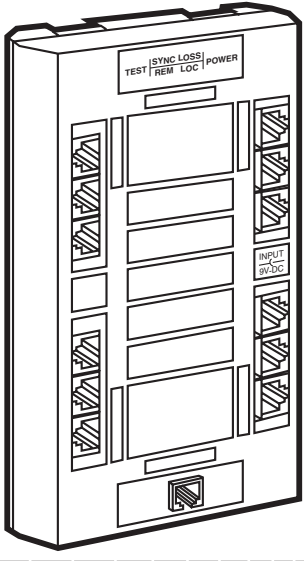
BLACK BOX®
NETWORK SERVICES

MAY 1998
MX873A

Miniature Local Mux-12



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FEDERAL COMMUNICATIONS COMMISSION AND INDUSTRY CANADA RADIO FREQUENCY INTERFERENCE STATEMENTS

This equipment generates, uses, and can radiate radio-frequency energy, and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio communication. It has been tested and found to comply with the limits for a Class A computing device in accordance with the specifications in Subpart B of Part 15 of FCC rules, which are designed to provide reasonable protection against such interference when the equipment is operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be necessary to correct the interference.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This digital apparatus does not exceed the Class A limits for radio noise emission from digital apparatus set out in the Radio Interference Regulation of Industry Canada.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de classe A prescrites dans le Règlement sur le brouillage radioélectrique publié par Industrie Canada.

NORMAS OFICIALES MEXICANAS (NOM)
ELECTRICAL SAFETY STATEMENT

INSTRUCCIONES DE SEGURIDAD

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

10. El equipo eléctrico deber ser situado fuera del alcance de fuentes de calor como radiadores, registros de calor, estufas u otros aparatos (incluyendo amplificadores) que producen calor.

11. El aparato eléctrico deberá ser connectado a una fuente de poder sólo del tipo descrito en el instructivo de operación, o como se indique en el aparato.

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

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

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

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

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

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

18. Servicio por personal calificado deberá ser provisto cuando:

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

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

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

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

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

TRADEMARKS USED IN THIS MANUAL

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

Contents

Contents (continued)

1. Specifications

1.1 Sub-Channels

Transmission Format—Asynchronous

Mode of Operation—Full duplex

Data Rate—Up to 19.2 kbps

Interface—EIA RS-232/CCITT V.24

Connectors—(12) RJ-45 female

Number of Sub-channels—12

Distortion—See **Table 1-1**. User may select six sub-channel operation for reduced distortion by internal strapping.

Table 1-1. Performance at various bit rates.

Sub-channel bit rate (Kbps)	Distortion (%) 6-channel mode	Distortion (%) 12-channel mode
19.2	12.5	25
9.6	6.3	12.5
4.8	3.2	6.3
2.4	1.6	3.2
1.2	0.8	1.6

1.2 Main Channel

Transmission Line—4-wire unconditioned telephone lines (two twisted pairs)

Operating Range—1 mile (1.6 km) maximum on 22 AWG cable (actual distance may vary, depending on the cable you use)

Data Rate—1.2288 Mbps

Output Format—Balanced bipolar transformer isolated

Output Level—6 V ptp (on 100 ohms)

Input Resistance—110 ohms

Connectors—(1) RJ-45 female

1.3 General

Indicators—Power, Local Sync Loss, Remote Sync Loss

Table 1-2. Indicators.

Indicator	Function
Power	ON when unit is powered.
Local Sync Loss	ON when synchronization is lost at the local Mux.
Remote Sync Loss	ON when synchronization is lost at the remote Mux.
Test	ON when remote Mux is performing a loopback.

Temperature—32 to 122°F (0 to 50°C)

Humidity—Up to 95%, noncondensing

Power Consumption—Input: 110 VAC, Output: 200 mA @ 9 VDC

Size—1.3"H x 4.5"W x 7.4"D (3.4 x 11.4 x 18.7 cm)

Weight—10.7 oz. (300 g)

2. Introduction

2.1 General

The Miniature Local Mux-12 is a time-division multiplexor that enables up to 12 terminals to be multiplexed onto a single cable, in point-to-point applications. The Mux-12 contains a built-in line driver that extends the high-speed multiplexed data over twisted pairs.

2.2 Functional Description

The Mux-12 has 12 sub-channels that are connected by RJ-45 connectors accessible from the top panel. The unit can be strapped for 6 or 12 sub-channels according to the desired application.

Multiplexing is implemented using an over-sampling technique that enables each one of the 12 channels to be sampled at a rate of 78.6 kbps. This technique results in oversampling distortions, with a magnitude proportional to the bit rate of the sub-channel. **Table 2-1** summarizes the performance at various speeds and modes of operation.

NOTE

Whenever possible (when the number of channels is 6 or less), we advise operating the Mux in the 6-channel mode, which results in less distortion.

Table 2-1. Performance at various bit rates.

Sub-channel bit rate (kbps)	Distortion (%) 6-channel mode	Distortion (%) 12-channel mode
19.2	12.5	25
9.6	6.3	12.5
4.8	3.2	6.3
2.4	1.6	3.2
1.2	0.8	1.6

2.3 Applications

The primary application of the Mux-12 is for point-to-point configurations at distances of up to 0.6 miles (1 km). A typical application is demonstrated in **Figure 2-1**, where a cluster of terminals is connected to a host computer through a single link.

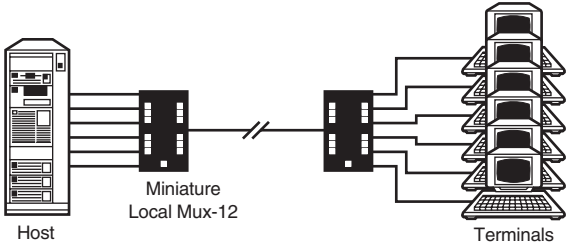

Figure 2-1. Typical point-to-point installation.

For installations involving clusters of terminals distributed in several locations, the Mux-12 units may be installed in a ring-type configuration as shown in **Figure 2-2**. At each site, the unconnected channels must be bypassed by shorting TX pin to RX pin of the relevant sub-channel's connector. Be aware that oversampling distortions are accumulative, so this application limits the bit rate of the sub-channels.

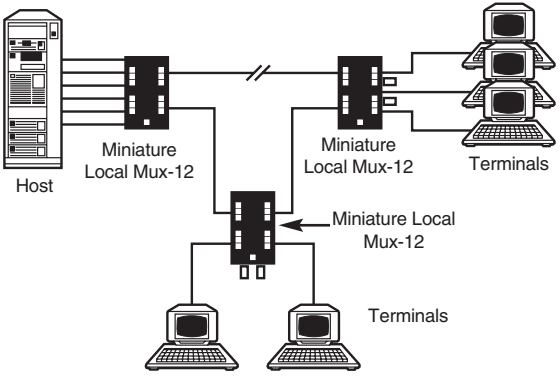

Figure 2-2. Typical ring installation.

3. Installation

3.1 General

This chapter provides the information you need to implement the mechanical and electrical installation of the Mux-12. After installation is complete, refer to **Chapter 4** for operating information and system checkout to assure normal operation.

3.2 Physical Installation

The Mux-12 comes completely assembled and is designed to be secured to a bench or wall using screws.

3.3 Site Preparation

The Mux-12 is installed within 5 ft. (1.5 m) of an AC outlet enabling connection of the power-supply adapter.

3.4 Setup

Installation of the Mux is straightforward. First review **Table 2-1**; the factory setting is for 12 sub-channels. If this suits your requirements, you can skip steps 1 through 3 below.

1. Open the top half of the plastic case by squeezing the marked places on the sides.

2. Strap the multiplexor for 6 or 12 sub-channels according to the printed circuit board.

3. To close the unit, simply press the two halves of the case together.

4. Install the Mux within 5 ft. (1.5 m) of an AC outlet. The unit can be wall-mounted by four screws through the mounting brackets located at both sides of the unit.

5. Connect 9 to 12 VDC from a wall-mounted AC adapter into the DC jack of the Mux. The "POWER" LED should be lit. Other LEDs may be lit as well.

6. Connect the sub-channels to your equipment. Pin assignment of the RJ-45 sub-channel connector is given in **Table 3-1**. For a description of the RJ-45 connector, see **Figure 3-2**.

7. Connect the main channel of the Mux to the wiring that connects it to the remote Mux. Pin assignment of the RJ-45 main channel connector is given in **Table 3-2**. Note that the Transmit Pair

of one unit should be connected to the Receive Pair of the other unit, and vice versa. All LEDs should be "OFF" (with the exception of "POWER") indicating normal operation.

3.5 Electrical Installation

3.5.1 AC Power

The Mux is powered by an external power supply of 9 to 12 VDC capable of supplying at least 300 mA. A miniature wall-mount power supply can be used to provide the required power. The power supply is connected to the Mux by a cable ending with a miniature 2 mm DC plug (tip positive, sleeve ground).

3.5.2 Sub-Channels

Twelve RJ-45 8-pin jacks located on the top panel enable end users to be connected to the unit. Detailed information about the signals present at this jack and pin configuration are given in **Table 3-2** and **Figure 3-2**.

Table 3-1. Sub-channel connector pin assignments.

CCITT V.24	EIA RS-232C	Pin No.	Signal Name	Description
102	AB	7	Signal Ground	Common signal.
103	BA	5	Transmit Data	Serial data from DTE into the Mux.
104	BB	3	Receive Data	Serial data output from the Mux
105	CA	2	Request to Send	Connected to CTS.
106	CB	8	Clear to Send	Connected to RTS.
107	CC	6	Data Set Ready	A positive level from the Mux except when either a sync loss occurs or remote loopback is performed.
109	CF	4	Receive Line Signal Detector (Carrier Detect)	A positive level from the Mux except when either a sync loss occurs or remote loopback is performed.
—	—	1	+V output	A positive unregulated voltage to power external equipment (up to 120 mA total).

Table 3-2. Main channel's connector pin assignment.

Pin No.	Signal Name	Description
1	RX-A	Receive Pair
2	RX-B	
7	TX-A	Transmit Pair
8	TX-B	

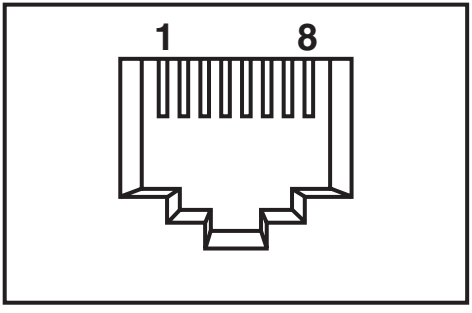

Figure 3-1. RJ-45 socket (female) external view.

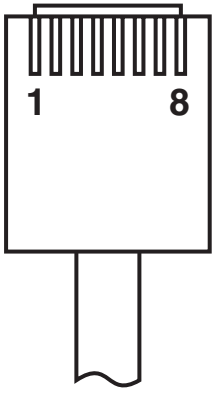

Figure 3-2. RJ-45 plug (male) clip at rear.

4. Operation

4.1 General

This chapter contains a list of the Mux-12's indicators, their functions and operating procedures. Installation procedures given in **Chapter 3** must be completed and checked before attempting to operate the Mux.

4.2 Indicators

Four indicators are located on the Mux's top panel (see **Figure 4-1**). Their functions are described in **Table 4-1**.

Table 4-1. Indicator functions.

Indicator	Function
Power	ON when unit is powered
Test	ON when remote Mux is performing a loopback
Local Sync Loss	ON when synchronization is lost at the local unit
Remote Sync Loss	ON when synchronization is lost at the remote unit

4.3 Operating Procedure

4.3.1 Powering On the Unit

To power on the Mux, connect the power cable to the Mux's jack, then plug the power supply unit into the mains. The POWER indicator should light. If the link to

the remote Mux is still not operational, the SYNC LOSS indicators should be lit.

4.3.2 Operation

The Mux operates entirely unattended except when occasional monitoring of LED indicators is required.

4.3.3 Powering Off the Unit

To power off the Mux, simply remove the power adapter from the AC source.

4.4 Operational Field Strapping Changes

If you need to reconfigure the Mux for 6- or 12-channel mode, simply follow the appropriate setup procedure given in **Section 3.2**.

5. Diagnostics

5.1 Remote Loopback

Remote loopback can be performed by the Mux-12 when operated in conjunction with the single-port Miniature Local Mux. The test is performed by pressing the RLB button switch located on the front panel of the single-port Mux, which results in looping data back from the remote Mux-12's receiver to the transmitter. The test checks the single-port Mux's digital circuitry as well as both local and remote analog interfaces, the main-channel link, and the Mux-12's digital receiver section.

NOTE

When either local or remote loopback test is performed by the single-port Mux, the TEST LED should be lit while all other LEDs should be off at the remote Mux-12. At the same time the Received Data signals (Circuit 104) at the Mux-12's sub-channels are set to MARK (negative voltage) condition.

5.2 Fault Isolation and Troubleshooting

The symptoms and corresponding procedures listed in **Table 5-1** enable you to identify, isolate, and correct faults.

WARNING

These service instructions are for use by qualified personnel only. To avoid shock, do not perform any servicing other than that contained in the operating instructions unless you are qualified to do so.

Table 5-1. Fault isolation and troubleshooting.

Symptom	Action
All front-panel indicators are off	a) Check that power is supplied to the unit. b) Replace unit. The fault is probably in the unit's power-supply circuits.
Local SYNC LOSS and/or REMOTE SYNC LOSS is ON	a) Check the main channel's connection at both sites. Verify that these connections are in accordance with the procedure described in **Section 3.4.7** and **3.5.3**. b) Replace both units: one at a time. If the problem still exists, the main channel link between the units is probably defective and should be checked.

Appendix: Bracket Assembly

1. The Mux is provided with two mounting brackets, which mate with a pair of slots on each end of the Mux case.

2. Each bracket has a pair of flanges that slide into the Mux case slots.

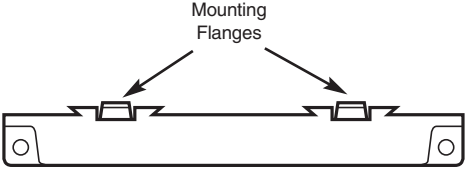

Figure A-1. Top view of mounting bracket.

3. To attach the brackets, hold the Mux case facing upward. Slide the bracket flanges firmly into their slots on the Mux case. When slid all the way, the brackets snap into a locked position.

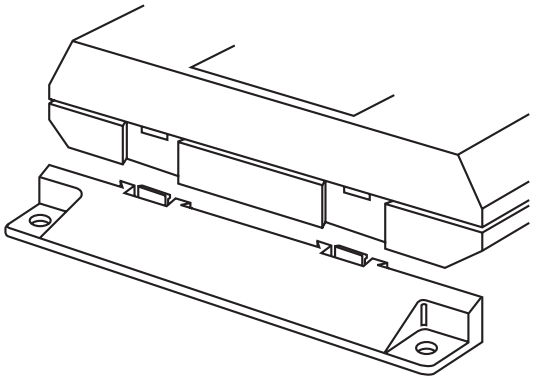

Figure A-2. Before mounting the brackets.

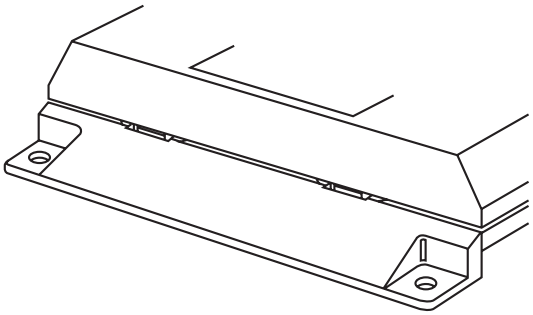

Figure A-3. After mounting the brackets.

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