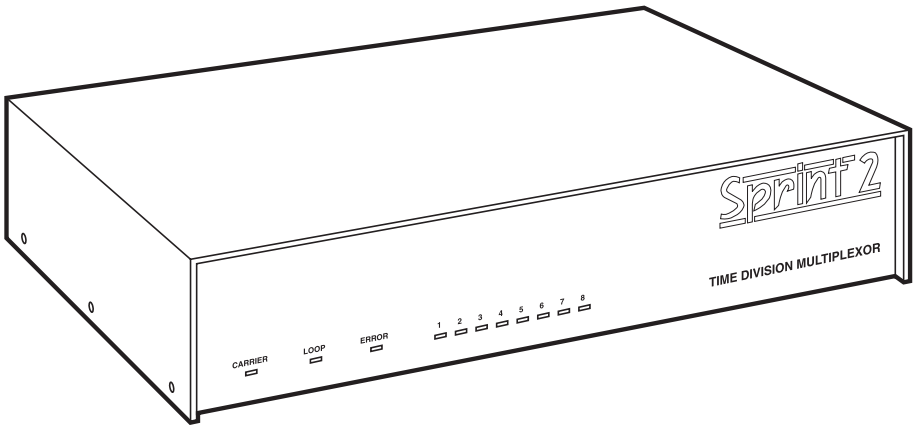
APRIL 2003
MX9010-R2
MX9011-R2
MX9012
MX9013
MX9014
MX9015
MX9020A
MX9021A

Sprint 2 Time-Division Multiplexor



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- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
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Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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Low Voltage Directive (73/23/EEC and amendment 93/68/EEC)

- EN60950: 1992 (Safety)

Electromagnetic Compatibility Directive (89/336/EEC and subsequent amendments to date):

- EN55022: 1994 (Emissions)
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CE

SAFETY

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INSTRUCCIONES DE SEGURIDAD

1. Todas las instrucciones de seguridad y operación deberán ser leídas antes de que el aparato eléctrico sea operado.
2. Las instrucciones de seguridad y operación deberán ser guardadas para referencia futura.
3. Todas las advertencias en el aparato eléctrico y en sus instrucciones de operación deben ser respetadas.
4. Todas las instrucciones de operación y uso deben ser seguidas.
5. El aparato eléctrico no deberá ser usado cerca del agua—por ejemplo, cerca de la tina de baño, lavabo, sótano mojado o cerca de una alberca, etc..
6. El aparato eléctrico debe ser usado únicamente con carritos o pedestales que sean recomendados por el fabricante.
7. El aparato eléctrico debe ser montado a la pared o al techo sólo como sea recomendado por el fabricante.
8. Servicio—El usuario no debe intentar dar servicio al equipo eléctrico más allá a lo descrito en las instrucciones de operación. Todo otro servicio deberá ser referido a personal de servicio calificado.
9. El aparato eléctrico debe ser situado de tal manera que su posición no interfiera su uso. La colocación del aparato eléctrico sobre una cama, sofá, alfombra o superficie similar puede bloquea la ventilación, no se debe colocar en libreros o gabinetes que impidan el flujo de aire por los orificios de ventilación.
10. El equipo eléctrico deber ser situado fuera del alcance de fuentes de calor como radiadores, registros de calor, estufas u otros aparatos (incluyendo amplificadores) que producen calor.
11. El aparato eléctrico deberá ser connectado a una fuente de poder sólo del tipo descrito en el instructivo de operación, o como se indique en el aparato.

12. Precaución debe ser tomada de tal manera que la tierra fisica y la polarización del equipo no sea eliminada.

13. Los cables de la fuente de poder deben ser guiados de tal manera que no sean pisados ni pellizcados por objetos colocados sobre o contra ellos, poniendo particular atención a los contactos y receptáculos donde salen del aparato.

14. El equipo eléctrico debe ser limpiado únicamente de acuerdo a las recomendaciones del fabricante.

15. En caso de existir, una antena externa deberá ser localizada lejos de las lineas de energia.

16. El cable de corriente deberá ser desconectado del cuando el equipo no sea usado por un largo periodo de tiempo.

17. Cuidado debe ser tomado de tal manera que objectos liquidos no sean derramados sobre la cubierta u orificios de ventilación.

18. Servicio por personal calificado deberá ser provisto cuando:

    A: El cable de poder o el contacto ha sido dañado; u

    B: Objectos han caído o líquido ha sido derramado dentro del aparato; o

    C: El aparato ha sido expuesto a la lluvia; o

    D: El aparato parece no operar normalmente o muestra un cambio en su desempeño; o

    E: El aparato ha sido tirado o su cubierta ha sido dañada.

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1. Specifications

1.1 V.24 Data Channels

Interface: V.24/V.28 DB25 female (DCE)

Capacity: MX9020A: 4-port chassis; MX9021A: 8-port chassis

Data Rates: 0, 1200, 2400, 4800, 7200, 9600, 14,400, 19,200, 28,800 bps

Data Format: Synchronous or asynchronous (7 or 8 bits)

Diagnostics: Local and Remote Loopbacks

1.2 Composite Link

Interface: V.35, V.24 [DB15 female (all DTE)]

Data Rates: 4.8 to 64 kbps

Link Protocol: Byte-interleaved fixed frame

1.3 Supervisor Port

Interface: V.24/V.28 DB9 female (DCE)

Data Rate: 9600 bps asynchronous

Data Format: 8 bits, no parity, 1 stop bit, X-on/X-off flow control with DTR

Supported Terminals: VT52™/HP2600, ANSI/VT100™/VT200, ADDS®, ADM3A, Hazeltine® 1500, Newbury 8009, TeleVideo® 910/920

1.4 General

Front-Panel Indicators: (11) LEDs: Carrier, Loop, Error, (8) Data

Temperature Tolerance: 32 to 104°F (0 to 40°C)

Humidity: Up to 90% noncondensing

Power: 100–240 VAC

Size: 3.2"H x 17"W x 10.8"D (8.1 x 43.2 x 27.4 cm)

Weight: 6.6 lb. (3 kg)

2. Introduction

2.1 Overview

The Sprint 2 is a four- (MX9020A) or eight-channel (MX9021A) time-division multiplexor that integrates voice and data over digital links up to 64 kbps.

You can easily configure both local and remote units from one end of the link using a terminal or PC terminal emulation software.

The V.24 data channels support synchronous and asynchronous data rates up to 28.8 kbps.

This manual describes the multiplexor's installation and configuration. Cable specifications are found in the appendices.

The composite link has a plug-in selectable interface (V.24, G.703, or V.35), depending on which part number you ordered.

The Sprint 2 can be used in many applications, from simple asynchronous V.24 data transfer to a complicated mix of low-speed V.24 and high-speed V.11 data with up to two voice channels.

2.1.1 Low-Speed V.24 Data Only

The simplest use of the Sprint 2 is interconnecting the data devices as shown in Figure 2-1.

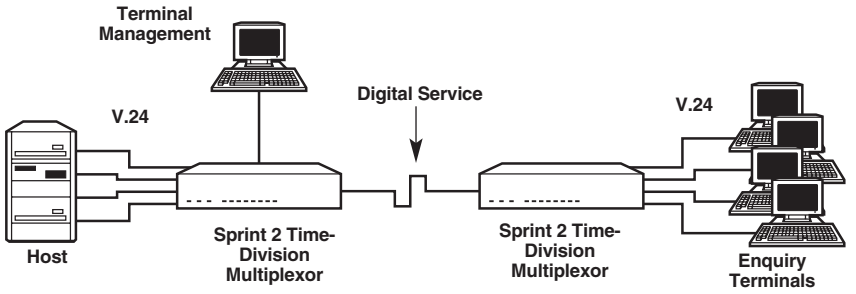

Figure 2-1. Interconnection of the data devices.

You can connect up to eight synchronous or asynchronous devices to a central computer when bandwidth allows. Bit stripping lets the Sprint 2 transmit eight asynchronous 9.6-kbps data channels through a 64-kbps link.

2.1.2 High-Speed V.24 Data

The Sprint 2 supports eight V.24 ports. You can connect several asynchronous terminals as shown in Figure 2-2.

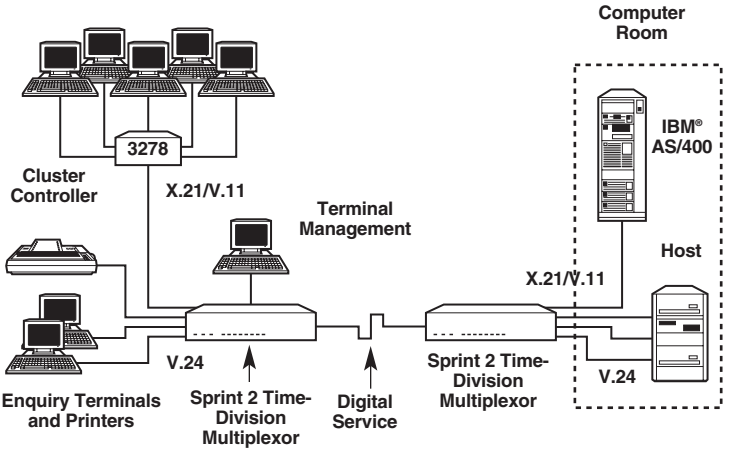

Figure 2-2. V.24 application.

2.2 Available Kits

Table 2-1. Kit part numbers and their contents.

Interface	Kit Part Number	Includes
X.21	MX9010-R2	MX9020A. . . . . 4-Port Chassis MX9063C . . . . . X.21 Composite Card EGM16E-0010-MM . . X.21 Cable EPWR08 . . . . . Power Cord
	MX9011-R2	MX9021A. . . . . 8-Port Chassis MX9063C . . . . . X.21 Composite Card EGM16E-0010-MM . . X.21 Cable EPWR08 . . . . . Power Cord
V.24, RS-232	MX9012	MX9020A. . . . . 4-Port Chassis MX9061C . . . . . RS-232 Composite Card EHN800. . . . . RS-232 Cable EPWR08 . . . . . Power Cord
	MX9013	MX9021A. . . . . 8-Port Chassis MX9061C . . . . . RS-232 Composite Card EHN800. . . . . RS-232 Cable EPWR08 . . . . . Power Cord
V.35	MX9014	MX9020A. . . . . 4-Port Chassis MX9062C . . . . . V.35 Composite Card EHN801. . . . . V.35 Cable EPWR08 . . . . . Power Cord
	MX9015	MX9021A. . . . . 8-Port Chassis MX9062C . . . . . V.35 Composite Card EHN801. . . . . V.35 Cable EPWR08 . . . . . Power Cord

3. Technical Features

3.1 Throughput/Efficiency

To calculate data throughput, refer to Table 3-1. For composite rates above 32.8 kbps, the data throughput is the same as the overhead (16 kbps). For rates below 32.8 kbps, cut the overhead of 16 in half. For example, a composite rate of 28.8 kbps yields a throughput of 8 kbps.

Table 3-1. Throughput/efficiency.

Link Rate (kbps)	Efficiency (%)	Throughput (kbps)
64	97.5	62.4
19.2	95.83	18.4

3.2 Data Format

3.2.1 Synchronous Data

The internally generated data channel clocks are derived from the composite link clock rate.

Each data channel has a flexible input buffer (size depends on bit rate) to allow external clock operation.

3.2.2 Asynchronous Data

Asynchronous data is transmitted across the composite link as synchronous data with each character occupying eight bits in the aggregate frame regardless of structure. Data parity is regenerated at the remote end. When the data channel is in idle or break condition, the aggregate is padded with one of two non-ASCII codes (0BAh and 0BBh). If these codes are received by the data channel, they are coded and appended with an escape character (0BCh) to allow them to pass across the aggregate link.

By stripping start, stop, and parity bits from data, the Sprint 2 reduces the number of data bits transferred across the composite link. An asynchronous channel with a word structure of 81N will discard two bits and transfer eight useful characters, thus requiring 80% of the nominal bandwidth, or 7680 bps for a 9600-bps channel.

In practice, the composite link is allocated in 800-bps slots, so this channel actually uses 8000 bps. When applied across all eight channels, the following combinations are possible.

Table 3-2. Asynchronous compression rates.

64-kbps Composite	19.2-kbps Composite	28.8-kbps Composite
8 x 9600 async	2 x 9600 async 1 x 2400 async/sync	3 x 9600 async 1 x 2400 async 1 x 1200 async
7 x 9600 async 1 x 9600 sync	2 x 9600 async 1 x 2400 async	3 x 9600 async 1 x 4800 async 1 x 2400 async
6 x 9600 async 1 x 19200 async		

3.3 Frame Length

Frame length is 160 bytes at 64 kbps (that is, a frame length of one byte has a data rate of 400 bps). The frame length is reduced at lower data rates to maintain a constant frame duration of 20 ms.

Table 3-3. Frame length/duration.

Link Rate (kbps)	Frame Length (bytes)	Frame Duration (ms)
94	160	20
19.2	48	20

3.4 Frame Structure

3.4.1 Composite Rates 32.8 kbps to 64 kbps

4 x 40 bytes at 64 kbps

S_1 DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD
C_1 DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD
C_2 DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD
C_3 DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD

S_1 Synchronizing byte

$C_1 – C_3$ Configuration bytes

D Data bytes

3.4.2 Composite Rates 4.8 kbps to 32 kbps

2 x 24 bytes at 19.2 kbps

S_1 DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD
C_1 DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD

S_1 Synchronizing byte
C_1 Configuration byte
D Data byte

3.5 Synchronization

Synchronization will occur when the mux receives a superframe (that is, 80 ms), regardless of the composite data rate. A superframe consists of four composite frames, each of which has a different sync character.

3.6 Composite Link Rates

The composite data rate can be selected in increments of 800 bps from 4.8 kbps to 64 kbps. This allows the most efficient use of data bandwidth if multiplexors are daisychained.

3.7 Round-Trip Polling Delay

Round-trip delay is defined as the time interval that elapses when a "poll" from a computer is transmitted from one of the low-speed data ports of the multiplexor, through the composite link, and then looped at the remote multiplexor to return to the computer. This is generally referenced when the computer data is transmitted through a 9.6-kbps channel. The multiplexor has a delay of only 12 ms at all link rates.

3.8 Interface Signals/Sample Rate

The multiplexor samples and transmits the RTS and DTR signals from all 4 or 8 channels approximately every 230 ms via the configuration bytes. If the full data bandwidth is not allocated, the residual is used to pass the interface signals, reducing delay to less than 15 ms (800 bps residual) or 10 ms (>2400 ms residual), respectively.

Therefore, if the requirement is for onward linked, half-duplex communication, you must leave some bandwidth unused to speed up the interchange of control signals. If the IBM® bisync protocol is being transmitted, we recommend that 2.4 kbps of bandwidth remain unused.

4. Use and Configuration

This chapter covers the connection and setup of the channel ports.

4.1 Data Channel Connection

Low-speed peripherals are connected to the V.24/V.28 (and X.21/V.11 where the high-speed data option is fixed) DB25 connectors configured as DCE and numbered 1 to 8 at the rear of the multiplexor. The pin connections for these data channels are defined in **Appendix H**.

4.2 Default Channel Setup

On delivery, all V.24 channels are configured as follows:

Rate:	4800 bps
Type:	Synchronous
Clocks:	Internal
Signals:	Both +
RTS/CTS Delay:	0 ms

4.3 Changing the Configuration

The multiplexor may be configured using an asynchronous terminal. A laptop PC running an asynchronous terminal emulation program such as pcANYWHERE®, Crosstalk®, or BLAST® is ideal for the field engineer. The terminal should be connected via its serial port to the supervisor port on the back of the multiplexor.

4.4 Supervisor Terminal Requirements

The 9.6-kbps terminal must be configured for soft flow control with an 8-bit word, one stop bit, and no parity (81N).

The supervisor port pinout is defined in **Appendix E**.

4.5 Supervisor Terminal Emulations

The multiplexor supports several terminal emulations. When a connection is made between the terminal or PC and the supervisor port, the following screen will appear.

1 = VT52/HP2600
2 = ANSI/VT100/VT200
3 = ADDS
4 = ADM-3A
5 = HAZELTINE 1500
6 = NEWBURY 8009
7 = TELEVIDEO 912/920

Figure 4-1.Terminal or PC connected to the supervisor port.

The terminal type or emulation in use should be selected by pressing the relevant number key on the PC or terminal. The monitor will now show the basic configuration screen for the multiplexor setup. This display shows standard V.24 data channels only.

TDM xxxxAE/x.xx

Mode : RUN
Data Monitor : RXD
Link Clock : AUTO 64000
X.21 Carrier : PRESENT
Residual : +24000
Option Cards : NONE
Configure : >ACCEPT
Display Page : LOCAL

COPY CHANNEL	:	1	2	3	4	5	6	7	X.21
RATE	:	4800	4800	4800	4800	4800	4800	4800	4800
TYPE	:	SYNC	SYNC	SYNC	SYNC	SYNC	SYNC	SYNC	SYNC
RX CLOCK	:	INT	INT	INT	INT	INT	INT	INT	INT
TX CLOCK	:	INT	INT	INT	INT	INT	INT	INT	INT
BITS/CHAR	:								
PARITY	:								
RTS/CTS DELAY	:	0 ms	0 ms	0 ms	0 ms	0 ms	0 ms	0 ms	0 ms
SIGNALS	:	BOTH+	BOTH+	BOTH+	BOTH+	BOTH+	BOTH+	BOTH+	BOTH+
CHANNEL MODE	:	RUN	RUN	RUN	RUN	RUN	RUN	RUN	RUN

Use cursor keys to select parameter, SPACE/- to toggle

Figure 4-2. Basic configuration screen.

4.6 Configuration Display Layout

There are two main areas on the supervisor setup screen used to change the multiplexor's parameters.

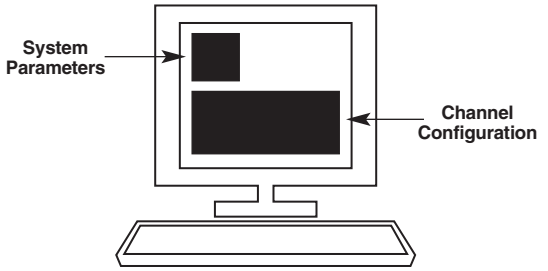

Figure 4-3. Configuration display layout.

UPPER LEFT

System parameters (mode, link clock, carrier, residual, and configure)

BOTTOM

Channel configuration

4.7 General Keyboard Conventions

Only a few keys are required to configure the multiplexor.

⇒ Right-arrow: Moves the cursor to the next field to the right.

⇐ Left-arrow: Moves the cursor to the next field to the left.

⇑ Up-arrow: Moves the cursor to the next field upwards.

⇓ Down-arrow: Moves the cursor to the next field downwards.

<spacebar>: Toggles the parameter value up to the next available setting.

<Enter> or <Return>: Moves the cursor back to the CONFIGURE line.

<CTRL> and <C>: Abandons all changes since the last update.

<CTRL> and A: Enables access to composite links settings.

4.7.1 Cursor Movement

Move the cursor symbol ">" around the screen to the required field using the arrow keys.

4.7.2 Changing Parameters

If you can modify the field over which the cursor is placed, pressing the <SPACEBAR> will toggle through the parameters available. Link parameters are only adjustable if <CTRL> and A are keyed in advance. No change is possible if the field is calculated, unchangeable, or hardware-set.

Pressing the <SPACEBAR> will toggle through the choices available for a parameter.

4.7.3 Accepting Changes and Updating the Configuration

If the Configure parameter is selected to Accept after the configuration has been suitably adjusted, the configuration is updated at the local and remote end as necessary and held in Non-Volatile Memory (NVRAM).

4.7.4 Abandoning Changes

Pressing <CTRL> and <C> together at any point before a configuration is updated will cause all modifications to be abandoned and the last updated configuration will be represented on the screen.

Alternatively, if the cursor remains unmoved for thirty seconds when in Enter mode, the cursor marker will automatically return to the Configure line and revert to Accept. The original configuration is maintained and any parameter changes will be lost.

4.7.5 Local or Remote Configuration

Most settings are independent at each end of the multiplexor link (for example, signals, clocks, and rates). The Display Page parameter in the upper left of the selected screen shows whether the Local or Remote multiplexor is being configured.

4.7.6 Screen Messages

The bottom of the configuration screen displays status messages as appropriate. When the Configure line is set to Accept, the following line will normally appear:

Use cursor keys to select parameter, SPACE/- to toggle

Two additional lines appear when the Configure line is set to Enter, as follows:

Type <CTRL>&A to enable access to link parameters
Use cursor keys to select parameter, SPACE/- to toggle
Select ACCEPT to apply changes, type <CTRL>&C to abort

If <CTRL> and A are keyed simultaneously, then the top line changes to:

Type <CTRL>&A to enable access to link parameters

If the remote unit is put into a composite loopback mode, the local unit cannot be configured and the following message is displayed:

Looping data back to remote—Keyboard Disabled

4.7.7 Error Messages

Error messages take precedence over any existing message and always appear at the top of the three previously described lines. The possible error conditions are as follows:

WARNING—MAXIMUM AGGREGATE SPEED EXCEEDED

WARNING—LOCAL AND REMOTE SET-UPS DO NOT MATCH

4.8 Data Channel Configuration

The display shows parameters for eight data channels CH1 to CH8. Each data channel has parameters selectable as shown in Table 4-1.

4.9 Copying a Channel Setup

Channel data may be copied from another similar data channel by placing the cursor over the channel number field of the channel to be changed.

The <SPACEBAR> allows you to toggle through each available channel so that the setup may be copied.

Table 4-1. Configuration display definitions.

Parameter	Display Options	Description
Mode	RUN Local Loopback Remote Loopback	Composite link operation mode.
Data Monitor	RXD TXD RXD/TXD	LEDs show receive data activity. LEDs show transmit data activity. LEDs show transmit and receive data activity.
With X.21 composite interface selected		
Link Clock	EXT xxxxx AUTO xxxxx INT xxxxx xxxx 4800 xxxx 64000	Link clock external, manually set. Link clock external, automatically calibrated. Link clock internally generated. Composite clock rate in 800-bps steps.
X.21 Carrier	PRESENT LOST	The multiplexor is receiving clock (from the link if EXT/AUTO is set) and is also communicating with the remote multiplexor. There is no communication between the local and remote multiplexors.
With V.24, V.35, or G.703 composite interface selected		
Link TXC	AUTO xxxxx RXC xxxxx EXT xxxxx INT xxxxx xxxx 4800 xxxx 64000	External link clock automatically calibrated. External link clock turn-around mode. External link clock manually set. Internally generated link clock. Composite clock rate in 800 bps steps.
V.xx Carrier	PRESENT	The multiplexor is receiving clock (from the link if EXT/RXC/AUTO clock V.35 carrier is selected) and is also communicating with the remote multiplexor.
	LOST	There is no communication between the local and remote multiplexor.

Table 4-1 (continued). Configuration display definitions.

Parameter	Display Options	Description
Link TXC	RxC(xx xxxxx)	Transmitted data clocked from receive clock.
	INT(xx xxxxx)	Internally generated transmit clock.
	xxx(OCTET)	TxD with G.703 octet timing CCITT compliant.
	xxx(NO OCTET)	TxD without G.703 octet timing.
G.703 Carrier	PRESENT	The multiplexor is receiving clock from the link and data from the remote unit.
	LOST	There is no communication between the local and remote multiplexor.
Residual	+xxxxx	Surplus bandwidth available with current configuration.
	-xxxxx	Excess bandwidth situation—NVRAM will not accept configuration. A warning is displayed at the bottom of the screen and a bleep is heard. (WARNING—MAXIMUM AGGREGATE SPEED EXCEEDED.)
Option Cards	NONE	No option card fitted.
	VOICE	Single-channel ADPCM voice option fitted.
	DUAL VOICE	Dual-channel ADPCM voice option fitted.
Configure	ACCEPT	The displayed configuration is stored in NVRAM in both local and remote multiplexors.
	ENTER	The configuration may be changed.
Display Page	LOCAL	The screen shows the configuration of the local unit.
	REMOTE	The screen shows the configuration of the remote unit.
Copy Channel	1–4, 1–8, or 1–7 & X.21	Provides facility to copy the setup parameters of any other data channel.

NOTE

All parameters in BOLD may be selected differently at Local and Remote ends.

Table 4-1 (continued). Configuration display definitions.

Parameter	Display Options	Description
Rate	V.24 0 1200 2400 4800 7200 9600 14400 19200 28800	Data channel bit rate.
Type	Sync Async	Data channel type
RX clock	Int Ext	Synchronous data receive clock setting.
TX clock	Int Ext	Synchronous data receive clock setting.
Bits/Char.	7 8	Asynchronous data channel word length.
Parity	Odd Even None	Asynchronous data parity.
RTS/CTS Dly	0 ms 50 ms	Data channel RTS/CTS delay.
Signals	Both+	DSR and DCD are both affirmed at the local multiplexor.
	Trans	Remote RTS transmitted to local DCD.
	DSR+	DSR is affirmed at the local multiplexor.
	DCD+	DCD is affirmed at the local multiplexor.
Channel Mode	Run	Data channel in run mode.
	LLOOP	Data channel in local loopback mode.
	RLOOP	Data channel in remote loopback mode.
	****	Remote page display cannot be set.

5. Installation

CAUTION

Before installation, please refer to the safety warnings, approvals requirements, and EMC requirements in Appendixes A, B, and C.

5.1 Supply Voltage and Connection

AC	100–240 VAC without adjustment
Optional DC	48 VDC without adjustment

The multiplexor may be either DC or AC powered. The AC power supply is a switched-mode unit, whereas the optional DC power supply is a DC-to-DC converter. Both allow considerable input voltage variation.

5.2 Environmental Conditions

The multiplexor must be operated under the following atmospheric conditions:

Temperature:	32 to 104°F (0 to 40°C)
Humidity:	Up to 90% noncondensing
Air Pressure:	86 to 106 kPa

5.3 Mechanical Construction

The multiplexor is housed in a 2U tall 19" enclosure. Optional rackmount kits are available upon request. Eleven LEDs on the front panel indicated the current status of the multiplexor.

WARNING

YOU MIGHT BE SHOCKED! Disconnect the multiplexor from the power supply before opening the unit or changing any network connections.

Remove the screws on the left, right, and top of the enclosure using a Posidrive screwdriver to access the interior. This lets you install interface and option cards.

The rear panel (illustrated in **Appendix D**) accommodates the link interface connectors and supervisor port.

5.4 Composite Interface Selection

Interface cards are used to determine the interface type (X.21/V.11, V.24, V.35, etc.) of the composite link. Use the corresponding external cable to make the connection once you fit the interface card.

Set the link positions on the composite interface cards as shown in Table 5-1:

Table 5-1. Link positions settings.

Interface	Link Number	DTE Setting (Network)
V.11	N/A	N/A
V.24	LK1, LK2	CMP
V.35	LK1, Nearest J1	EXT
	LK2, Nearest J2	EXT

You can access the interface cards when the cover is removed, as described in **Section 5.3**. The position for each card is described in Table 5-1. Anti-static precautions must be taken while fitting or changing the interface cards that simply plug into the motherboard at the positions shown.

5.5 Composite Network Connection

The multiplexor supports many different network interfaces including X.21/V.11, V.35, G.703, and V.24.

The composite port appears on the back panel as a DB15 connector. The pinout for each interface standard is described in **Appendix F**. Correct cables for network connection are shown in **Appendix I**.

5.6 Composite Link Parameters

You can toggle parameters using the <SPACEBAR> as described previously. To access the settings, press **<CTRL>** and **A**.

6. Troubleshooting

6.1 Front-Panel LEDs

During normal operation, only the Carrier LED will be constantly lit.

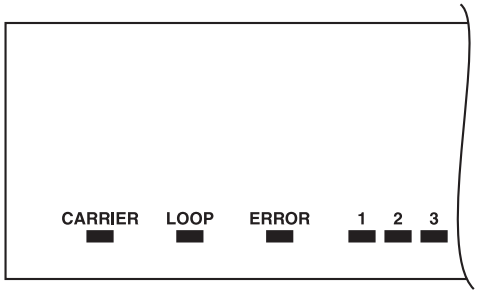

Figure 6-1. Front-panel LEDs.

Table 6-1. LEDs.

LED Label	Condition	Notes
Carrier	Even Flash	No communication with remote unit—link or multiplexor fault.
	Uneven Flash	High error rate or intermittent communication on remote link.
	Steady Green	Link OK—framing signal present from remote unit.
Error	**Not Illuminated**	Configuration OK.
	Red	Configuration not acceptable (for example, channel data rate aggregate exceeds available bandwidth).

Table 6-1 (continued). LEDs.

LED Label	Condition	Notes
Loop	**Not Illuminated**	No diagnostics running.
	Green	Some channels looped or in QBF test modes.
Data	**Intermittent**	Lit when channel is passing data.

6.2 Diagnostics and Loopbacks

A number of diagnostic configuration options are available. The mux can loopback the data channels and the composite link, both locally and remotely, to test for correct operation.

The configuration procedure is described in **Chapter 4**.

Local composite loopback loops back the composite link of the local multiplexor, that is, the unit to which a VDY being used to perform set-up is connected. While the composite link on the local multiplexor is being looped back, incoming data from the remote multiplexor is ignored.

When Remote Composite Loopback is selected, the composite link is looped back at the remote unit, which returns data to the local multiplexor. Data inputs at the remote multiplexor are ignored.

Channel Loopbacks, which may be Local or Remote, are not intrusive to other data channels.

Loopbacks are not bilateral and may only be set at one end of the link for one channel at any time.

6.2.1 Self-Test Procedure

The multiplexor automatically initiates a self-test procedure when powered on. The progress of the self-test is indicated by the LEDs and by a scrolling display if a terminal is connected for configuration.

**********SELF TEST**********

ROM TEST PASSED

RAM TEST PASSED

LED TEST

CTC READ/WRITE TEST PASSED

SIO READ/WRITE TEST PASSED

INTERRUPT DAISYCHAIN TEST PASSED

INTERNAL CLOCK/P.L.L./TLOK/FLASH TEST PASSED

CHANNEL CLOCK TEST PASSED

****

If any part of the self-test fails, the display will stop and indicate "FAILED" after the appropriate test. The display does not proceed to the display of VDU emulations. The front-panel LED display also stops. This indicates a fault that cannot be remedied. Please contact Black Box Technical Support at 724-746-5500 for assistance.

6.2.2 Back-to-Back Testing

You can test a pair of multiplexors in a back-to-back mode. This is a useful way to become familiar with the configuration procedures and to check for correct operation if you suspect a malfunction.

To carry out a back-to-back test, connect a multiplexor pair via the composite connector using the appropriate cable selected from **Appendix G**.

Our normal procedure is to use the X.21/V.11 composite back-to-back cable with the interface selection also set to X.21/V.11.

When connected by the cable, one multiplexor is selected to Internal Clock and the data rate is set to an appropriate value (64 kbps). The second multiplexor is selected to AUTO or EXT, thus accepting clock from the other.

When correctly interconnected and appropriate clocking is accepted, the multiplexor pair will intercommunicate as if a link was present. Carrier is then indicated as Present on the VDU, with the Carrier LED lit.

After back-to-back testing, you must reconfigure the composite clocking, from internal (INT) to external (EXT or AUTO) on the unit originally providing a system clock.

6.3 Calling Black Box

If you determine that your Sprint 2 Time-Division Multiplexor is malfunctioning, do not attempt to alter or repair the unit. It contains no user-serviceable parts. Contact Black Box at 724-746-5500.

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

- the nature and duration of the problem.
- when the problem occurs.
- the components involved in the problem.
- any particular application that, when used, appears to create the problem or make it worse.

6.4 Shipping and Packaging

If you need to transport or ship your Sprint 2:

- Package it carefully. We recommend that you use the original container.
- If you are shipping the Sprint 2 for repair, make sure you include everything that came in the original package. Before you ship, contact Black Box to get a Return Authorization (RA) number.

Appendix A. Safety Requirements

WARNING

THIS EQUIPMENT MUST BE EARTH-GROUNDED. This equipment relies on the Earth/Ground connection for safe operation to adequately protect the user and Telecom network. NEVER operate it without an earth connection! You might be shocked!

WARNING

Only qualified service personnel should install this equipment.

WARNING

This equipment allows connection only of suitably approved equipment to its ports, the safety status of which are defined below.

SELV ports:

i) Supervisor port
ii) Composite port
iii) 1 to 8 (Channel ports)

The above named ports are classified as SELV (Safety Extra Low Voltage) in accordance with Clause 2.3 of EN60950 (BS7002, IEC950 as applicable), and must only be connected to equipment that similarly complies with the SELV safety classification.

Appendix B. Approval Requirements

The Sprint 2 Time-Division Multiplexor carrying the BABT/CE168 assessment symbols and approval number is approved for connection to the networks identified in this appendix.

X.21bis/V.24/V.35

In the UK only, when mains powered, subject to the following requirements:

- Service category 1 at rates of 2400, 4800, 9600, and 19,200 bps when composite link (LINK A) or High-Speed Channel (HSC) is fitted with a V.24 interface card linked for DTE. Connection must be made using a suitable non-integral interface-specific cable, as described in **Appendix I**.

- Service category 2 at rates of 48,000, 56,000, and 64,000 bps when composite link (LINK A) or High-Speed Channel (HSC) is fitted with a V.35 interface card linked for DTE. Connection must be made using a suitable non-integral interface-specific cable, as described in **Appendix I**.

Approval for both service categories has been granted in accordance with BS6328, part 7, 1990 section 4.3, connection being only to a relevant branch system for particular digital circuits. The above defined interface-specific cables constitute a relevant branch system for the particular digital circuit.

If any other apparatus, including cable or wiring, is to be connected between the apparatus and the point of connection to any particular digital circuit, then that apparatus shall conform to the following:

a) The overall transmission characteristics of all that other apparatus shall be such as to introduce no material effect upon the electrical conditions presented to one another by the apparatus and the particular digital circuit;

b) All other apparatus shall be made up of only:

1. apparatus approved for the purpose of connection between the apparatus and a particular digital circuit, and

2. cable and wiring complying with a code of practice for the installation of apparatus covered by BS6328, part 7, or such other requirements as may be applicable.

Appendix C. EMC Requirements

To ensure compliance with the EMC directive, the units must be installed properly, using suitable cables and connections.

C.1 Limitation of Emissions

C.1.1 Data Connections

This product relies on the use of screened cables for connection to the DB15 and DB25 ports. The cables must have the foil or braid screen connected effectively to the metal headshell to ensure continued compliance.

Figure C-1 illustrates an example of a suitable screen connection. The foil or braid screen is bent back over the "C" clip to achieve a pressure contact of the screen against the shell.

Keep the screen-to-shell connection as short as possible.

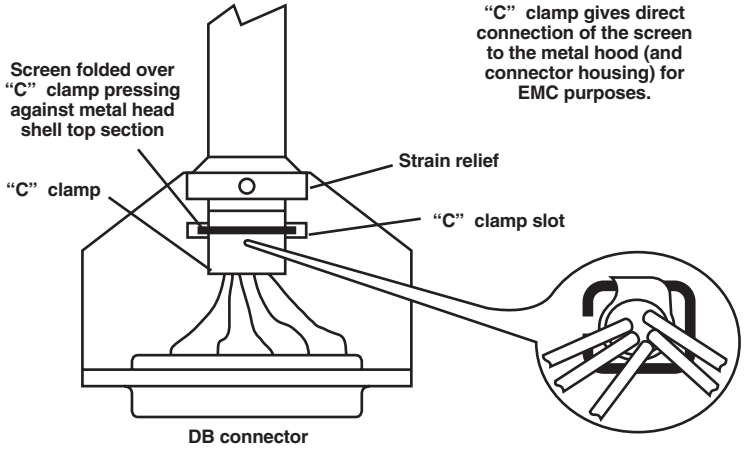

Figure C-1. Suitable screen connection.

C.1.2 Mains Connection

The mains connection is internally filtered and requires no special consideration.

C.2 To Ensure Adequate Immunity is Achieved

Protect the product from a) transients from the mains and b) static discharge. Make sure the product is effectively earthed.

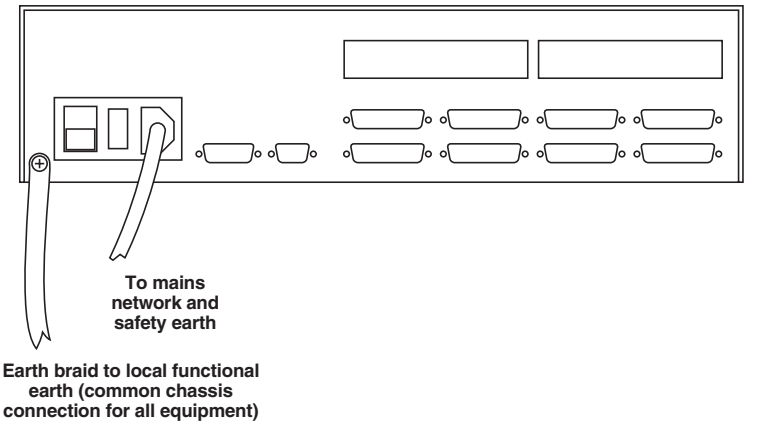

Figure C-2. Separate chassis earth connection.

The mains IEC cable provides some protection, but to achieve optimal immunity, the chassis Earth screw connection should be connected to a local Earth busbar or cabinet frame wherever possible, as shown above.

Appendix D. Rear-Panel Layout

The layout of ports on the multiplexor's rear panel is shown below.

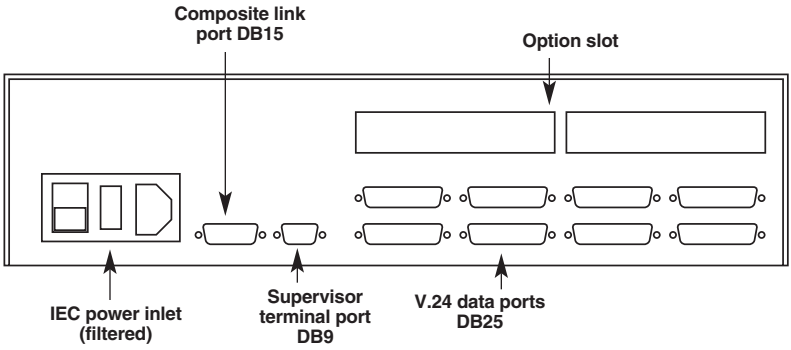

Figure D-1. Rear-panel layout.

Appendix E. Supervisor Port Pinout

Table E-1. V.24 supervisor port pinout (DB9 configured as DCE).

Pin	Signal
1	DCD
2	RXD
3	TXD
4	DTR
5	Signal Ground
6	DSR
7	RTS
8	CTS
9	—

The multiplexor requires connections to TXD, RXD, and Common only. The output signals CTS, DSR, and DCD are provided for the terminal if required.

NOTE

Connector shell and termination must be as specified in Appendix C.

Appendix F. Composite Link DB15 Pinout

Table f-1. DB15 composite interface pin connections (DTE).

DB15 Mux Connector	X.21/V.11	V.35	V.24	G.703	Type at Connector
1	Ground				
8	G	Common	Common	—	Common Return
2	T(A)	TXDa	TXD	T(A)	Generator
9	T(B)	TXDb	—	T(B)	Generator
3	C(A)	RTS	RTS	S(R)[5]	Generator
10	C(B)	DTR	DTR	S(T)[5]	Generator
4	R(A)	RXDa	RXD	R(A)	Load
11	R(B)	RXDb	—	R(B)	Load
5	I(A)	DCD	DCD	S(ext)[5]	Load
12	I(B)	DSR	DSR	—	Load
6	S(A)[2]	RXCa[3]	RXC	—	Load
13	S(B)[2]	RXCb[3]	—	—	Load
7	—	TXCa[3]	TXC[4]	—	Load
14	—	TSCb[3]	TXCO[4]	—	See Note 1.

NOTES

1. Pin 14 on Mux **V.11 Not connected**
V.35 Load
V.24 Generator

2. V.11 clocks S(A), S(B) may be configured as generators for DCE or test purposes.

3. V.35 clocks TXC and RXC may be configured as generators for DCE or test purposes.

4. TXC should be derived from TXCO externally for V.24 internal clock and clock turnaround mode.

5. G.703 interface Transmit and Receive screens should be connected to S(T) and S(R) respectively. An on-board link connects these to signal ground (1–2) or S(Ext) external ground (2–3). External ground may be connected externally to Pin 1 if link grounding to protective/chassis ground is required.

6. Connector shell and termination must be as specified in Appendix C.

Appendix G. Composite Back-to-Back Test Cables

G.1 X.21/V.11 Test Cable

Table G-1. X.21/V.11 cable pinning.

	DB15 male (Mux A)	DB15 male (Mux B)
Common	8	8
TxDa/RxDa	2	4
TxDb/RxDb	9	11
RxDa/TxDa	4	2
RxDb/TxDb	11	9
Clock a	6	6
Clock b	13	13

G.2 X.21/V.35, V.24, and V.36 Test Cables

Table G-2. X.21/V.34, V.24, and V.36 cable pinning.

	DB15 male (Mux A)	DB15 male (Mux B)
Common	8	8
TxDa/RxDa	2	4
TxDb/RxDb	9	11
RxDa/TxDa	4	2
RxDb/TxDb	11	9
RxCa/TxCa	6	7
RxCb/TxCb	13	14
TxCa/RxCa	7	6
TxCb/RxCb	14	13

G.3 G.703 Test Cable

Table G-3. G.703 cable pinning.

	DB15 male (Mux A)	DB15 male (Mux B)
TxDa/RxDa	2	4
TxDb/RxDb	9	11
TxDa/RxDa	4	2
RxDa/TxDa	11	9

NOTE

Set Link TXC to INT (Octet) unit A. Set Link TXC to RXC (octet) unit B.

The connector shell and termination must be as specified in Appendix C.

Appendix H. Data Channel Pinout

Table H-1. V.24 data channel connectors 1–8 (DB25 female configured as DCE).

V.24 Pin	V.24 Signal
1	Ground
2	TxD
3	RxD
4	RTS
5	CTS
6	DSR
7	Common
8	DCD
15	TxC
17	RxC
20	DTR
24	ExtClk

NOTE

1. INDb should be connected to 0V to enable equipment connected to the multiplexor.

2. The connector shell and termination must be as specified in the EMC section (Appendix C).

Appendix I. Network Composite Cables

Table I-1. X.21/V.11 straight DB15 female multiplexor composite DTE to network DCE cable.

Mux DB25 Male Connector UNC 4/40 Screws	V.11 DB15 Male Connector M3 Screws		Type at Connector (Normal Use)
1	1	Shield	—
8	8	G	Common Return
2	2	T(A)	Generator
9	9	T(B)	Generator
3	3	C(A)	Generator
10	10	C(B)	Generator
4	4	R(A)	Load
11	11	R(B)	Load
5	5	I(A)	Load
12	12	I(B)	Load
6	6	S(A)	Load
13	13	S(B)	Load

NOTES

1. Pin 14 on the multiplexor is not connected.

2. V.11 male for connection to NTU must have M3 screws. The mux end has 4/40 screws unless national regulations permit the use of UNC 4/40. Each cable end must be clearly identifiable.

3. Dashed lines show wires to be twisted pairs.

4. Cable type: Belden 9506, 6-wire twisted-pair overall screen (or equivalent). Maximum length 100 meters.

5. The connector shell and termination must be as specified in the EMC section (Appendix C).

Table I-2. X.21/V.35 straight DB15 female multiplexor composite DTE to network DCE cable.

Mux DB25 Male Connector UNC 4/40 Screws	V.35 34-Pin Male Connector M3 Screws		Type at Connector (Normal Use)
1	A	Shield	—
8	B	Common	Common Return
2	P	TXDa	Generator
9	S	TXDb	Generator
3	C	RTS	Generator
10	H	DTR	Generator
4	R	RXDa	Load
11	T	RXDb	Load
5	F	DCD	Load
12	E	DSR	Load
6	V	RXCa	Load
13	X	RXCb	Load
7	Y	TXCa	Load
14	AA	TXCb	Load

NOTES

1. Dashed lines show wires to be twisted pairs.

2. Cable type: Belden 9507, 7 twisted-pair overall screen (or equivalent). Maximum length 100 meters.

3. Connector shell and termination must be as specified in the EMC section (Appendix C).

Table I-3. X.21bis/V.24 straight DB15 female multiplexor composite DTE to network DCE cable.

Mux DB15 Male Connector UNC 4/40 Screws	V.24 DB15 Male Connector UNC 4/40 Screws		Type at Connector (Normal Use)
1	1	Shield	—
8	7	Common	Common Return
2	2	TXD	Generator
9	—	—	Generator
3	4	RTS	Generator
10	20	DTR	Generator
4	3	RXD	Load
11	—	—	Load
5	8	DCD	Load
12	6	DSR	Load
6	17	RXC	Load
13	—	—	Load
7	15	TXC	Load

NOTES

1. Cable type: Belden 9540, 10 conductors overall screen (or equivalent). Maximum length of 10 meters.

2. Connector shell and termination must be as specified in the EMC section (Appendix C).

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