANNEL 1 CONFIGURATION	These two items are used to select local sub-channel parameters of the command sub-channel as the last item
2	SUB-CHANNEL 2 CONFIGURATION	Always change the parameters of the command sub-channel as the last item
3	DIAGNOSTICS	Used to control the various test loops that can be controlled by the Mux (see Section 6.2)
4	EXIT TO NORMAL OPERATION	Ends the current configuration session

Procedure:

To select a configuration task, type the corresponding code number; the Multiplexor will switch to the corresponding screen.

To end the configuration session, type 6. The TEST indicator will turn off, and you will receive the message:

```
EXIT COMMAND MODE  
MULTIPLEXOR IS IN NORMAL MODE
```

4.10 System Configuration Menu

Select the parameters that affect the whole system: change X-ON and X-OFF characters, change password, and prepare remote Multiplexor configuration.

Table 4-5. System Configuration Parameters.

Code	Item	Description
1	X-ON CONTROL CHARACTER	Used to display X-ON character selection screen
2	X-OFF CONTROL CHARACTER	Used to display X-OFF character selection screen
3	MODIFY PASSWORD	Used to display password-changing screen
4	REMOTE MUX CONFIGURATION	Used to display the main menu used for remote Multiplexor configuration
Q	EXIT	Used to return to the main menu.

To select a configuration task, type the corresponding code number: the Multiplexor will switch to the corresponding screen.

Type Q to return to the main menu.

4.11 X-ON Control Character Screen

View the character currently used to start data transfer when using software flow control, and select if desired, another character.

Code numbers 1) through 8) present the various characters that can be used as X-ON control characters: 11 (DC 1),12H (DC2),13H (DC3),14H(DC4), 91H, 92H, 93H or 94H.

The CURRENT STATE line shows the X-ON character now in use.

To change the current selection, type the code number corresponding to the desired character: always check that this character is different from the current X-OFF control character. The CURRENT STATE line reflects the change.

To exit with or without change, type Q. You will return to the SYSTEM CONFIGURATION menu.

4.12 X-OFF Control Character Screen

View the character currently used to stop data transfer when using software flow control, and select another character.

Code numbers 1) through 8) present the various characters that can be used as X-OFF control characters: 11 (DC 1), 12H (DC2), 13H (DC3), 14H (DC4), 91 H, 92H, 93H, or 94H.

The CURRENT STATE line shows the X-OFF character now in use.

To change the current selection, type the code number corresponding to the X-ON control character.

To exit with or without change, type Q. You will return to the SYSTEM CONFIGURATION menu.

4.13 Modify Passwords Screen

Select a new password. The new password is activated after its verification.

The screen prompts you to enter the new password (any two characters, except the characters serving as X-ON and X-OFF flow control characters), or exit to the SYSTEM CONFIGURATION menu.

a. Type the desired password. You will receive the following message:

ENTER NEW PASSWORD AGAIN FOR VERIFICATION

b. Type the same characters again.

1. If no difference is found, the new password is accepted and you will receive the following message:

NEW PASSWORD HAS BEEN ACTIVATED

ENTER ANOTHER PASSWORD (two characters) OR PRESS Q TO EXIT J

If the password need not be changed again, press Q to return to the SYSTEM CONFIGURATION menu. Otherwise, repeat password entry procedure.

2. If the two passwords differ, no change is made, and the following screen is presented:

INCORRECT VERIFICATION, PASSWORD HAS NOT BEEN CHANGED
ENTER NEW PASSWORD (two characters) OR PRESS Q TO EXIT

You can now repeat the procedure, or quit.

4.14 Sub-Channel 1/2 Configuration Screens

Select and view the current values of the parameters of the sub-channel whose number appears in the screen header, and enter the corresponding sub-channel parameter configuration screens when changes are needed. The various parameters that can be selected are explained in **Section 4.6**).

Code numbers 1 through 8 list the various sub-channel parameters that can be changed:

1. Sub-channel baud rate
2. Number of data bits in sub-channel data frame
3. Type of parity used in sub-channel data frame
4. Number of stop bits in sub-channel data frame
5. Software flow control function at the local end of the sub-channel
6. End-to-end software flow control
7. End-to-end hardware flow control (by means of DTR line).
8. RTS-to-DCD control passing

Code Q is used to return to the SYSTEM CONFIGURATION screen.

The CURRENT CONFIGURATION line lists the current parameter values.

Type the code number corresponding to the desired configuration action.

4.15 Baud Rate Screen

View the current sub-channel baud rate and select, if desired, a new rate.

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Code numbers 1 through 9 list the available sub-channel rates; 19200, 14400, 9600, 7200, 4800, 2400, 1200, 600, and 300 bps. Code Q is used to return to the SUB-CHANNEL CONFIGURATION screen.

The CURRENT STATE line shows the current sub-channel rate.

To change sub-channel rate, type the appropriate code number. The new selection appears in the CURRENT STATE line.

If you changed the rate of the command sub-channel (the sub-channel to which you are now connected), reprogram your terminal for the new rate, so that you will be able to continue.

NOTE

If you made an error and lost communication with the Multiplexor being programmed, select the default configuration described in Section 4.3 and start again.

After completing the required actions, type Q to return to the SUB-CHANNEL CONFIGURATION screen.

4.16 Data Bits Screen

View the current number of data bits used on this sub-channel and select, if desired, a new value.

Code numbers 1 through 4 list the available selections of data bits number: 5, 6, 7, or 8. Code Q is used to return to the SUB-CHANNEL CONFIGURATION screen.

The CURRENT STATE line shows the current code number of data bits.

To change the number of data bits, type the appropriate code number. The new selection appears in the CURRENT STATE line.

If you changed the number of data bits on the command sub-channel (the sub-channel to which you are now connected), reprogram your terminal for the new value, so that you will be able to continue.

After completing the required actions, type Q to return to the SUB-CHANNEL CONFIGURATION screen.

4.17 Parity Screen

View current parity used by the sub-channel and select, if desired, a new type.

Code numbers 1 through 3 list the available parity types: odd, even or none.

Code Q is used to return to the SUB-CHANNEL CONFIGURATION screen.

The CURRENT STATE line shows the current type of parity.

To change the type of parity, type the appropriate code number. The new selection appears in the CURRENT STATE line.

If you changed the type of parity on the command sub-channel (the sub-channel to which you are now connected), reprogram your terminal for the new value, so that you will be able to continue.

After completing the required actions, type Q to return to the SUB-CHANNEL CONFIGURATION screen.

4.18 Stop Bits Screen

View the current number of stop bits used by the sub-channel and select, if desired, a new value.

Code numbers 1 through 3 list the available selections of stop bits number: 1, 1.5, or 2.

Code Q is used to return to the SUB-CHANNEL CONFIGURATION screen.

The CURRENT STATE line shows the current code number of stop bits.

To change the number of stop bits, type the appropriate code number. The new selection appears in the CURRENT STATE line.

If you changed the number of stop bits on the command sub-channel (the sub-channel to which you are now connected), reprogram your terminal for the new value, so that you will be able to continue.

After completing the required actions, type Q to return to the SUB-CHANNEL CONFIGURATION screen.

4.19 Multiplexor to DTE Software Flow Control Screen

View the current status of end-to-end software flow control used on this sub-channel and select, if desired, a new status.

The Multiplexor must be able to command the DTE connected to it to interrupt the flow of data when Multiplexor buffers fill, and restart the flow when the Multiplexor can accept new data for transmission. This function is mandatory whenever statistical multiplexors are used, and is additional to the end-to-end flow control function (see **Sections 4.20** and **4.21**).

Some DTEs have the capability to stop data flow when receiving a special character, X-OFF, and renew data flow when receiving another character, X-ON. This capability is termed “software data flow control,” and the Multiplexor can be programmed to use this capability by selecting the ON option on this screen.

If the DTE cannot recognize the X-ON and X-OFF characters, the OFF option must be selected. In this case, the control of data flow between the Multiplexor and the DTE connected to it is performed by means of the CTS control line contained in the RS-232 interface.

NOTE

The CTS line of the Multiplexor is always active, regardless of the selection made on this screen.

Screen selections are as follows:

Code numbers 1 and 2 list the available selections of software flow control status: on or off.

Code Q is used to return to the SUB-CHANNEL CONFIGURATION screen.

The CURRENT STATE line shows the current status of software flow control used on this sub-channel.

To change the status of software flow control, type the appropriate code number.

The new selection appears in the CURRENT STATE line.

Type Q to return to the SUB-CHANNEL CONFIGURATION screen.

4.20 End-to-End Software Flow Control Screen

View the current status of end-to-end software flow control used on this sub-channel and select, if desired, a new status.

In addition to the STM-to-DTE control function (**Section 4.19**), the Multiplexor provides a DTE-to-DTE (or “end-to-end”) flow-control function. This function allows a receiving DTE to command the remote transmitting DTE to interrupt data flow, because temporarily it can not accept new data, flow required action on the local sub-channel. This avoids problems that could be caused by the link transmission delay.

This is done by selecting the ON option on this screen. The Multiplexor is then configured to recognize the two special flow control characters (selected by means of the screens presented in **Sections 4.11** and **4.12**): X-OFF, that conveys local DTE “stop flow” command, and X-ON, that conveys local DTE “restart flow” command.

The detected X-ON/X-OFF commands are sent to the remote Multiplexor, which converts them to flow-control commands for the remote DTE connected to it.

When an X-OFF command is received from the local DTE, the local Multiplexor interrupts immediately the transfer of received data to the local DTE. The additional data sent by the remote DTE during the time it takes to transfer the X-OFF command accumulates in Multiplexor buffers. Similarly, when an X-ON command is received from the local DTE, the local Mux immediately starts the transfer of received data (accumulated as explained before).

The flow control commands supplied to the remote DTE depend on the Mux-to-DTE flow control mode selected at the remote DTE: the same X-ON/X-OFF characters, or use of CTS line (see **Section 4.19**).

When the local DTE does not have software flow control capability, the Multiplexor “end-to-end software flow control” must be configured as OFF, to prevent the Multiplexor from responding to the X-ON and X-OFF characters. In this case, see also **Section 4.21**. Screen selections are as follows:

Code numbers 1 and 2 list the available selections of end-to-end software flow-control status: on or off.

Code Q is used to return to the SUB-CHANNEL CONFIGURATION screen.

The CURRENT STATE line shows the current state of end-to-end software flow control used on this sub-channel.

To change the status of end-to-end software flow control used on this sub-channel, type the appropriate code number. The new selection appears in the CURRENT STATE line.

Type Q to return to the SUB-CHANNEL CONFIGURATION screen.

4.21 End-to-End DTR Flow Control Screen

View the current status of end-to-end hardware flow control (via the DTR line) used on this sub-channel and select, if desired, a new status.

There are applications in which end-to-end (DTE-to-DTE) software flow control cannot be used, but the end-to-end flow control function described in **Section 4.20** is nevertheless essential.

In these applications, the Multiplexor can be configured to use “end-to-end” DTR flow control by setting ON in this screen.

In this mode, the Multiplexor monitors the DTR line contained in the local sub-channel RS-232 interface, and transmits the status of this line to the remote Multiplexor. The remote Multiplexor then supplies to the DTE connected to it the flow control commands according to the Mux-to-DTE flow control modes selected at the remote Multiplexor.

Selecting OFF on this screen disables the transmission of flow control commands to the remote Multiplexor when the DTR line changes state.

Screen selections are as follows:

Code numbers 1 and 2 list the available selections of end-to-end hardware flow control status: on or off.

Code Q is used to return to the SUB-CHANNEL CONFIGURATION screen.

The CURRENT STATE line shows the current status of end-to-end hardware flow control.

To change the status of end-to-end hardware flow control used on this sub-channel, type the appropriate code number. The new selection appears in the CURRENT STATE line.

Type Q to return to the SUB-CHANNEL CONFIGURATION screen.

4.22 RTS Control Pass Screen

View the current status of the RTS-to-DCD control function used on this sub-channel, and select, if desired, a new status.

The Multiplexor stand-alone and card models can transfer end-to-end (in both directions) one RS-232 interface control signal per channel; when this function is enabled, the condition of the RTS line is copied to the remote DCD line.

NOTES:

- 1. You must always select the same mode for both Multiplexors connected in a link.**
- 2. When you select OFF, the DCD line is always active (DCD on).**
- 3. When you select ON, the remote DCD line follows the local RTS line. In case synchronization is lost, the DCD lines switches to the not-active state (DCD OFF). If your command terminal requires DCD to be active in order to communicate, you must establish communication with the remote Multiplexor before starting a configuration session.**

Screen selections are as follows:

Code numbers 1 and 2 list the available selections of the RTS-to-DCD transfer status: on or off.

Code Q is used to return to the SUB-CHANNEL CONFIGURATION screen.

The CURRENT STATE line shows the current status of the RTS-to-DCD transfer.

To change the status of the RTS-to-DCD transfer for this sub-channel, type the appropriate code number. The new selection appears in the CURRENT STATE line.

Type Q to return to the SUB-CHANNEL CONFIGURATION screen.

4.23 Diagnostics Menu

Select the control screens for the various test loops that can be activated from the local Multiplexor, for diagnostic purposes. See **Chapter 6** for a description of the test loops.

Code numbers 1 through 3 are used to select the desired test loop type: local loops, remote loops and modem loops.

Code Q is used to return to the MAIN MENU screen.

When you first enter the DIAGNOSTICS menu, the CURRENT STATE line shows: ALL TESTS IN THE OFF STATE.

Type the code number corresponding to the desired test loop type.

Type Q to return to the MAIN MENU screen.

4.24 Local Loops Screen

View the current status of the local sub-channel and composite channel loops and go, if desired, to the control screen for any of these loops.

Code numbers 0 through 2 list the available local loops: composite loop and loops for each sub-channel.

Code Q is used to return to the DIAGNOSTICS screen.

The CURRENT STATE line shows the current status of the available local loops: on or off.

To change the condition of any test loop, type the appropriate code number to go to the loop control screen.

After completing the required actions, type Q to return to the DIAGNOSTICS screen.

4.25 Remote Loops Screen

View the current status of the remote sub-channel and composite channel loops and go, if desired, to the control screen for any of these loops.

Its functions are similar to those of the LOCAL LOOPS screen.

NOTE

Remote digital loopback is performed by toggling pin 21 to the modem connected to the local Multiplexor. This forces the modem to transmit a command to the remote modem. Before attempting to perform loopback, make sure that:

1. The local and remote modems do have V.54 remote loopback capability.
2. Pin 21 of the local modem is configured to accept loop command.
3. Jumper PIN 21 (Section 4.3) of the Multiplexor is set to ON.

4.26 Modem Loops Screen

View the current status of the loops on the modem serving the main (composite) channel and go, if desired, to the control screen for any of these loops. Its functions are similar to those of the LOCAL LOOPS screen.

4.27 Loop Control Screens

Change the current status of the test loop selected on one of the loop selection screens.

Code numbers 1 and 2 list the two possible conditions of the selected loop: on or off.

Code Q is used to return to the loop selection screen, from which this screen was accessed.

The CURRENT STATE line shows the current loop status.

To change the condition of any test loop, type the appropriate code number.

After completing the required actions, type Q to return to the loop selection screen, from which this screen was accessed.

4.28 Remote Multiplexor Configuration Menu

Select screens that provide system management functions, including configuration tasks, related to the remote Multiplexor.

Table 4-6. Remote Configuration Menu Items.

Code	Item	Description
1	TRANSFER CONFIGURATION FROM REMOTE TO LOCAL	Used to initiate transfer of current remote Multiplexor configuration to the local Multiplexor. After remote configuration is received by the local Mux, it can be examined using the terminal connected to the local Mux. As an additional convenience, remote Mux configuration can be stored in the local Mux, thereby serving as a backup that can be downloaded again into the remote Mux in case that unit is replaced.
2	TRANSFER CONFIGURATION FROM LOCAL TO REMOTE	Similar to item 1 except that it is used to initiate transfer of the remote Mux configuration, prepared on the local Mux, to the remote Mux.
3	PREPARE REMOTE MULTIPLEXOR CONFIGURATION	Used to initiate preparation of remote Mux configuration, using the terminal connected to the local Mux.
4	ACTIVATE REMOTE MULTIPLEXOR CONFIGURATION	Used to restart the remote Mux; if a new configuration was transferred from the local Mux to the remote Mux, this command will activate the new configuration.
Q	EXIT	Return to SYSTEM CONFIGURATION menu.

4.29 Transfer Configuration from Remote to Local Screen

Provides an indication that the Multiplexor is executing the required actions after selecting item 1 on the REMOTE MULTIPLEXOR CONFIGURATION menu above.

This screen is displayed after selecting item 1 on the REMOTE MULTIPLEXOR CONFIGURATION menu, while the remote configuration information is transmitted to the local Multiplexor.

In most cases, the screen is displayed for a very short interval; however, under certain traffic conditions, the user may become aware of the transmission delay, so this screen is used to notify that the required action is being cried out:

TRANSFER CONFIGURATION FROM REMOTE TO LOCAL

WAIT FOR SAVING ACKNOWLEDGE

If you want to exit, press Q.

No action is required on this screen, and after the remote configuration information is received, the REMOTE MULTIPLEXOR CONFIGURATION menu is automatically displayed.

However, the screen does provide you with the option to abort the operation, by pressing Q: this will return you to the REMOTE MULTIPLEXOR CONFIGURATION menu.

4.30 Remote Multiplexor Configuration Screen

Define the action to be performed on the information regarding remote Multiplexor configuration, just received after selecting item 1 on the REMOTE MULTIPLEXOR CONFIGURATION menu.

Table 4-7. Remote Configuration Menu Items.

Code	Item	Description
1	EXAMINE	Used to display the received configuration: choose this action after saving the received configuration (item 2 below).
2	SAVE IN LOCAL MULTIPLEXOR	Used to save (store permanently) the received configuration in the local Multiplexor.
Q	EXIT	Return to REMOTE MULTIPLEXOR CONFIGURATION screen.

Type the code number corresponding to the desired function.

Type Q to return to the REMOTE MULTIPLEXOR CONFIGURATION menu.

4.31 Examine Remote Multiplexor Configuration Screen

Displays the information regarding remote Multiplexor configuration, received by selecting item 1 on the REMOTE MULTIPLEXOR CONFIGURATION menu.

The screen displays the parameters selected for the remote Multiplexor sub-channels.

No action is required on this screen. When you finish looking at this information, press **Q** to go back to the REMOTE MULTIPLEXOR CONFIGURATION menu.

4.32 Save in Local Multiplexor Screen

Confirms that a copy of the configuration of the remote Multiplexor has been stored in the local Multiplexor, as you instructed by selecting item 1 on the REMOTE MULTIPLEXOR CONFIGURATION menu.

NOTE

The remote configuration does not override the local configuration: it is only stored for receiving and backup purpose.

REMOTE CONFIGURATION HAS BEEN SAVED ON LOCAL MULTIPLEXOR

Press **Q** to exit

Typing **Q** on this menu will return you to the REMOTE MULTIPLEXOR CONFIGURATION menu.

4.33 Transfer Configuration from Local to Remote Screen

Provide an indication that the Multiplexor executes the required actions after selecting item 2 on the REMOTE MULTIPLEXOR CONFIGURATION menu (**Section 4.28**).

This screen is displayed after selecting item 2 on the REMOTE MULTIPLEXOR CONFIGURATION menu, while the configuration of the local Multiplexor is transmitted to the remote Multiplexor, for viewing it there, or for back-up purposes.

In most cases, the screen is displayed for a very short interval; however, under certain traffic conditions, the user may become aware of the transmission delay, so this screen is used to notify that the required action is being carried out:

TRANSFER CONFIGURATION FROM LOCAL TO REMOTE WAIT
FOR SAVING ACKNOWLEDGE

If you want to exit, press Q.

No action is required on this screen, and after the remote configuration information is received, the acknowledgment screen shown below is automatically displayed:

LOCAL CONFIGURATION HAS BEEN SAVED ON REMOTE MULTIPLEXOR

Press Q to exit

However, the screen does provide you with the option to leave without seeing the acknowledgment message, by pressing Q: this will return you to the REMOTE MULTIPLEXOR CONFIGURATION menu, while configuration transfer is being performed.

4.34 Prepare Remote Multiplexor Configuration Menu

Main menu used to select the configuration task to be carried out on the remote Multiplexor.

Menu functions are similar to the corresponding functions of the main menu.

Typing Q on this screen will return you to the REMOTE MULTIPLEXOR CONFIGURATION menu.

4.35 Remote Multiplexor System Configuration Menu

Select the X-ON and X-OFF characters and change the password used by the remote Multiplexor.

Menu functions are similar to the corresponding functions of the SYSTEM CONFIGURATION menu (2 above), except that the selections made from this screen affect only the remote Multiplexor.

Typing Q on this screen will return you to the REMOTE MULTIPLEXOR CONFIGURATION screen.

4.36 Remote Sub-Channel 1, 2, Configuration

View and select the current parameter values of remote Multiplexor sub-channels.

Configuration screens are identical to the sub-channel 1 configuration screen described in **Section 4.14**. The only difference is in the identification of the sub-channel displayed on the screen.

Typing Q on this screen will return you to the PREPARE REMOTE MULTIPLEXOR CONFIGURATION screen.

4.37 Activate Remote Multiplexor Configuration

Provide an indication that the remote Multiplexor has activated its new configuration after selecting item 4 on the REMOTE MULTIPLEXOR CONFIGURATION menu (**Section 4.28**).

This screen is displayed after selecting item 4 on the REMOTE Multiplexor CONFIGURATION menu, after the remote configuration information is transmitted from the local Multiplexor to the remote Multiplexor using item 2 on that menu, and it carries the message:

ACTIVATE REMOTE MULTIPLEXOR CONFIGURATION

Press Q to exit

No action is required on this screen. After it has been displayed, press Q to return to the REMOTE MULTIPLEXOR CONFIGURATION menu.

5. Operating Instructions

5.1 Controls, Indicators, and Connectors

Table 5-1 lists the functions of the Multiplexor indicators and connectors. The numbers under the heading “Item” refer to the identification numbers in Figure 5-1.

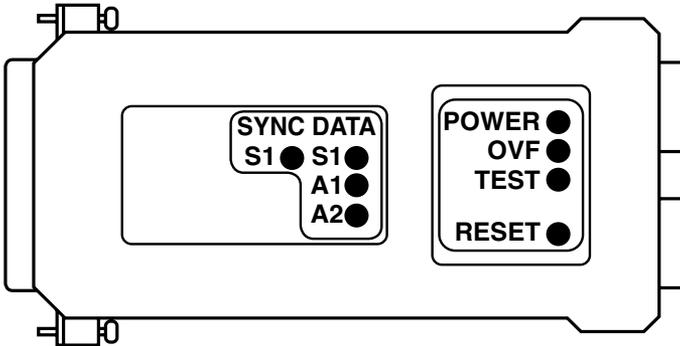


Figure 5-1. Indicators.

Table 5-1. Multiplexor Controls, Indicators, and Connectors.

Item	Control, Indicator, or Connector	Function						
1	POWER Indicator	Lights when the Multiplexor is powered						
2	DATA Activity Indicators	Indicators, one for each sub-channel, light when the corresponding channel is active (receives or transmits frames)						
3	SYNC Indicator	Indicator for main link, indicates Multiplexor synchronization status						
		<table border="1"> <thead> <tr> <th><u>Condition</u></th> <th><u>Indication</u></th> </tr> </thead> <tbody> <tr> <td>Off</td> <td>Mux not powered</td> </tr> <tr> <td>On</td> <td>Mux powered and synchronized</td> </tr> </tbody> </table>	<u>Condition</u>	<u>Indication</u>	Off	Mux not powered	On	Mux powered and synchronized
<u>Condition</u>	<u>Indication</u>							
Off	Mux not powered							
On	Mux powered and synchronized							

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Table 5-1. Multiplexor Controls, Indicators, and Connectors.

Item	Control, Indicator, or Connector	Function	
		Condition	Indication
		Flashing (Continuous)	Mux powered, but not synchronized with remote Mux
		Flashing (Intermittent)	Mux retransmits data frame upon request of remote Mux (usually because a noisy line causes errors in the data received by the remote Mux)
4	OVF Indicator		Lights when Mux buffers are full. In a properly designed system, this condition usually indicates that one of the DTE units connected to the Mux does not respond to configured flow-control commands.
5	RESET		Resets the Mux.
6	TEST		Lights to indicate that the Mux is in diagnostics mode (one of the test loops active) or in the command mode. In either case, traffic is interrupted.
7	Power Connection		Socket for power supply, 5 VDC regulated supply
8	Channel Connectors		Connections to Mux channels
9	Link Connector		Connector to main link

5.2 Operating Instructions

5.2.1 GENERAL

After being prepared for operation as explained in **Sections 4.3** through **4.7**, the Multiplexor normally operates unattended. Operator intervention is only required when the Multiplexor is setup for the first time or must be adapted to new operational requirements. Multiplexor configuration is stored in a non-volatile memory, and is not affected when power is turned off.

5.2.2 POWER-ON

Connect the power cable to the Multiplexor jack, then plug the power-supply unit into the mains. The SYNC indicator should light.

If the link to the far Multiplexor is not yet operational, the SYNC indicator will flash. Wait until the link becomes operational, and check that the SYNC indicator stops flashing and lights continuously.

Check that after a few seconds (during which Multiplexor performs its self-test), the OVF indicator is extinguished.

5.2.3 NORMAL OPERATION

During normal operation, the PWR (when present), SYNC, and MAIN indicators should light continuously, and the TEST and OVF indicators must remain off.

Sub-channel activity indicators flash according to the traffic load, and are extinguished when the sub-channel is idle.

NOTE

When the TEST indicator lights, traffic is interrupted, even if all the other indications are normal.

On noisy links, the SYNC indicator may flash from time to time: this indicates automatic retransmission of a data frame. Automatic retransmission occurs upon remote Multiplexor request: the request is sent when errors are detected in the received data, and its use ensures that only valid data is transferred.

5.2.4 POWER-OFF

To power off the Multiplexor, disconnect the power supply from the mains, then disconnect, if required, the power cable from Multiplexor jack.

5.3 What to Do in Case of Malfunction

5.3.1 PRELIMINARY ACTIONS

Here is a list of actions that will help you return to normal operation in case a problem occurs. Additional information on Multiplexor diagnostics appears in **Chapter 6**.

1. Check that the Multiplexor is powered (SYNC indicator lights or flashes).
2. Check that cables are properly connected.
3. Check that the equipment connected to the Multiplexor is powered and operates normally.

5.3.2 CHECK MULTIPLEXOR INDICATIONS

Table 5-2. Multiplexor Indications.

No.	Indication	Probable Cause	Action
1	TEST lit	Mux in command mode	Check whether the Mux is being configured, and wait until configuration is completed (at any time, only one sub-channel can be in the command mode).
		Mux in diagnostics mode	Enter command mode, and select the DIAGNOSTICS item, to see whether one of the test loops is on. If a test loop is on, but is no longer needed, disconnect it.
2	SYNC flashes continuously	Remote Mux not operational	Check whether the remote Mux is powered ON, and operates normally.
		Problems in communication link to remote Mux	Check whether communication equipment is powered and properly connected, then use the diagnostics function described in Chapter 6 to identify fault location.

Table 5-2. Multiplexor Indications.

No.	Indication	Probable Cause	Action
3	OVF lights	Mux buffers full	One of the DTE units connected to the Mux does not respond to flow control commands; check that all the DTEs do have a flow control option, and the Mux flow control is properly configured.
4	One or more sub-channel indicators are permanently off	No traffic on sub-channel Mux problem	If traffic is expected, but no activity is indicated, check DTE equipment and its connections. Turn the Mux off, then on again. If ERR indicator lights, replace the Mux.

5.3.3 CONFIGURATION

Check the configuration of local and remote Multiplexor and make sure it corresponds to the requirements of the equipment connected to its sub-channels.

6. Diagnostics

6.1 General

Multiplexor diagnostics functions use test loops and indicators to provide the user with the tools required for rapid identification of faults that affect system operation.

The test loops available for diagnostics and test purposes are:

a. Local Loops:

1. Local sub-channel loop.
2. Local composite channel loop

b. Remote Loops:

1. Remote sub-channel loop
2. Remote composite channel loop

c. Modem Loops:

1. Analog loop.
2. Remote digital loop

(option—depends on the characteristics of the modem used for the composite channel, as explained in **Section 4.3**).

The various test loops are identified in Figure 6-1.

The recommended procedure for locating a problem in the system, is to press the RESET push-button (or turn the Multiplexor off and on again), in order to obtain the self-test results, then perform test loops in the order given above.

All the test loops are initiated from the DIAGNOSTICS screen, accessed from the main menu (see **Section 4.8**).

This paragraph describes the use of the test loops; refer to **Section 4.8** for detailed instructions on loop activation.

6.2 Description of Test Loops

Whenever a test loop is on, the TEST indicator will light and traffic will be disrupted.

6.2.1 LOCAL LOOPS

(1) Local composite channel loop

When the local composite channel loop is connected, the composite channel data transmitted by the local Multiplexor is applied to the receive line of the local Multiplexor, and the communication link is disconnected (this causes the remote Multiplexor to lose frame synchronization). All the data arriving from the remote Multiplexor while this loop is connected is lost.

This loop tests the complete local Multiplexor.

As long as the loop is connected, the SYNC indicator of the local Multiplexor must light continuously. If they do not, this indicates a local Multiplexor problem.

Sub-channel activity indicators light according to traffic; the lighting of the OVF indicator means that Multiplexor buffers are full because of flow control problems caused by the equipment connected to one of the local sub-channels.

(2) Local sub-channel loop

When a local sub-channel loop is connected, the local transmit data is returned as receive data on the same sub-channel. The local data is also multiplexed into the transmit data stream sent to the remote Multiplexor. All the data arriving from the remote Multiplexor sub-channel while this loop is connected is lost.

As long as the loop is connected, the sub-channel activity indicator lights according to traffic. The equipment connected to the sub-channel must receive its own transmit data without errors. Failure to do so usually indicates problems with the sub-channel connection cable or with equipment connected to that sub-channel.

6.2.2 REMOTE LOOPS

(1) Remote composite channel loop

When the remote composite channel loop is connected, the composite channel data transmitted by the local Multiplexor is returned from the remote Multiplexor after regeneration but without any other processing. Any data transmitted from the remote Multiplexor sub-channels is lost during loop connection. This loop tests the complete transmission path, including the local Multiplexor and the communication link.

As long as the loop is connected, the SYNC indicator of the local Multiplexor must light continuously; failure to do so, after the local Multiplexor performed satisfactorily on the local composite channel loop, indicates a problem in the communication link. For example, intermittent flashing of the SYNC indicator indicates high error rate on the link.

Sub-channel activity indicators light according to traffic; the lighting of the OVF indicator means that the Multiplexor buffers are full because of flow control problems caused by the equipment connected to one of the local sub-channels.

(2) Remote sub-channel loop

When a remote sub-channel loop is connected, the local transmit data is transmitted to the remote Multiplexor, and returned to the local Multiplexor sub-channel instead of the transmit data connected to the remote Multiplexor sub-channel. All the data arriving from the remote Multiplexor sub-channel while this loop is connected is lost.

As long as the loop is connected, the sub-channel activity indicator lights according to traffic. The equipment connected to the sub-channel must receive its own transmit data without errors. Failure to do so, after the local Multiplexor

performed satisfactorily on the local sub-channel loop, usually indicates a problem in the remote Multiplexor.

6.2.3 MODEM LOOPS

(1) Analog modem loop

When the analog modem loop is connected, the composite channel data transmitted by the local Multiplexor is returned to the receive line of the local Multiplexor after passing through the local modem, and the communication link is disconnected. All the data arriving from the remote Multiplexor while this loop is connected is lost.

This loop tests the complete local Multiplexor, its composite-channel connection cable, and the local modem.

As long as the loop is connected, the SYNC indicator of the local Multiplexor must light continuously; failure to do so, after the local Multiplexor performed satisfactorily on the local composite-channel loop, indicates a problem in the composite-channel connection cable and/or in the local modem.

(2) Remote digital modem loop

When the remote digital modem loop is connected, the composite channel data transmitted by the local Multiplexor is returned, from the remote modem, after passing through the communication link and the local modem, to the receive line of the local Multiplexor. Any data transmitted from the remote Multiplexor is lost during loop connection.

This loop tests the complete transmission path, including the local Multiplexor, its composite-channel connection cable, the communication link, and the local and remote modems.

As long as the loop is connected, the SYNC indicator of the local Multiplexor must light continuously. Failure to do so, after satisfactory performance in the analog modem loop, usually indicates a problem in the communication channel and/or in the remote modem.

Appendix A: Functional Interface Specifications

A.1 Main (Composite) Channel Interface

Table A-1. Main (Composite) Channel Connector.

CCITT V.24 Circuit Number	EIA RS- 232C Line	Pin	Signal Name	Description
101	AA	1	Protective Ground	Chassis ground (may be isolated from signal ground or connected to it—refer to Section 4.3)
102	AB	7	Signal Ground	Common signal and DC power supply ground
103	BA	2	Transmit Data	Serial digital transmit data from the Mux
104	BB	3	Receive Data	Receive data from modem
105	CA	4	Request to Send	Continuous positive level from the Mux
109	CF	8	Data Carrier Detect	Data carrier detect indication from modem
114	DB	15	Transmitter Signal	Transmit clock from modem
115	DD	17	Receiver Signal Element	Receive clock from modem
141		18	Loop 3 Test Command	Control signal from Mux: positive level commands the modem into analog loopback

Table A-1. Main (Composite) Channel Connector.

CCITT V.24 Circuit Number	EIA RS- 232C Line	Pin	Signal Name	Description
108	CD	20	Data Terminal Ready	Remains positive for a period of 20 seconds then drops to a negative level for approximately 1 second and returns to the positive level for another 20 seconds continuously until synchronization with the remote Mux is established
140		21	Loop 3 Test Command	Control signal from Mux to modem. Positive level commands the attached modem to send a remote loopback command to the remote modem. If the attached modem uses pin 21 as a signal quality indication output, set pin 21 to OFF, disabling this function (refer to Section 4.3)

A.2 Sub-Channel Interface

Multiplexor sub-channel interfaces are configured as asynchronous DCE RS-232 interfaces. The sub-channel connectors have RJ-45 sockets. Pin allocations are listed in Table A-2.

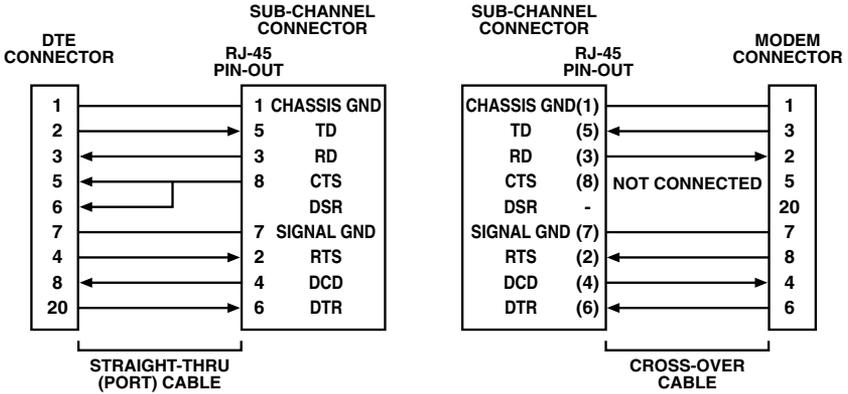
MINIATURE 2-CHANNEL STATISTICAL MULTIPLEXOR

Table A-2. Sub-Channel Connector.

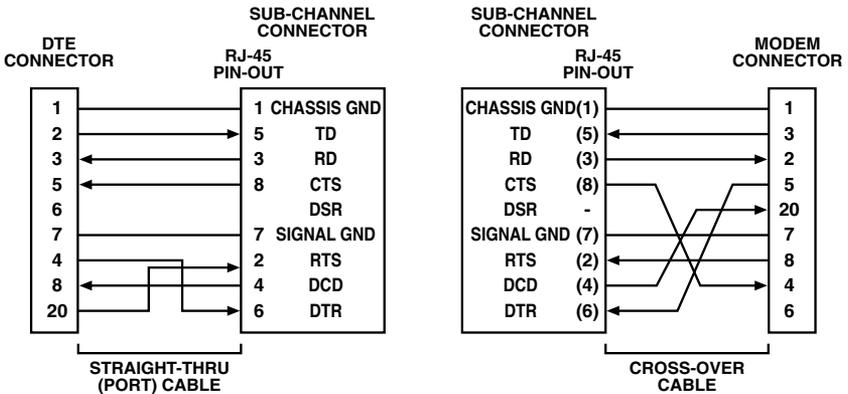
CCITT V.24 Circuit Number	EIA RS- 232C Line	Pin	Signal Name	Description
101	AA	1	Protective Ground	Chassis ground (may be isolated from signal ground or connected to it; refer to Section 4.3).
102	AB	7	Signal Ground	Common signal and DC power-supply ground.
103	BA	5	Transmit Data	Serial digital transmit data from the Mux.
104	BB	3	Receive Data	Receive data provided by Mux receiver.
105	CA	2	Request to Send	Received by Mux from DTE, controls DCD at remote side.
106	CB	8	Clear to Send	A positive level from the Mux indicates that the terminal is allowed to send data. This pin is used for hardware flow control. Computers or terminals that do not support this pin (they send data even if CTS is negative) must have software flow control.
107	CC	—	Data Set Ready	The Mux sends positive level to DTE when it is powered.
109	CF	4	Data Carrier Detect	If local and remote Muxes are synchronized, then follows CTS from sub-channel of remote Mux.
108	CD	6	Data Terminal Ready	Used for end-to-end flow control.

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Sub-channel connection cables depend on application: a port (“straight-through”) cable is generally used to connect the Mux to a DTE, and a modem (“crossover”) cable is used to connect the Mux to a tail-end modem (see Figure A-1).



Flow Control X-ON/X-OFF or DTR/DSR.



Flow Control X-ON/X-OFF or RTS/CTS.

Figure A-1. Typical Sub-Channel Cable Wiring.

Appendix B: Configuration Record

This appendix presents a typical configuration record form, which you can use as a worksheet during configuration planning, and as a permanent record of the actual configuration.

Multiplexor Configuration Form

Date: _____ Prepared by: _____
Location: _____ Far Location: _____
Multiplexor Serial No.
Local _____ Remote _____
System Password _____
X-ON Character _____ X-OFF Character _____
Character Length _____
Flow Control (FC) _____
Data Sub-Channel Data Rate _____
Parity _____ Stop Bits _____



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