Digi-Mux HS

**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 la classe A prescrites dans le Règlement sur le brouillage radioélectrique publié par Industrie Canada.

NORMAS OFICIALES MEXICANAS (NOM)
ELECTRICAL SAFETY STATEMENT

INSTRUCCIONES DE SEGURIDAD

1. Todas las instrucciones de seguridad y operación deberán ser leídas antes de que el aparato eléctrico sea operado.

2. Las instrucciones de seguridad y operación deberán ser guardadas para referencia futura.

3. Todas las advertencias en el aparato eléctrico y en sus instrucciones de operación deben ser respetadas.

4. Todas las instrucciones de operación y uso deben ser seguidas.

5. El aparato eléctrico no deberá ser usado cerca del agua—por ejemplo, cerca de la tina de baño, lavabo, sótano mojado o cerca de una alberca, etc..

6. El aparato eléctrico debe ser usado únicamente con carritos o pedestales que sean recomendados por el fabricante.

7. El aparato eléctrico debe ser montado a la pared o al techo sólo como sea recomendado por el fabricante.

8. Servicio—El usuario no debe intentar dar servicio al equipo eléctrico más allá a lo descrito en las instrucciones de operación. Todo otro servicio deberá ser referido a personal de servicio calificado.

9. El aparato eléctrico debe ser situado de tal manera que su posición no interfiera su uso. La colocación del aparato eléctrico sobre una cama, sofá, alfombra o superficie similar puede bloquea la ventilación, no se debe colocar en libreros o gabinetes que impidan el flujo de aire por los orificios de ventilación.

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

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

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

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

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

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

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

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

18. Servicio por personal calificado deberá ser provisto cuando:

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

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

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

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

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

TRADEMARKS USED IN THIS MANUAL

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

Contents

Chapter

Page

1. Specifications

Multiplexor Technique—Time-division, interleaved

Protocol—Synchronous

Speed—*Link*: Up to 2.048 Mbps (with no bit-timing on Channel 4, selectable rates up to 2.048 Mbps); *Channel*: A 25% split per channel; a 50/25/25 split between channels 1, 2, and 4; a 50/50 split between channels 1 and 4; a 75/25 split between channels 1 and 4

Interface—V.35

Connectors—(5) V.35 34-pin female

Indicators—*Channels*: Transmit (TD), Receive (RD);
Link: Transmit (TD), Receive (RD), Data Carrier Detect, Synchronization Loss, TEST

Configuration—*Link*: DTE externally clocked;
Link: Channels 1, 2, and 3: DCE or DTE; Channel 4: DCE only

Diagnostics—Local loop

Temperature—32 to 122°F (0 to 50°C)

Humidity—Up to 90%, non-condensing

Power—115/230 VAC, 42 to 63 Hz, 10 watts

Size—1.7"H x 17"W x 8.2"D (4.3 x 43.2 x 20.8 cm)

Weight—4.4 lb. (2 kg)

2. Introduction

2.1 General Description

The Digi-Mux HS is a high-speed, bit-interleaved time division multiplexor, enabling up to four channels to be multiplexed onto the trunk line of a Digital Data Service or modem. It can multiplex two, three or four channels onto one link without overhead. For example, four data sources (such as computers, controllers or multiplexors) operating at a data rate of 64 kbps can share a single modem or DDS link at a data rate of 256 kbps. The Digi-Mux HS provides full-duplex synchronous operation at selected data rates up to 2048 kbps.

2.2 Functional Description and Applications

2.2.1 MULTIPLEXING

The Digi-Mux HS selects one data bit from each active channel and serially transmits the combined data stream over the high speed link. At the receive end, it reverses the procedure, allocating each data bit to its respective channel.

2.2.2 SYNCHRONIZATION

The Digi-Mux HS uses one bit in every 2048 bits on the main link to synchronize the data, while it takes bit-time from channel 4 bandwidth. Though this does not result in loss of data, it does prevent connection of a tail-end circuit or DTE equipment that cannot tolerate clock-phase discontinuity to channel 4 (e.g. other TDM multiplexors).

   Synchronization occurs in 3 stages.

Stage 1

The Digi-Mux HS sends a synchronization bit every 4096 bits and waits to receive a similar bit from the remote Digi-Mux HS (within every 4096 bits). After receiving a synchronization bit it advances to the next step.

Stage 2

The Digi-Mux HS sends a synchronization bit every 2048 bits and waits to receive a similar bit from the remote Digi-Mux HS before advancing to step 3.

NOTE

As long as the Digi-Mux HS receives a synchronization bit every 4096 bits, it remains in stage 2.

Stage 3

Full synchronization state. The Digi-Mux HS transmits and receives a synchronization bit every 2048 bits. If it doesn't receive a synchronization bit at this value, the unit is out of synchronization, and it stops transmitting to the remote Digi-Mux HS (over a long period of time), causing the remote to exit its synchronization state. Both Digi-Mux HSs then revert to stage 1.

The synchronization bit in the main channel is transmitted and received in the timeslot of channel 4. To stop the data stream during this time period, the Digi-Mux HS does not send clocks on channel 4.

2.2.3 TIMING

The Digi-Mux HS link rate can be up to 2048 kbps and is externally clocked from the modem or the Digital Data Service line.

Channel rate is determined as a percentage of the link rate. The Digi-Mux HS supports four modes:

1. Each channel is allocated 25% of the link rate.

2. Channel 1 is allocated 50%, and channels 2 and 4 are each allocated 25% of the link rate.

3. Channel 1 and channel 4 are each allocated 50% of the link rate.

4. Channel 1 is allocated 75% of the link rate, and channel 4 is allocated 25% of the link rate.

The clocks to the sub-channels are a division of the main channel clocks, with the division determined according to the mode of operation.

The clocks of sub-channel 4 are not the regular clocks, because the synchronization bit produces one missing clock during transmit or receive periods of the bit. For sub-channel 4 clocks there are 2 options, for equipment sensitive to discontinuity in the clock phase (missing clock in the regular clock cycle).

Option 1—Without smoothing:

The clocks are the nominal clocks, while every 2048 clocks a missing clock occurs.

Option 2—With smoothing:

The clocks will be set with 50% duty cycle and will not be the nominal clocks. The missing clock period is evenly spread over the other clocks.

2.2.4 DIAGNOSTICS

To activate the Digi-Mux HS's local main loop, press the front-panel push button.

The Digi-Mux HS provides continuous LED monitoring of transmit and receive data for each channel and link, as well as receive Data Carrier Detect and Synchronization loss of the link.

2.2.5 DCE/DTE SELECTION

With jumpers, you can set Channels 1, 2 and 3 independently to operate as DCE or DTE, so you can directly connect tail-end circuits to to the Digi-Mux HS without a cross cable. Whenever a channel is set as DTE, an elastic buffer is automatically activated.
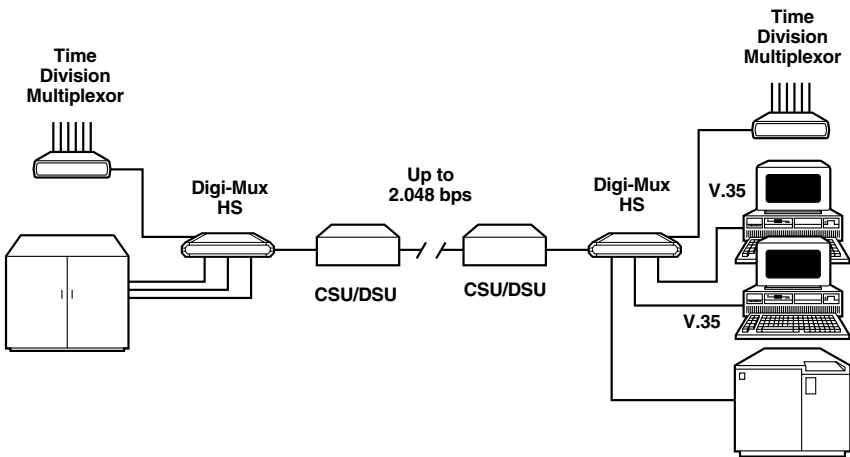

**Figure 2-1. Remote Units Linked to
Central Communication Controller.**

3. Installation

3.1 General

This chapter provides information on the mechanical and electrical installation of the Digi-Mux HS. To ensure normal operation after installation, refer to **Chapter 4** for operating information and system checkout.

3.2 Preparing the Site

The Digi-Mux HS should be installed within 5 feet (1.5 m) of a grounded, easily accessible AC outlet. The outlet should be capable of furnishing 115 VAC or 220 VAC (depending on the power voltage available in your area).

Allow at least 36 in (90 cm) of frontal clearance for operating and maintenance accessibility. Ensure that there is at least 4 in (10 cm) clearance at the rear of the unit for signal lines and interface cables.

3.3 Mechanical Assembly

The Digi-Mux HS is designed to be placed on a tabletop or bench, and is delivered completely assembled. You cannot bolt the Digi-Mux HS to the tabletop.

3.4 Electrical Installation

3.4.1 AC POWER CORD

AC power is supplied to the Digi-Mux HS through a standard 5-foot (1.5-m) detachable power cord terminated by a standard 3-prong plug. The power inlet on the rear panel incorporates an integral fuse.

3.4.2 REAR-PANEL CONNECTORS

The main and sub-channels consist of five 34-pin V.35 interface connectors. Table 3-1 provides detailed information on these interface connectors.

3.4.3 STRAP SELECTION

After you complete and check the electrical installation, determine the configuration of the Digi-Mux HS in the data system, and position the straps as required. The strap locations noted on the PCB Layout Diagram (Figure 3-1) correspond to the numbers listed under "Strap Identity" in Table 3-2.
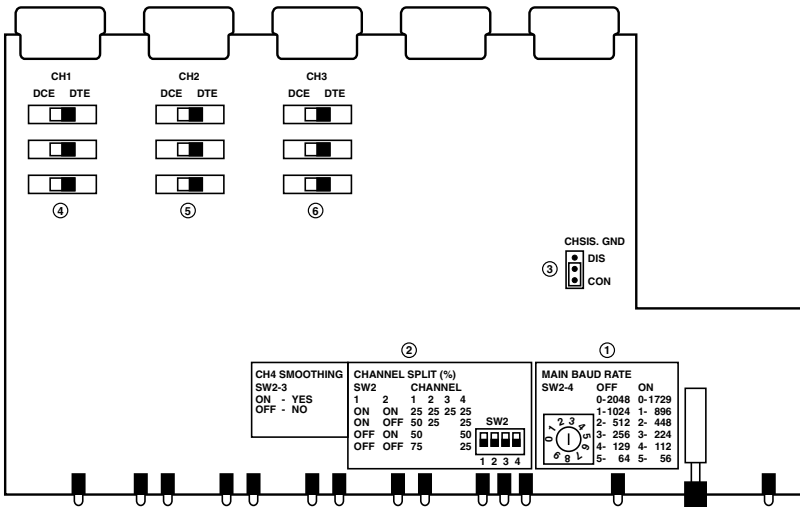
Figure 3-1. PCB Layout.

3.4.4 CHANGING INTERNAL JUMPERS AND SWITCHES

1. Disconnect the power cable.

2. Loosen the rear screw holding the top cover in place.

3. Remove the top cover.

4. Adjust the jumpers as required.

5. Replace the top cover and tighten the retaining screw.

Table 3-1. Interface Signal List (female connector).

Signal Function	Pin	Circuit		Description
Protective Ground	A	Frame	101	Chassis ground. May be isolated from signal ground (refer to Table 3-2).
Signal	B	Signal	102	Common signal and DC power-supply ground.
Transmitted Data	P S	TD (A) TD (B)	103 103	Serial digital data from DTE. The data transition must occur on the rising edge of the transmit clock.
Received Data	R T	RD (A) RD (B)	104 104	Serial digital data to DTE. The data transition must occur on the rising edge of the receive clock.
Request to Send	C	RTS	105	A positive level to the Digi-Mux HS when data transmission is desired.
Clear to Send	D	CTS	106	A positive level from the Digi-Mux HS after receiving RTS.
Data Set Ready	E	DSR	107	A positive level from the Digi-Mux HS when power is on.
Data Terminal Ready	H	DTR	108	Not used.
Carrier Detect	F	DCD	109	A positive level from the Digi-Mux HS.

Table 3-1 (continued). Interface Signal List (female connector).

Signal Function	Pin Circuit		Description
External Transmit Clock	U SCTE (A) W SCTE (B)	113 113	A serial data rate clock input from the data source. Positive clock transition must correspond to data transition.
Transmit Clock	Y SCT (A) a SCT (B)	114 114	A transmit data rate clock output for use by external data sink. Positive clock transition corresponds to data transition.
Receive Clock	V SCR (A) X SCR (B)	115 115	A receive data rate clock output for use by external data sink. Positive clock transition corresponds to data transition.

Table 3-2. Digi-Mux HS Strap Selection.

Strap Identity	Function	Possible Settings			Factory Setting
No. 1 Main Channel Data Rate (kbps)	Selects the main channel data rate for channel 4 smoothing clocks		Option 1 (SW2-4=OFF) 0 2048 1 1024 2 512 3 256 4 128 5 64	Option 2 (SW2-4=ON) 1792 896 448 224 112 56	256 kbps
No. 2 Channel Split(%) SW2-1, SW2-2	Selects main split between the sub-channels (measured as a percentage)	Switch 1 2 On On On Off Off On Off Off	Sub-channel 1 2 3 4 25 25 25 25 50 25 - 25 50 - - 50 75 - - 25		25 25 25 25
Smoothing SW2-3	Selects sub- channel 4's clock	On: Smoothing clock 50% duty cycle Off: Without smoothing clock			Off
Main Channel Data Rate Option SW2-4	Selects main channel data rate option (for No. 1 above)	Off: Option 1 (multiple of 64 bps) On: Option 2 (multiple of 56 bps)			Off
No. 3 GND	CON setting connects Signal Ground to Chassis Ground; DIS setting isolates them	CON DIS			CON

Table 3-2 (continued). Digi-Mux HS Strap Selection.

Strap Identity	Function	Possible Settings	Factory Setting
No. 4 DTE/DCE	Selects equipment connected to sub-channel 1	DTE for DTE equipment DCE for DCE equipment	DCE
No. 5 DTE/DCE	Selects equipment connected to sub-channel 2	DTE for DTE equipment DCE for DCE equipment	DCE
No. 6 DTE/DCE	Selects equipment connected to sub-channel 3	DTE for DTE equipment DCE for DCE equipment	DCE

4. Operation

4.1 General

This chapter describes the functions of the controls and indicators, and provides operating instructions and strapping information. You must complete and check the installation as described in **Chapter 3** before you operate the Digi-Mux HS.
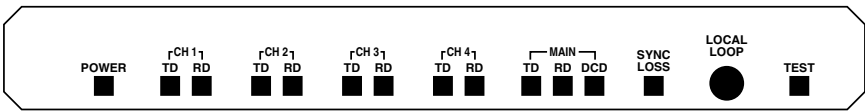
Figure 4-1. Digi-Mux HS Front Panel.

4.2 Control

The Local Loop button located on the front panel performs a loop on the
main channel towards the sub-channels. When activated, it loops the transmit
main channel data and clock to its receive data and clock.

4.3 Indicators

All LED indicators are located on the front panel and described in Table 4-1.
The numbers listed under "Item" in Table 4-1 correspond to the
identification numbers in Figure 4-1.

Table 4-1. Indicators.

Item	Indicator	LED Color	Function
1	POWER	Green	ON when power is on.
2	CH-1 thru CH-4: TD	Yellow	ON when steady space is transmitted in sub-channel. Flickers when data is transmitted.
3	CH-1 thru CH-4: RD	Yellow	ON when steady space is received in sub-channel. Flickers when data is received.
4	MAIN: TD	Yellow	ON when steady space is transmitted in main channel. Flickers when data is transmitted.
5	MAIN: RD	Yellow	ON when steady space is received in main channel. Flickers when data is received.
6	MAIN: DCD	Yellow	ON when a DCD signal is received from the main channel modem.
7	SYNC LOSS	Red	ON when Digi-Mux HS does not receive a synchronization bit from the remote Digi-Mux HS.
8	TEST	Red	ON when Digi-Mux HS is in loopback.

4.4 Operating Procedure

4.4.1 POWER ON

Apply AC power by connecting the AC power cord to an acceptable AC source, and place the power button on the rear panel in the ON position. The power LED should light up, indicating that the Digi-Mux HS is on. If the local and remote Digi-Mux HS units are connected to modems and all these units are operating and passing data, the following indicator conditions should exist:

- POWER: ON

- All sub-channels, TD: Flashing or OFF

- All sub-channels, RD: Flashing or OFF

- Main channel, TD: Flashing

- Main channel, RD: Flashing

- Main channel, DCD: ON

- SYNC LOSS: OFF

- TEST: OFF

4.4.2 SELF-TEST

To verify that the Digi-Mux HS is operating correctly, use the local loopback test as described in **Chapter 5**.

4.4.3 OPERATION

The Digi-Mux HS operates entirely unattended, except for occasional monitoring of the front panel.

4.4.4 POWER OFF

To power off the Digi-Mux HS, simply switch the power button on the rear panel of the Digi-Mux HS to the OFF position.

4.5 Reconfiguring

If you must reconfigure the Digi-Mux HS for a different type of operation, you must change the jumpers to correspond to the new operating mode. See **Section 3.4.4**.

5. Testing

This chapter explains how to use the loopback test.

The test switch and front panel indicators built into the Digi-Mux HS allow rapid checking of the Digi-Mux HS. Use the test procedure provided in this chapter to verify normal operation and to isolate faulty equipment in the event of failure.

Before testing the operation of data system equipment circuits, make sure that all units are turned on and configured correctly.

The test checks the performance of the local multiplexor, the local equipment attached to the multiplexor, and the cables between them. It is performed separately at the local and the remote sites.

PROCEDURES

1. Press the LOCAL LOOP button on the front panel. The TEST indicator should turn on. The Digi-Mux HS's transmit output is now connected to its own receive (Figure 5-1).

2. Verify that the equipment attached to the Digi-Mux HS is operating properly and can be used for test. If a fault is indicated, call a technician or replace the unit.

3. Execute the test using one of the methods described below:

   a. Use the equipment and check the echoed stream.

   b. Use an external Bit Error Rate Tester (BERT) unit.

4. Perform step 3 above at both ends. If BERT test equipment indicates no fault, but the regular equipment does indicate a fault, follow the manufacturer's test procedures for the equipment and verify that the cable connecting the Digi-Mux HS and the equipment is properly connected and in good condition. After completing the test (or when the fault has been corrected), press the LOCAL LOOP button again. The TEST LED should be OFF.
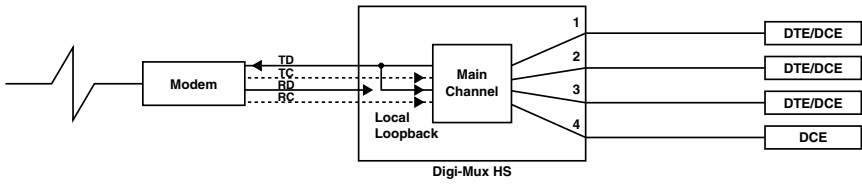
Figure 5-1. Digi-Mux HS in Local Loop.

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