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MARCH 1997
ME280A-35
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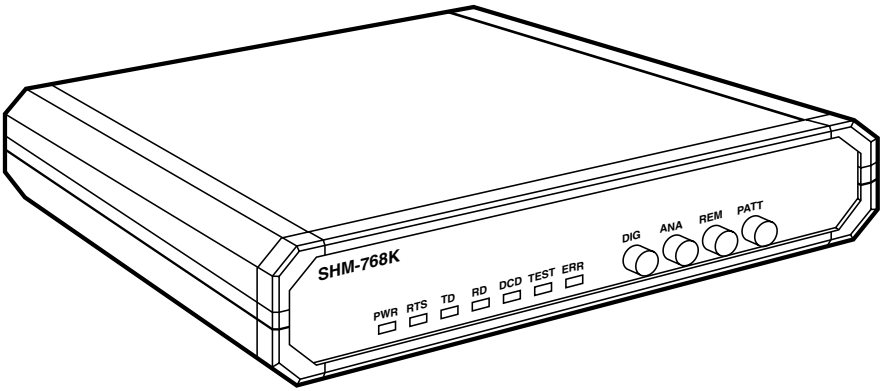
ME280A-X21
ME280AE-35
ME280AE-X21
ME280C-35
ME280C-530

SHM-768K



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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.

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Contents (continued)

Chapter **Page**

1. Specifications

1.1 Analog Interface

Line Type—Unloaded 4W twisted pair 19 to 26 gauge

Range—Refer to Table 1-1

Level—Strap-selectable to 0 dBm or -6 dBm

Impedance—120 Ω

Return Loss—Greater than 15 dB

Carrier—Controlled by RTS or constantly ON

Modulation—Conditioned diphase Eurocom Std. D1

Connector—Terminal block

1.2 Digital Interface

Type—RS-530, RS-422/V.36, V.35, X.21

Baud Rates—Strap-selectable to: 128, 256, 384, 512, or 768 kbps

RTS/CTS Delay—0 msec

Connectors—ME280A-35, ME280C-35: (1) 34-pin female; ME280A-36, ME280A-530, ME280C-530: (1) DB25 female; ME280A-X21, ME280AE-X21: (1) DB15 female

1.3 Test Switches/Diagnostics (Comply with the V.54 Standard)

Digital Loopback—Local (DIG), activated by a manual switch, Remote (REM), activated by a manual switch or by the DTE interface connector signal

Analog Loopback—Local (ANA), activated by a manual switch or by the DTE interface signal

Teat Pattern—Activated by a manual switch (PATT)

1.4 Timing Elements

Receive Clock—Derived from the receive signal

Transmit Clock—Derived from 3 alternative sources: 1) Internal oscillator, 2) External from the DTE, 3) Loop clock derived from the receive signal, looped back as a transmit clock

1.5 Indicators

Transmit Data—TD

Receive Data—RD

Request to Send—RTS

Data Carrier Detect—DCD

Test—TEST

Power—PWR

Bit Errors—ERR

1.6 Physical

Size—ME280A: 1.75"H x 9.6"W x 7.6"D (4.4 x 24.3 x 19.3 cm); ME280C: 0.9"H x 6.2"W x 9"D (2.5 x 15.7 x 23 cm); Rack: 7”H x 19"W x 8.5"D (17.8 x 48 x 21.6 cm)

Weight—ME280A: 3.4 lb. (1.5 kg); ME280C: 10.1 oz. (0.36 kg); Rack: 8.8 lb. (4 kg)

1.7 Power Supply

Voltage—115 or 230 VAC ±10%

Frequency—47 to 63 Hz

Power—5 watts

1.8 Environment

Temperature—32 to 122°F (0 to 50°C)

Humidity—Up to 95% noncondensing

Table 1-1. Approximate Range.

Baud Rate (Kbps)	22 AWG (0.7 mm) km	miles	24 AWG (0.5 mm) km	miles	26 AWG (0.4 mm) km	miles
128	6.5	4.1	5.25	3.3	4.25	2.6
256	4.2	2.6	3.5	2.2	2.8	1.7
384	3.1	1.9	2.5	1.6	2	1.2
512	2.5	1.6	2	1.2	1.6	1
768	1.5	0.9	1.25	0.8	1	0.6

2. Introduction

2.1 General

The SHM-768K operates synchronously, full duplex over 4-wire unconditioned lines. It has a range of 4.1 miles (6.5 km) and operates at 5 selectable rates up to 768 kbps. One of four interfaces are available: V.35, RS-422/V.36, X.21, and RS-530. Card versions are available for V.35 and RS-530. Applications are shown in Figures 2-1 and 2-2.

The modem uses conditioned diphase modulation (Eurocom Std. D1) to provide immunity from background noise, eliminate normal line distortion, and enable efficient transmission and reception of serial data over twisted-pair cable. Transmit timing is provided internally, or derived externally from the data terminal or from the receive signal. Receive timing is regenerated from the received data.

The SHM-768K features V.54 diagnostic capabilities for performing local analog loopback and remote digital loopback. The loopbacks are controlled manually from a front-panel push-button or—for RS-530 and V.35 only—via the DTE interface.

Pressing the front-panel push-button generates a pseudo-random test pattern (511 bits according to CCITT V.52) for testing end-to-end connectivity. The ERROR LED flashes for each bit error.

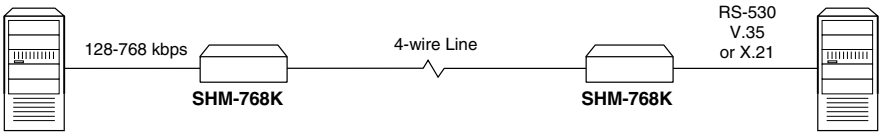

Figure 2-1. Point-to-Point Application.

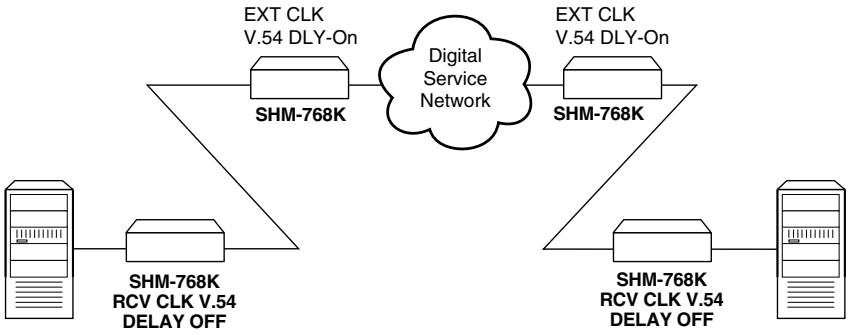

Figure 2-2. Tail-end for DDS Service Application.

The SHM-768K is coupled to the line through isolation transformers which, in conjunction with protective circuitry, protect against AC or DC overvoltages. The protective circuitry enables operation even when DC is connected to the line.

2.2 Physical Description

The SHM-768K is available as a desk-top unit or as a rack-mount card for a 19" rack. The rack can carry up to 14 SHM-768K cards and is supplied with 25-pin D-type connectors. Optional interface attachments (CIA/V.35 or CIA/X.21) provide two V.35 or X.21 connectors for any two adjacent cards. Up to seven attachments can be connected side by side.

2.3 Functional Description

This section contains functional descriptions of the SHM-768K circuit blocks. These descriptions focus on the circuits required for setting the correct configuration of the modem. Refer to the SHM-768K Block Diagram, Figure 2-3.

2.3.1 Transmitter

CDP Encoder

The encoder modulates the input (NRZ) data from the DTE using the "conditional diphase modulation" technique. The carrier may be ON constantly or controlled by RTS.

Timing Generator

This circuit supplies the transmit clock to the encoder. The setting of the XMT CLK jumper selects one of three available clock sources:

- INTERNAL CLK (from the modem's internal crystal oscillator)
- EXTERNAL CLK (from DTE)
- RECEIVE CLK (recovered from receive signal)

XMT Level

The XMT LEVEL jumper selects XMT level (0 or -6 dBm).

2.3.2 Receiver

Equalizer and Automatic Gain Control (AGC)

The equalizer and AGC circuitry are activated according to the baud rate and automatically compensate for line attenuation.

CDP Decoder

The decoder demodulates the incoming CDP signal to NRZ.

Clock Recovery and Carrier Detect

The clock-recovery and carrier-detect circuits provide a received clock synchronized with the data, and a carrier detect using a digital technique.

2.3.3 V.54 Diagnostics

V.54 loops are activated manually from the front panel push-buttons, by Pins 18 and 21 of the RS-530, or Pin "h" or "j" of the V.35 interface. These pins can be enabled or disabled separately by the DTE command jumpers (ALB and RLB).

When using the SHM-768K as a tail-end to a digital network or multiplexor, set the V.54 DELAY jumper (in the modems located close to the digital network) to ON to prevent multiple loopbacks upon activation of RLB. The delay jumper prevents the digital modems at the remote network side from receiving the complete V.54 data sequence and, in turn, being induced into a loop.

2.3.4 Test Pattern Generator and Receiver

This feature allows for easy and quick testing of the local modem as well as the communication link. When the PATT button on the front panel is activated, the circuit sends and checks a standard 511-bit pseudo-random pattern. If errors are encountered, the ERROR LED remains ON or blinks.

The test pattern can be carried out in local analog loopback, in remote digital loopback or in normal point-to-point operation opposite a remote SHM-768K modem (press the PATT button on the remote unit or connect a Bit Error Rate Tester that uses the standard 511 bit pattern).

2.3.5 X.21 Buffer (for X.21 interface)

To allow tail-end connection on an X.21 interface, a buffer is provided on received data. When the SHM-768K is used in external clock configuration, set Jumper X.21 EX.CK to EXT. When internal or receive clock configuration is used, set the jumper to INT.

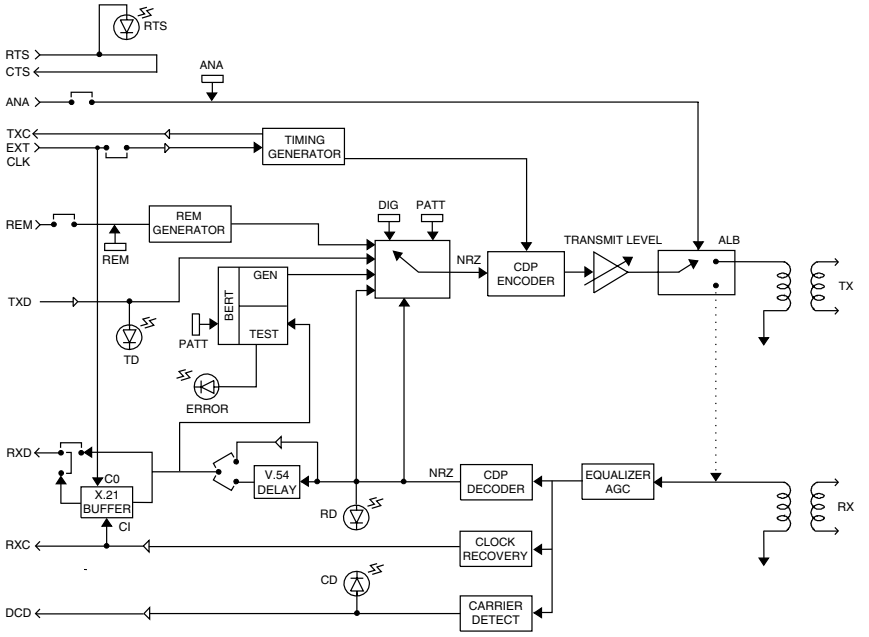

Figure 2-3. SHM-768K Block Diagram.

3. Installation

3.1 General

This chapter provides instructions for mechanical and electrical installation of the SHM-768K stand-alone model. (Refer to **Chapter 6** for rack installation instructions.) After completing installation, refer to **Chapter 4** for operating information and system checkout to assure normal operation.

3.2 Site Preparation

Install the SHM-768K within 5 feet (1.5 m) of an easily accessible grounded AC outlet. The outlet should be capable of furnishing 115 VAC or 230 VAC (depending on rated voltage of unit).

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

3.3 Mechanical Assembly

The SHM-768K is designed for tabletop or bench installation, and is delivered completely assembled. No provisions are made for bolting the SHM-768K to the tabletop.

3.4 Electrical Installation

3.4.1 Power Connection

AC power is supplied to the SHM-768K through a 5-ft. (1.5-m) permanently attached power cable. The power cable is located on the rear panel and is terminated by a standard 3-prong plug. (Refer to Figure 3-1.)

WARNING

Before connecting AC power to this unit, the protective earth terminals of this unit must be connected to the protective ground connector of the (mains) power cord. The mains plug should only be inserted in a socket outlet provided with a protective earth contact. The protective action must not be negated by use of an extension cord (power cable) without a protective conductor (grounding).

The fuse is located in a bayonet-type fuse holder located on the rear panel (as shown in Figure 3-1). Make sure that only fuses of the required rating, as marked on the SHM-768K rear panel, are used for replacement. Do not use repaired fuses or short-circuit the fuse holder. Always disconnect the mains cable before removing or replacing the fuse.

Whenever it is likely that the fuse protection has been damaged, make the unit inoperative and secure it against unintended operation.

WARNING

Grounding: Interrupting the protective (grounding) conductor (inside or outside the unit), or disconnecting the protective earth terminal can make this unit dangerous.

3.4.2 Rear-Panel Connectors

The line and digital interface connectors (located on the rear panel of the SHM-768K as shown in Figure 3-1) consist of a DTE interface connector (J1) and a five-screw terminal clock (TB1). The DTE interface connector (J1) may be 15-pin for X.21, 34-pin for V.35 or 25-pin for RS-530. The terminal clock (TB1) provides four screws for connecting the transmit and receive twisted pair lines. The transmit and receive pairs are polarity insensitive. The transmit pair is connected to the terminals marked XMT, the receive pair is connected to the terminals marked RCV, and the screw marked GND is connected to the AC power ground wire. Table 3-1 provides detailed information on the interface connector (J1).

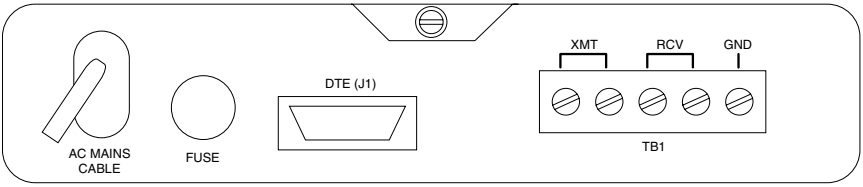

Figure 3-1. SHM-768K Rear Panel.

NOTE

For applications using an X.21 interface external clock (DTE timing source), connect the input clock to pins 7(A) and 14(B) of the 15-pin connector.

We recommend that you configure one of the units as RCV clock, and the other unit as either INT or EXT clock.

Appendix A describes the cabling connection between the EIA-530 interface and the RS-442 (V.36).

We recommend using a shielded twisted-pair cable between the SHM-768K and the DTE. The receivers on the SHM-768K are 100 Ω terminated (for X.21 and RS-530). If problems are encountered with the connection to the DTE interface, make sure that the DTE interface is terminated correctly.

Table 3-1. Interface Signal List (Female Connectors) Pins and Standard Signal Names.

Signal Function	V.35 DB25 Frame	34-Pin Standalone Pin Circuit	EIA-530 DB25 Standalone Pin Circuit	DB25 Frame	X.21 DB15 Standalone Pin Circuit/ (Function)	Description
Protective Ground	1	A Frame 101	1	1	1 (Shield)	Chassis ground. May be isolated from Signal Ground (refer to Table 3-2).
Signal Ground	7	B Signal 102	7 AB	7	8 — (Gnd)	Common signal and DC power supply ground.
Transmitted Data	11 9	S TD(B) 103 P TD(A) 103	2 BA(A) 14 BA(B)	2 14	2 T(A) 9 T(B) (Transmit)	Serial digital data from DTE. The data transitions must occur on the rising edge of the transmit clock.
Received Data	12 13	R RD(A) 104 T RD(B) 104	3 BB(A) 16 BB(B)	3 16	4 R(A) 11 R(B) (Receive)	Serial digital data at the output of the modem receiver The data transitions occur on the rising edge of the clock.
Request to Send	4 15	C RTS 105	4 CA(A) 19 CA(B)	4 19	3 C(A) 10 C(B)	A positive level to the SHM when data transmission is desired.

Table 3-1. Interface Signal List (Female Connectors) Pins and Standard Signal Names (continued).

Signal Function	V.35 DB25 Frame	34-Pin Standalone Pin Circuit	EIA-530 DB25 Standalone Pin Circuit	DB25 Frame	X.21 DB15 Standalone Pin Circuit/ (Function)	Description
Clear to Send	5	D CTS 106	5 CB(A) 13 CB(B)			A positive level from the SHM without delay, after receipt of Request to Send, and when the SHM is ready to transmit.
Data Set Ready	6	E DSR 107	6 CC(A) 22 CC(B)			A positive level from the SHM when the power is on, and the SHM (a) is not in the DIGITAL LOOP mode, or (b) has not received a REMOTE LOOPBACK signal from the remote unit.
Data Terminal Ready	20	H DTR 108	20 CD(A) 23 CD(B)			Not used.
Carrier Detect	8	F DCD 109	8 CF(A) 10 CF(B)	8 10	5 I(A) 12 I(B) (Indication)	A positive level from the SHM, except when a loss of the received carrier signal is detected, or when Data Set Ready is negative.

Table 3-1. Interface Signal List (Female Connectors) Pins and Standard Signal Names (continued).

Signal Function	V.35 DB25 Frame	34-Pin Standalone Pin Circuit	EIA-530 DB25 Standalone Pin Circuit	DB25 Frame	X.21 DB15 Standalone Pin Circuit/ (Function)	Description
External Transmit Clock	19 16	U SCTE(A) 113 W SCTE(B) 113	24 DA(A) 11 DA(B)	24 11	7 (A) 14 (B)	A serial data rate clock input from the data source. Positive clock transitions must correspond to data transitions.
Transmit Clock	14 10	Y SCT(A) 114 a SCT(B) 114	15 DB(A) 12 DB(B)	15 12	6 S(A) 13 S(B) (Signal Timing)	A transmit data rate clock for use by an external data source. Positive clock transitions correspond to data transitions.
Receive Clock	22 23	X SCR(B) 115 V SCR(A) 115	17 DD(A) 9 DD(B)			A receive data rate clock output for use by external data sink. Positive clock transitions correspond to data transitions.
Local Analog Loop	18	j	18 LL			A control signal input: when on, commands the SHM into Local Analog Loopback (V.54 Loop 3).

Table 3-1. Interface Signal List (Female Connectors) Pins and Standard Signal Names (continued).

Signal Function	V.35 DB25 Frame	34-Pin Standalone Pin Circuit	EIA-530 DB25 Standalone Pin Circuit	DB25 Frame	X.21 DB15 Standalone Pin Circuit/ (Function)	Description
Remote Loopback	21	h	21 RL			A control signal input; when on, commands the SHM to send a remote Loop-back command (V.54 Loop 2) to the remote SHM
Test Indicator	25	k	25 TM			A control signal output from the SHM; positive during any test mode.

3.4.3 Strap Selection

When the electrical installation has been completed and checked, determine the required configuration of the SHM-768K and position the straps accordingly. The strap locations on the PCB Layout Diagram (Figure 3-2) correspond to the numbers listed under the "Strap Identity" column in Table 3-2.

3.4.4 Installation of Internal Jumpers and Switches

- Disconnect the power cable from the AC outlet.
- Release the drawer on the unit by unscrewing the two rear panel screws.
- Use the screws to withdraw the unit drawer.
- Adjust the jumpers and switches as required.
- Replace the unit drawer and tighten the screws.

WARNING: HIGH VOLTAGE

Disconnect the SHM-768K power cable before opening the top cover.

Table 3-2. SHM-768K Strap Selection.

Strap Identity	Function	Possible Settings	Factory Setting
No. 1 Baud Rate (kbps)	Selects the data rate.	768 512 384 256 128	256
No. 2 XMT CLK	Selects the transmit timing signal from either: internal clock, external clock, or receive clock.	EXT INT RCV	INT
No. 3 CARRIER	Selects the transmit carrier mode. When “ON,” transmit carrier is constantly “ON.” When “CNTRL,” transmit carrier is “ON” only when RTS is high.	ON CNTRL	ON
No. 4 XMT Level (dBm)	Selects the transmit output level to the line.	0 -6	0 dBm
No. 5 DTE Command ALB	Enables Analog loopback command from the DTE (via Pin 18) for EIA-530, or via Pin J for V.35.	EN DIS	DIS

Table 3-2. SHM-768K Strap Selection (continued).

Strap Identity	Function	Possible Settings	Factory Setting
No. 6 DTE Command RLB	Enables Remote loopback command from the DTE (via Pin 21) for EIA-530, or via Pin H for V.35.	EN DIS	DIS
No. 7 V.54 DLY	When set to ON, the V.54 delay is activated, preventing multiple loopback of tail-end circuits.	ON OFF	OFF
No. 8 X.21 EX. CK	Used only for X.21 interface. When using an external clock, set the jumper to EX. CK. In other cases (internal or receive clock), set to INT.	EX. CK INT	INT
No. 9 CHASSIS GND	In CONNECT position, signal ground is connected to chassis ground. In DISCONN position, the signal ground is isolated from the chassis ground.	CONNECT DISCONN	CONNECT

NOTE

If the DTE does not provide the test pins for analog and remote loopback, the "DTE command" jumper for ALB and RLB must always be set to DIS.

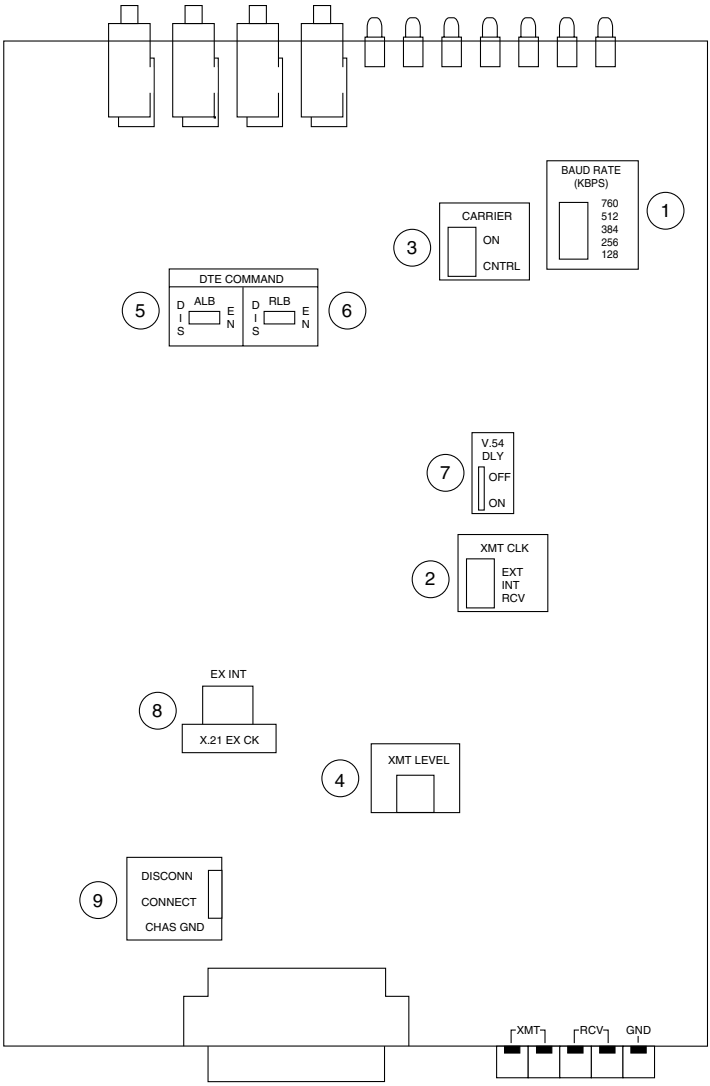

Figure 3-2. Printed Circuit Board Layout.

4. Operation

4.1 General

This chapter describes and explains the SHM-768K controls and indicators, provides operating procedures, and supplies instructions for field strapping changes.

Installation procedures given in **Chapter 3** must be completed and checked before attempting to operate the SHM-768K.

4.2 Controls and Indicators

All controls (push-button switches) and LED indicators are located on the SHM-768K front panel. Their functions are described in Tables 4-1 and **4-2**. The numbers under the heading "Item" in Tables 4-1 and 4-2 correspond to the identification numbers in Figure 4-1.

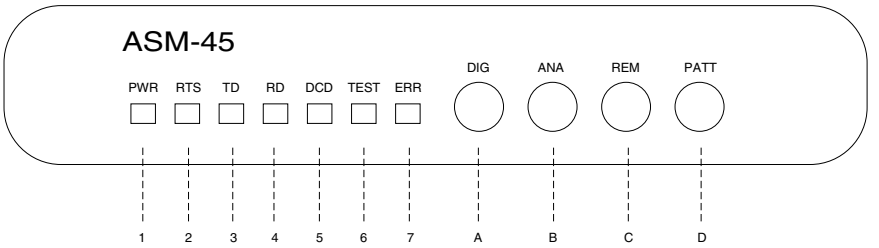

Figure 4-1. SHM-768K Front Panel.

Table 4-1. Control Functions. (The item labels in this table correspond to Figure 4-1.)

Item	Control	Function
A	DIG	The Digital loopback switch causes the local SHM-768K to loop received data and clock to its transmitter. Data Set Ready goes low (Figure 5-5).
B	ANA	The Analog loopback (V.54 loop 3) switch causes the local SHM-768K to loop its transmitter output back to its receiver (Figure 5-3). This loopback may also be activated from the DTE when "DTE COMMAND ALB" strap is set to EN.
C	REM	The Remote Digital Loopback (V.54 Loop 2) switch causes the remote SHM-768K to loop received data and clock to its transmitter (Figure 5-4). Data Set Ready goes low. This loopback may also be activated from the terminal when "DTE COMMAND RLB" strap is set to RLB EN.
D	PATT	The PATT switch causes the SHM-768K to send and receive a 511 test pattern. If errors are encountered, the ERROR LED is ON or blinks. Receive Data and Clear to Send go low. NOTE: Jumper "CARRIER" should be set to "ON;" if the jumper is set to "CNTRL," the RTS signal must be high.

Table 4-2. Indicators. (The item labels in this table correspond to Figure 4-1.)

Item	Indicator	Function
1	PWR	Green LED is ON when power is on.
2	RTS	Yellow LED is ON when terminal activates Request to Send.
3	TD	Yellow LED is ON when steady SPACE is being transmitted. It flickers when data is transmitted.
4	RD	Yellow LED is ON when steady SPACE is being received. It flickers when data is received.
5	DCD	Yellow LED is ON when a valid receive signal is present.
6	TEST	Red LED is ON when the SHM-768K is in any of the three loopback modes.
7	ERR	LED goes ON when PATT switch is activated and then dims. If there are errors in the test pattern, the LED blinks or remains ON.

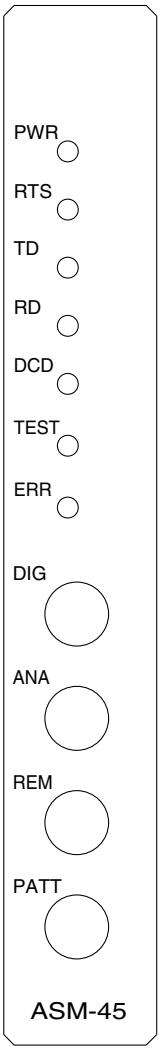

Figure 4-2. SHM-768K, Card Version: Front Panel.

4.3 Operating Procedure

The SHM-768K operates unattended once installed (refer to **Chapter 3**). Intervention is only required when:

- The SHM-768K is set up for the first time.
- The SHM-768K must be adapted to new operational requirements.
- Diagnostic loops are required.

4.3.1 Power-on Procedure

The SHM-768K is turned on as soon as the AC power cord is connected to the AC power mains outlet. The PWR LED should light up, indicating that the SHM-768K is on. Verify that the local and remote SHM-768K units are in operation and passing data by checking that the front-panel LEDs match the indicator conditions described below. (If the LEDs do not match the indicator conditions, verify that none of the front-panel test buttons are pressed in.)

- PWR: On
- TD: Flashing or Off
- RD: Flashing or Off
- RTS: On
- DCD: On
- TEST: Off
- ERR: Off

4.3.2 Self Test

In order to verify that the SHM-768K is operating correctly, use the internal BERT and analog loopback tests as described in **Sections 5.3** and **5.5**.

4.3.3 Operation

The SHM-768K operates entirely unattended, except for occasional monitoring of LED indicators as required.

4.3.4 Power-off Procedure

To turn off the AC power to the SHM-768K, simply remove the AC power cord from the AC source.

4.4 Operational Field Strapping Changes

If it becomes necessary to reconfigure the SHM-768K for a different type of operation, field straps must be changed to correspond to the new operating mode.

For guidance in repositioning the straps and switches, refer to **Section 3.4.4** and to **Table 3-2**. Field straps should be changed by an experienced technician.

WARNING: HIGH VOLTAGE

Disconnect the SHM-768K power cable before opening the top cover.

5. Tests and Diagnostics

5.1 General

This chapter contains information on system test and fault isolation procedures.

5.2 Loop Tests Procedure

The test switches and LED indicators built into the SHM-768K allow rapid checking of the data terminals, SHM-768K and lines. Use the test procedures provided in this chapter to verify normal system operation and to isolate faulty equipment in the event of failure. Each test verifies the operational performance of a unit in the system or provides a positive indication of equipment failure.

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

5.3 Bit Error Rate Tester (BERT)

The Bit Error Rate Tester (BERT) can be activated in any diagnostics test in which the test pattern transmitted is looped back to the BERT for comparison (Figure 5-1).

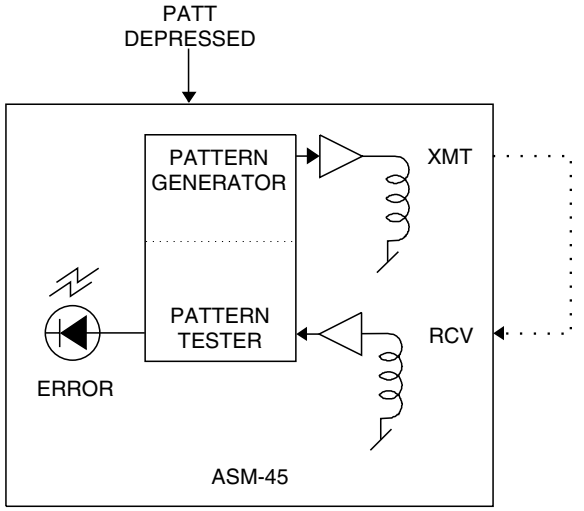

Figure 5-1. BERT Using Loops.

Alternatively, the complete link can be tested when used opposite an SHM-768K either with the PATT button pressed or with an external BERT transmitting the same 511-bit pattern (according to V.52), as in Figure 5-2. To activate the BERT, press the PATT button. If errors are encountered, the ERROR LED will light (continuous errors) or blink (intermittent errors). When PATT is pressed, the ERROR LED will light for a short time to confirm that the ERROR LED is working.

NOTE

For correct operation of the BERT, the jumper CARR must be set to ON or the RTS signal must be high.

When PATT is pressed, the external BERT is functionally disconnected.

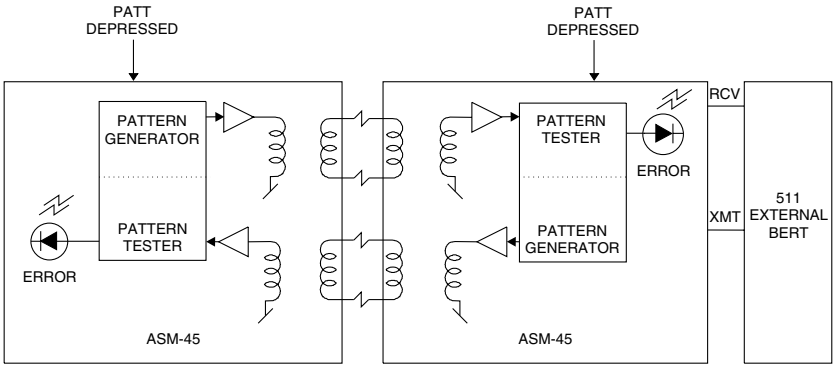

Figure 5-2. Two BERTs Operating End-to-End.

5.4 Modem Self-Test

To verify that the SHM-768K is operating correctly, follow the instructions below:

Step A

Press the ANA (Analog Loopback) button on the front panel. Both the TEST and DCD LEDs should light. If the DCD LED does not light, verify that the CARRIER jumper is ON or that the RTS signal is ON (high).

Step B

Press the PATT button. Verify that:

- DCD LED is still lit
- TEST LED is still lit
- RD LED lights
- ERR LED lights for a short period

The ERR LED should then go off. If it lights up or blinks, then the SHM-768K is faulty and should be replaced. If the test executes correctly, restore all the push-buttons and jumpers to the required position.

5.5 Local Test—Analog Loopback

This test checks the performance of the local modem, the local data terminal and the cables between them. It is performed separately at the local and the remote sites.

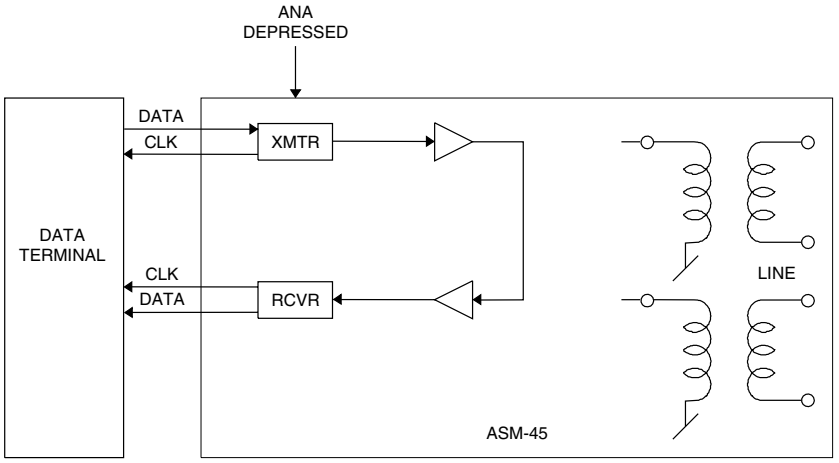

Figure 5-3. Local SHM-768K in Analog Loopback.

- Step A: Press the ANA (Analog Loopback) button on the front panel (Figure 4-1). (This test can also be activated via the pin on the DTE interface.) The TEST LED should turn on. The SHM-768K transmit output is now connected to its own receiver.
- Step B: Verify that the data terminal equipment is operating properly and can be used for a test. If a fault is indicated, call a technician or replace the unit.
- Step C: Execute the test using one of the methods described below:
- Use the DTE and check the echoed data stream.
- Use an external Bit Error Rate Tester (BERT) unit.

- Use the internal Bit Error Rate Tester (BERT). Press the PATT button. The ERR LED lights briefly to indicate that the LED is functioning. If any bit error is encountered the LED blinks or remains ON.

- Step D: Perform Step C at both ends. If BERT test equipment indicates no fault, but the data terminal indicates a fault, follow the manufacturer's test procedures for the data terminal and verify the cable connecting the terminal and the SHM-768K. After completion of the test (or when the fault has been corrected), restore the ANA push-button to the OFF position by pressing it again. Proceed to the Communication Link Tests (**Section 5.6**).

5.6 Communication Link Tests

5.6.1 Remote Digital Loopback

This test determines the performance of both the local and the remote SHM-768K, and of the lines between the local and remote units.

- Step A: Press the REM (Remote Loopback) button, providing a loopback at the remote SHM-768K (Figure 5-4). (This test can also be activated via the pin on the DTE interface.) The TEST LED should light at both the local and remote units.

- Step B: Perform the BERT test as explained in **Section 5.5**, Step C.

- Step C: If Step B indicates a fault, and if the modem test described in **Section 5.4** was successful for both the local and remote modems, the line circuits are not operating properly.

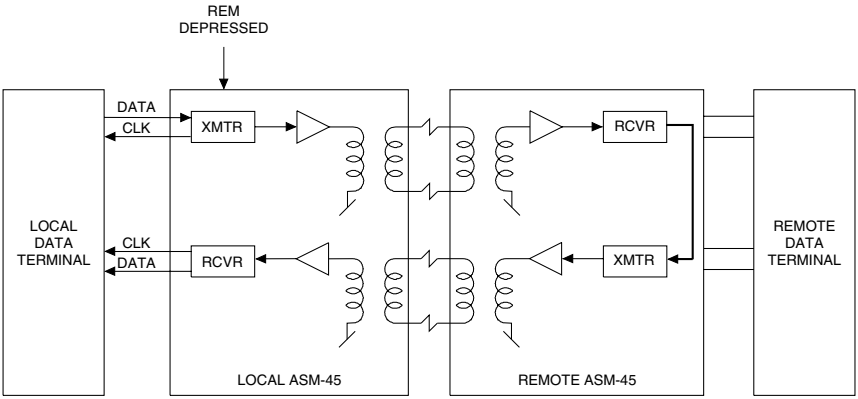

Figure 5-4. Remote SHM-768K in Digital Loopback.

5.6.2 Local Digital Loopback

This test is activated by depressing the DIG pushbutton. It loops the received data back to the remote SHM-768K. (This test is equivalent to activating the remote loopback from the remote SHM-768K—refer to Figure 5-5). The operator at the remote end can determine the performance of the local and remote SHM-768K units, and of the lines between them.

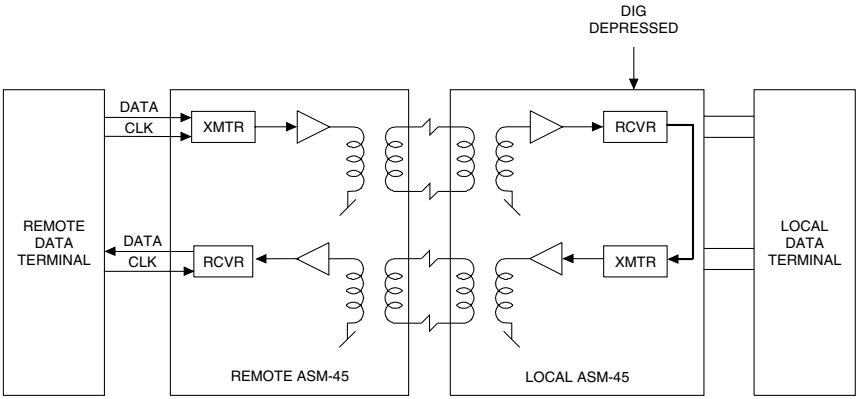

Figure 5-5. Local SHM-768K in Digital Loopback.

6. SHM-768K 19" Rack Version

6.1 Description

The Rack (part number RM110A) shown in Figures 6-1 and 6-2 consists of a power supply and up to 14 plug-in card modems. The rear panel consists of fourteen five-screw terminal blocks (TB1) and fourteen connectors (J1). The terminal block (TB1) provides five screws for connecting the transmit and receive lines. The transmit pair is connected to the terminals marked XMT, and the receive pair is connected to the terminals marked RCV. A nut for optional ground connection is supplied at the left side of the rear panel. The interface connector (J1) is a 25-pin female connector, which provides all digital interface signals (refer to Table 6-1 for pinout). Optional CIA/V.35 or CIA/X.21 interface adapters provide two V.35 or X.21 connectors for any two adjacent cards.

6.2 Card Modem

The SHM-768K (Card) short-range modems, part number ME280C-35 and ME280C-530, are card versions of the SHM-768K. Indicator LEDs and test push-buttons of each ME280C are conveniently located on the front panel for clear visibility and easy handling.

6.3 Power Supply

The power supply accepts either 115 or 230 VAC according to the stated rated voltage of the unit. It consists of a power-line transformer, fuse, and an operating switch. All power-regulating circuitry is located on the card modems. Each card has two fuses which protect the entire system against power failure due to a short circuit in one card. Primary power needed is 115/230 VAC ±10%, 47 to 63 Hz, at 24 VA maximum.

AC power should be supplied through a 5-ft (1.5-m) standard power cable between the AC mains socket at the rear of the power supply module and a standard, grounded, easily accessible AC outlet. An integral fuse is located in the AC mains socket of the power supply.

WARNING

Before connecting AC power to this unit, the protective earth terminals of this unit must be connected to the protective ground connector of the (mains) power cord. The mains plug should only be inserted in a socket outlet provided with a protective earth contact. The protective action must not be negated by use of an extension cord (power cable) without a protective conductor (grounding).

The fuse is located in a bayonet-type fuse holder located on the rear panel. Make sure that only fuses of the required rating, as marked on the rear panel, are used for replacement. Do not use repaired fuses or short-circuit the fuse holder. Always disconnect the mains cable before removing or replacing the fuse.

WARNING

Whenever it is likely that the fuse protection has been damaged, make the unit inoperative and secure it against unintended operation.

Grounding: Interrupting the protective (grounding) conductor (inside or outside the unit), or disconnecting the protective earth terminal can make this unit dangerous.

6.4 Installation

After installing the RM110A in the 19" rack:

- Insert SHM-768K cards.
- Tighten the nut on the top of each card.
- Push the bottom of the cards further into the rack to ensure they are fully inserted into the edge connectors.

Do not use excessive force. If the card does not go in easily, remove the card, realign it with the enclosure guides, and push it in place.

6.5 Operation

The power supply is controlled from the power module on the right hand side of the RM110A (Figure 6-1). The ON/OFF switch controls the power supply to all the cards.

When the unit is ON, personnel are not exposed to any voltage over 30V on any card or accessible area of the rack.

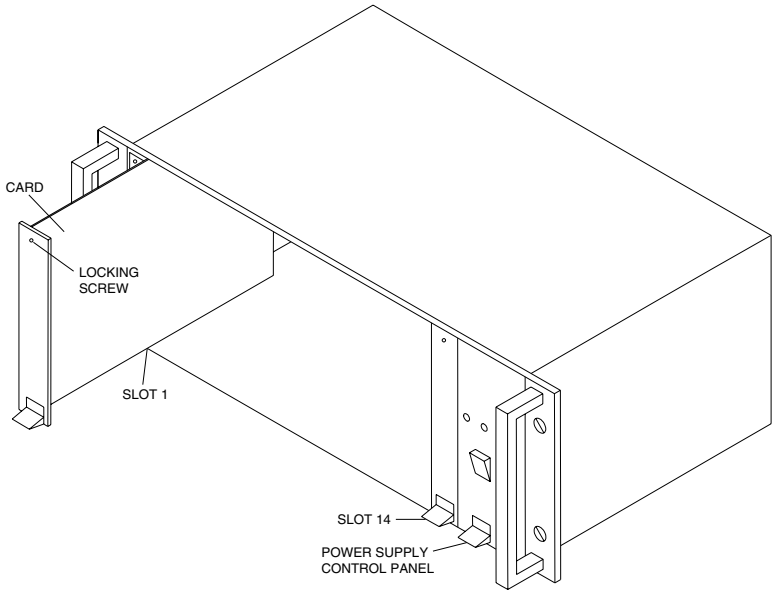

Figure 6-1. Rack Installation.

6.6 Power Supply Options

6.6.1 Choosing a Power Supply

Three power supply options are available:

- Single or dual transformer of 100 VA (4.25A x 24 VAC)
- Single transformer of 200 VA (8.5A x 24 VAC)

The power supply is a function of the power consumption per card.

The RM110A rack serves a number of different modems. To choose the appropriate power supply option, a summation of all the card power consumptions must be made (Table 6-1).

Table 6-1. Power Consumption per Card.

Card Name	Power Consumption Per Unit	Required P.S. Option
ME280C-530	9 VA	(100 VA—10 Cards) (200 VA—14 Cards)
ME280C-35	7 VA	(100 VA-14 Cards)

6.6.2 Two-Transformer Option

This option provides dual, redundant 100 VA transformers in a single power-supply module. The PS-1/PS-2 switch selects the power-line transformer to be used. In the event of a failure of one transformer, it is possible to switch over to the second transformer. The LEDs indicate which of the two transformers is being used (Figure 6-2).

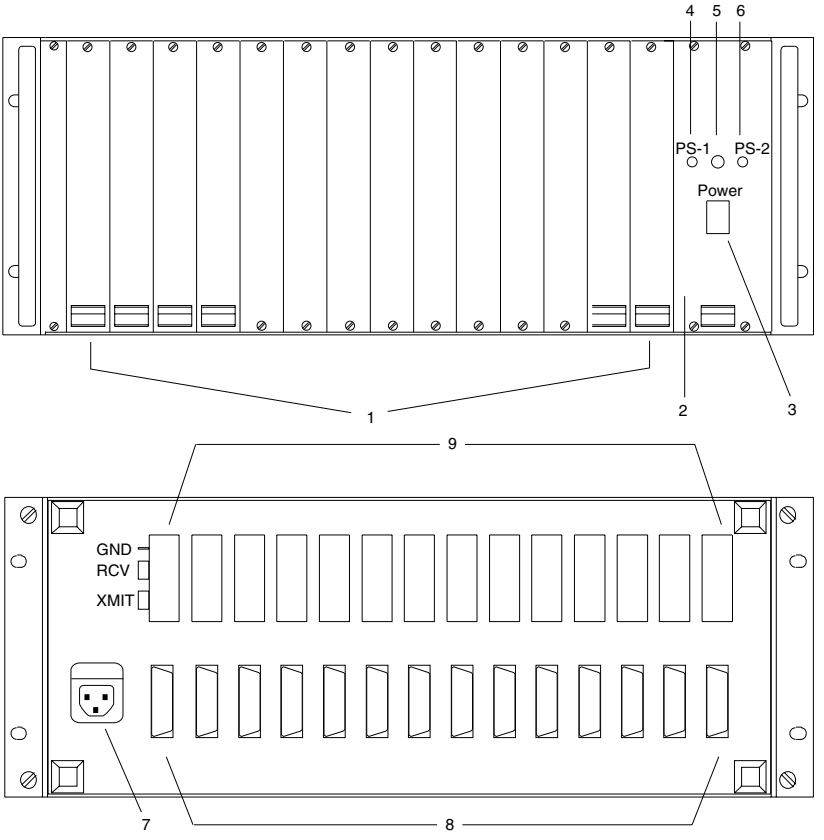

Figure 6-2. Rack Enclosure with Dual Power Supply.

The item numbers in Table 6-2 correspond to the reference numbers in Figure 6-2.

Table 6-2. Controls, Indicators, and Connectors.

Item	Control, Indicator or Connector	Function
1	Card Slots	Slots for installation of SHM-768K cards (slot no. 1 located at the left-hand side). Unused slots are closed with blank panels.
2	Power Supply Module	Provides power to modules installed in the enclosure.
3	POWER Switch	Turns the power supply ON/OFF.
4	PS-1 Indicator (DT power supply only)	Lights when Power Supply 1 (PS-1) is operating
5	PS-1/PS-2 Selector (DT power supply only)	Selects the active power supply.
6	PS-2 Indicator (DT power supply only)	Lights when Power Supply 2 (PS-2) is operating.
7	Power Connector	Power connector with integral fuse.
8	Main Channel Connectors (J1)	DB25 connectors for the module DTE connection. For pinouts of available interfaces, see Table 3-1. Alternatively, use an interface adapter.
9	4-Wire Terminal Blocks (TB1)	For connection of 4-wire lines. Each modem card has a separate terminal-block connector.

Appendix A: Connecting to RS-422

Table A-1. Interface List for Connecting SHM-768K to RS-422 (V.36) DTE.

Signal Function	RS-449 (RS-422/423) 37 pins		EIA 530 DB25 Female Standalone and Frame	
	Pin	Circuit	Pin	Circuit
Protective Ground	1	Shield	1	
Signal Ground	19, 37, 20		7	AB
Transmitted Data	4 22	SD(B) SD(A)	2 14	BA(A) BA(B)
Received Data	6 24	RD(A) RD(B)	3 16	BB(A) BB(B)
Request to Send	7 25	RS(A) RS(B)	4 19	CA(A) CA(B)
Clear to Send	9 27	CS(A) CS(B)	5 13	CB(A) CB(B)
Data Set Ready	11 29	DM(A) DM(B)	6 22	CC(A) CC(B)
Data Terminal Ready	12 30	TR(A) TR(B)	20 23	CD(A) CD(B)
Carrier Detect	13 31	RR(A) RR(B)	8 10	CF(A) CF(B)
External Transmit Clock	17 35	TT(A) TT(B)	24 11	DA(A) DA(B)
Transmit Clock	5 23	ST(A) ST(B)	15 12	DB(A) DB(B)
Receive Clock	8 26	RT(B) RT(A)	17 9	DD(A) DD(B)

Table A-1. Interface List for Connecting SHM-768K to RS-422 (V.36) DTE (continued).

Signal Function	RS-449 (RS-422/423) 37 pins		EIA 530 DB25 Female Standalone and Frame	
	Pin	Circuit	Pin	Circuit
Local Analog Loopback	10	LL	18	LL
Remote Loopback	14	RL	21	RL
Test Indicator	18	TM	25	TM

Appendix B: Unit Case Assembly

B.1 Installing the Standalone Unit in a Rack

The height of the unit is 1U (1.75"); the width of the unit is slightly more than half the available mounting width. A rack adapter kit is available for installing either a single unit or two units side by side in the 19" rack.

CAUTION

Disconnect AC power before opening the unit.

B.1 Installation of a Single Unit

Rack adapter components for installing a single unit include one short bracket and one long bracket. Each bracket is fastened to the side walls of the unit by two screws (with flatwashers) which are inserted into the two front holes on the side wall (The unit is supplied with nuts already in place on the inner side wall). Note that the short bracket fastens to the left side of the unit, and the long bracket to the right side of the unit. See Figure B-1.

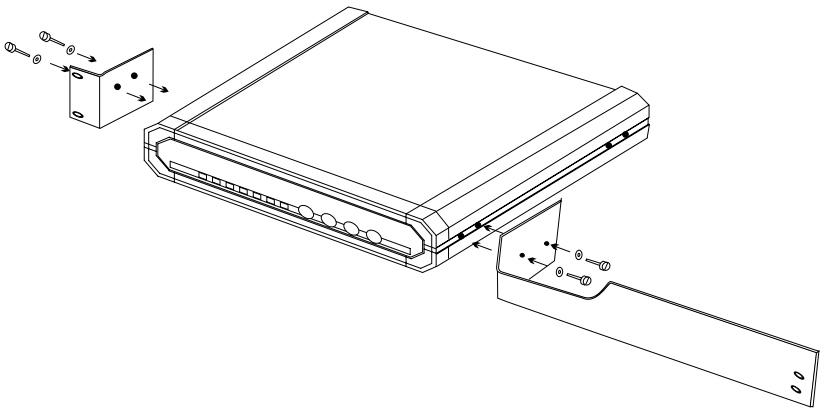

Figure B-1. Installation of a Single Unit.

Once the brackets are fastened to the side walls, the unit is ready for installation in the 19" rack. Place the unit in the rack and fasten the brackets to the side rails of the rack by means of the two screws situated on each side (not included in the kit).

B.2 Installation of Two Units

Rack adapter components for installing two units include two long side rails (one for each unit), which slide one into the other fastening the two units together, and two short side brackets, which hold the two units in the 19" rack. See Figure B-2.

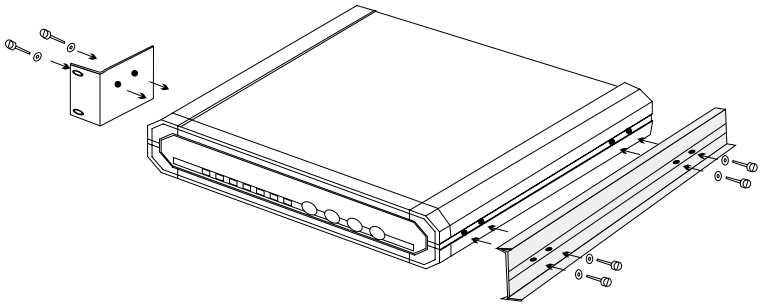

Figure B-2. Installation of Two Units, Part 1.

To install two units follow these instructions:

1. Fasten one long side rail to each unit (one on the right side of one unit, the other on the left side of the other unit) using the 4 screws and flatwashers supplied. The side rails must be attached in opposing fashion, the narrow flange of the first rail opposite the wide flange of the second rail.

2. Attach one short bracket opposite the side rail on each unit using the 4 screws and flatwashers supplied.

3. Slide the side rail of one unit into the side rail of the other unit, fastening the two units together. See Figure 3-3.

4. Secure the supplied plastic caps to the ends of the rails, to prevent the units from moving and to protect the rail ends.

Place the assembled units in the rack and fasten the brackets to the side rails of the rack, by means of the four screws situated on each side (not included in the kit).

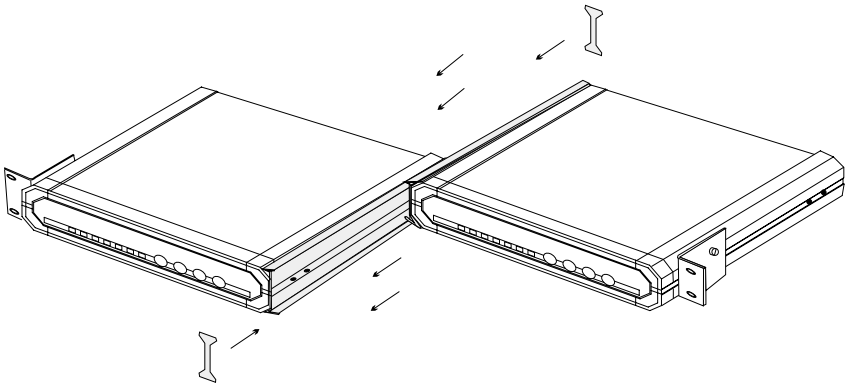

Figure B-3. Installation of Two Units, Part 2.

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