USER MANUAL

G703/64-RM

G.703 64Kbps Co-Directional
Rack Mount
1 to 13 Ports or 12 Ports + SNMP

CTC union CTC Union Technologies Co.,Ltd.
ISO 9001

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Chapter 1. Introduction

1.1 General

The ***G703/64-RM*** is a 4U (7") high 19" Rack, containing multiple G.703 64Kbps Co-directional to Datacom converters for network access. The ***G703/64-RM*** provides an economic solution in high density installations such as central offices. There are 13 slots available for installation of **G703/64 Cards** (G.703 64Kbps Co-directional) into the ***G703/64-RM*** compact RACK. An optional **SNMP Card** may be installed into the last slot, for local and remote management purposes, leaving 12 slots available for **G703/64 Cards**. Each **G703/64 Card** may be linked to a remote **G703/64A** or **G703/64A-STD** stand alone 64Kbps Co-directional Access Unit to provide a variety of LAN-to-LAN, Video Conference, Host to client, or Host to Host applications over G.703 64Kbps Network Services.

1.2 Functional Description

The ***G703/64-RM*** may optionally incorporate two separate Power Module supplies, which, depending on the model, may derive power from either an AC power source (95~250VAC) or DC (-54 to -42VDC) power source. The power supply modules provide for power sharing and are hot swappable even during the **G703/64 Cards**' transmissions. The ***G703/64-RM*** provides all interface connections on the rear panel. RJ-45 and Terminal Blocks are used for G.703 64Kbps Co-directional interface connections, while optional cable adapters are used to convert the HDB26 DCE ports to V.35, RS-232, RS-530, RS-449 or X.21. When cards are inserted in slots, LEDs on the front panel will show both the Co-directional Line and Data port statuses, Power Status, and any Alarm indications.

The **G703/64 Card** data channel supports a fixed transmission rate of 64Kbps on two twisted pair wire (4-wires) for an approximate operating range of up to 800 meters. (over 24AWG wire).

The ***G703/64-RM*** and **G703/64 Cards** fully meet ITU-T specifications including ITU-T G.703 and G.823.

Each **G703/64 Card** features V.54 diagnostic capabilities for performing local loop back and remote loop back. The operator at either end of the G.703 line may test both the **G703/64 Card** and the line in the digital loop back mode. The loop back is controlled by either a manual push-button switch or by the DTE interface for V.35 or RS-530.

When the local loop back switch is activated, an internal 511 bit pseudo random test pattern is generated, according to ITU-T, for direct end-to-end integrity testing. The Err indicator LED flashes for each bit error detected.

Multiple clock source selection provides maximum flexibility in connecting both the G.703 and user data interface. The G.703 64Kbps converter may be clocked from the recovered receive clock, from user data port, from both the recovered receive clock and user data port (transparent clock) or from the on-card (internal) oscillator.

When the ***G703/64-RM*** is ordered with an optional **SNMP Card**, the card is placed in slot number 13. Each **G703/64 Card** will have DIP Sw1-8 turned ON to enable SNMP setting. In this mode, the other DIP switch settings are ignored while the **SNMP Card** controls all settings. Control is accomplished either via local control on the asynchronous RS-232 craft port with an VT-100 terminal (terminal mode) or via Ethernet and any standard SNMP network management software. If the **SNMP Card** option is not installed, slot number 13 may hold an additional **G703/64 Card**. However, only DIP switch configuration may be applied to all cards in the rack.

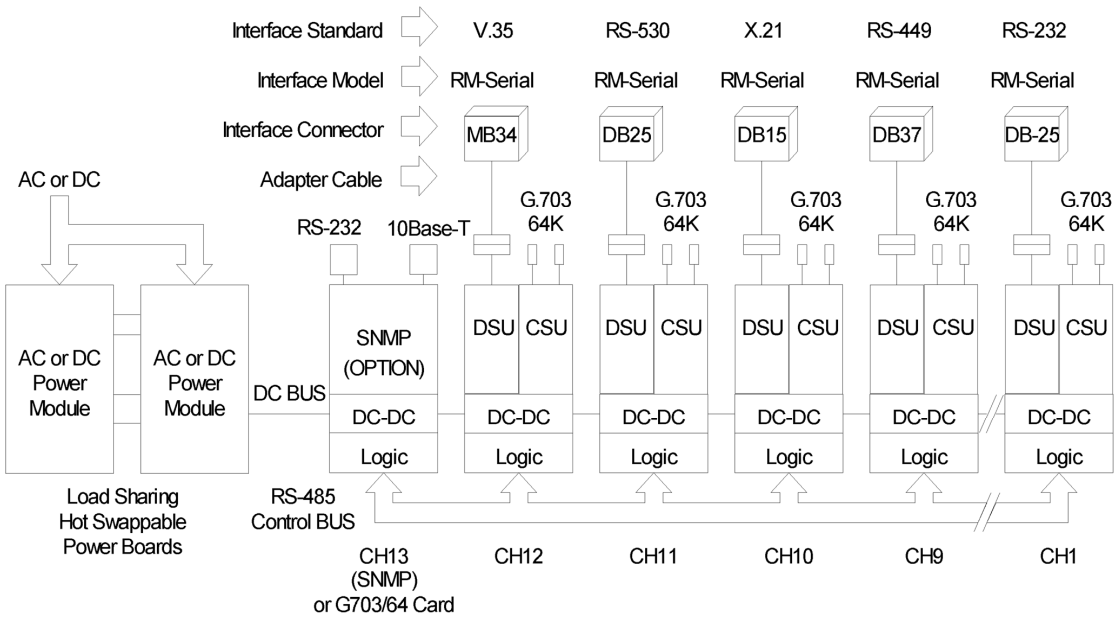


Figure 1-1 : *G703/64-RM* Block Diagram

1.3 Technical Specifications

G.703 64Kbps Link		**User Data Channel**	
Framing	Unframed	Interface Type	V.35
Bit Rate	64kbps		RS-530
Line Code	Co-directional		RS-449
Impedance	120 Ohm		X.21
Transmit Levels			RS-232
Pulse amplitude	1.00V +/-10% (120 Ohm)	I/F Connectors	HDB26 female
		Line Code	NRZ
Zero amplitude	0.0V +/-0.1V		
		Data Rate	64Kbps(Sync) 19.2Kbps (Async)
Transmit Frequency Tracking			
	+/-100ppm	Clock Modes	
Jitter performance	According to ITU-T G.823	Recovery (Network)	Rx and Tx clock recovered from G.703 Timing
Pulse shape complies with	ITU-T G.703	Master (internal)	Rx and Tx clock internal oscillator
I/F connectors	Shielded RJ-45 or 5 pin Molex ™	Transparent (Bi-directional)	Sync to Rx clock (transparent)
		Data Port (external)	Tx and Rx both from ETC
		Handshaking control signals	CTS constantly ON
			DSR constantly ON except during test

Table 1-1 : *G703/64-RM* Specifications

1.4 G.703 64K Signal Structure

The G.703 Interface used in the ***G703/64A-STD*** has a through rate of 64Kbps and operates in codirectional mode as described in more detail below.

Codirectional
The term codirectional is used to describe an interface across which the information and its associated timing signal are transmitted in the same direction (see Figure 1-2).

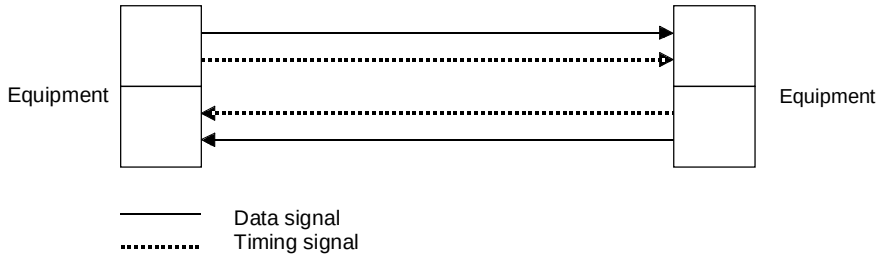


Figure 1-2; Codirectional interface

This mode is the most popular for point-to-point applications. In this case, any remote ***G703/64A*** or ***G703/64A-STD*** units should have their *Dip switches* set to the codirectional mode. All timing modes (recovery, transparent, dataport or oscillator) are possible in codirectional mode.

G.703 Codirectional Code Conversion Rules

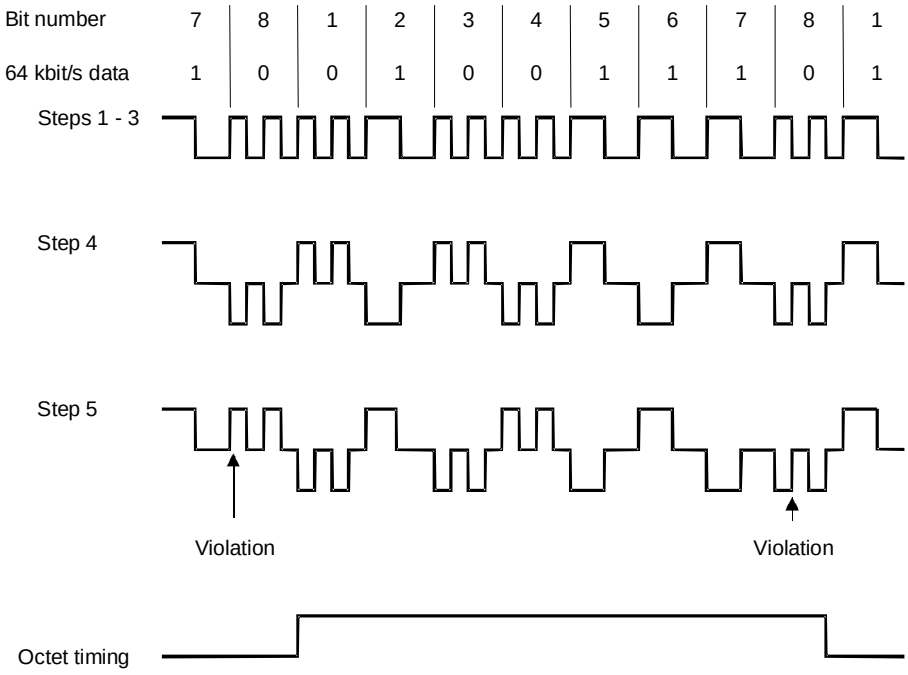
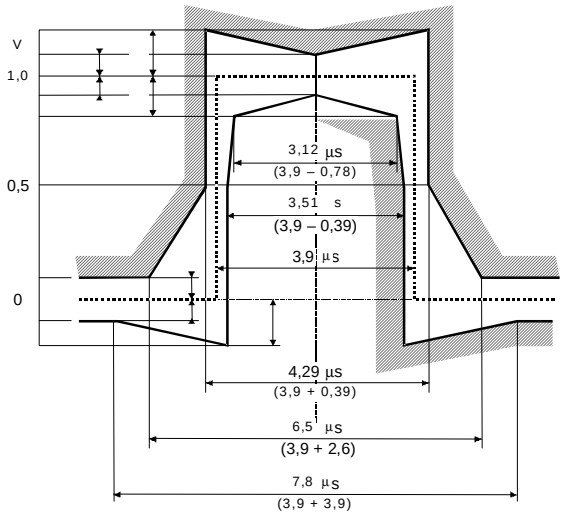
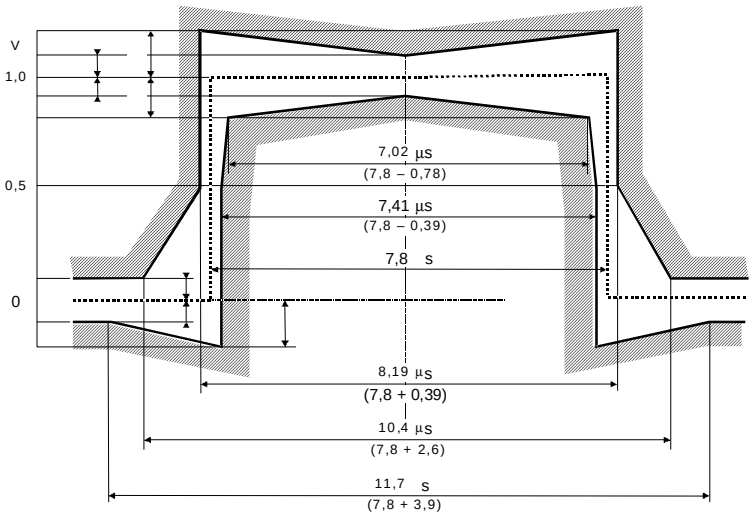


Figure 1-3; G.703 Codirectional Code Conversion Rules Illustration

Step 1: A 64Kbps period is divided into four unit intervals.
Step 2: A binary "one" is coded as a block of four bits "1100".
Step 3: A binary "zero" is coded as a block of four bits "1010".
Step 4: The binary signal is converted into a three-level signal.
Step 5: A "Violation" block marks the last bit in an octet.



a)Mask for *single* pulse



b)Mask for *double* pulse

Figure 1-4; Pulse Masks for the 64Kbps codirectional interface.

Data Port Interface

The Data Port interface of the ***G703/64K Card*** is configurable for four different electrical interfaces. Configuration settings performed on the internal Dip switches select the electrical standard while adapter cables provide the standard physical connections to V.35, X.21, RS-232 or RS-449 (V.36). When an SNMP card is installed in the system rack, the interface may be selected through the software. The actual HDB26F pin connector definitions and adapter cable pin outs may be found in Appendix B of this manual.

Remote Loop back

V.54 remote loop back may be implemented, depending upon the setting of DSW2-7. When set to "ON", the unit will be able to send or receive standard V.54 loop back codes. When set to "OFF", the front panel "***Rem loopbk***" switch will have no function and the unit will ignore any in-band loop back codes.

DSW2-6 will enable or disable the "auto release" loop back function. When DSW2-7 is enabled and when "auto release" is enabled (DSW2-6 "ON"), if the unit enters loop back due to reception of the loop back code from the remote unit (the remote unit has its "***Rem loopbk***" push-button depressed), normal operation will automatically resume (loop back will release) after a 15 minute period of time.

OPERATION: Front Panel Switch Functions

Local digital: This pushbutton switch initiates a loop back to the connected DTE device connected to the unit's data port.

Local analog: This pushbutton switch initiates an analog loop back to the connected G.703 device.

Remote digital: This pushbutton switch sends a loop back code to the remote unit which enables its local analog loop back.

Test: This pushbutton switch initiates the internal 511 pattern generator. If the Remote digital pushbutton is pressed or if the remote unit has its Local analog switch depressed, the local unit will receive and test the 511 pattern for errors. The Error LED will flash for each bit error received.

Figure 10; Front Panel Graphic

LED Indicators

PWR	Unit is powered ON.
TD	Transmit data from the connected DTE.
RD	Receive data at output of unit receiver.
RTS	ON when unit data transmission is desired
DCD	Constantly ON
TX	G.703 Transmit data.
RX	G.703 Receive data.
Signal Loss	G.703 Signal loss.
Timing Loss	G.703 Timing loss.
Error	A G.703 error has occurred.
TEST	Test pattern generator is active and/or a loop back is active.

1.5 Applications / Capabilities

In the following example, the ***G703/64-RM*** is installed at an ISP's central office and provides "last mile" access to corporate customers over dedicated G.703 64Kbps transmission lines. The customer site utilizes a single data port converter, which could be one of our pack series or standalone units.

The **G703/64 Cards** in the ***G703/64-RM*** could all be set to internal oscillator timing or they could receive timing from the DTE on the data port. The remote units would all be set to recovery.

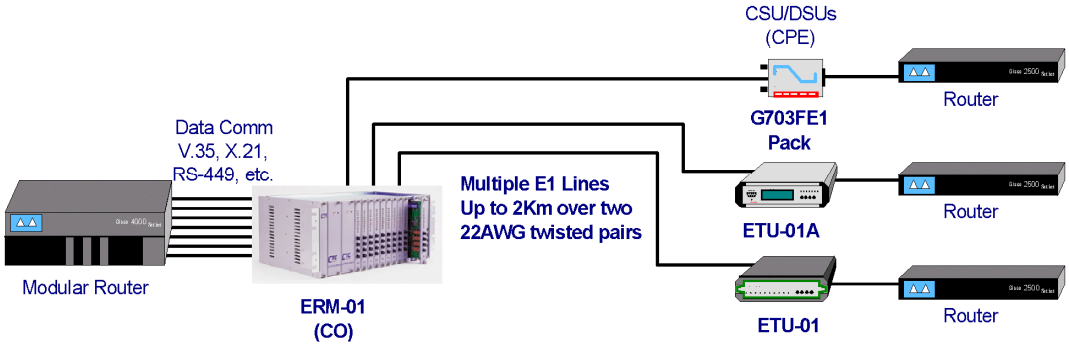


Figure 1-2 : G.703 64Kbps nest for ISP

In the next application example, the ***G703/64-RM*** is used in a point-to-point E1 line environment. Each **G703/64 Card** acts as a stand alone Digital Access Unit, connecting individual twisted pair lines to data port interfaces. For any G.703 64K link, one converter should provide internal timing while the linked unit should be set to recovery.

Figure 1-3 : Point-to-point Application of *G703/64-RM*

In the last application example, the ***G703/64-RM*** 's **G703/64 Cards** provide multiple data port connections via G.703 64K lines connected through an E1 multiplexer from an E1 line. Since the timing is normally passed from the network side, the **G703/64 Cards** should all be set to recovery.

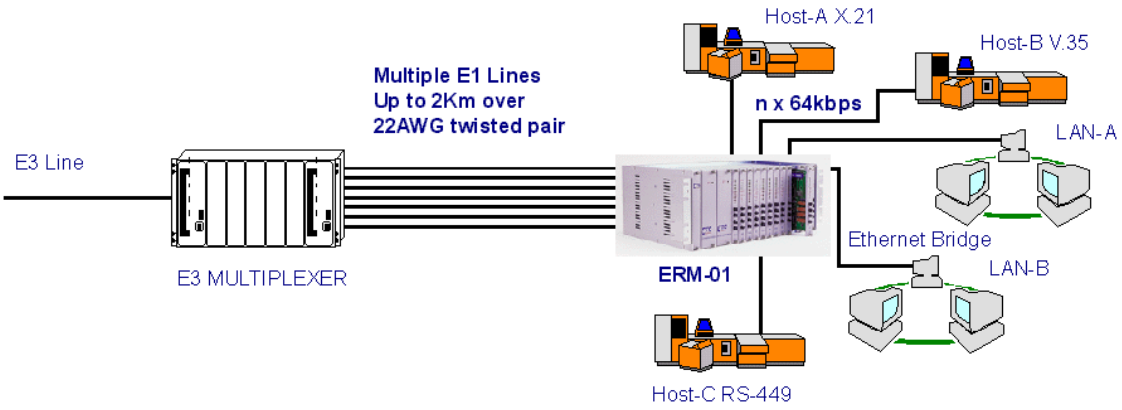


Figure 1-5 : Multiple G.703 64K Access via E1 multiplexer

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Chapter 2. Installation

2.1 General

This chapter explains in detail the requirements and procedures for the installation of the ***G703/64-RM*** Rack Mount Series G.703 64K Interface Converter Unit.

2.2 Site Preparation

Install the ***G703/64-RM*** within reach of an easily accessible grounded AC outlet. The outlet should be capable of furnishing 90 to 250 VAC. Allow at least 10cm (4 inch) clearance at the rear of the ***G703/64-RM*** for signal lines and interface cables.

2.3 Mechanical Assembly

The ***G703/64-RM*** is designed for rack mount installation and only requires 4U space (7") in a standard EIA 19 inch rack. It is highly recommended that the unit be placed in a rack. The ***G703/64-RM*** is delivered completely assembled. No provision is made for bolting the ***G703/64-RM*** to a tabletop.

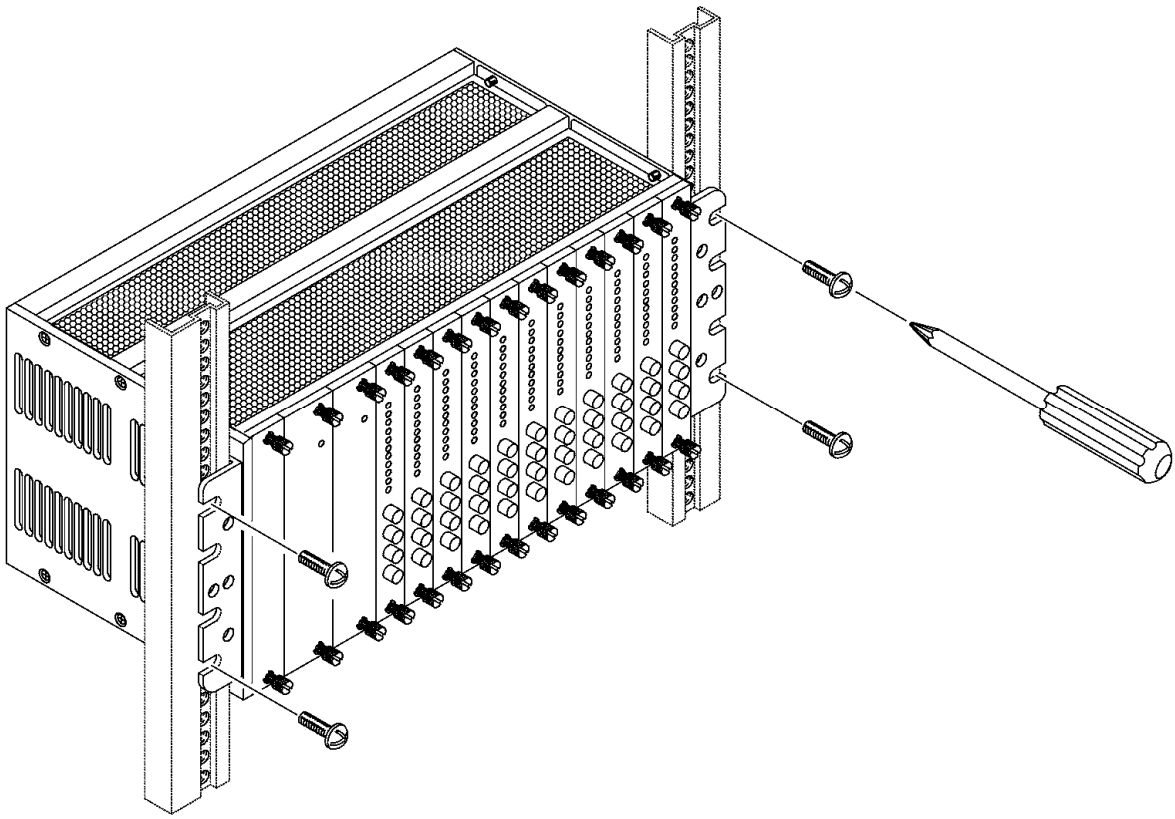


Figure 2-1 : Rackmount Installation of the *G703/64-RM* Unit

2.4 Electrical Installation

2-4-1. Power connection

In the AC model, AC power is supplied to the ***G703/64-RM*** through a standard IEC 3-prong receptacle, located on the rear of the chassis. In the DC model, DC –48V is connected to the lower terminal block, observing the proper polarity. The ***G703/64-RM*** should always be grounded through the protective earth lead of the power cable in AC installations, or via the ground connection for DC installations.

The line fuses for the ***G703/64-RM*** are located on the Power Module units themselves. Access to the fuses requires removal of the Power Module card. The fuse, a 20mm type, is located in the fuse holder labeled "F1". Make sure that only fuses of the same rating are used for replacement. Do not use repaired fuses or short-circuit the fuse holder.

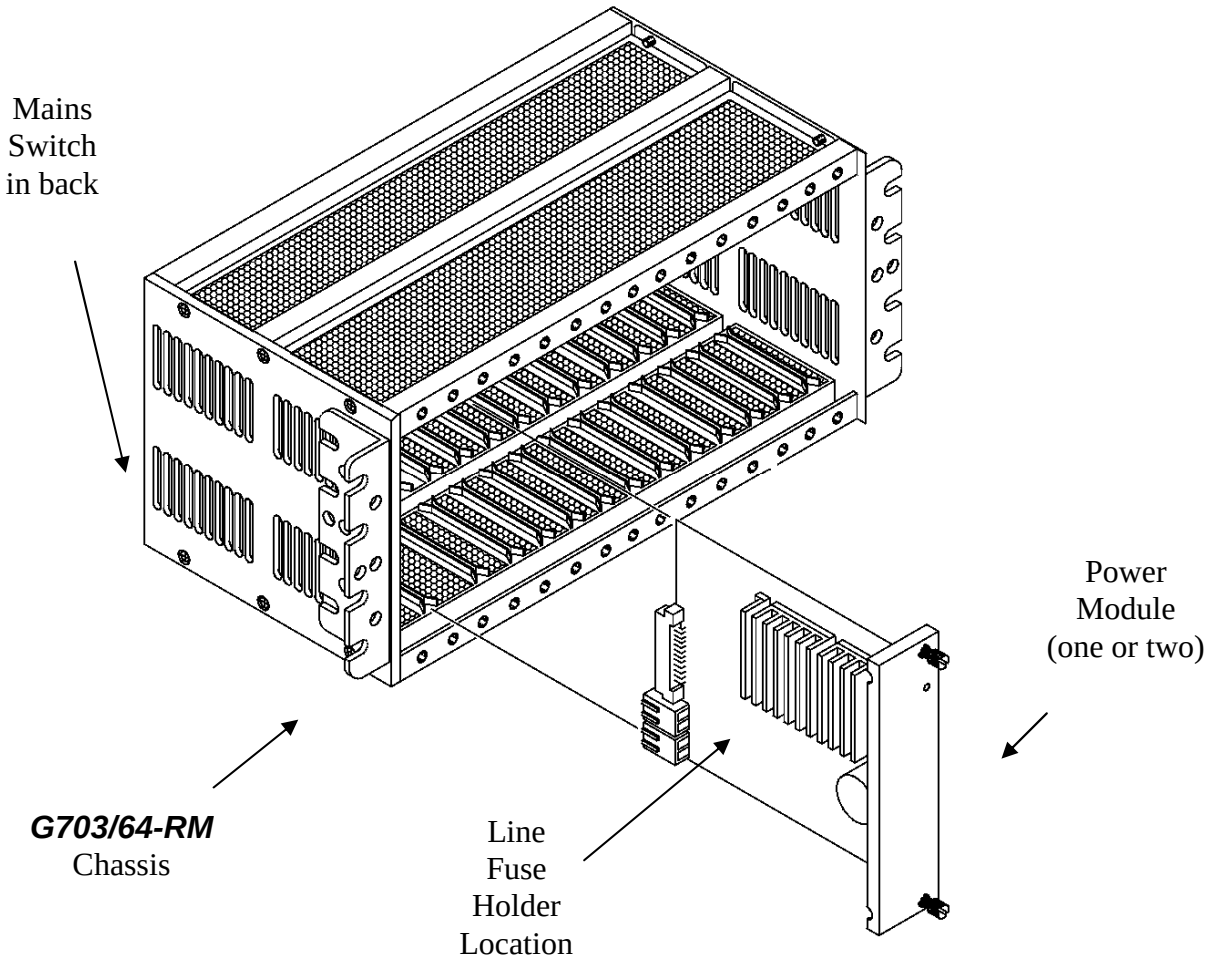


Figure 2-2 : Fuse Location on AC Power Module

2-4-2. Rear panel connectors

The **G703/64 Cards** install into the front of the ***G703/64-RM*** and receive DC power from the back plane or "main board". The back plane provides both DC power to the **G703/64 Cards** and routes signals from the cards to the G.703 64K (CSU) and data port (DSU) connectors accessible at the rear of the ***G703/64-RM.*** Three interface connector groups are provided for each slot. The G.703 64K signals may use either the RJ-45 or the 5pin Molex connectors with terminal block adapters for balanced transmissions. The data port connections are made with optional adapter cables, using a common panel connector, HDB26F for all interfaces.

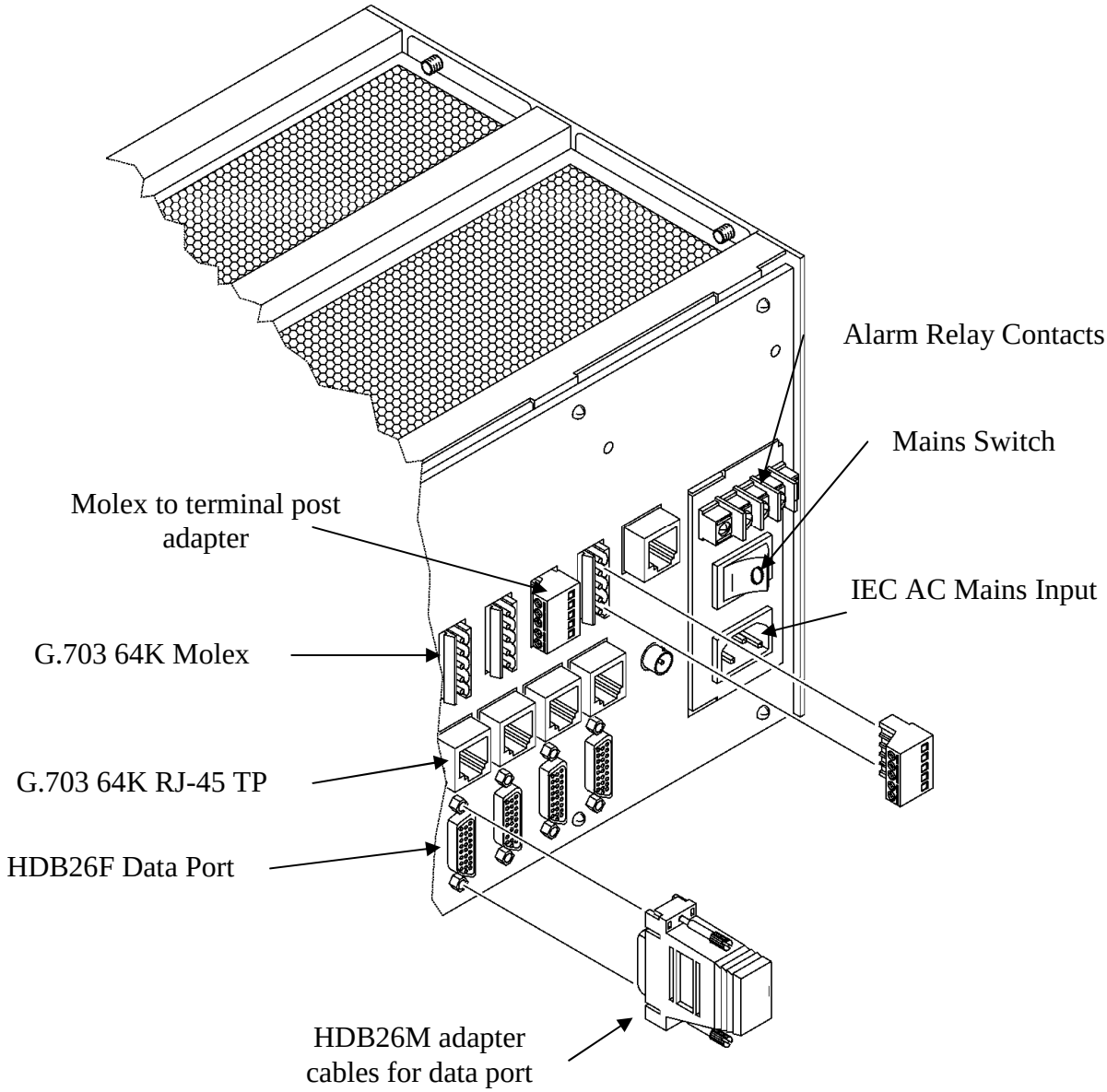


Figure 2-3 : *G703/64-RM* Rear Panel Connections

2.5 Power Supply Modules

The Power Supply Modules in the ***G703/64-RM*** are available in two versions, AC or DC. The AC version supports input voltages of 90 to 250 volts at frequencies of 50 to 60 Hertz. The DC version supports –42 to -54VDC input voltage. Only one power supply module is required to power a completely full rack. When two Power Supply Modules are installed, the supplies are hot swappable, meaning any one supply may be removed and replaced without impacting the operation of the ***G703/64-RM*** Rack. The power supply modules of the are load sharing.

When an AC Power Module is used in the ***G703/64-RM***, AC power enters from the IEC mains input connector on the rear panel. AC power is supplied to the AC Power Module card(s) when the mains toggle switch is closed. The AC passes through the F1 fuse(s), located on the Power Module card(s). The AC power is rectified and filtered before being passed to the regulator module. The regulator module is factory adjusted to provide 48VDC to the back plane with complete regulation and over-voltage, over-current, and over-temperature protection.

When a DC Power Module is used in the ***G703/64-RM***, DC –48V enters from the terminal block on the rear panel (see Figure 2-4). DC power is supplied to the DC Power Module card(s) when the mains toggle switch is closed. The DC passes through the F1 fuse(s), located on the Power Module card(s). The DC power passes through the rectifier and filtering circuits, which provide reverse polarity protection before being passed to the DC-DC regulator module. The regulator module is factory adjusted to provide 48VDC to the back plane with complete regulation and over-voltage, over-current, and over-temperature protection.

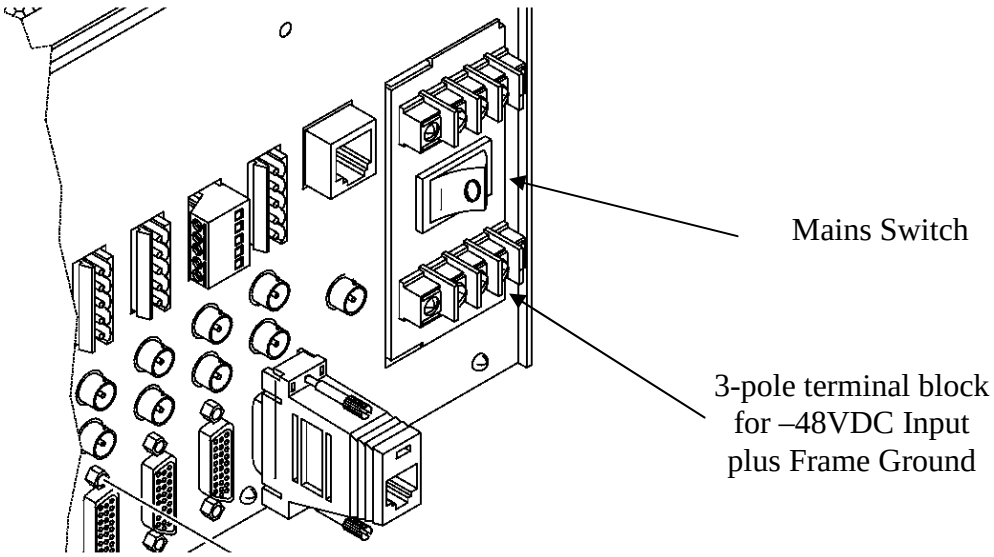


Figure 2-4 : DC Model Power Connection

Chapter 3. Data Module

3.1 Data Module Overview

The Data Modules for the ***G703/64-RM*** are **G.703/64K Cards** which slide into the ***G703/64-RM*** chassis, and interface with the pack panel "main board". The back panel provides an interface connection to the **G703/64 Cards** for power, channel connection, data port connection and control logic (for optional SNMP/local management terminal). The cards are designed to be "hot" swappable, meaning the ***G703/64-RM*** chassis need not be powered off in order to replace a card or pull it for configuration setting. Each **G703/64 Card** has a protection fuse and its own on card DC-DC regulator. Each **G703/64 Card** in the ***G703/64-RM*** receives the DC buss 48VDC and uses its own on-card DC to DC converter to derive the required operating voltage of 5VDC. Removal and installation of **G703/64 Cards** with the rack chassis under power will not effect the operation of other **G703/64 Cards**. The one exception to this would be a case where the improper fuse (rated too high) were placed on a defective **G703/64 Card**, causing the main AC or DC power module's fuse(s) to open. It should also be noted, that the **G703/64 Cards** themselves have no redundancy. Therefore, if a card is pulled from the chassis while the communication link is active, that link will be broken.

Removal of a **G703/64 Card** is accomplished by loosing the two (2) captive screws on the face plate of the card module, and then pulling the card straight out of the chassis with the same screws. Apply equal pulling force to both top and bottom captive screws to avoid the card binding in the rails of the chassis. (refer to Figure 3-1) Replace the card by reversing the procedure, align in the slot groove and gently seat the card. Retighten the captive screws.

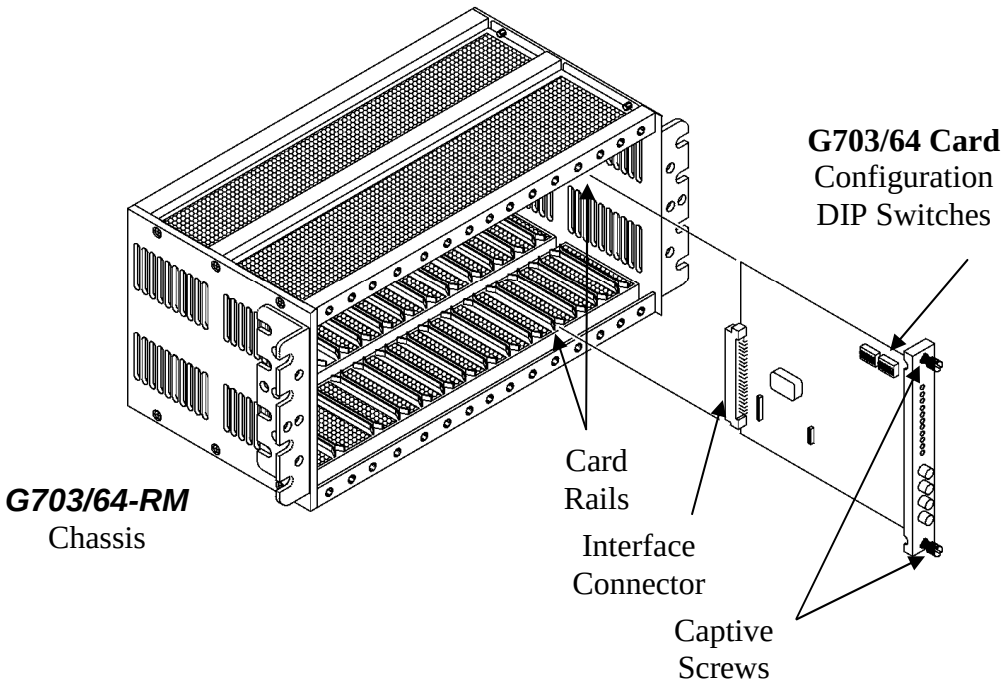


Figure 3-1 : Removal/Replacement of G703/64 Card in *G703/64-RM* Chassis

Chapter 3. Data Module

The **G703/64 Card** in the ***G703/64-RM*** uses a common PC board for all data port interfaces. Only the DIP switch settings and appropriate interface adapter cable is necessary for proper functioning. Care must always be taken when swapping boards. Always check and match the correct interface setting with the proper interface adapter cable.

There are two (2) DIP (Dual Inline Package) Switches located along the top of the **G703/64 Card** numbered DSW1~2. The switches function to set the Rx and Tx timing mode, data interface type, Rx and Tx clock polarity, handshaking mode, and loop back functioning. Please refer to Appendix A for the DIP setting table.

Located on the upper half of the front panel are the indicator LEDs. There is a green power indicator which will light when the card is placed in an active chassis. Failure of this LED to light indicates a possible power failure on the **G703/64 Card** itself. The TD, RD, RTS, and DCD yellow LEDs indicate status of the data communication port. The red Signal Loss, Timing Loss and Error LEDs all indicate error conditions on the G.703 64K line or link connection. When loop back testing is being performed, the red Test LED will light. If any bits are received in error, the red Error LED will blink.

Located on the lower half of the front panel are the manual test switches. The top three switches set the type of loop back test to be performed. The bottom switch enables the internal pattern generator. The ***Local digital*** (local digital loop back) switch tests the performance of the local **G703/64 Card**, the remote unit and the connections between by looping back the G.703 64K received data to the remote unit. The ***Local analog*** (local analog loop back) switch tests the performance of the local **G703/64 Card**, the data terminal device and the connections between by looping back the received terminal's data back to the terminal. The ***Remote digital*** (remote digital loop back) switch tests the performance of the local and remote units, as well as the line, by issuing a proprietary loop back command to the remote CSU/DSU. When the ***Test*** switch is depressed, the local **G703/64 Card** sends out a 511-bit test pattern (according to ITU-T V.54) on the G.703 link, enabling testing of the entire link. Refer to Chapter 4 for detailed diagrams of the loop back functions of the ***G703/64-RM***'s **G703/64 Card**.

3.2 Data Module LED Indicators

PWR: This green LED should be lit when the chassis is powered and the **G703/64 Card** is seated in the rack slot.

DATA - 4 LEDs monitor the DTE equipments connection

TD: This yellow LED will flash when there is transmit data activity from the connected DTE equipment to the **G703/64 Card**.

RD: This yellow LED will flash when there is receive data activity from the **G703/64 Card** to the connected DTE equipment.

RTS: This yellow LED will be lit when the Request To Send signal is active on the data port.

DCD: This yellow LED will be lit when the carrier signal is active between the DSU and the connected DTE equipment.

G703 - 5 LEDs monitor the channel side connection

TX: This yellow LED will flash when there is transmit data activity from the **G703/64 Card** to the G.703 64K channel.

RX: This yellow LED will flash when there is receive data activity from the G.703 64K channel to the **G703/64 Card**.

Signal Loss: This red LED will light in the event of CSU signal loss.

Timing Loss: This red LED will light in the event of CSU clock signal loss.

Error: This red LED will flash upon receiving an error while in BERT mode (pattern depressed and looped back).

Test: This red LED will light if any of the test pushbuttons are depressed or if the **G703/64 Card** is in analog loop back due to reception of a V.54 remote loop back code from the remote unit.

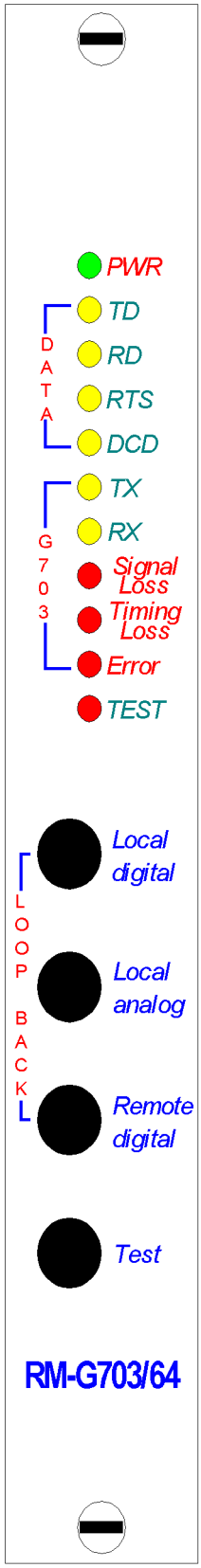


Figure 3-3 : **G703/64 Card** face (For V.35, RS-232, X.21, RS-530, or RS-449)

3.3 V.35 Data Module

When the ***G703/64-RM*** is ordered with an **V.35** option, an **FE1/V35** card is supplied and an optional V.35 adapter cable may be ordered or assembled according to the following table. The adapter cable follows the pin out standards shown below exactly.

Abbreviation	HDB26 PIN#		MB34 PIN#	V.35 Circuit
FG	1	↔	A	Frame
SG	7	↔	B	Signal Ground
TD(A) TD(B)	2 11	↔ ↔	P S	TD(A) TD(B)
RD(A) RD(B)	3 21	↔ ↔	R T	RD(A) RD(B)
RTS(A)	4	↔	C	RTS
CTS(A)	5	↔	D	CTS
DSR(A)	6	↔	E	DSR
DTR(A)	20	↔	H	DTR
DCD(A)	8	↔	F	DCD
ETC(A) ETC(B)	24 16	↔ ↔	U W	ETC(A) ETC(B)
TC(A) TC(B)	15 23	↔ ↔	Y AA	TC(A) TC(B)
RC(A) RC(B)	17 25	↔ ↔	V X	RC(A) RC(B)
RLB	9	↔	HH	RL
LLB	18	↔	JJ	LL
TM	10	↔	KK	TM

Table 3-1 : HDB26 –MB34 adapter cable pin out for V.35

3.4 RS-530 Data Module

When the ***G703/64-RM*** is ordered with an **ERM01/530** option, an **FE1/530(public)** card is supplied and an optional RS-530 adapter cable may be ordered or assembled according to the following table. The adapter cable follows the pin out standards shown below exactly.

Abbreviation	HDB26 PIN#		DB25 PIN#	RS-530 Circuit
FG	1	↔	1	Frame
SG	7	↔	7	AB
TD(A)	2	↔	2	BA(A)
TD(B)	11	↔	14	BA(B)
RD(A)	3	↔	3	BB(A)
RD(B)	21	↔	16	BB(B)
RTS(A)	4	↔	4	CA(A)
RTS(B)	13	↔	19	CA(B)
CTS(A)	5	↔	5	CB(A)
CTS(B)	14	↔	13	CB(B)
DSR(A)	6	↔	6	CC(A)
DSR(B)	22	↔	22	CC(B)
DTR(A)	20	↔	20	CD(A)
DTR(B)	12	↔	23	CD(B)
DCD(A)	8	↔	8	CF(A)
DCD(B)	26	↔	10	CF(B)
ETC(A)	24	↔	24	DA(A)
ETC(B)	16	↔	11	DA(B)
TC(A)	15	↔	15	DB(A)
TC(B)	23	↔	12	DB(B)
RC(A)	17	↔	17	DD(A)
RC(B)	25	↔	9	DD(B)
RLB	9	↔	21	RL
LLB	18	↔	18	LL
TM	10	↔	25	TM

Table 3-2 : HDB26 –DB25 adapter cable pin out for RS-530

3.5 RS-449 Data Module

When the ***G703/64-RM*** is ordered with an **ERM01/449** option, an **FE1/530(public)** card is supplied and an optional RS-449 adapter cable may be ordered or assembled according to the following table. The adapter cable follows the pin out standards shown below exactly.

Abbreviation	HDB26 PIN#		DB37 PIN#	RS-449 Circuit
FG	1	↔	1	Frame
SG	7	↔	19,20,37	SG,RC,SC
TD(A) TD(B)	2 11	↔ ↔	4 22	SD(A) SD(B)
RD(A) RD(B)	3 21	↔ ↔	6 24	RD(A) RD(B)
RTS(A) RTS(B)	4 13	↔ ↔	7 25	RS(A) RS(B)
CTS(A) CTS(B)	5 14	↔ ↔	9 27	CS(A) CS(B)
DSR(A) DSR(B)	6 22	↔ ↔	11 29	DM(A) DM(B)
DTR(A) DTR(B)	20 12	↔ ↔	12 30	TR(A) TR(B)
DCD(A) DCD(B)	8 26	↔ ↔	13 31	RR(A) RR(B)
ETC(A) ETC(B)	24 16	↔ ↔	17 35	TT(A) TT(B)
TC(A) TC(B)	15 23	↔ ↔	5 23	ST(A) ST(B)
RC(A) RC(B)	17 25	↔ ↔	8 26	RT(A) RT(B)
RLB	9	↔	14	RL
LLB	18	↔	10	LL
TM	10	↔	18	TM

Table 3-3 : HDB26 –DB37 adapter cable pin out for RS-449

3.6 X.21 Data Module

When the ***G703/64-RM*** is ordered with an **ERM01/X21** option, an **FE1/530(public)** card is supplied and an optional X.21 adapter cable may be ordered or assembled according to the following table. The adapter cable follows the pin out standards shown below exactly.

Abbreviation	HDB26 PIN#		DB15 PIN#	X.21 Circuit
FG	1	↔	1	Shield
SG	7	↔	8	Ground
TD(A) TD(B)	2 11	↔ ↔	2 9	Transmit(A) Transmit(B)
RD(A) RD(B)	3 21	↔ ↔	4 11	Receive(A) Receive(B)
RTS(A) RTS(B)	4 13	↔	3 10	Control(A) Control(B)
DCD(A) DCD(B)	8 26	↔	5 12	Indication(A) Indication(B)
ETC(A) ETC(B)	24 16	↔ ↔	7 14	Ext. Timing(A) Ext. Timing(B)
RC(A) RC(B)	17 25	↔ ↔	6 13	Signal Timing(A) Signal Timing(B)

Table 3-4 : HDB26 –DB15 adapter cable pin out for X.21

3.7 ET10 10Base-T Ethernet Bridge Module

When the ***G703/64-RM*** is ordered with an **ERM01/ET10** option, an **FE1/ET10** card and HDB26 to RJ-45 adapter are supplied and assembled according to the following table. The **FE1/ET10** Card includes an additional "daughter" board to handle the Ethernet interface and Bridging functions. This board has two (2) DIP switches which may only be accessed by removing the daughter board. (Refer to Figure 3-4.) Pull the board straight out and avoid bending the pins. After setting, press the daughter board back onto the **G703/64 Card**, closely observing the 20 and 26 pin connectors.

Connection to HUB (1:1) (depends on S1 setting)		Connection to PC (cross) (depends on S1 setting)	
HDB26	RJ-45	HDB26	RJ-45
11	1 T+	11	1 R+
12	2 T-	12	2 R-
13	3 R+	13	3 T+
14	4	14	4
15	5	15	5
16	6 R-	16	6 T-
17	7	17	7
18	8	18	8

Table 3-5 : HDB26 –RJ-45 adapter pin out for 10Base-T

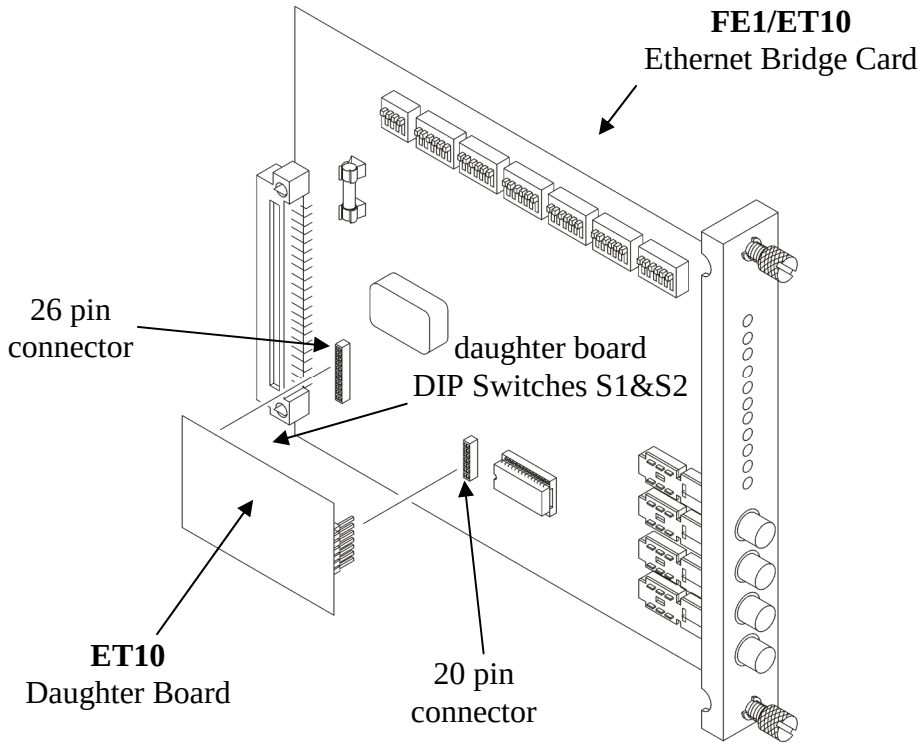


Figure 3-4 : ET10 Daughter Board Removal/Replacement

ET10 : Attach to HUB (1:1) or PC (Crossover)

S1	===	=x=
1	ON*	OFF
2	ON*	OFF
3	ON*	OFF
4	ON*	OFF
5	OFF*	ON
6	OFF*	ON
7	OFF*	ON
8	OFF*	ON

* factory setting

Table 3-6 : ET10 Daughter Board DIP Switch S1 Settings

S2	Set	Comment	Comment
1	ON*	Factory Default	Do not change
2	ON*	Factory Default	Do not change
3	ON*	Factory Default	Do not change
4	OFF*	Factory Default	Do not change
5	ON*	Factory Default	Do not change
6	X	OFF* = Full Duplex	ON = Half Duplex
7	X	OFF* = Compression enabled	ON = Compression disabled
8	X	OFF* = Filter Disabled (Repeater mode)	ON = Filter Enabled (Bridge mode)

* factory setting

Table 3-7 : ET10 Daughter Board DIP Switch S2 Settings

SPECIFICATIONS

- **BRIDGE**
  LAN Table: 10,000 MAC address with 5 minute automatic aging
  Filtering and Forwarding: 15,000 frames/sec
  Buffer: 256 frames
  Delay: 1 frame
- **LAN**
  Standard: Conforms to IEEE 802.3 / 10Base-T Ethernet
  Data Rate: 10Mbps (20Mbps/ 10Base-T in Full duplex topology)

Filter:

When this feature is disabled (S2-8 OFF), all frames are passed transparently. In this configuration, the **ET10** acts as a repeater. When the filter is enabled, frame destinations are tested against the internal MAC address table. Filtering enabled is the normal selection for Bridging.

Compression:

Enhanced Tinygram Compression increases data throughput over the WAN. Valid Ethernet frames have a minimum length of 64 bytes. Frames shorter than 64 bytes are padded. With compression enabled (S2-7 OFF), these padding bytes are stripped off before being transmitted over the WAN, and re-padded when received on the other side.

Chapter 4. Loop Back Testing

4.1 General

In this chapter we shall explain the detailed functioning of the loop back switches.

4.2 User Activated Loop back

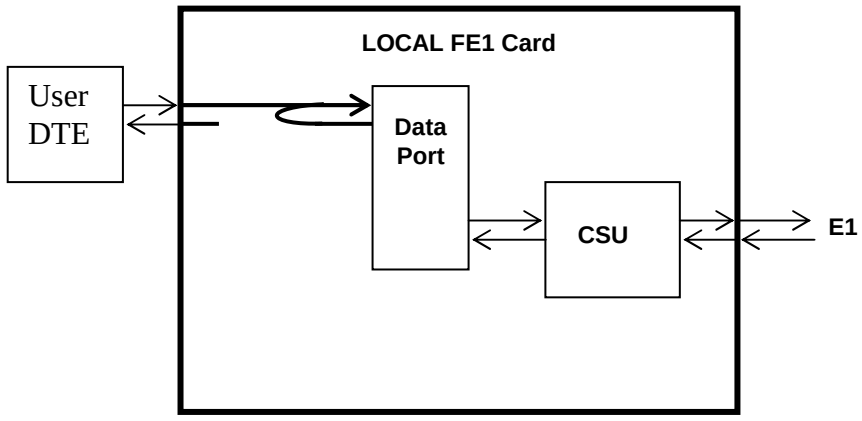
The **G703/64 Card** supports the following types of test loop backs.

Data Port local analog loop back.
E1 link local digital loop back.
E1 link remote loop back. (only works in CAS or CCS frame mode)

The user activated loop back functions may be accessed from the front panel **G703/64 Card** push-button switches, via the LOOPBACK PARAMETER menu under ASCII terminal mode, or via SNMP. The latter two methods both require the optional **SNMP Card** installed and will not be discussed any further here. The available test functions via pushbutton switches are described on this and the following pages.

4.3 E1 link local digital loop back

The **G703/64 Card** local digital loop back is established as close to the DTE interface as possible to check the satisfactory working of the **G703/64 Card** and the E1 link connection. Using this setting, the remote CSU/DSU must supply the test signal and verify it upon its return.

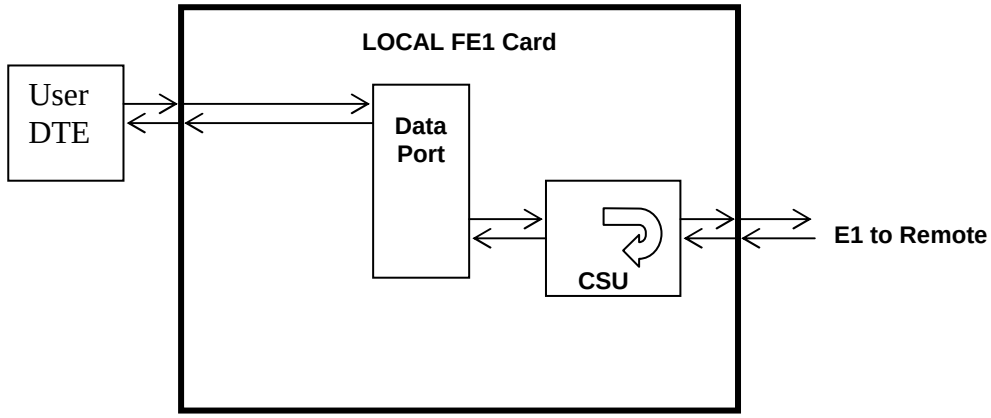


(***Loc dig loopbk*** depressed)

Figure 4-1. E1 link local digital loop back

4.4 Data port local analog loop back

The **G703/64 Card** local analog loop back is established in analog mode as close as possible to the E1 line, to check the satisfactory working of the **G703/64 Card** and the connection between the DTE and **G703/64 Card**. This returns the transmit signal of the Data port to the receive path of the Data port. The Data Port must receive its own transmission, therefore we recommend never doing this test when the data port is ET10 Ethernet bridge or collisions may result.

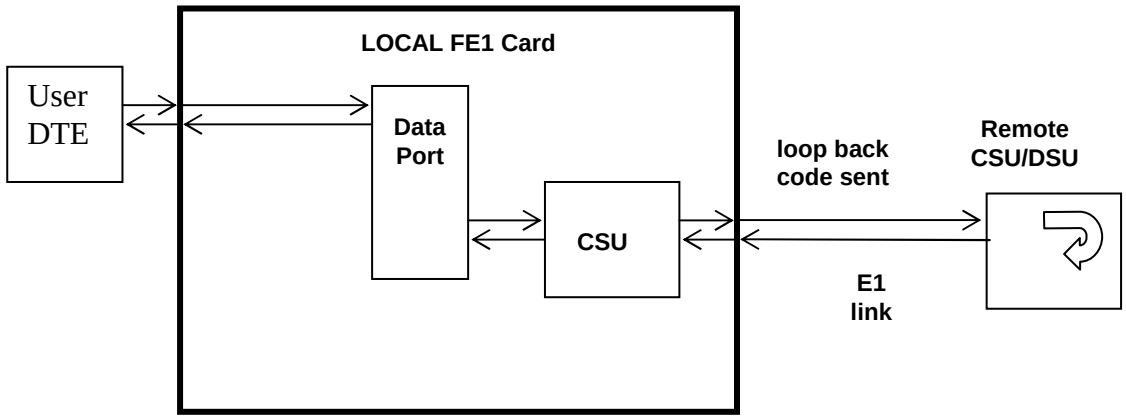


(***Loc ana loopbk*** depressed)

Figure 4-2. Data port local analog loop back

4.5 E1 link remote loop back

The local **G703/64 Card** signals the remote unit into digital loop back to check satisfactory operation of the local **G703/64 Card**, remote CSU/DSU and the link between. If the User DTE is replaced with a BERT tester, the data cable, **G703/64 Card**, remote CSU/DSU and E1 link may all be tested.

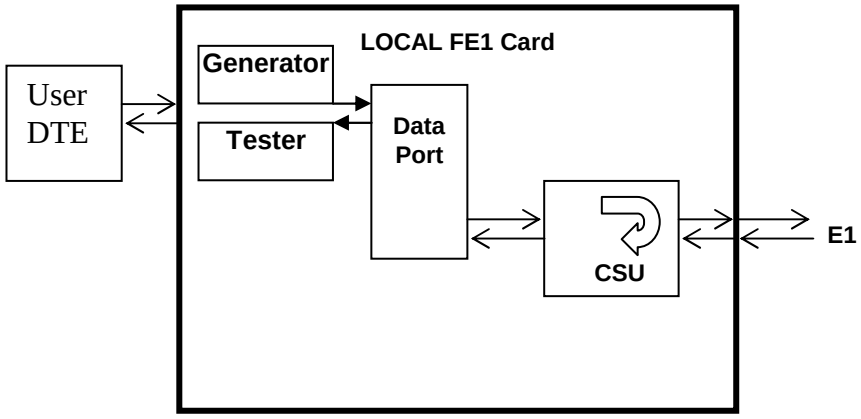


(***Rem loopbk*** depressed)

Figure 4-3. E1 link remote loop back

4.6 BERT local loop back

For a **local test**, depress the ***Loc ana loopbk*** pushbutton or physically hardwire the E1 link TX to the E1 link RX with coaxial (BNC) cable. Depress the ***Pattern*** push-button switch. During BERT testing, the local DTE is disconnected and the DSR line is off. An internal 511-bit pattern will be generated according to ITU-T and connected to the transmit input of the local data channel interface. The receive output is connected to the pattern tester. The tester compares the received and transmitted patterns and detects errors, as shown in Figure 4-4. (Err LED should be off during successful loop back.)

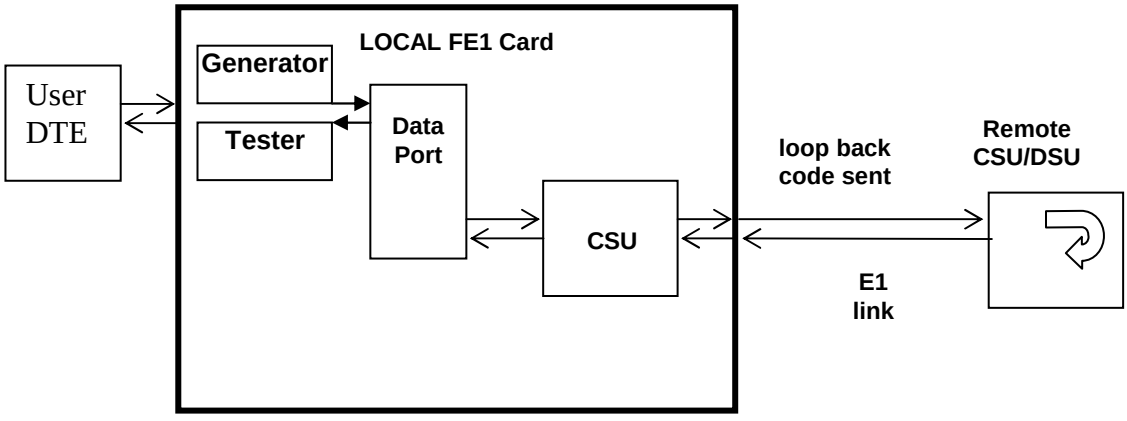


(***Pattern*** and ***Loc ana loopbk*** depressed)

Figure 4-4. BERT for local test

4.7 BERT remote loop back for system test

For a **system test**, the remote site CSU/DSU must support CTC's proprietary remote loop back (Such as **ETU-01** or another **G703/64 Card**) and both must be in matching frame mode. The local unit will depress both the ***Pattern*** and ***Rem loopbk*** pushbutton switches. The entire E1 link may then be tested, as shown in Figure 4-5.



(***Rem loopbk*** and ***Pattern*** depressed)

Figure 4-5. BERT used for system test

Chapter 4. Loop Back Testing

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Chapter 5. Troubleshooting

5.1 General

As in troubleshooting any type of computer, network, or communication problem, it is very important to follow a very logical procedure. During any troubleshooting session, the importance of taking notes cannot be overstated. It is very easy to forget connections or settings when troubleshooting a large network. Notes will help in logically checking all items and will also serve as a valuable aid in writing a system log or other report to your supervisor or your customer following successful completion of work. Notes also serve as important tools for future troubleshooting or for training of new personnel or just simply as a memory refresher.

When dealing with troubleshooting of first time installation problems, the best place to start is with double-checking of configuration settings and connections. It is very easy to misinterpret a DIP switch setting and cause the failure of a link. Initial configuration problems will also cause either immediate failure or inconsistent operations. Although the **G703/64 Cards** all comply with ITU G.703 recommendations, it is very important to understand the differences in terminology between different equipment manufactures. A thorough understanding of the settings and configuration of related equipment is mandatory when integrating many vendors' equipment.

Having the proper tools is also important in any troubleshooting endeavor. When troubleshooting E1 connections a transmission analyzer is an invaluable tool in isolating configuration, line or hardware problems. CTC Union's BTM-10 E1 Transmission Analyzer is an excellent choice. The unit is very portable, battery operated, with built-in keyboard and LCD display. The tester is designed to do BERT (Bit Error Rate) testing via E1 connection or via Data Port connection at speeds up to 2.048Mbps.

5.2 Connections

When checking for connection related problems, start by looking for physical defects in the connectors themselves. Check for broken or bent pins, corrosion and mis-wiring. Check cables for pinching that could indicate a broken or shorted wire. For twisted pair wiring, confirm that a wire pair actually goes to the proper transmit or receive signal pairs. Build yourself an RJ-45 break-out-box from a pigtail converter. Loop back the pairs in the BOB and confirm continuity with a multi-meter.

5.3 Configuration

When physical connections have been confirmed, start looking for configuration problems. Confirm that the proper line code is being used. The **G703/64 Cards** all support AMI and HDB3 line codes. In almost all instances, the line code will be HDB3. Confirm settings.

Framing errors can result if setting errors are made. Confirm the mode, whether unframed, framed PCM31 or framed PCM30 and whether CRC is enabled or not. If both sides of the E1 link are using different framing, there will be alarm indications.

Data errors may result if the timeslot assignments in fractional mode do not match. Check the settings carefully. For reduced monthly charges, a customer may only request a fraction of the E1 bandwidth. In this instance, an ISP may provide a fraction of the full 2.048Mbps bandwidth to a customer by utilizing Fractional E1. If only 512Kbps is requested, only eight (8) timeslots are required to carry the data payload. Carefully check the settings at the central site and confirm that the same eight timeslots are active on each end of the link.

Configuration check list:

E1 Line Code: Under most circumstances, line code should be set to HDB3. Confirm settings on both sides of the E1 link. (Sw6-4)

Frame Mode: Confirm switch settings for unframed or framed PCM30/PCM31. Both sides of E1 link must match. (Sw2-1, Sw6-5)

Timeslot settings: Double check same active timeslots on each side of link. (Sw2-2 ~ 8, Sw3, Sw4, Sw5) In PCM30, TS16 may not be set active.

CRC4: In framed mode, CRC4 may be enabled or not. Confirm same settings on each side of link. (Sw6-6)

Cascade: If not cascading, ensure this setting is off. (Sw7-5)

Data channel rate: May be set for 56 or 64Kbps. (Sw6-8)

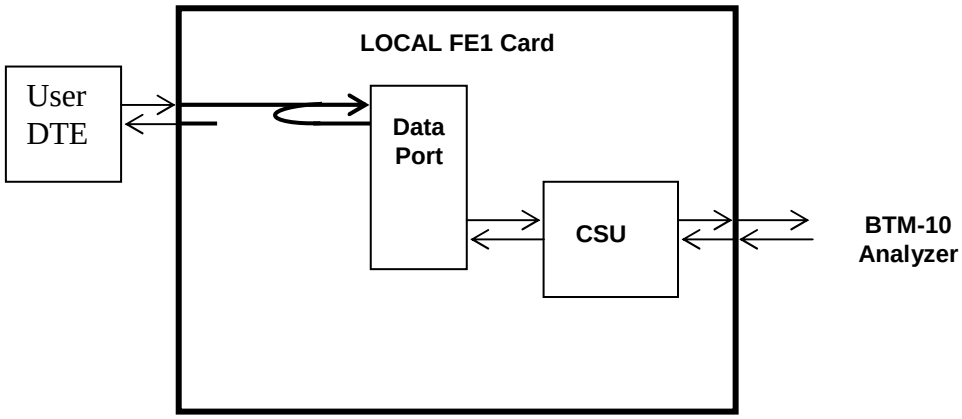
DTE/DCE: The G703/64 Card's data port is DCE. Connect to DTE equipment or custom make the appropriate "null" cable.

System timing: In point-to-point applications, one unit must provide clock, whether from internal or from the data port. The other unit must be set to recovery. For network connections, both units are usually set to recovery, as the network provides the timing source.

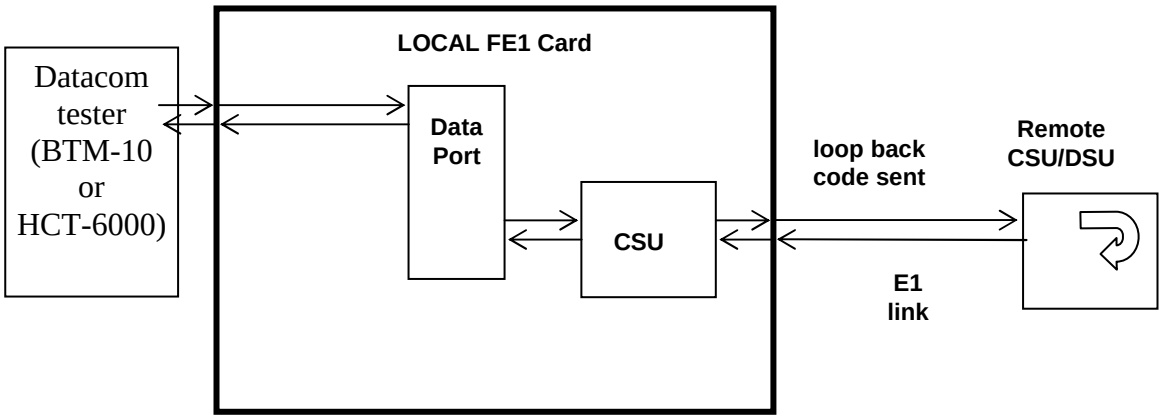
5.4 G703/64 Card Testing

The example given here refers to use of CTC Union's BTM-10 E1 Transmission Analyzer. To test any of the **G703/64 Cards**, connect either an RJ-45 E1 cable or two coaxial cables between the Device Under Test (DUT) and the BTM-10 tester.

Configure the **G703/64 Card** for CCS (PCM31) framed mode, HDB3 line code, termination (75 ohm, if using coaxial connections or 120 ohm for twisted pair) and internal clock source. **Depress the front panel *Loc dig loopbk* switch.** Configure the analyzer for E1 BERT, unframed, 75 ohm termination, HDB3 line code, external Tx and Rx clock, QRSS pattern and run "forever". Run the BERT. Confirm 1.984Mbps rate and no receive errors. If testing a remote link, inject a forced error and confirm loop back receipt of one error.



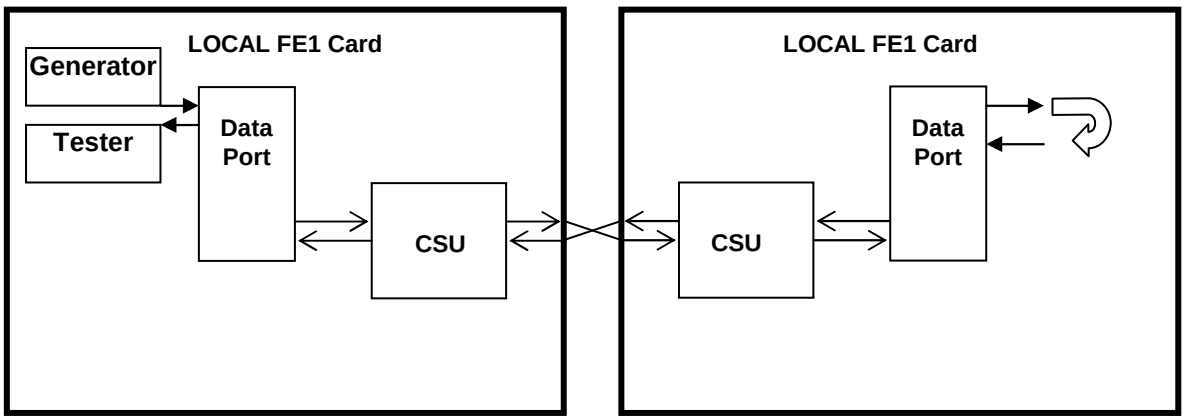
The BTM-10 may also be configured to do high-speed BERT from its data port. Alternatively, our HCT-6000 or HCT-BERT 2M analyzers may be configured to connect to the data port side of the DUT. In this setup, the **G703/64 Card** and the link may be tested.



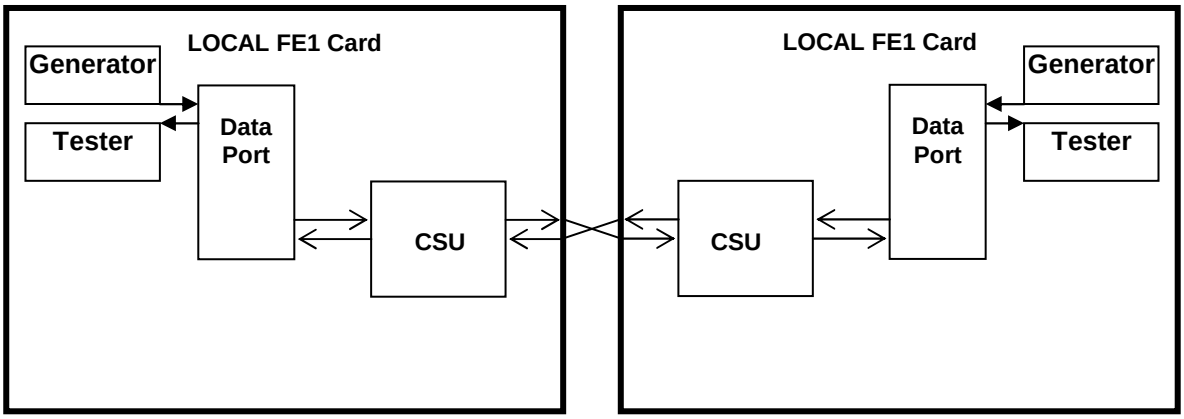
If for example the **G703/64 Card** is an FE1/RS530, the tester is connected directly to the RS-530 interface of the data port. The clock on the tester is set to "external". Set up for BERT test and run a pattern to the data port. **Depress the Rem loopbk switch on the local unit**. This will place the remote CSU into loop back mode allowing the BERT signal to be received at the local unit. You may run the BERT for a twenty-four hour period for a longevity test. It is always a good idea to manually inject an error and confirm proper receipt of the error from the link.

To test the **G703/64 Card** standalone in the rack, the on-card pattern generator and local loop back functions may be used without any external equipment. Ensure that the **G703/64 Card** has its clock source set to internal. Depress both the ***Pattern*** and ***Loc ana loopback*** switches. The pattern generator is internally connected to the DSU side while the loop back is placed on the CSU in analog mode. (Refer to Figure 4-4 on page 25) The red ***Test*** LED will be lit and there should be no ***Err*** LED indications. The yellow ***RD*** LED will flash since the pattern generator is connected, running, and looping back to the DTE. The E1 link will experience ***Sig Loss***, since it is not connected.

To test a pair of **G703/64 Cards** in a rack, cross connect the E1 lines (Rx to Tx, Tx to Rx), configure both cards for CCS (PCM31), and time slots 1 ~ 31 all active. Set one card with internal clock source and the other for recovery. On one card depress both the ***Pattern*** and ***Rem loopbk*** switches. Alternatively, on one card depress the ***Pattern*** switch while depressing the ***Loc dig loopbk*** switch on the other card. During successful loop back, both cards will exhibit flashing yellow ***RD*** LEDs, and no red LED indications except ***Test***.



Here's one more test based upon the previous setup. Depress both ***Pattern*** switches on each card. Now, each pattern generator is sending to the other card, while each pattern tester is receiving the 511-bit pattern from the other card. The same successful indicators as previous apply.



Chapter 5. Troubleshooting

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Appendix A. DIP Switch Settings

***G703/64-RM* G703/64 Card** Quick Reference Setup Table

Sw. No.	DIP switch setting					Function	Comment
Sw 1	1	2	3	4	5	E1 Line Impedance	
	on	on	on	on	on	75 ohms	
	off	off	off	off	off	120 ohms	
Sw 2	1 off					Unframed	
	on					Framed	
	2 ~ 8					TS 1 ~ 7	Active ON. Ignored if Sw2-1 is off
Sw 3	1 ~ 8					TS 8 ~ 15	
Sw 4	1 ~ 8					TS 16 ~ 23	
Sw 5	1 ~ 8					TS 24 ~ 31	
Sw 6	1		2	3		Rx / Tx timing source	
	off		off	off		Recovery from E1 Rx	
	on		off	off		Internal Oscillator	
	off		on	off		DTE1; Transparent	
	on		on	off		DTE2; Rx<Erc,Tx<Etc	
	off		off	on		DTE3; Rx & Tx<Etc	
	on		off	on		Reserved	
	off		on	on		Reserved	
	on		on	on		Reserved	
	4 off					Line code: HDB3	
	on					Line code: AMI	
	5 off					Frame mode: CCS	(PCM31)
	on					Frame mode: CAS	(PCM30)
	6 off					CRC4: off	
	on					CRC4: on	
	7 off					Idle code: Mark 0xff	
	on					Idle code: Flag 0x7e	
	8 off					Data ch. rate: n x 64K	
	on					Data ch. rate: n x 56K	
Sw 7	1					Reserved	
	2					Reserved	
	3 off					Rx Clk polarity:Normal	
	on					Rx Clk polarity:Invert	
	4 off					Tx Clk polarity:Normal	
	on					Tx Clk polarity:Invert	
	5 off					Cascade: Disabled	
	on					Cascade: Enabled	
	6 off					Remote set disabled	NON-SNMP
	on					Remote set enabled	Option installed
	7 off					Data Port control of loop back	Disable
	on						Enable
	8 off					Front panel switch functions	Disable
	on						Enable

Table A-1 : QUICK REFERENCE TABLE

Important Notice: This and all following tables are based upon the versions current with the writing of this document. The **G703/64 Card** printed circuit board (pcb) current version is V2.1 while current firmware version is 0403. For updated firmware for V2.1 pcb or for settings with V1.0 pcb, please contact your distributor or CTC Union directly.

DIP SWITCH FUNCTION DESCRIPTIONS

DIPSW	FUNCTION	COMMENT
1	Line impedance setting	See Table A-3
2	Time slot 0 to 7 setting	See Table A-4
3	Time slot 8 to 15 setting	See Table A-5
4	Time slot 16 to 23 setting	See Table A-6
5	Time slot 24 to 31 setting	See Table A-7
6	Parameter group 1 setting	See Table A-8
7	Parameter group 2 setting	See Table A-9

Table A-2 : DIP SWITCH FUNCTION DESCRIPTIONS

DIPSW1

DIP SW1	STATE	FUNCTION	COMMENT
ALL	OFF	Line impedance: **120 ohm**	
	ON	Line impedance: **75 ohm**	

Table A-3 : DIPSW1 E1 LINE IMPEDANCE SETTING

DIPSW2

DIP SW2	STATE	FUNCTION	COMMENT
-1	OFF	Unframed mode	Note 1
	ON	Framed mode	Note 2
-2	OFF	Time slot 1 disable	
	ON	Time slot 1 enable	
-3	OFF	Time slot 2 disable	
	ON	Time slot 2 enable	
-4	OFF	Time slot 3 disable	
	ON	Time slot 3 enable	
-5	OFF	Time slot 4 disable	
	ON	Time slot 4 enable	
-6	OFF	Time slot 5 disable	
	ON	Time slot 5 enable	
-7	OFF	Time slot 6 disable	
	ON	Time slot 6 enable	
-8	OFF	Time slot 7 disable	
	ON	Time slot 7 enable	

Table A-4 : DIPSW2 TIME SLOT 0 TO 7 SETTING

Note 1: In unframed mode, the user data rate is fixed at 2048K, DIPSW1 to DIPSW4 and DIPSW5 bit 5-8 settings are ignored.

Note 2: In framed mode, the user data rate is n×64K or n×56k.
Where n = number of time slots, 1 to 31.

DIPSW3

DIP SW3	STATE	FUNCTION	COMMENT
-1	OFF	Time slot 8 disable	
	ON	Time slot 8 enable	
-2	OFF	Time slot 9 disable	
	ON	Time slot 9 enable	
-3	OFF	Time slot 10 disable	
	ON	Time slot 10 enable	
-4	OFF	Time slot 11 disable	
	ON	Time slot 11 enable	
-5	OFF	Time slot 12 disable	
	ON	Time slot 12 enable	
-6	OFF	Time slot 13 disable	
	ON	Time slot 13 enable	
-7	OFF	Time slot 14 disable	
	ON	Time slot 14 enable	
-8	OFF	Time slot 15 disable	
	ON	Time slot 15 enable	

Table A-5 : DIPSW3 TIME SLOT 8 TO 15 SETTING

DIPSW4

DIP SW4	STATE	FUNCTION	COMMENT
-1	OFF	Time slot 16 disable	
	ON	Time slot 16 enable	Note 1
-2	OFF	Time slot 17 disable	
	ON	Time slot 17 enable	
-3	OFF	Time slot 18 disable	
	ON	Time slot 18 enable	
-4	OFF	Time slot 19 disable	
	ON	Time slot 19 enable	
-5	OFF	Time slot 20 disable	
	ON	Time slot 20 enable	
-6	OFF	Time slot 21 disable	
	ON	Time slot 21 enable	
-7	OFF	Time slot 22 disable	
	ON	Time slot 22 enable	
-8	OFF	Time slot 23 disable	
	ON	Time slot 23 enable	

Table A-6 DIPSW4 TIME SLOT 16 TO 23 SETTING

Note 1: In CAS mode, DIPSW4-1 must **NOT** be set ON.

DIPSW5

DIP SW5	STATE	FUNCTION	COMMENT
-1	OFF	Time slot 24 disable	
	ON	Time slot 24 enable	
-2	OFF	Time slot 25 disable	
	ON	Time slot 25 enable	
-3	OFF	Time slot 26 disable	
	ON	Time slot 26 enable	
-4	OFF	Time slot 27 disable	
	ON	Time slot 27 enable	
-5	OFF	Time slot 28 disable	
	ON	Time slot 28 enable	
-6	OFF	Time slot 29 disable	
	ON	Time slot 29 enable	
-7	OFF	Time slot 30 disable	
	ON	Time slot 30 enable	
-8	OFF	Time slot 31 disable	
	ON	Time slot 31 enable	

Table A-7 : DIPSW5 TIME SLOT 24 TO 31 SETTING

DIPSW6

DIP SW6	STATE			FUNCTION	COMMENT
-1,-2,-3	OFF	OFF	OFF	Clock mode 0 (**DCE1**)	Recovery [1]
	ON	OFF	OFF	Clock mode 1 (**DCE2**)	Internal Osc. [1]
	OFF	ON	OFF	Clock mode 2 (**DTE1**)	Transparent [1]
	ON	ON	OFF	Clock mode 3 (**DTE2**)	Data Port [1]
	OFF	OFF	ON	Clock mode 4 (**DTE3**)	Data Port [1]
	ON	OFF	ON	Reserve	
	OFF	ON	ON	Reserve	
	ON	ON	ON	Reserve	
-4	OFF			Line code: **HDB3**	
	ON			Line code: **AMI**	
-5	OFF			Frame mode: **CCS (PCM31)**	ignored when unframed
	ON			Frame mode: **CAS (PCM30)**	ignored when unframed
-6	OFF			CRC4: **OFF**	ignored when unframed
	ON			CRC4: **ON**	ignored when unframed
-7	OFF			Idle code: **Mark (0xff)**	ignored when unframed
	ON			Idle code: **Flag (0x7e)**	ignored when unframed
-8	OFF			Data channel rate: **n ×64K**	ignored when unframed
	ON			Data channel rate: **n ×56K**	ignored when unframed

Table A-8 : DIPSW6 PARAMETER GROUP 1 SETTING

Note 1: See Table A-10 for detailed clock mode.

DIPSW7

DIP SW7	STATE	FUNCTION	COMMENT
-1	OFF	Reserved	
	ON	Reserved	
-2	OFF	Reserved	
	ON	Reserved	
-3	OFF	Receive clock polarity: **Normal**	
	ON	Receive clock polarity: **Inverted**	
-4	OFF	Transmit clock polarity: **Normal**	
	ON	Transmit clock polarity: **Inverted**	
-5	OFF	Cascade: **Disabled**	
	ON	Cascade: **Enabled**	
-6	OFF	Remote setting: **Disable**	Note 1
	ON	Remote setting: **Enable**	Note 2
-7	OFF	Data port controlled loopback: **Disable**	
	ON	Data port controlled loopback: **Enable**	
-8	OFF	Front panel loopback: **Disable**	Note 3
	ON	Front panel loopback: **Enable**	

Table A-9 : DIPSW7 PARAMETER GROUP 2 SETTING

Note 1: This is default setting when no **SNMP Card** option is installed at the factory.
Note 2: This is the setting required for SNMP or local control of the **G703/64 Card**. This switch will be set if the unit is factory ordered with the SNMP option.
Note 3: Use this setting to de-activate the front panel pushbuttons. This will prevent un-authorized or accidental link breakage. In order for the front panel switches to function, this setting must be ON. By default, it is ON from the factory.

CLOCK MODE DESCRIPTION

CLOCK MODE	DIPSW 6 STATE			E1 LINE	USER DATA PORT	
	-1	-2	-3	TRANSMIT CLOCK SOURCE	RECEIVE CLOCK SOURCE	TRANSMIT CLOCK SOURCE
0***** (DCE1)	OFF*****	OFF*****	OFF*****	RECOVERY (from E1 Receive)	RECOVERY Output to RC pin	RECOVERY Output to TC pin
1 (DCE2)	ON	OFF	OFF	INTERNAL OSCILLATOR	INTERNAL Output to RC pin	INTERNAL Output to TC pin
2 (DTE1)	OFF	ON	OFF	EXTERNAL Locked to ETC pin	RECOVERY Output to RC pin	EXTERNAL Input from ETC pin
3 (DTE2)	ON	ON	OFF	EXTERNAL Locked to ETC pin	EXTERNAL Input from ERC pin	EXTERNAL Input from ETC pin
4 (DTE3)	OFF	OFF	ON	EXTERNAL Locked to ETC pin	EXTERNAL Input from ETC pin	EXTERNAL Input from ETC pin

Table A-10 : CLOCK MODE DESCRIPTION

***** This is the normal setting for network operation.

Appendix A. DIP Switch Settings

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notes:

Technical Inquiry Form

G703/64-RM MODEL No.: FE1/V.35 FE1/RS-530 FE1/ET10

Please fill in the DIP switches configuration with '✓' marks into the following table. Send it to us by fax, and we will reply to you immediately.

SW NO.	DIP	FUNCTION	Your Setting		CTC Suggestion	
			ON	OFF	ON	OFF
SW1	1	E1 Line Impedance Setting				
	2	E1 Line Impedance Setting				
	3	E1 Line Impedance Setting				
	4	E1 Line Impedance Setting				
	5	E1 Line Impedance Setting				
SW2	1	Unframed/ framed				
	2	Timeslot 1				
	3	Timeslot 2				
	4	Timeslot 3				
	5	Timeslot 4				
	6	Timeslot 5				
	7	Timeslot 6				
	8	Timeslot 7				
SW3	1	Timeslot 8				
	2	Timeslot 9				
	3	Timeslot 10				
	4	Timeslot 11				
	5	Timeslot 12				
	6	Timeslot 13				
	7	Timeslot 14				
	8	Timeslot 15				
SW4	1	Timeslot 16				
	2	Timeslot 17				
	3	Timeslot 18				
	4	Timeslot 19				
	5	Timeslot 20				
	6	Timeslot 21				
	7	Timeslot 22				
	8	Timeslot 23				
SW5	1	Timeslot 24				
	2	Timeslot 25				
	3	Timeslot 26				
	4	Timeslot 27				
	5	Timeslot 28				
	6	Timeslot 29				
	7	Timeslot 30				
	8	Timeslot 31				
SW6	1	Rx/Tx timing source				
	2	Rx/Tx timing source				
	3	Rx/Tx timing source				
	4	Line code: HDB3 or AMI				
	5	CAS/PCM30 or CCS/PCM31 mode				
	6	CRC4: enabled or not				
	7	Idle code: Mark or Flag				
	8	Data port rate: n x 64K or n x 56K				
SW7	1	Reserved				
	2	Reserved				
	3	Rx Clock polarity				
	4	Tx Clock polarity				
	5	Cascade mode: enabled or not				
	6	Remote setting				
	7	Data port loop back				
	8	Front panel switch functions				

E1 Access Unit

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