GDC 036R320-000
Issue 9, February 2002

Instruction Manual

TMS Compact

Transport Management System

General DataComm

Warning

This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to CISPR 22, which is designed to provide reasonable protection against such interference when 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 required to correct the interference. The user is cautioned that any changes or modifications not expressly approved by General DataComm void the user's authority to operate the equipment.

This digital apparatus does not exceed Class A limits for radio noise emissions from digital apparatus described in the Radio Interference Regulations of the Canadian Department of Communications.

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 édicté par le ministère des Communications du Canada.

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Electrostatic discharge (ESD) results from the buildup of static electricity and can cause computer components to fail. Electrostatic discharge occurs when a person whose body contains a static buildup touches a computer component.

The equipment may contain static-sensitive devices that are easily damaged and proper handling and grounding is essential. Use ESD precautionary measures when installing parts or cards and keep the parts and cards in antistatic packaging when not in use. If possible, use antistatic floorpads and workbench pads.

When handling components, or when setting switch options, always use an antistatic wrist strap connected to a grounded equipment frame or chassis. *If a wrist strap is not available, periodically touch an unpainted metal surface on the equipment.* Never use a conductive tool, like a screwdriver or a paper clip, to set switches.

Safety Guidelines

The following symbols are used when unsafe conditions exist or when potentially hazardous voltages are present:

Caution statements identify conditions or practices that can cause damage to the equipment or loss of data.

Warning statements identify conditions or practices that can result in personal injury or loss of life.

Always use caution and common sense. *To reduce the risk of electrical shock, do not operate equipment with the cover removed.* Repairs must be performed by qualified service personnel only.

- Never install telephone jacks in a wet location unless the jack is designed for that location.
- Never touch uninsulated telephone wires or terminals unless the telephone line is disconnected at the network interface.
- Use caution when installing telephone lines and never install telephone wiring during an electrical storm.

FCC Part 68 Compliance

Connection of data communications equipment to the public telephone network is regulated by FCC Rules and Regulations. This equipment complies with Part 68 of these regulations which require all of the following.

All connections to the telephone network must be made using standard plugs and telephone company provided jacks or equivalent. Connection of this equipment to party lines and coin telephones is prohibited. A label on the back of the front panel of data communications equipment and on the underside or rear panel of other equipment provides the FCC Registration number and the Ringer Equivalence Number (REN) for the unit. If requested, give this information to the telephone company.

If the unit causes harm to the telephone network, the telephone company may discontinue your service temporarily and if possible, you will be notified in advance. If advance notice is not practical, you will be notified as soon as possible and will be advised of your right to file a complaint with the FCC. The telephone company may change its communication facilities, equipment, operations and procedures where reasonably required for operation. If so, the telephone company will notify you in writing. You must notify the telephone company before disconnecting equipment from 1.544 Mbps digital service. All repairs or modifications to the equipment must be performed by General DataComm. Any other repair or modification by a user voids the FCC registration and the warranty.

Canada DOC Notification

The Industry Canada label identifies certified equipment. This certification means that the equipment meets telecommunications network protective, operation and safety requirements as prescribed in the appropriate Terminal Equipment Technical Requirements document(s). The Department does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be coordinated by a representative designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

Caution: Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.

NOTICE: The Ringer Equivalence Number (REN) assigned to each terminal device provides an indication of the maximum number of terminals allowed to be connected to a telephone interface. The termination on an interface may consist of any combination of devices subject only to the requirement that the sum of the Ringer Equivalence Numbers of all the devices does not exceed 5.

Deutschland

Installations Anweisungen: Installieren Sie die Telefonleitungen nicht während eines Gewitters. Installieren Sie die Telefonleitungen nicht in einem feuchten Raum, auβer die Dose entspricht den Vorschriften für Feuchträume. Berühren Sie unisolierte Telefonleitungen oder Einrichtungen nicht, auβer diese sind vom Telefonnetz getrennt. Vorsicht bei der Installierung oder Änderung von Telefonleitungen. *Achtung:* Es gibt keine durch den Benutzer zu wartende Teile im Gerät. Wartung darf nur durch qualifiziertes Personal erfolgen.

United Kingdom

The 4WE&M is approved for all Rx base level gain pad settings up to +2dB. The 4WE&M is not approved for Rx base level gain pad settings above +2dB, and higher gain settings must not be selected for use within the United Kingdom.

Table of Contents

Preface

Scope

This manual describes how to install and configure a Transport Management System Compact (TMSC) and explains how to monitor and manage network devices. This documentation is written for operators and installers, and assumes a working knowledge of data communications equipment. In most cases in this manual references to controllers are to PC controllers.

Document Conventions

Note *Notes present special instructions, helpful hints or general rules.*

Caution *A caution indicates an operation that could cause instrument damage if precautions are not followed.*

Warning *A warning indicates an operation that could cause personal injury if precautions are not followed.*

Related Publications

The following documents have additional information that may be helpful when using this product:

GDC Number	Subject	Type of Manual
Marketing Document	Transport Management System	Product Portfolio
035R007-000	GPS-8A Power Supply	Instruction
035R009-000	GPS-8B Power Supply	Installation and Operation
036R304-000	TMS-3000 Technical Overview	Technical Overview
036R305-000	Quad Stat Mux Channel	Installation and Operation
036R340-000	OCM-2000, OCM-1000	Installation and Operation
036R452-000	Sync Status Module	Instruction
S-036R042-001	Sync Status Module with Enhancements	Addendum
036R475-000	VLBRV	Installation and Operation
036R477-000	T1-DS0	Installation and Operation
036R478-000	Digital Bridging Card	Installation and Operation
036R479-000	Turbo Data Channel	Installation and Operation
036R480-000	CELP Channel	Installation and Operation
036R483-000	Turbo Data Channel-2, -5	Installation and Operation
036R485-000	T1-FT1	Operating and Installation
036R602-nnn	Controller Procedures, MSO software	User
036R603-Vnnn	Controller Procedures, GTS software	User
036R610-000	TMS Maintenance Console	User

GDC publication numbers (e.g., GDC 032R163-000-03) are used to track and order technical manuals. Publication numbers use the following format:

GDC NNNRnnn-000-IS or GDC NNNRnnn-Vnnn-IS where NNN identifies the product family

R denotes a technical publication

nnn a number assigned by Technical Publications

000 identifies a hardware product and does not change

Vnnn designates software version associated with a product, which may be updated periodically. Note that in some earlier software manuals, the designation may be nnn.

IS The issue number of the manual (e.g., for issue 2 of a manual, IS is 02).

Note that the part number of earlier GDC manuals may not include the issue number.

The issue number on the title page changes only when a hardware manual is revised or when a manual is reprinted for some other reason; it does not automatically change when the software is updated. A new Software Version is always Issue 1. Other specialized publications such as Release Notes or Addenda may be available depending on the product.

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Chapter 1, Introduction

Overview

This chapter provides a general description of the TMS Compact (TMSC). Components of the TMSC, its various configurations and associated part numbers, its technical characteristics and features are described. Topics in this chapter include:

Note *The TMSC utilizes the following components in the main shelf. Note that the terms "Card" and "Module" are commonly used and interchanged in the field (and in this manual). For example, Redundancy Control Card and Redundancy Control Module refer to the same component.*

ACC (Aggregate Control Card)

ACM (ADPCM Compression Module)

CDA (Combined Digital Aggregate) Module

CIC (Channel Interface Card)

DBC (Digital Bridging Card)

ESCC (Enterprise System Control Card) or SCC (System Control Card)

IAC (ISDN Aggregate Control Card)

RCC (Redundancy Control Card)

Description

The TMS (Transport Management System) Compact is a multinodal and multiaggregate network multiplexer. The system is capable of multiplexing synchronous, asynchronous, isochronous, and anisochronous data. Voice-grade telephone signals are digitized using CVSD, PCM, ADPCM, ASP or VLBRV coding techniques and multiplexed through the system. By the use of advanced bit interleaved multiplexing techniques, channel data is combined into a synchronous aggregate serial data stream.

Several types of multiplexer nodes may be included in a TMS system:

- TMS-3000
- MEGAMUX PLUS
- TMS Compact (TMSC)
- OCM-2000 (a feeder multiplexer for a TMS-3000 network), also referred to as OCM*TMS

This manual describes the TMSC. A typical TMSC node with one Expansion Shelf is shown in *Figure 1-1* .

The TMSC is a scaled-down version of a TMS-3000 multiplexer node. Aggregate and channel capacities and shelf size have been reduced to provide a fully functional TMS node that is cost-efficient and conserves space taken up by equipment.

A TMS-3000 node and a TMSC node use the same set of printed circuit cards. The TMSC supports most TMS-3000 functions, and is end-to-end compatible with a TMS-3000 node, as well as the other TDM or TMS network nodes listed above.

Note *Associated software manuals are O36R602-nnn (mso software) and 036R603-Vnnn (gts software).*

MSO software is used in networks that use all SCCs or a mixture of SCCs and ESCCs. GTS software is used only in all ESCC networks.

*OCM*TMS information is found in GDC 036R340-000.*

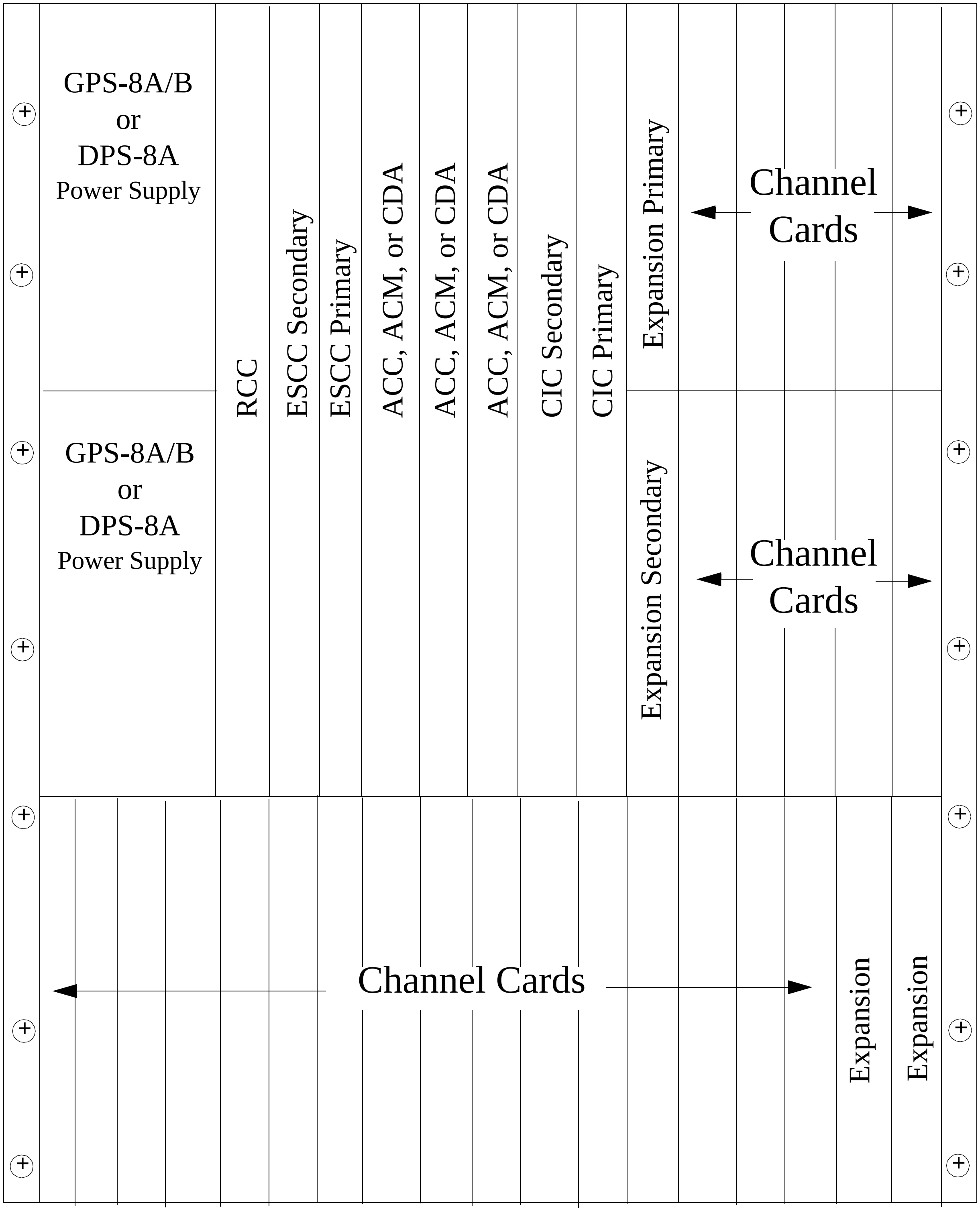


Figure 1-1 TMS Compact with One Expansion Shelf

Up to two aggregate trunks can be supported by a TMSC node. Each trunk requires one ACC, one CDA-T1, CDA-E1 or ACM Module in the TMSC shelf. A third ACC, ACM, CDA-T1 or CDA-E1 Module provides "1 of 2" redundant backup in a redundant system. A single Channel Interface Module provides the interface for up to 58 channels. In a redundant system, a second Channel Interface Module is included in the shelf for redundant backup.

A node with Channel Interface Modules only may be used as a local channel switch, where channel data is exchanged between local channels only, and is never multiplexed onto an aggregate trunk.

A typical node uses Aggregate Module(s) and Channel Interface Modules allowing local channel switching, aggregate switching, and multiplexing of local channel data across aggregate trunks to other network nodes. *Figure 1-2* illustrates a typical equipment configuration at a local TMSC node. Aggregate Modules can be either ACC, ACM, CDA-T1 or CDA-E1.

In a TMSC, the local node is generally configured as the Master Controller. In a multiple controller environment, only one master controller serves as the point of control for the entire network. All other controllers (referred to as slave or subordinates) serve as backups. The master controller's responsibility is to synchronize its data base (only for configuration data portion) with all subordinate controllers. The master controller can run diagnostics, modify configuration data (either on-line or off-line network), examine on-line network status, or activate download. From the subordinate controller, the user can modify off-line network configuration data. The TMSC supports up to 5 subordinate and one master controller. In a TMSC either the local (master) or subordinate node can be a source of timing for the network.

The TMSC can incorporate a Combined Digital Aggregate (CDA) Module that represents a dramatic change in operation and networking applications of the TMSC. The CDA Module allows the TMSC compatibility with the Digital Access Cross-connect System (DACS), while providing the capability to place the TMS channels onto a DS1 aggregate under a DS0 (byte-oriented) frame format.

A CDA-E1 Module (GDC Part No. 036M328-001) provides the TMSC with full duplex access to CCITT structured public networks at an aggregate rate of 2.048 Mbps. Specifically, the CDA-E1 provides the necessary framing, synchronization and alarm monitoring required by CCITT G.732 standards.

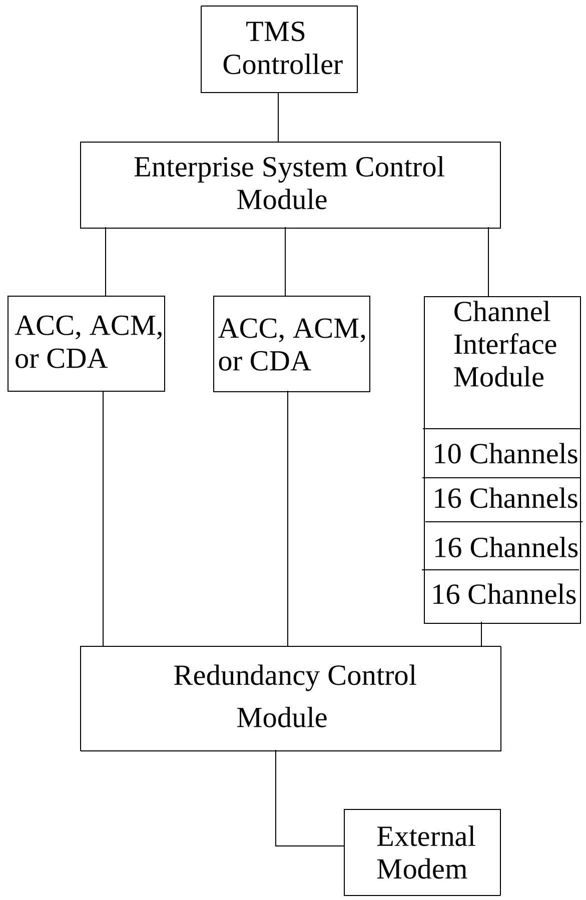


Figure 1-2 Typical TMSC Local Node Configuration

The CDA Module exchanges data with other ACC, ACM, CDA, or CIC modules in the TMSC Shelf through the TMSC fast bus. The CDA Module can be configured to operate as a redundant pair or nonredundant.

The TMS Controller is used to control and configure any TMS network, including those with TMSC nodes. The controller is connected to the "supervisory" port of the local node, and communicates with all network nodes through aggregate trunks.

Various network applications are available for the TMSC. In a large TMS network, a TMSC node may be used to provide network communications to a remote location with low channel and aggregate requirements. This application is illustrated by *Figure 1-3* .

A medium-size link between two locations may be supported by a point-to-point TMSC link, as shown in *Figure 1-4* . Either one or two aggregate trunks may connect this network. A medium-size delta network may also be supported using TMSC nodes. This application is shown in *Figure 1-5* .

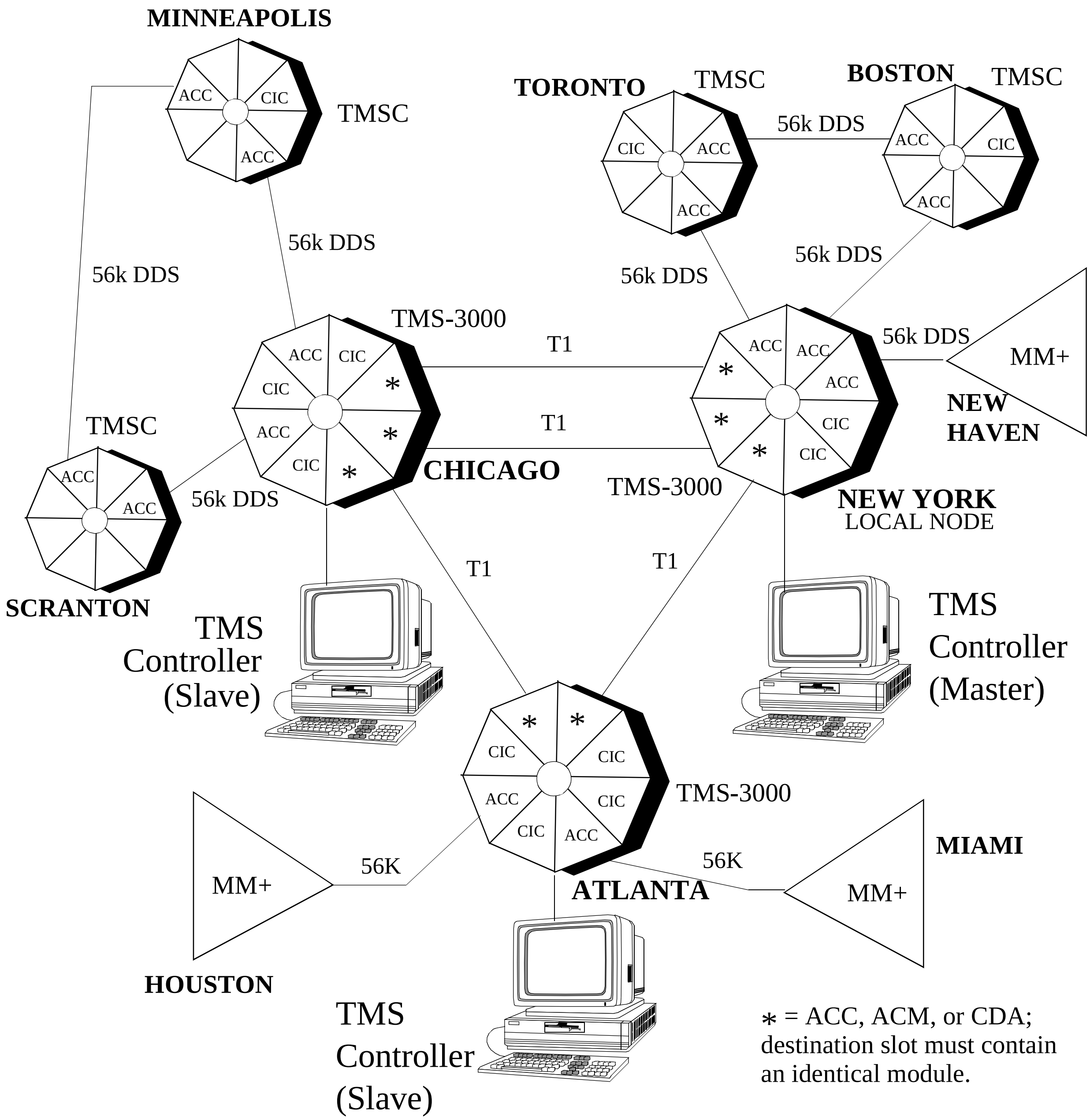


Figure 1-3 TMSC in a Large TMS Network

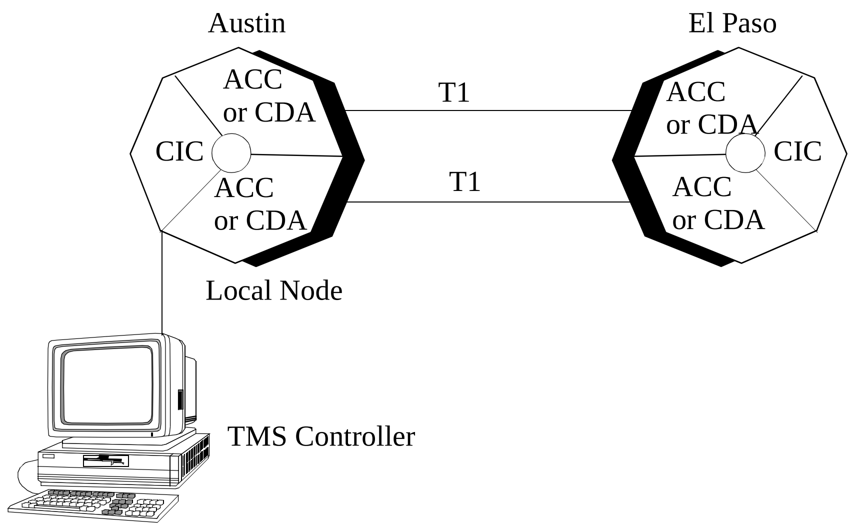


Figure 1-4 TMSC Nodes in a Point-to-Point Application

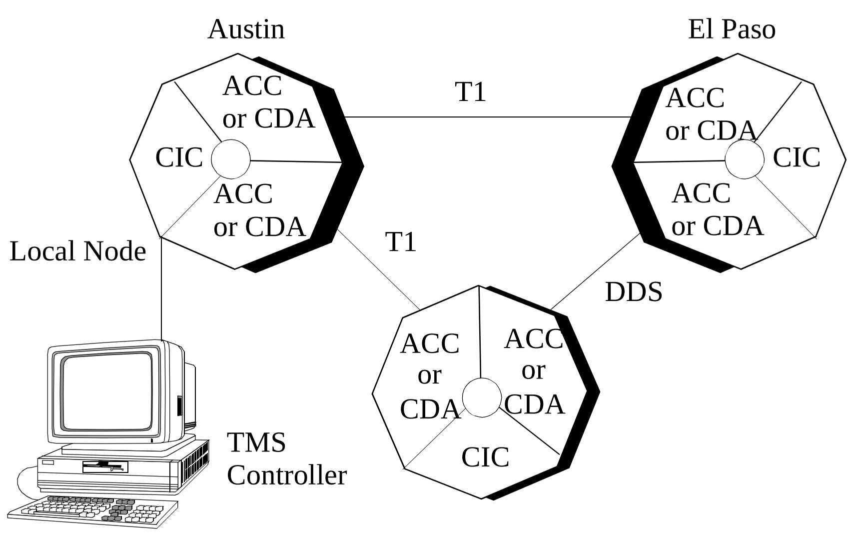


Figure 1-5 TMSC Nodes in a Delta Network Applicat

Programmed rerouting may be used to maintain the system during network failures. Aggregate disruption is automatically detected; the system can then implement a different network configuration which routes channels away from the failed aggregate.

The TMSC System is fully software driven. Redundancy is provided on all Common Modules (except the Redundancy Control Card) for greater system reliability.

TMS Controller

The TMS provides control of the system to an operator through a TMS Controller. The TMS Controller site is designated as the "Master" node; the operator at the controller site commands the following control capabilities:

- Configuration Control
- Status and Alarm Reporting
- Diagnostic Control

Software in the TMS allows the use of redundant (multiple) pc controllers. One node in the network is designated as the master controller site. The master pc controller communicates to the other "slave" controllers through software. The use of multiple controllers provides the capability to control a network from a remote location in the event a master site becomes isolated from the rest of the network.

At the other TMS sites, alarms are reported locally by front panel indicators and through the slave controllers.

The PC controller used with the TMS Compact system requires:

- A Model 486 or better computer containing a minimum of 5 Megabytes of RAM (*8 megabytes recommended*).
- One hard disk with a minimum of 80 megabytes of storage is required (*200 megabytes recommended*).
- If *not* using an ESDI, IDE (Intelligent Drive Electronics) computer, a copy of the list of bad tracks located on top of the hard disk drive (if your disk supplies such a list)
- One double-sided 1.44 Mb (3.5-inch) floppy drive

Specific setup procedures for various PC models are described later in this manual.

Note *GDC reserves the right to make hardware and software updates. We strongly recommended that you buy your controller as part of the TMS system. Otherwise forward compatibility cannot be guaranteed by GDC.*

TMS Compact Timing

Node Timing — There are 19 timing choices for each node. The master timing source can be derived from one of the 16 possible aggregate trunks, or it can be derived from the external timing connector J4 on the Main Harness Backplane. In the last case, the timing comes from an external source or through a channel. A special "Y" cable is required for this application. (see Chapter 4, “TMS Compact Node External Timing Connectors"). The internal clock of the ESCC/SCC can be used as the master timing source as well.

System timing is under software control and is software selectable. A backup timing configuration goes into effect if system timing is disrupted. Minimal data loss occurs when a backup timing configuration goes into effect.

Note *CDA node timing and Fast Clock Switch capabilities is available in MSO Version 2.0.4 (or higher) software.*

CDA Link Timing — Transmit timing for the CDA-T1 and CDA-E1 Module is configured through the TMS Controller software. Each CDA Module has two aggregate ports (Ports A and B) from which node timing can be derived. Several timing selections are possible for each CDA port. To select CDA provided node timing, the user must first select the link destination type. The possible link destination types are Remote CDA-T1 and CDA-E1, DACS Network, DTE device, and No Link. Next, the interface clocking and node clocking options are determined.

The interface clocking parameters selected provides the source of timing for aggregate data to be transmitted to the destination node. For a DACS network the interface clocking source is generally the DACS network with the System Control Module phase locking to link connected in the DACS. The CDA Transmit clock is configured as "Node." In selecting DTE device as link and destination, the previous interface clocking options can be selected.

Three CDA options that affect the Node Clocking must also be established. These options are:

- Self Clocking — The master clock provides timing for the entire node.
- Available — This CDA Module is allowed for use as a node timing source.
- Not Available — This CDA Module cannot be used for a node timing source.

The preference option allows the user to assign a specified priority number to each clocking option. Preference values range from 1 to 4.

For more information on CDA Node Clocking, please refer to the MEGAMUX TMS Controller User Guide, 036R602-nnn, Operation Manual for TMS-3000 Controller, GDC 036R603-Vnnn, or Technical Overview for TMS-3000, GDC 036R304-000.

Station Clock — The GDC Station Clock assembly can be used as a clock source for network timing. It is a shelf-based unit integrating multiple cards to provide a reliable network timing source for TMS and MEGAMUX PLUS. The Station Clock features redundant clock source input capability allowing the use of two separate master clock inputs (typically DDS) through a user-selectable interface which can be programmed for V.35, RS-422, or RS-423 standards. Typical use of the station clock assembly would be to provide master clock sources for multiplexers that are collocated.

Note *If you need to use a Station Clock with your system, contact your GDC sales representative for technical assistance.*

The Station Clock Facility is usually located at the Master Node. Its master reference source may be any two of the 56 kbps DDS circuits (or any other reference) entering the site. A timing reference signal is fed from the station clock assembly into the External Timing Connector (J18) of the TMS-3000, (J4) on TMSC. Dividing circuits on the SCC/ESCC use the reference to create the needed clocks. Multiplexers at all remote sites usually use the receive aggregate clock as their timing source. It may also be timed from station clock assemblies, as required.

System Components

A TMS Compact node is made up of several types of modules that function together as a TDM. These modules can be divided into three broad categories:

- Common Modules
- Channel Modules
- Power Supplies

Common Modules

TMS Compact Common Modules perform the multiplexing and demultiplexing of data. They also handle the control and support tasks of an individual TMS Compact node. The following are the Common Modules:

In the Main Shelf

- ADPCM Compression Module (ACM)
- Aggregate Control Card (ACC)
- Channel Interface Card (CIC)
- Combined Digital Aggregate (CDA) Module
- Redundancy Control Card (RCC)
- Enterprise System Control Card (ESCC) or System Control Card (SCC)

In the Main Shelf/Expansion Shelf

- Expansion Module

Note *MSO software is used in networks that use all SCCs or a mixture of SCCs and ESCCs. GTS software is used only in all ESCC networks.*

GDC recommends periodically testing the "out-of- service" modules in a TMS Compact that utilizes redundant common modules. In a TMS Compact, not all failures of the out-of-service module are detectable. Certain conditions may prevail, causing disruption of the network when that module is placed into service.

The ESCC/SCC sequentially selects one of the Channel Interface and two Aggregate Control or Combined Digital Aggregate (CDA) Modules to place data or control information onto the 16.896-MHz Common Equipment Bus. This bus contains the following information:

- The address of the Common Module that will receive the data or control information
- The address of the Channel Module which has been selected for communication
- Data, control, and synchronization information.

Channel Interface Card

The Channel Interface Card is the node interface for up to 58 local channel modules. It multiplexes and demultiplexes data from Channel Modules onto a high-speed 16.896-MHz Common Equipment Bus. This bus allows communication to all Common Modules and Channel Modules.

The Channel Interface Module is also responsible for frame calculation, channel control, and communication with the System Control and Redundancy Control Modules.

Aggregate Rates and special channel interface rates are covered in *Table 1-2* , *Table 1-3* , and *Table 1-3* respectively.

Aggregate Control Card

The Aggregate Control Module controls the transfer of data across an aggregate trunk to another TMS Compact, TMS-3000, MEGAMUX PLUS, or TDM 1258. Data can be derived from ACC, CDA, or Channel Interface Modules via the Common Equipment Bus, assembled into an aggregate frame, and transmitted across the aggregate trunk. Data received from the aggregate trunk is demultiplexed and distributed to either ACC, ACM, CIC, or CDA or Modules.

The Aggregate Control Module also performs the frame calculation from configuration data received from the System Control Module via the Communication Bus. It buffers the data coming in on the 16.896-MHz Common Equipment Bus (Fast Bus). This data is made to conform with the transmit framing ordered by the System Control Module. Overhead and frame sync bits are added, and then the data passes through the aggregate interface for transmission across the aggregate trunk.

The Receive section synchronizes to the frame sync bits so that channel data, channel control, and overhead bits can be sent to the correct channel destination via the Fast Bus and Channel Interface Modules.

The Aggregate Interface Plug-In Cards on the Aggregate Control Modules convert aggregate data to the signal standards required by a particular aggregate trunk. The Aggregate Interface Plug-In cards are listed below:

- EIA/TIA-232-E (CCITT V.24)
- CCITT V.35
- EIA RS-422/423 (MIL-STD-188-144) (CCITT V.10, V.11)
- T1 (For Non-ATT T1 Lines Only)
- CCITT G.703 64 kbps Codirectional
- CCITT G.703 64 kbps Contradirectional
- CCITT G.703 256 kbps (75-ohm or 120-ohm)
- CCITT G.703 2.048 Mbps (75-ohm or 120-ohm)
- T1/D4 (1.544 Mbps)
- T1/D4E (1.544 Mbps)
- CCITT G.704 2.048 Mbps (75-ohm or 120-ohm)

G.704 Aggregate Interface Piggyback Card

The G.704 Aggregate Interface is a piggyback card that mounts onto the Aggregate Control Module allowing connection to a CCITT G.704/G.703 aggregate link. Its main purpose is to add CCITT framing to the GDC proprietary framing format used on aggregate links. This causes a reduction in the aggregate bandwidth from 2.048 Mbps to N x 64 kbps (where N is a value from 1 to 31) or 64 kbps to 1.984 Mbps.

The G.704 Aggregate Interface Piggyback Card also features G.703 electrical/timing compatibility at 2.048 Mbps, G.823 input jitter/tolerance attenuation, HDB3 encoding, optional 75/120 ohm line impedance, and the ability to generate CRC4 multiframes including the CRC4 bits.

Elastic buffers provide the slip rate objectives of G.822 for terrestrial (plesiochronous data) and satellite links (plesiochronous or synchronous data). These buffers are introduced into the transmit and receive data streams to smooth out the effects of jitter and wander.

The G.704 Aggregate Interface Piggyback Card reports alarms for these conditions: Carrier Detect, Local Out-of-Sync, and Remote Out-of-Sync.

A switch option provides 120 ohm balanced or 75 ohm unbalanced termination impedance as per G.703 specifications. The card also provides N x 64 kbps subaggregate data rates, where N is a value from 1 to 31.

Since the N x 64 kbps subaggregate data rate characteristically has some jitter and Aggregate Control Modules cannot tolerate more than a few bits of jitter, the G.704 Aggregate Interface Piggyback contains a variable depth elastic buffer in the transmit and receive data paths. These buffers smooth out the data flow between the Aggregate Control Module and the G.704 Aggregate Interface Piggyback Card.

Several buffering modes are used for different applications. They are Plesiochronous Mode (Satellite), Plesiochronous Mode (Terrestrial), and Synchronous mode.

In the Plesiochronous Mode (Terrestrial), clocks at either end of an aggregate link are synchronized by two different master clock sources.

In the Plesiochronous (Satellite) Mode, clocks at either end of satellite link may or may not be locked. A satellite diurnal shift shows up as wander (up to ±2000 bits within a 12 hour period) and can be compensated by the plesiochronous buffers on the G.704 Aggregate Interface Piggyback Card.

Note *Because of the requirement that the plesiochronous interface in both directions shall lie in the same node, a plesiochronous buffer is inserted in both the transmit and receive directions. Only one end of the aggregate link should be placed in the plesiochronous mode by software. The other end should be in the synchronous mode. Otherwise, frequent buffer crashes may occur because the aggregate link does not have a master clock.*

In the Synchronous Mode, both ends of the aggregate link have their transmit and receive clock synchronized to the same master clock. Therefore, no long-term slippage of the phase clock phases occurs. The elastic buffers reduce the amount of jitter that may be associated with the N x 64 kbps data.

Three alarm conditions are reported by the G.704 Aggregate Interface Piggyback Card to the Aggregate Control Module.

- Local Out of Sync — The G.704 receiver is out of sync. It does not reflect the state of the mux frame. It indicates to the Aggregate Control Module that the Aggregate Interface Piggyback is searching for G.704 frame sync.
- Remote Out of Sync — The G.704 receiver at the remote end is out of G.704 frame sync. It does not reflect the state of the mux frame. It indicates to the Aggregate Control Module that the Aggregate Interface Piggyback is searching for G.704 frame sync.
- Carrier Detect — Carrier fail status occurs if approximately 200 consecutive bit times occur with no signal received on the aggregate.

CDA-T1 Module

The CDA-T1 Module is used to interface between the public T1 network and a TMS Compact network. The module provides two ports that enable interfacing with a DACS, a D4 device (such as a channel bank or digital PBX), or an internodal trunk with a CDA-T1 Module at another TMS Compact node. The CDA-T1 contains a DS1 interface for domestic applications.

The CDA-T1 Module introduces several important features to the TMS Compact:

• Converts TMS Compact bit-oriented aggregate stream into a byte format. The converted bytes are transferred as DS0 channels through the CDA-T1 Module's DS1 ports.

• Transfers byte-oriented DS0 channels between two DS1 ports on a CDA-T1 Module.

• Receives DS0 channels containing TMS Compact channel data and converts the DS0-formatted bytes to a bit format. The TMS Compact channels are then transferred to Aggregate Control or Channel Interface Modules at a TMS Compact node.

• Synchronizes to DS1 data streams at each DS1 port.

• Transfers byte-oriented DS0 channels via the Fast Bus to the other CDA-T1 modules.

The CDA communicates with the ESCC or SCC as though it were a normal Aggregate Control Module. The TMS Controller provides configuration, diagnostic, and alarm reporting for the CDA.

The CDA Module is link independent and flexible for new link formats. Adding a G.732 plug-in piggyback card onto the CDA base card (referred to as the CDA-E1 Module) allows the CDA Module to be used on CCITT networks at rates up to 2.048 Mbps.

A CDA Module can be backed up by a redundant CDA Module. A redundant CDA pair occupies one primary/secondary pair of module slots in the TMS Compact common shelf. A fully equipped TMS Compact contains up to 16 CDA Modules.

Switchover of a redundant CDA Module is under the control of the Redundancy Control Module. The redundant CDA Module is placed in service upon detection of a failure. In the event of an aggregate link failure, software determines alternate routing of channels around the failed link. This eliminates a situation where restoral is prolonged by attempting to switch secondary CDA modules in and out of service.

CDA-E1 Module

The CDA-E1 Module provides the TMS Compact with full duplex access to CCITT structured public networks at 2.048 Mbps. Specifically, the CDA-E1 Module provides the necessary framing, synchronization and alarm monitoring required by CCITT G.732 standards.

The CDA-E1 Module interfaces and accepts data from the CDA basecard in the form of 64 kbps timeslots. It monitors the signaling information appended to each timeslot and forms an additional timeslot (TS 16). Data is then framed into the structured format specified by CCITT G.704, and transmitted onto an E1 line at 2.048 Mbps. Conversely, the I/O card receives data from the E1 line, effects synchronization with this data and frames it into 64 kbps timeslots.

Additionally, the CDA-E1 Module monitors alarm conditions and performs CRC error checking in accordance with CCITT G.704. Timeslot 16 (in the frame) is disassembled into signaling information and appended to the remaining timeslots, which are sent to the CDA basecard.

The CDA-E1 Module operates on either a 120-ohm balanced or 75-ohm unbalanced line termination impedance. The card features local and remote loopback diagnostic capability, clock selection for data trans-mission and alarm detection circuitry. In addition, the card generates Cyclic Redundancy Check (CRC) and Channel Associated Signaling (CAS) multiframes.

Refer to Chapter 3, Principles of Operation for more information on the CDA-E1 Module.

ADPCM Module (ACM)

The ADPCM Common Module (ACM) provides the means for a single DS1 (E1) line, containing 24 (30) PCM voice circuits, to be brought into the TMS Compact and compressed via GDC ADPCM compression techniques. After compression, these circuits are transported across an aggregate via an Aggregate Control Module or framed into a TMS Compact subaggregate, in bit format, of a CDA Module.

The termination of the voice circuit can occur on a GDC Universal Voice Card (UVC), via a Channel Interface Module, MEGAMUX Plus, or Minimux. Also, it can be terminated via another ACM, on a Digital PBX. Optionally, 30 PCM voice channels can be accommodated by making use of the CCITT version of the card (ACM/E1).

The ACM Module mounts in the main shelf (similar to an Aggregate Control or CDA Module).

The use of the ACM allows the compression of multiple voice channels which affords a substantial bandwidth savings over 64K PCM. This bandwidth savings can be utilized for transporting data traffic on the same T1 pipe that previously carried voice alone.

Furthermore, during disaster recovery and fallback, and through the use of Intelligent Automatic Re-routing (IAR), the ADPCM voice channels can be compressed further, to occupy even less bandwidth, thus allowing more circuits to remain active. A digital PBX, can now be transported via the TMS Compact and terminated at an analog PBX.

The ACM also allows the GDC UVC cards to be converted to public network compatibility, (byte oriented, 64 kbps PCM).

The ACM also has pass-through channel capability which allows any or all channels to be passed unmodified (800 Hz overhead still required) through the module. This feature allows data (clear) or uncompressed voice to be passed by the ACM. This allows for signaling information (CCS) to be transported via any timeslot.

TMS Compact Compatibility

The ACM can exchange bit formatted channel data with Aggregate Control, Channel Interface, or CDA Modules but is not end to end compatible across an aggregate trunk with any other common module. The ACM will not exchange byte (or nibble) formatted data with CDA modules. There are several reasons for this:

The CDA uses byte-oriented channels for transporting network DS0's (64 kbps) across the backplane. In the case of the ACM, this translates to 64 kbps PCM channels. The ACM utilizes a proprietary bit format for exchange with the ACC, CIC or TMS circuits on the CDA.

Byte-oriented channels reduce backplane bandwidth. The ACM uses only one backplane select when 30-32 kbps ADPCM channels are configured. This format also allows network compatible 64 kbps voice circuits with the ACM by making use of an external cable.

The ACM does not internally perform any echo cancellation functions, either bulk or per channel. If this feature is desired by the customer an external bulk echo cancellation module can be supplied by GDC through a third party vendor. This module should be connected between the ACM port and the DPBX, channel bank, or public network.

More information on ACM applications, signaling and conditioning can be found in Appendix D.

Enterprise System Control Card

The TMS-3000 Enterprise System Control Card (ESCC) is a printed circuit board assembly that is installed in a TMS-3000 shelf to monitor and control the activities of all the other cards and modules in that shelf.

The ESCC is responsible for the following functions:

1. Permanent storage of software programs for all of the common cards in the entire TMS-3000 network [Aggregate Control Card (ACC), Combined Digital Aggregate (CDA) card, Channel Interface Card (CIC), Digital Bridging Card (DBC), ADPCM Compression Module (ACM), ISDN Aggregate Card (IAC) and the Office Communications Manager System (OCM 2000)]. The ESCC also stores configuration information for the local TMS-3000 node.

2. Communications with the TMS-3000 Controller if locally connected.

   Communications with other ESCCs in neighboring TMS-3000 and TMSC nodes in the TMS-3000 network and with SCCs in MEGAMUX TMS nodes in mixed networks.

   Communications within the node with all common and channel cards and with the redundant ESCC.

   Information transferred includes: common card program's download (during software upgrade procedure), alarms, status and configuration.

3. Control of all customer data traffic between common cards within the TMS-3000 node and control of all block mode transfers within the TMS-3000 node between TMS Packet Processor Modules (TPP). All customer data is transferred via the TMS Microcell Backplane.

4. Generation of timing information for use within the local node and transfer of network timing between nodes.

5. The ESCC is compliant with the Stratum 4 Enhanced Level Clocking specification as defined by AT&T Tech. Ref. 62411. A reference clock can be accepted from any common card in the node or the external timing port. The ESCC phase locks to the reference and provides a stable timing output for use by all aggregates and channels. Additionally, a stable 512K output reference clock is provided to allow timing transference to adjacent nodes or other equipment.

6. Control of the redundancy of the common cards in the local node is performed by the ESCC's commands to the Redundancy Control Card (RCC). Based on the alarm information received from the local common cards, the ESCC can decide to activate the standby card of any of the eight redundant pairs. This is done via a command sent from the ESCC to the RCC to perform the redundant switch.
7. Control of the answer-only 212A modem located on early versions of the RCC or control of an external modem. This modem can be used to remotely connect a TMS-3000 Controller to the node.

Compatibility

The ESCC is compatible with all MEGAMUX TMS and TMS-3000 products. Any TMS node using the ESCC must also use an ESCC, not a SCC as backup, if desired. But, SCC and ESCC TMS nodes may be used within the same network.

The ESCC supports all current TMS diagnostic features.

System Control Module

This module monitors and controls the activities of all other modules in the local node. Control and configuration information is downloaded from the TMS Controller at the master site to the ESCC/SCC at each TMS Compact node.

Control and framing information is then exchanged locally between the System Control Module and the Aggregate Control, Channel Interface, and CDA Modules via the Communication Bus.

Control and status information is exchanged between the System Control Module, Channel Interface Modules, and CDA Modules via the 16.896 MHz Common Equipment Bus or Fast Bus. The System Control Module has an Enable/Disable Switch located on the front panel.

When the switch is in the disabled position, the System Control Module may be temporarily removed from the expansion shelf without disrupting the memory contents containing control and configuration information.

The System Control Module controls an answer-only domestic 212A Modem located on early versions of the Redundancy Control Module. The System Control Module can switch to an external modem, bypassing the on-board modem.

Redundancy Control Module

The Redundancy Control Module switches from one module of a redundant pair to the other. In a redundant system, this is the only module without a twin in the main shelf. All other common modules are connected in series with an identical module that is on stand-by in case the primary module goes out of service.

The microprocessor on the ESCC/SCC monitors the alarm conditions of the Common Modules. If conditions merit a switch, the ESCC/SCC orders the Redundancy Control Module to switch. The nine pairs of redundant modules can be switched individually or in combination.

Hardware on the Redundancy Control Module monitors the ESCC/SCC and will make the redundant switch if the ESCC/SCC goes out of service.

Early versions of the Redundancy Control Module have an on-board domestic 212A modem. This port is a two-wire telephone connection controlled by the ESCC/SCC which auto-answers incoming calls. Data transfers are 1200 bps full duplex in the answer mode only. The 212A Modem is for domestic use. For international or higher speed applications use the external modem port. The 212A modem provides full-duplex asynchronous data communications over the standard telephone company lines at 1200 bps and is compatible with other 212A-type modems operating at 1200 bps. The modem is used for the dial backup and supervisory pass-through functions.

The modem can automatically answer incoming telephone calls and has two diagnostic tests (local loopback and remote loopback) to assist in isolating problems in the data communication system. These are software selected through the TMS Controller.

The purpose of this modem is to enable communication between a remote node and the TMS Controller after an aggregate trunk failure has isolated the node.

Expansion Module

The Expansion Module serves as the interface between the Expansion Shelf and the Channel Interface Module. By means of jumper selections on the Expansion Module, a shelf address may be assigned to each Expansion Shelf linked to a particular Channel Interface Module.

Channel Modules

The following describes the data and voice channel modules available for use in the TMSC.

Data Channel Modules

This module provides the channel interface for data multiplexed by the TMS Compact. The module is controlled by the Channel Interface Module and can be programmed to accept any of the following types of data:

- Synchronous
- Asynchronous
- Isochronous
- Anisochronous (data transition-encoded according to CCITT R.111 standards)

Data rates for the channel are programmable. See Appendix A. The Data Channel Module may be set to operate according to any of the following interfaces:

• EIA/TIA-232-E • MIL-STD-188-144

• EIA RS-422/423 • CCITT V.25

Normally all interface control signals are at EIA/TIA-232-E levels unless modified by an adapter. Channel adapters are available to extend the interface characteristics of the Data Channel module. An RS-422/423 adapter supplies control signals at EIA RS-422 or 423 levels (the Data Channel module supplies only data and timing signals at those levels). A digital line driver adapter is available. These adapters mount in a CP-12 shelf, which attaches to the back of the MEGAMUX PLUS or TMS Compact Shelves.

Note *There are several versions of the Data Channel Module that are available for the TMS-3000. One version is identified as the Data II Channel Module, the second version is the Data III Channel Module, the third version is the Data IV Channel Module, and the fourth version is the Universal Data Channel (UDC) Module. The UDC Module replaces the existing Data II, III, and IV Channel Modules. A fifth type, based on the UDC, is the G.703 Data Channel.*

In most respects, all versions operate identically. The difference is that the Data III Channel Module supports multi-drop polling applications, while the Data II Channel module, without a polling piggyback card, does not. The Data IV and UDC modules contain a special Sync LSI chip that prevents lockup situations that can occur when using either card in multi-drop polling applications. In addition, the Data IV and UDC modules contain several options that are configured through software. The G.703 Data Channel supports 64 KHz, 128 KHz, or 256 KHz co-directional interfaces, the rate depending on the version of the card (s) installed in your system. A list of all channel rates is shown in Appendix A.

As mentioned earlier, there are two basic data channel modules available for OCM-2000, the single circuit and dual circuit versions. Additionally, for the OCM, an X.50 Data Channel card is available which supports up to four circuits per card and has the capability of terminating X.50 type circuits. The X.50 format is an ITU-T multiplex standard for a gross bit rate of 64 KHz. For additional information about the OCM hardware, refer to GDC 036R340-000.

Throughout this manual, all versions are implied when the Data Channel module is discussed. A detailed explanation of the differences between modules is given where applicable.

The Data Channel Module accepts up to four input control signals from a channel device and transmits the states of these signals to the remote channel module where they are applied to the channel device as output control signals. The off-to-on transition of one of these signals may be transmitted as an in-band control, permitting rapid channel turnaround for polling and other channel applications.

The Data Channel Module may be set to exhibit the interface characteristics of data terminal equipment (DTE) for interface connections to data communication equipment (DCE), or may be set to exhibit the interface characteristics of data communication equipment for interface connections to data terminal equipment.

Hyper Plug-In Card

In the TMS-3000, the Hyper Plug-In Card option allows data channels to operate error free in the presence of up to 32 bits of frame jitter. This feature extends the receive buffer up to 64 bits. Frame jitter can occur on high speed (384 Kbps or greater) data channels when more than one common card frame is “intermixed” by a CIC receive FIFO.

The Hyper Plug-In Card is a plug-in option and mounts onto a Data III Channel, Data IV Channel or Universal Data Channel (UDC) Module.

The Hyper Plug-In Card is recommended for the following application:

- When a CIC is configured for a Data Channel of 384 Kbps (or greater) and more than one common card (ACC, CIC, ACM, or CDA Module) has channels terminating on the CIC. Additionally, the CIC must be terminating low speed channels (≤19.2 Kbps).

If an application exists for a Hyper Plug-In Card on a circuit which is configured between two TMS-3000s, a Hyper Plug-In Card should be installed on the Data III Channel, Data IV Channel, or UDC Module at both ends.

TID-III Data Channel Module

The TID-III (Time-Independent Data) Channel Module allows true isochronous/ plesiochronous data communication in a TMS Compact. The TID-III Data Channel Module accepts RS-422 data and clock inputs at any one of 18 standard rates from 1.0 kbps to 1.024 Mbps. The TID-III can be programmed to accommodate special rates or to automatically track variable rate input clocks up to a specified maximum.

The TID-III Data Channel Module utilizes both RS-422 clock and data inputs. These inputs are time dependent from the multiplexer timing. The isochronous/plesiochronous data is converted to the next higher TDM synchronous data rate. Time-independent data is then recovered at the remote end of the link and the appropriate clock is generated by a numerically controlled oscillator (NCO) for output of data.

The TID-III Data Channel Module consists of three pc boards. The transmitter board consists of an RS-422 interface, a logic interface circuit, control and status circuits, buffers, and front panel status indicators. The receiver board contains a data correlator, FIFO buffers, and data accumulator circuits. The numerically controlled oscillator (NCO) is a piggyback mounted on the receiver board. The NCO's function is to generate the appropriate clock for data output. The TID-III Data Channel Module mounts into the expansion shelf cabinet.

When installed in two TMS Compacts, the TID-III Data Channel Module pair establish a full-duplex data link between corresponding TMS sites.

TID-III Data Channel Modules may be installed at both ends of the link or, alternately, a TID-III Data Channel Module may be on one end of a link with either a TID I (ECH-11) or TID-II (ECH-12) Data Channel Module installed on the remote end. A TID-I or TID-II Data Channel Module is available for the TDM 1257/1258 and interfaces to a TID-III Data Channel Module through a TMS Compact.

The TID-III Data Channel Module is equipped with an automatic alarm detector which provides a front panel indication of alarm conditions should a malfunction occur.

The TID-III Data Channel Module provides five modes of operation. Modes 1 through 3 provide data bit delay, external receive clock timing, and allow tracking of varying input frequencies. Mode 4 emulates the operation of an ECH-11 channel. An automatic mode of operation (Mode 5) allows a TDM rate to be selected, and a channel tracks this rate within the range of 200 bps to 1.024 Mbps.

The TID-III Data Channel Module is configured through the TMS Controller. A user control interface is consistent with other TMS Compact channels for control and status display screens. A TID control/status screen, comparable to other existing channel screens, is provided. Miscellaneous tests for the TID-III Data Channel Module are available.

In addition, the TID-III Data Channel Module screen will include protected fields, conditional and otherwise, that may be necessary to prevent misconfiguration.

Voice Channel Modules

The following describes the voice channel modules available for use in the TMSC.

Voice II Channel Modules

The Voice II Channel modules convert voice grade telephone signals to synchronous data which are multiplexed to the remote site and reconstructed as voice signals.

Three types of Voice Channel modules may be used with the TMS Compact system. These are defined as follows.

Voice II/CVSD Channel Module

This module converts voice grade telephone signals to synchronous data, which is multiplexed to the remote site and converted back to a voice signal. The continuously-variable-slope delta (CVSD) modulation technique is used for the voice-to-data conversion process. Input and output amplitudes for the module are selectable.

Data rates are selectable from 14.4 kbps to 64.0 kbps. Voice quality improves as the data rate increases.

The module also supports all types of 4-wire E and M signaling. E-Lead states (idle or busy) for loss of synchronization or power may be selected.

Voice II/ASP Channel Module

The ASP (Advanced Speech Processing) module can give quality voice reproduction while using only 16.8 kbps of aggregate bandwidth.

The data rate for the Voice II/ASP Channel Module is selectable at either 16 kbps in the ASP mode or 64 kbps in the PCM mode. 16.8 kbps and 64.8 kbps, respectively, of aggregate bandwidth are required to allow for signaling and overhead requirements. A multirate ASP card is available for the TMS Compact.

Universal Voice Card

The Analog Universal Voice Card configures the TMS to provide full-duplex voice communication capabilities. By using certain configurations of the Universal Voice card, Pulse Code Modulation (PCM) and Adaptive Differential Pulse Code Modulation (ADPCM) can be provided. The Universal Voice Card configurations are compatible with PCM and ADPCM cards currently in use. The card connects to the backplane of the TMS Compact Channel Expansion shelf through dual 28-pin card edge fingers.

- Universal Voice Card (GDC P/N 036P265-002) — This card provides PCM voice encoding at a data rate of 64 kbps.
- Universal Voice Card (GDC P/N 036P265-003) — This card provides ADPCM voice encoding at software controlled variable data rates of 16 kbps, 24 kbps, or 32 kbps with a PCM fallback mode (PCM-T) at a 64 kbps rate.

Echo Canceller

The Echo Canceller Piggyback Card (GDC P/N 036P270-001) mounts on the Universal Voice Card/PCM (GDC P/N 036P265-002) or the Universal Voice Card/ADPCM (GDC P/N 036P265-003).

If a significant round trip time delay (40 ms or more) occurs between the two ends of a line (caused by a long terrestrial line or a satellite link), an echo results which interferes with normal voice conversation. This echo may be eliminated by installing an Echo Canceller Piggyback Card on the Universal Voice Card located at each end of the system.

The design of the Echo Canceller is based upon an adaptive digital filter that attempts to model the impulse response of the analog path through the external hybrid circuitry. By passing speech from the far end of the line through this filter, the Echo Canceller is able to generate a "synthetic echo" which is subtracted from the actual echo. In this manner, the actual echo is cancelled.

CELP Module

The CELP Channel Module furnishes CELP (Codebook Excited Linear Prediction) voice encoding algorithms to make the most of voice channel bandwidth. The voice is compressed at rates of 4.8 Kbps, 6.4 Kbps, or 9.6 Kbps.

The CELP consists of base and piggyback cards. The base card converts four-wire analog voice to 64 Kbps synchronous data. The piggyback card uses CELP technology to compress the 64 Kbps data to 4.8 Kbps, 6.4 Kbps, or 9.6 Kbps. An adaptive digital echo canceller removes 8-millisecond near-end echoes.

The Operating and Installation Instructions for the CELP module are covered in detail in *GDC 036R480-000*.

VLBRV Module

An additional analog voice channel card is available for the TMS Compact. The VLBRV (Very Low Bit Rate Voice/FAX) Module provides voice encoding algorithms that maximize voice channel bandwidth utilization while offering low bit rate values of 9.6, 4.8 and 2.4 kbps.

The VLBRV Module's primary use is in satellite transmission applications to maximize available bandwidth. Other applications include use in digital services such as ASDS (FT-1), ADN and in feeder applications in which a customer needs to integrate both voice and data into a single DS0.

The VLBRV consists of two pc cards: a base card and piggyback card. Voice data is first processed on the base card and sent through the multiplexer network by an analog-to-digital conversion to yield a 64 kbps data rate. This data is then converted to a low bit channel rate through software on the piggyback card.

The standard bit rate is 9.6 kbps with fallback frequencies of 4.8 and 2.4 kbps. An echo canceller feature is provided for any large inherent delays involved in the digital signal processing of the voice channel. Only 2-state E&M and In-band signaling is supported. No overhead bandwidth data will be required through the multiplexer network.

The VLBRV Module offers an option that allows CCITT G3 FAX signals to be transmitted at a data rate of 9600 bps, 4800 bps or 2400 bps.

The VLBRV Module mounts into the TMS Compact channel shelf. The module connects to the telephone line via a 600-ohm 4-wire interface and standard voice channel connection cables.

Sync Status Module

The Sync Status Module (SSM) functions with high security TDM systems that employ cryptographic equipment to scramble aggregate data. The SSM accepts an input to report the synchronization status of scrambled aggregate data and transmits a TDM synchronization status output signal to the cryptographic equipment.

The SSM also supports dial backup applications of diverse ACC links and distinct ACC links. It senses an out of sync condition of the primary ACC link and uses its output signal to connect the backup link.

For additional information on the SSM, refer to GDC 036R452-000 and GDC S-036R042-001.

Power Supplies

The power supplies for the TMS are modular and may be removed from their mounting shelves without disconnecting power cables.

Two modules supply sufficient power for one fully redundant TMSC Main Shelf. Additional power supplies may be necessary to provide power for channel expansion shelves, depending on the types of channel modules installed in the shelf.

See your configuration package for exact configuration specifications. If your configuration uses many ACC or CDA Modules, you may need more power supplies.

The GPS-8A and GPS-8B power supplies work with ac supply power; the DPS-8A works with 48-volt dc supply power. Each is described below.

Note *TMSC units provided by General DataComm Ltd. in the United Kingdom may use other power supplies. If your TMSC is supplied through General DataComm Ltd., contact your area manager for details on your power supply.*

GPS-8A

Different GPS-8A models are available for three different ac line voltages.

- GPS-8A — 100/117 V ac
- GPS-8AE — 220 V ac
- GPS-8AU — 240 V ac

For more technical characteristics *refer to the Instruction Manual for GDC GPS-8A, GDC 035R007-000*.

GPS-8B

The GPS-8B is a universal input unit. The ac power cord uses an international color-coded ac line cord terminated in a UL/CSA approved molded three-prong USA type plug.

For more technical characteristics refer to the Installation and Operation manual for GDC GPS-8B, GDC 035R009-000.

DPS-8A

The DPS-8A uses 48-volt dc supply power for TMSC sites with dc battery power available.

Expansion Shelves

The TMS Compact contains one shelf consisting of ten voice or data channel cards. Additional expansion shelves can be added to increase the voice and data channel capacity of the TMS Compact.

The TMS Compact allows up to three additional expansion shelves by utilizing separate EP-4 or EP2T cabinets. These shelves are attached to the main shelf with ribbon cables or Flex Cards. Information on expansion shelf configurations is provided in Chapter 4, Installation.

Flex Cards

Flex Cards represent an enhancement to the TMSC. Flex Cards serve to connect expansion shelves together, eliminating the ribbon cables previously used. Several advantages are gained when incorporating the Flex Cards:

- Enhanced signal quality when using multiple shelves
- Easier installation and removal
- Improved reliability
- Improved access to the channel module EIA connector

The main shelf is still attached to the first expansion shelf by two ribbon cables. The lengths and number of connectors on each flex card are different to accommodate the number of expansion shelves configured for each channel group.

Redundancy

Redundant TMSCs guard against system failures. Different aspects of redundancy protect the system from potential malfunctions.

Common Card Redundancy

In a redundant TMS Compact node, primary and secondary Channel Interface, Aggregate Control, CDA, and System Control Modules can be supplied in the system. The ESCC/SCC monitors the TMS Compact. If a major alarm condition occurs the System Control Module signals the Redundancy Control Module to switch between primary and secondary modules until system operation is restored. Minimal data loss occurs during a redundant switchover.

One-of-Two Aggregate Control Redundancy

A TMS Compact node has adjacent slots reserved for three Aggregate Control, ACM, or CDA, or Modules. The left and right modules are primary modules, and are normally "in service" The middle module serves as a secondary or backup module.

In a three ACC configuration, one of the two Aggregate Control Modules is designated as the "priority" module; the designation is made in the node configuration entered through the TMS Controller. During normal operation, the backup Aggregate Control, Module contains the same configuration as the priority module. If the priority Aggregate fails, the backup Aggregate Control switches into service immediately, replacing the priority Aggregate Control Module.

If the nonpriority Aggregate Control Module fails, the System Control Module must download the configuration of the nonpriority aggregate to the backup Aggregate Control Module. Once the configuration is downloaded, the backup Aggregate Control Module switches into service, replacing the failed nonpriority Aggregate Control Module.

The priority Aggregate Control Module always has first access to the backup Aggregate Control Module. Once the priority module fails, the nonpriority aggregate has no access to the backup module.

If the backup Aggregate Control goes into service to replace the non-priority Aggregate Control Module, and the priority module fails, the configuration of the priority Aggregate Control Module is downloaded to the backup module. The backup module then goes into service to replace the failed priority module.

One-of-Two Redundancy/Non-redundancy, ACM, and CDA

The CDA or ACM Module can be configured as either non-redundant or one-of-two redundancy. The center backup slot can be used in conjunction with primary slot #1 to create a redundant pair of CDAs or ACMs. The remaining slot (primary #3) can be configured as a nonredundant ACC, CDA, or ACM. Optionally, both primary slots can be configured as nonredundant ACC, CDA, or ACM modules with the backup slot left empty.

The ACC can be configured as one-of-two redundant by using either primary slot #1 or #3 in conjunction with the center backup slot. The remaining primary slot can be configured as a nonredundant ACC, CDA, or ACM Module.

Power Supply Redundancy

GPS-8A/B power supplies may be used in a redundant configuration, so that one power supply takes over if another fails. One power supply may be removed from the TMS Compact shelf without disrupting the system. Power supply failures are reported as an alarm condition.

Configuration

The TMS Compact is configured from the TMS Controller. Each channel is entered in the configuration with the channel types, operating parameters specific to each channel type, and channel control information. The TMS controller and software may be used to configure most node types, including the TMS Compact.

All the standard aggregate data rates available are listed in *Table 1-1* .

For the details of software configuration for the TMSC, refer to GDC 036R602-nnn for mso software and GDC 036R603-Vnnn for gts software.

Table 1-1 Aggregate Data Rates

T1/D4 or T1/D4/E	T1	CCITT 2.048 M	64-kHz contra-dir	64-kHz co-dir	CCITT V.35	BELL 303	MIL 188-114	EIA/TIA-232-E	RS-422 (V.11)	RS-423 (V.10)
1.536 M	1.544 M	2.048 M	64.00 K	64.00 K	4.8 K	19.2 K	4.8 K	4.8 K	4.8 K	4.8 K
					6.4 K	50.0 K	6.4 K	6.4 K	6.4 K	6.4 K
1.472 M*					7.2 K	230.4 K	7.2 K	7.2 K	7.2 K	7.2 K
					8.0 K	460.8 K	8.0 K	8.0 K	8.0 K	8.0 K
					9.6 K		9.6 K	9.6 K	9.6 K	9.6 K
					12.0 K		12.0 K	12.0 K	12.0 K	12.0 K
					14.0 K		14.0 K	14.0 K	14.0 K	14.0 K
					14.4 K		14.4 K	14.4 K	14.4 K	14.4 K
					16.0 K		16.0 K	16.0 K	16.0 K	16.0 K
					19.2 K		19.2 K	19.2 K	19.2 K	19.2 K
					24.0 K		24.0 K		24.0 K	24.0 K
					25.0 K		25.0 K		25.0 K	25.0 K
					28.0 K		28.0 K		28.0 K	28.0 K
					28.8 K		28.8 K		28.8 K	28.8 K
					32.0 K		32.0 K		32.0 K	32.0 K
					36.0 K		36.0 K		36.0 K	36.0 K
					38.4 K		38.4 K		38.4 K	38.4 K
					48.0 K		48.0 K		48.0 K	48.0 K
					50.0 K		50.0 K		50.0 K	50.0 K
					56.0 K		56.0 K		56.0 K	56.0 K
					57.6 K		57.6 K		57.6 K	57.6 K
					64.0 K		64.0 K		64.0 K	64.0 K
					72.0 K		72.0 K		72.0 K	72.0 K
					76.8 K		76.8 K		76.8 K	76.8 K
					96.0 K		96.0 K		96.0 K	96.0 K
					100.0 K		100.0 K		100.0 K	100.0 K
					112.0 K		112.0 K		112.0 K	
					115.2 K		115.2 K		115.2 K	
					128.0 K		128.0 K		128.0 K	
					144.0 K		144.0 K		144.0 K	
					153.6 K		153.6 K		153.6 K	
					192.0 K		192.0 K		192.0 K	
					224.0 K		224.0 K		224.0 K	
					230.4 K		230.4 K		230.0 K	
					256.0 K		256.0 K		256.0 K	
					288.0 K		288.0 K		288.0 K	
					384.0 K		384.0 K		384.0 K	
					512.0 K		512.0 K		512.0 K	
					576.0 K		576.0 K		576.0 K	
					768.0 K		768.0 K		768.0 K	
					1.024 M		1.024 M		1.024 M	
					1.152 M		1.152 M		1.152 M	
					1.344 M		1.344 M		1.344 M	
					1.528 M*		1.528 M		1.528 M*	
					1.536 M		1.536 M		1.536 M	
					1.544 M		1.544 M		1.544 M	
					2.048 M		2.048 M		2.048 M	

*This rate must be externally provided. A special arrangement is required for use of these aggregate rates. Contact GDC for details.

Special Rates

A TMS Compact may be configured to operate with special aggregate or channel rates that are not available in the standard system. Programming is required to supply these rates. Talk to your GDC sales representative for more information on special rates. *Table 1-2* lists the available nonstandard aggregate rates. *Table 1-3* lists the available special channel interface rates.

Not all special data rates can be created or used in a TMS Compact system. The following rules apply to special data rates.

- All special data rates must be evenly divisible by 25.
- Special data rates created for use on aggregate trunks may not be less than 4800 Hz for a TMS node or less than 56 kHz for a MEGAMUX PLUS node.
- Some data rates may be generated, but may not be used as node timing sources.

Table 1-2 Special Nonstandard Aggregate Rates

CCITT (V.35)	MIL-STD-188-114	EIA/TIA-232-E	RS-422 (V.11)	RS-423 (V.10)
4825	4825	4825	4825	4825
5000	5000	5000	5000	5000
5250	5250	5250	5250	5250
5600	5600	5600	5600	5600
6000	6000	6000	6000	6000
6250	6250	6250	6250	6250
7000	7000	7000	7000	7000
8000	8000	8000	8000	8000
9000	9000	9000	9000	9000
9650	9650	9650	9650	9650
10000	10000	10000	10000	10000
11200	11200	11200	11200	11200
12500	12500	12500	12500	12500
12800	12800	12800	12800	12800
14000	14000	14000	14000	14000
18000	18000	18000	18000	18000
19300	19300	19300	19300	19300
20000	20000		20000	20000
21000	21000		21000	21000
22400	22400		22400	22400
24125	24125		24125	24125
25000	25000		25000	25000
25600	25600		25600	25600
36000	36000		36000	36000
38600	38600		38600	38600
42000	42000		42000	42000
44800	44800		44800	44800
48250	48250		48250	48250
51200	51200		51200	51200
77200	77200		77200	77200
84000	84000		84000	84000

Table 1-2 Special Nonstandard Aggregate Rates (Continued)

CCITT (V.35)	MIL-STD-188-114	EIA/TIA-232-E	RS-422 (V.11)	RS-423 (V.10)
96000	96000		96000	96000
96500	96500		96500	
102400	102400		102400	
154400	154400		154400	
168000	168000		168000	
179200	179200		179200	
193000	193000		193000	
204800	204800		204800	
307200	307200		307200	
308800	308800		308800	
386000	386000		386000	
409600	409600		409600	
448000	448000		448000	
460800	460800		460800	
672000	672000		672000	
772000	772000		772000	
921600	921600		921600	
1344000	1344000		1344000	
	2034000			

NOTES: 1.For the special nonstandard aggregate rate entry, any of the special rates listed in this table may be entered, in addition to the standard aggregate data rates listed in *Table 1-1* .

2. Rates below 56000 are not usable for a node terminating at a MEGAMUX PLUS site.

Table 1-3 Special Channel Interface Rates

CCITT (V.35)	MIL-STD-188-114	EIA/TIA-232-E	RS-422 (V.11)	RS-423 (V.10)
25	25	25	25	25
50	50	50	50	50
125	125	125	125	125
250	250	250	250	250
375	375	375	375	375
500	500	500	500	500
625	625	625	625	625
750	750	750	750	750
1125	1125	1125	1125	1125
1250	1250	1250	1250	1250
1400	1400	1400	1400	1400
1750	1750	1750	1750	1750
2250	2250	2250	2250	2250
2500	2500	2500	2500	2500
2625	2625	2625	2625	2625
2800	2800	2800	2800	2800
3000	3000	3000	3000	3000
3500	3500	3500	3500	3500
4500	4500	4500	4500	4500
4825	4825	4825	4825	4825
5000	5000	5000	5000	5000
CCITT (V.35)	MIL-STD-188-114	EIA/TIA-232-E	RS-422 (V.11)	RS-423 (V.10)

Table 1-3 Special Channel Interface Rates (Continued)

5250	5250	5250	5250	5250
5600	5600	5600	5600	5600
6000	6000	6000	6000	6000
6250	6250	6250	6250	6250
7000	7000	7000	7000	7000
9000	9000	9000	9000	9000
9650	9650	9650	9650	9650
10000	10000	10000	10000	10000
11200	11200	11200	11200	11200
12500	12500	12500	12500	12500
12800	12800	12800	12800	12800
14000	14000	14000	14000	14000
18000	18000	18000	18000	18000
19300	19300	19300	19300	19300
20000	20000		20000	20000
21000	21000		21000	21000
22400	22400		22400	22400
24125	24125		24125	24125
25600	25600		25600	25600
38600	38600		38600	38600
42000	42000		42000	42000
44800	44800		44800	44800
48250	48250		48250	48250
51200	51200		51200	51200
77200	77200		77200	77200
84000	84000		84000	84000
89600	89600		89600	89600
96500	96500		96500	96500
102400	102400		102400	102400
154400	154400		154400	154400
168000	168000		168000	168000
179200	179200		179200	179200
193000	193000		193000	193000
204800	204800		204800	204800
307200	307200		307200	307200
308800	308800		308800	308800
386000	386000		386000	386000
409600	409600		409600	409600
448000	448000		448000	448000
672000	672000		672000	672000
772000	772000		772000	772000
921600	921600		921600	921600

NOTES: 1.For the special channel interface rate entry, any of the special rates listed in this table may be entered, in addition to the standard channel data rates listed in Appendix A.

2. Special channel rates of 175, 350, and 700 may be selected if the special clock bus rate of 896K is the source.

Dial Backup

The Dial Backup function allows you to communicate from a TMS Controller to a remote node that has become isolated from the network. Dial Backup utilizes Port 1 of the TMS Controller as the alternate communications channel. Port 1 of the TMS Controller is defined as the Dial Backup (DBU) link. Port 0 is the primary port used for supervisory data.

To access a remote node that is isolated, the local TMS Controller has a pre-stored phone number that exists in the node configuration screen. When the line is established, the TMS Controller routes supervisory data along the DBU link. This permits the TMS Controller to communicate not only with local nodes but with the isolated network as well. *Figure 1-6* illustrates how a network is configured for Dial Backup.

The Dial Backup port returns to normal once the Dial Backup function is terminated. This allows field personnel to dial into the system from a remote terminal to troubleshoot the node. The user can initialize Dial Backup for test purposes. The TMS Controller will communicate on the DBU port. Messages addressed to the DBU port will be sent to the remote node, but other nodes will still communicate via the primary port.

Dial Backup utilizes two methods to configure the DBU link. The first method uses an external auto dial modem from the TMS Controller to the on board 212A modem on older versions of the Redundancy Control Module. A security password is provided for by the user or a default password is assigned. When Dial Backup is initiated, the TMS Compact retrieves and dials the pre-stored phone number. If the remote modem answers, the password is verified and the DBU link is established.

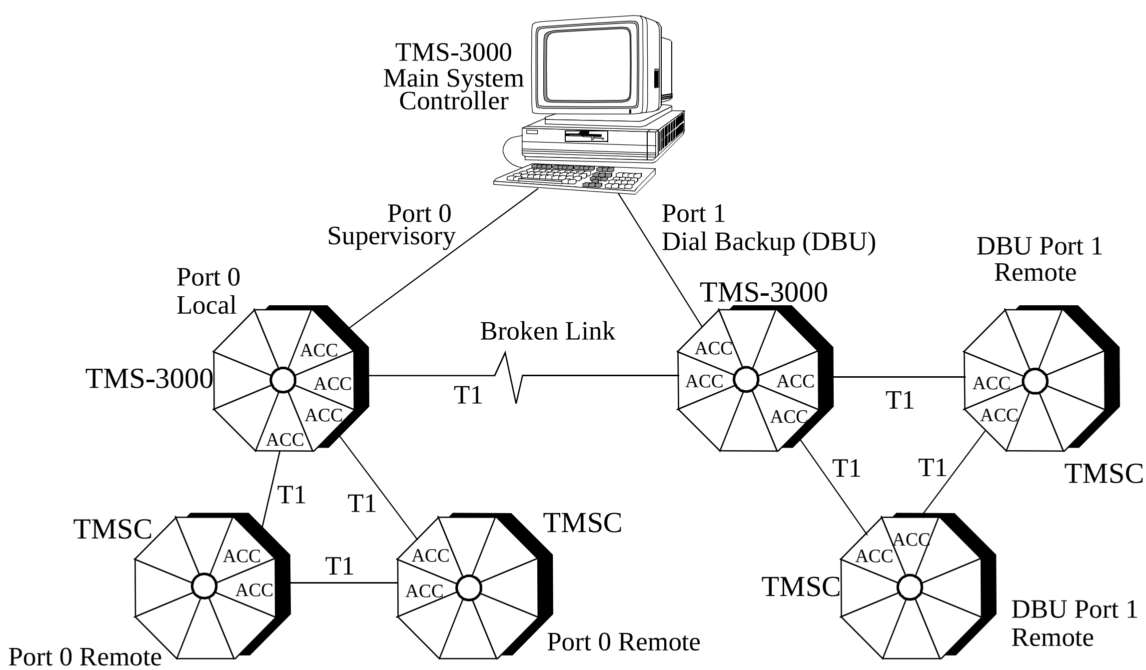


Figure 1-6 TMS Controller Configured for Dial Backup Operation

The second method uses an external modem at the remote node as well as the TMS Controller. This method is a high-security mode of Dial Backup. The TMS Controller calls the remote node, the controller sends the password and the controller phone number to the remote node. The node validates the password, then the controller hangs up.

The remote node calls back to reestablish the modem link so that the problem can be diagnosed.

The passwords and method of Dial Backup are configured using the TMS Controller main configuration routines.

Supervisory Pass Through

This type of connection is also referred to as a "Daisy Chain." To support supervisory pass through, the ports at both nodes must be configured through software using the TMS Controller.

This option provides a supervisory data path to several TMS nodes at a local site. Transmission capacity increases at a local site by the availability of multiple aggregate trunks.

The TMS Controller sends supervisory information on Port 1 to J6 on the TMS Compact Main Shelf Backplane. The TMS software configures the ESCC/SCC at the first node to pass the supervisory information through jack J8 on the TMS Compact Main Shelf Backplane. A cable connects to the next node at the site to continue the supervisory data route. The process continues until all nodes at the site have a supervisory data path established.

Physical description

There are two physical configurations of a TMS Compact node: standalone and rackmount.

Standalone

A TMS Compact standalone consists of the TMS Compact main shelf only, with a standalone enclosure housing the main shelf. No more than 10 channels may be included in a standalone TMS Compact node. The TMS Compact Standalone accepts ac power only. Dimensions of the standalone enclosure follow:

Height:21.125 in.

Width:19.25 in.

Depth:18.5 in.

Rackmount

A TMS Compact rackmount includes the TMS Compact main shelf and Channel Expansion shelves, as required, up to a maximum of three Channel Expansion shelves (a maximum of 58 channels).

In the rackmount configuration the expansion shelf (or shelves) must be next to the main shelf or directly under the main shelf. The TMS Compact rackmount is available in both ac- and dc-powered versions and may be housed in GDC EP-2T, EP-2M, or EP-4 cabinets.

The TMS Compact Main Shelf houses the TMS Compact Common Cards, 10 channel cards, and two DPS-8A or GPS-8A power supplies. Each section of the main shelf has a different depth. The overall dimensions of the TMS Compact Shelf follow:

Height:14 in.

Width:16.5 in.

Depth:16 in.

Following are the overall dimensions of a Channel Expansion Shelf:

Height: 7 in.

Width:16.5 in.

Depth:10 in.

Equipment List

A top-level breakdown of the components in redundant and nonredundant TMS Compact units is presented in the Equipment List (see *Table 1-4*). The part numbers in the list generally represent assemblies made up of several discrete parts. Chapter 4 of this manual gives breakdowns of these assemblies into their respective parts.

Technical Characteristics

Technical characteristics of the TMS Compact are presented in Appendix B.

Service and Training

See Preface for information on service and training available from GDC.

Note *In the list of GDC Part Numbers, the dash number (last 3 digits of the part number), which represents a revision level of the card, may be different in your system. Also note that part numbers for TMS software versions and Controllers vary and, therefore, are not listed below.*

Table 1-4 Equipment List

Equipment Supplied	Designation	GDC Part No.
TMS Compact Non-redundant contains:	MM TMSC (NR) (AC)	036M357-001
TMS Compact Common Shelf (AC)	—	036B302-001
Enterprise System Control Card (1) **or**	ESCC	036P336-001
System Control Module (1)	SCC-II	036P301-003
Aggregate Control Module (Up to 2)	ACC-IIE	036M313-001
Channel Interface Module (1)	CIC-II	036P304-001
CDA-T1 (Combined Digital Aggregate Module) (Up to 2)	CDA-T1	036M309-001
CDA-E1 (CDA CCITT version) Module (Up to 2)	CDA-E1	036M328-001
ACM (ADPCM Compression Module) (Up to 2)	ACM/T1	036M330-002
ACM/E1 (ADPCM Compression Module CCITT version) (Up to 2)	ACM/E1	036M330-001
Redundancy Control Module (1)	RCC-II	036P302-001, -002, -003*
Expansion Channel Control Module (1)	ECC-II	036P307-002
Aggregate Interface Piggyback Card		See Agg. Int.
Channel Modules (up to 10)		See Channel Mods.
GPS-8A AC Power Supply MOPS (1)		See Power Supply Mods.
GPS-8B AC, Universal Power Supply (1)		
TMS Controller		
TMS Software Set		
TMS Compact Redundant contains:	MM TMSC (R) (AC)	036M357-002
TMS Compact Common Shelf (AC)	—	036B302-001
Enterprise System Control Card (2) **or**	ESCC	036P336-001
System Control Module (2)	SCC-II	036P301-003
Aggregate Control Module (Up to 3)	ACC-II	036M313-001
Channel Interface Module (2)	CIC-II	036P304-001
Combined Digital Aggregate Module (up to 3)	CDA-T1	036M309-001
CDA-E1 (CDA CCITT version) Module (up to 3)	CDA-E1	036M328-001
ACM (ADPCM Compression Module) (up to 3)	ACM/T1	036M330-002
ACM/E1 (ADPCM Compression Module CCITT version) (Up to 3)	ACM/E1	036M330-001
Redundancy Control Module (1)	RCC-II	036P302-001/-002, -003
Expansion Channel Control Module (2)	ECC-II	036P307-002
Aggregate Interface Piggyback		See Agg. Int.
Channel Modules (up to 10)		See Channel Mods.
GPS-8A AC Power Supply MOPS (2)		See Power Supply Mods.
GPS-8B AC, Universal Power Supply (2)		
* The -003 version of the RCC does not contain an internal modem.		

Table 1-4 Equipment List (Continued)

Equipment Supplied	Designation	GDC Part No.
TMS Controller		
TMS Software Set		
TMS Compact Non-redundant DC contains:	MM TMSC (NR) (DC)	036M358-001
TMS Compact Common Shelf (DC)	—	036B303-001
Enterprise System Control Card (1) **or**	ESCC	036P336-001
System Control Module (1)	SCC-II	036P301-003
Aggregate Control Module (Up to 2)	ACC-II	036M313-001
Channel Interface Module (1)	CIC-II	036P304-001
Combined Digital Aggregate Module (up to 2)	CDA-T1	036M309-001
CDA-E1 (CDA CCITT version) Module (Up to 2)	CDA-E1	036M328-001
ACM (ADPCM Compression Module) (Up to 2)	ACM/T1	036M330-002
ACM/E1 (ADPCM Compression Module CCITT version) (Up to 2)	ACM/E1	036M330-001
Redundancy Control Module (1)	RCC-II	036P302-001, -002, -003
Expansion Channel Control Module (1)	ECC-II	036P307-002
Aggregate Interface Piggyback Card		See Aggregate Interface Plug-In Cards
Channel Modules (Up to 10)		See Channel Mods.
DPS-8A DC Power Supply MOPS (1)	DPS-8	041B008-001
TMS Controller		
TMS Software Set		
TMS Compact Redundant DC contains:	MM TMSC (R) (DC)	036M358-002
TMS Compact Common Shelf (DC)	—	036B303-001
Enterprise System Control Card (2) **or**	ESCC	036P336-001
System Control Module (2)	SCC-II	036P301-003
Aggregate Control Module (Up to 3)	ACC-II	036M313-001
Channel Interface Module (2)	CIC-II	036P304-001
Combined Digital Aggregate Module (Up to 3)	CDA-T1	036M309-001
CDA-E1 (CDA CCITT version) Module (Up to 3)	CDA-E1	036M328-001
ACM (ADPCM Compression Module) (Up to 3)	ACM/T1	036M330-002
ACM/E1 (ADPCM Compression Module CCITT version) (Up to 3)	ACM/E1	036M330-001
Redundancy Control Module (1)	RCC-II	036P302-001, -002, -003
Expansion Channel Control Module (2)	ECC-II	036P307-002
Aggregate Interface Piggyback		See Agg. Int.
Channel Modules (Up to 10)		See Channel Mods.
DPS-8A DC Power Supply MOPS (2)		041B008-001
TMS Controller		
TMS Software Set		

Table 1-4 Equipment List (Continued)

Equipment Supplied	Designation	GDC Part No.
Channel Equipment		
TMS Compact Channel Expansion Shelf — Non-Redundant	 EXP-II/N	036M302-001
Redundant	EXP-II/R	036M302-002
Data Channels:		
EIA/TIA-232-E Data II Channel EIA RS-422 Data II Channel EIA RS-423 Data II Channel CCITT V.35 Data II Channel	Data II/232 Data II/422 Data II/423 Data II/V.35	036M048-001 036M048-002 036M048-003 036M048-004
EIA/TIA-232-E DATA III Channel EIA RS-422 DATA III Channel EIA RS-423 DATA III Channel CCITT V.35 DATA III Channel	DATA III/232 DATA III/422 DATA III/423 DATA III/V.35	036M058-001 036M058-002 036M058-003 036M058-004
EIA/TIA-232-E DATA IV Channel EIA RS-422 DATA IV Channel EIA RS-423 DATA IV Channel CCITT V.35 DATA IV Channel	DATA IV/232 DATA IV/422 DATA IV/423 DATA IVV.35	036M079-001 036M079-002 036M079-003 036M079-004
EIA/TIA-232-E UDC Module EIA RS-422 UDC Module EIA RS-423 UDC Module CCITT V.35 UDC Module	UDC/232 UDC/422 UDC/423 UDC/V.35	036M078-001 036M078-002 036M078-003 036M078-004
TID-III Data Channel Module	TID-III	18607-201
Voice Channels: Voice II/CVSD Voice II/PCM Voice II/PCM (with E and M) Voice II/ADPCM Voice II/ADPCM (with E and M)	Voice II/CVSD Voice II/PCM Voice II/PCM (with E &M) Voice II/ADPCM Voice II/ADPCM (with E &M)	036P271-001 036P250-002 036M202-002 036M200-004 036M201-004
Voice II/ASP/16K	Voice II/ASP/16K	036M259-001
Voice II/ASP/Multi	Voice II/ASP/Multi	036M259-002
PCM Analog Universal Voice Card	UVC/PCM	036P265-002
ADPCM Analog Universal Voice Card	UVC/ADPCM	036P265-003
Echo Canceller Plug-In Card	VEC 1	036P270-001
VLBRV (Very Low Bit Rate Voice) Module Assembly	—	036M283-001
Consists of the following:		
VLBRV Base Card	—	036P283-001
VLBRV Piggyback Card	—	036P284-001
Optional FAX Relay card	—	To be determined
ACM Cards		
ACM Base Card		036P330-001
ACM Plug-In Microprocessor (T1/E1)		036P316-001
ACM I/O Plug-In Card (T1)		036P310-001
ACM I/O Plug-In Card (E1)		036P282-001
ADPCM SMT Plug-In		036P331-001
ADPCM SMT Plug-In (E1)		036P331-002
NOTE: For more than 10 channels, additional power supplies and channel expansion shelves are required.		

Table 1-4 Equipment List (Continued)

Equipment Supplied	Designation	GDC Part No.
Aggregate Interface Plug-In Cards		
EIA/TIA-232-E/CCITT V.24 Aggregate Interface	EIF-E	036P041-001
CCITT V.35 Aggregate Interface	EIF-V	036P042-001
EIA RS-422/423/MIL-STD-188/CCITT V.10/V.11 Aggregate Interface	EIF-P	036P043-001
T1/D4 1.544 Mbps Aggregate Interface	T1/D4	036P315-002
T1/D4 1.544 Mbps Aggregate Interface	T1D4	036P315-003
T1D4/E (ESF) 1.544 Mbps Aggregate Interface	T1D4/E	036P325-001
CCITT G.703 64 kbps Co-directional Aggregate Interface	EIF-G	036P064-001
CCITT G.703 2.048 Mbps 75-ohm Aggregate Interface	EIF-M1	036P065-001
CCITT G.703 2.048 Mbps 120-ohm Aggregate Interface	EIF-M2	036P065-002
CCITT G.703 64 kbps Contra-directional Aggregate Interface	EIF-C	036P066-001
CCITT G.703 256 kbps 75-ohm Aggregate Interface	EIF-K1	336P065-001
CCITT G.703 256 kbps 120-ohm Aggregate Interface	EIF-K2	336P065-002
CCITT G.704 2.048 MHz 75/120-ohm Aggregate Interface	—	036P281-001
CDA Plug-in Cards		
PCB Assembly, Base Card		036P309-001
PCB Assembly, Micro Piggyback		036P316-001
CCITT G.732 (E1) I/O Plug-in Interface CEPT 2.048 MHz		036P282-001
T1 I/O Plug-in Interface 1.544 Mbps		036P310-001
T1 I/O Plug-in Interface 1.544 Mbps		036P310-001
Flex Cards		
Flex Board Assembly, L2	—	036P090-001
Flex Board Assembly, R2	—	036P091-001
Flex Board Assembly, L3	—	036P092-001
Flex Board Assembly, R3	—	036P093-001
Power Supply Modules		
GPS-8A		
GPS-8A AC Power Supply MOPS 100/117 V AC		035B008-011
GPS-8A AC Power Supply MOPS 220 V AC		035B008-012
GPS-8A AC Power Supply MOPS 240 V AC		035B008-014
DPS-8A DC Power Supply MOPS -48 V DC		041B008-001
GPS-8A Shelf; 1 MOPS, 100/117 V AC	GPS-8A-1	035A011-001
GPS-8A Shelf; 2 MOPS, 100/117 V AC	GPS-8A-2	035A011-002
GPS-8A Shelf; 1 MOPS, 220 V AC	GPS-8AE-1	035A012-001
GPS-8A Shelf; 2 MOPS, 220 V AC	GPS-8AE-1	035A012-002
GPS-8A Shelf; 1 MOPS, 240 V AC	GPS-8AU-1	035A014-001
GPS-8A Shelf; 2 MOPS, 240 V AC	GPS-8AU-2	035A014-002
GPS-8B		
GPS-8B-1-1 Power Supply, universal VAC		035A016-001
GPS-8B-1-2 Power Supply, universal VAC		035A016-002
GPS-8B-1-3 Power Supply, universal VAC		035A016-003
GPS-8B-1-4 Power Supply, universal VAC		035A016-004
GPS-8B Harness Card		035P006-002

Table 1-4 Equipment List (Continued)

Equipment Supplied	Designation	GDC Part No.
Power Supply Modules (Cont.)		
GPS-8B Power Supply Assembly		035P011-001
GPS-8B Panel Blank		035D028-001
GPS-8B Shelf Assembly		035B006-012
Share signal jumper cable, optional		035H002-001
Power harness cable, optional		S-036H009-001, 002
Power harness cable, optional		S-036H010-001, 002
dc interconnect cable, optional		S-036H010-001, 002
DPS-8A		
DPS-8A Shelf; 1 MOPS, 48 V DC	DPS-8A-1	041A006-001
DPS-8A Shelf; 2 MOPS, 48 V DC	DPS-8A-2	041A006-002

Chapter 2, Operation

Scope

Topics covered in this chapter include:

Overview

The chapter provides information on the TMS Controller keyboard, screen format and colors, general operating procedures, multiport cards, printer options, and the front panels of TMS cards.

Note *In this chapter, the description of the Controller applies only to MSO and GTS controllers (earlier than TMS 4000). For additional information on the TMS 4000 Controller, refer to your Sun documentation, Chapter 5 of this manual, and to the Operation Manual for TMS 4000 Controller, GDC 036R604-V100.*

TMS Controller Operation

An example of a TMS Controller is pictured in *Figure 2-1*. A software version of the Operation manual for the TMS Controller for GTS and MSO software is installed on the hard disk drive and is referred to as a disk-based manual. This disk-based manual provides:
Menu-driven selection

- Cursor position selection method
- Option to have information displayed on the Controller CRT screen or printed from the Controller printer port.

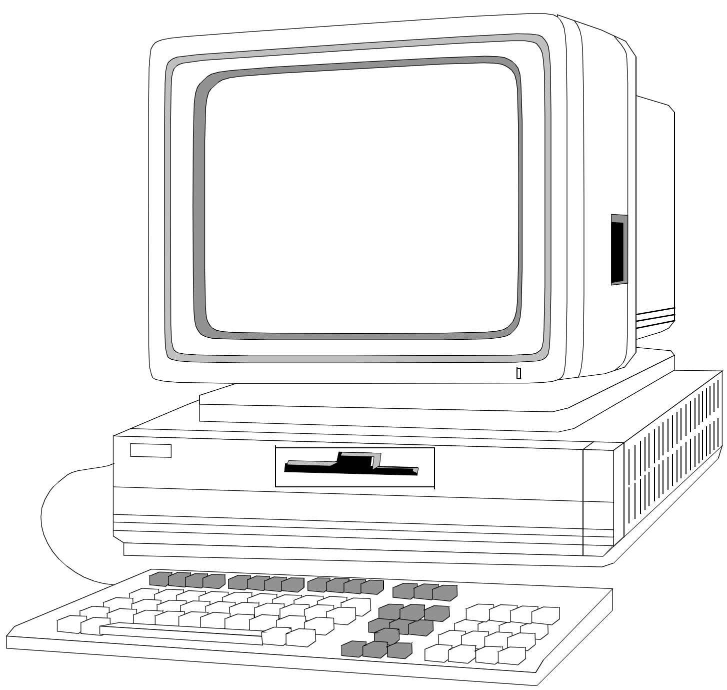


Figure 2-1 Example of TMS Controller

Function Keys

The function keys on the PC keyboard (located at the top of the keyboard and labeled F1 through F12) are the primary means of selecting and exiting from TMS routines. The keys also step between display pages within a routine. These keys are illustrated in *Figure 2-2*.

F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12
Special	Key Help	Back Display	Next Display	Backup Page	Advance Page	Test Function	Help Screen	DEL/RD Status	Abort		Shut Audible

Figure 2-2 TMS Controller Function Keys

The following describes each function key.

F1 Special

This key functions similarly to a shift key on a keyboard. It selects an alternate function for any function key or keys in the numeric key pad. Whenever the Special key must be used to obtain an alternate key function, this is indicated.

F2 Help

This key selects Help screens for the function keys and the numeric keypad keys. Once you have selected Help, select information on a key by pressing that key. The Help screen for that key appears. Help screens contain directions for returning to TMS displays.

F3 Back Display

This key steps backward through a sequence of displays and menus, reversing the steps that you followed to enter that routine. This is the normal method of exiting from a routine. Repeatedly pressing F3 brings you back to the TMS Main Menu.

Take care in using F3 to exit a Diagnostic routine. Some TMS tests continue to run until stopped. If you exit a test routine by using F3, make sure you end the test first if you don't want it to continue.

F4 Next Display

This key steps forward through a display sequence in those instances where there is only one possible forward sequence (no menu or other choices required). In the Modify Node Equipment Routine, this key selects the Aggregate Configuration and Channel Configuration displays when the cursor is positioned at a parameter field for that node component in the Modify Node Equipment display.

F5 Backup Page

This key is used in routines that require more than one display page for a particular display. Pressing this key returns the previous display page to the screen.

F6 Advance Page

This key is used in routines that require more than one display page for a particular display. Pressing this key brings the next display page to the screen.

F7 Test Function

This key is used in status and diagnostic routines for channels. In specific applications, it is pressed to start a test or select a display (the screen directs you whenever this key is required).

F8 Help Screen

This key selects the Disk-Based Manual topic that is most relevant to the current operating routine.

F9 Del/Read Status

This key steps through the status messages displayed on the Status Line (the lower green line in all displays). Each message is deleted after it appears unless you press the F1 key before pressing the F9 key.

The message queues can hold up to forty messages. The messages report important events occurring in the system. When such an event occurs, the normal alarm information is overwritten by the resulting status message, and the line becomes yellow. You must then press the Status Message key up to forty times to return the normal alarm information to the status line.

F10 Abort

This key aborts the retrieval of active or historical alarm messages from the alarm data base.

F12 Shut Audible

This key lets you turn off the terminal beep for the current alarm. When a new alarm is received, the beep resumes. To shut off the beep permanently, select NO for terminal beep in the Modify Alarm Handling screen.

Editing Keys

The editing keys (located in the block of keys at the right side of the keyboard) provide utilities for entering and changing information within configuration displays. These keys are illustrated in *Figure 2-3*.

Insert

This key functions exactly like the `Enter` key in the main section of the keyboard. It may be used to:

- Select a menu item (with the cursor positioned at that entry)
- Step forward through a limited range of values
- Enter a response to a prompt (such as Y for Yes)

Home

This key restores a previously entered character string to a string field while the cursor is positioned at that field.

Page Up

This key deletes an entire character string in a field when the cursor is positioned at that field.

Delete

This key deletes a single character within a character string entry. The character at the current cursor position is deleted. Characters to the right of the cursor shift one position to the left.

End

In a limited range entry, this key steps backward (that is, the reverse order from that obtained by the `Enter`/Step Forward key) through the list of selections.

Page Down

This key, when pressed alone, deletes all characters from the right of the cursor to the next space in the field. When pressed simultaneously with F1, it restores a word previously deleted by the Del Wrd key.

Cursor Position Keys

The cursor position keys (located below the editing keys) move the cursor to desired locations in menus and displays.

Cursor Up

This key moves the cursor in an upward direction to the next highest modifiable parameter field on the screen. When the cursor reaches the topmost position on the screen, it "wraps" to the bottom of the screen when you press the key again.

Cursor Left

This key moves the cursor to the left, between each modifiable parameter field on the screen. When the cursor reaches the leftmost position on the screen, it "wraps" to the right side of the screen and also moves up to the next row of modifiable fields.

Within a character string field, the cursor moves only to the left until it reaches the leftmost character position of the field. You must use the up or down cursor to exit the field.

Cursor Down

This key moves the cursor down to the next lowest modifiable parameter field on the screen. If the cursor reaches the bottom field, it "wraps" to the top of the field when you press the Cursor Down key.

This key also moves the cursor out of a character string field. When the cursor leaves the field, the character string is complete until you reenter that field.

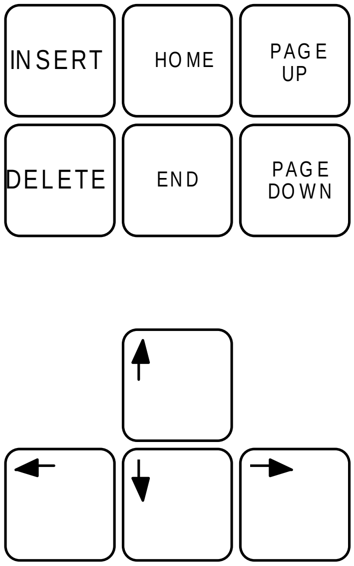


Figure 2-3 TMS Controller Editing and Cursor Position Keys

Cursor Right

This key moves the cursor to the right between each modifiable parameter field on the screen.

When the cursor reaches the rightmost position on the screen, it "wraps" to the left side of the screen and also moves down to the next row of "live" fields.

Within a character string field, the cursor moves to the right only until it reaches the rightmost character position of the field. You must use the up or down cursor to exit the field.

Alphanumeric/ASCII Keys

These keys are enabled by the Controller whenever a character string entry or numerical range entry is required. When entering a character string, you may use any character shown on the main keyboard (alphabet characters, numbers, punctuation marks, etc.). The first character of a character string must, however, be an alphabet character.

Enter Key

The `Enter` key is used in several ways to select, enter, and perform Controller operations.

- Select a menu item (with the cursor positioned at that entry)
- Step through a limited range of values for a configuration entry
- `Enter` a response to a prompt (such as Y for Yes)

Control Keys

Combinations of the Ctrl (Control) key and various alphabet keys select specific controller functions.

Screen Print/Control P

To print the current screen, press the Ctrl and the P keys simultaneously. The screen display is immediately printed to either LP0 or LP2, depending on which one was selected in Controller Maintenance (Configure Parallel Ports).

Flow Control/Control S

To "freeze" the screen, press the Ctrl and the S keys simultaneously. The display remains locked after this action. To resume normal operation, press any key on the keyboard.

Restore Field/Control X

This restores the previously stored character string to the field. Press the Ctrl and X keys simultaneously.

Refresh Screen/Control W

To refresh the screen, press the Ctrl and the W keys simultaneously. The reverse video disappears (except when the cursor is in a prompt or string field) until the next keystroke is entered.

Screen Format and Colors

All displays of the TMS Control System are framed within a screen format and include certain display colors. The intent of the format and color combination is to provide as much information as possible concerning the current status of the system, regardless of what routine is running.

Screen Format

The Controller screen is 80 characters wide. There are 25 lines from the top of the screen to the bottom of the screen.

The top line of the display is highlighted in green and reports the following:

- Name of Currently Displayed Menu or Routine
- Current Software Version or Network Currently Displayed
- Current Time/Date

The next 20 lines are the display window (or "page") for the TMS operating routines. All menus and displays occur on these 20 lines. Any display that contains too much information to fit into this window is divided into two or more pages. You use the Advance Page (F6) and Backup Page (F5) to change pages for these displays.

Line 22 is reserved for system messages and prompts from the Controller. The messages report error conditions and indicate intermediate processes (such as Searching For Node) that may delay initiation of a routine. The prompts solicit information required in the course of a routine (node, circuit, or route names, for example) and enable you to save configuration changes before exiting a routine.

Line 23, called the alarm/status line and normally highlighted in green or yellow, reports network status information. The on-line network and active configuration are reported. The number of Active alarms (those alarm conditions which exist presently in the network) are reported in three categories — Major, Minor, and Warning.

A Major Alarm indicates a failure which could disrupt the flow of network traffic (usually disrupts a group of channels or an aggregate trunk). A Minor Alarm indicates a failure of a lesser extent (usually disrupts only a single channel). A Warning Alarm is for information about an event that has occurred in the system.

Line 23 also displays status messages from "asynchronous" processes occurring in the network. For example, a downloading operation in a complex network may take several minutes. Complete messages from the download appear in this status line.

This report facility frees the Controller to perform other tasks in the "foreground," while a time-consuming process runs in the "background."

The alarm/status line is blue whenever a status message is present. Up to forty status messages may be stored for display on the status line. The function key F9 is used to step through each status message present and delete them after display. You may read these messages without deleting them by pressing F1 before pressing the F9 key. With either display method, the green alarm line is eventually returned to the screen. As many as 40 such messages may be accessible through this line.

Lines 24 and 25 report the two most recent alarm messages received from the network by the Controller.

Screen Colors

Colors in the Controller screen display reflect the type of information provided by the Controller or the type of entries required by the Controller. The screen may display text presented in a single color or in a combination of a highlighted field color and a text color.

The color arrangements used on TMS Controller displays are:

- White Text on Blue Field — Display Headers
- Blue Text on White Field — Limited Range Entry
- Black Text on Blue Field — String Entry
- Black Text on White Field — Cursor Selection (Pokepoint)
- Red Text — Indicates failure condition for alarms, status, or diagnostics
- Green Text — Indicates normal operating condition for alarms, status, or diagnostics
- Yellow Text — Indicates warning (potential problem) condition for alarms, status, or diagnostics

General Operating Procedures

TMS Controller operation is characterized by:

- Menu-Driven Selection of Operating Routines

- Cursor Position Selection Method
- Prompt/Message System Responses
- Predefined Key Functions
- Formatted Screen Displays

The first step in entering TMS operating procedures is password entry — you must enter a Login Name and a Password to gain access to the system.

The display then presents the TMS Main Menu. The tasks required to initialize, configure, and maintain a TMS system are represented by the entries in the main menu. MAIN MENU FUNCTIONS describes each item in the TMS Main Menu.

To select an entry from the main menu, move the cursor to the desired entry and press the `Enter` key. Another menu appears listing the operating routines that perform specific functions. Select an entry from this menu in the same manner. Depending on the particular task that you wish to perform, you may encounter another level of menus or enter the operating routine that performs the task.

As you step through menus to initiate a routine, you may need to specify a node or other device that the operating routine is directed toward. For example, to select a status display for a node, you must enter the symbolic name of that node. At these points, the system prompts you to enter the symbolic name or other information required and highlights a field where the entered characters appear.

A typical prompt is:

Enter Node Name:

You answer this prompt by typing in an already configured symbolic name for the node, and pressing the `Enter` key. If you make a mistake, such as mistyping the node name, the system reports the problem through a message such as:

Node Does Not Exist. Continue? [Default YES (Y/N)]

To enter another node, answer Yes (or simply Y). Entering No (or N) returns you to the previous level of menus. If you press the `Enter` key without entering an answer, the default response shown is selected (in this case, pressing the `Enter` key is interpreted as a Yes response).

These prompts and messages always appear on line 22 of the screen. Whenever any event or problem occurs that should be reported, messages and prompts appear on that line.

When you reach an operating routine, a display related to that routine is presented. Depending on the exact nature of the routine, you probably must supply some information as you use the routine. The information is located in labeled fields in each display.

For example, the configuration routines require the entry of much specific information that defines equipment operation and desired modes of operation for the equipment at a node.

Several types of entries are used to supply information to the system. They are Cursor Position Entry, String Entry, and Limited Range Entry. For detailed descriptions of these entry types, refer to Entry Types.

After completing all entries, or having finished with an operating routine, press F3 to exit from the routine. You may have to respond to a prompt, such as:

Do you wish to save your configuration? [Default Continue Y/N/C]

Repeatedly pressing F3 brings you back to the TMS Main Menu. You also may have to answer prompts to return there.

Use the other Function Keys and Editing Keys to accomplish specialized operating functions in the TMS system. While most operations may be performed in the manner described above, these keys enable you to operate the system more efficiently.

Entry Types

Three types of entries supply information to the TMS controller. The entry types are:

- Cursor Position Entry
- String Entry
- Limited Range Entry.

Cursor Position Entry

This entry is made by moving the cursor (using the cursor position or "arrow" keys) to the desired field and pressing the `Enter` key. Normally, a cursor position entry selects an item from a menu. The menu may occupy an entire screen or only a small section of a screen.

When you move the cursor to a desired field, it becomes highlighted in white, with black letters.

Making a cursor position entry usually results in the initiation of a new routine. In some situations, a function may be selected for the current display. For example, some configuration displays contain a Delete field within them.

You may select the Delete field by positioning the cursor at that field and pressing `Enter`.

String Entry

Any symbolic name, password, number, or other sequence of characters that must be entered is a character string entry.

String entries perform several functions. A password allows access to a routine. A symbolic name represents some unique entity in the network (including the network itself) and functions as an address for that device. Some strings function only as reference information for an operator of a TMS Controller (for example, names and street addresses for node sites).

A numerical entry is a form of string entry. The only difference between a numerical string and any other character string is that each entry must be within some numerical range. For example, the node address of a TMS node must be between 1 and 126.

The TMS Controller does not accept any TMS node numbers higher than 126, or OCM node numbers higher than 9999.

To make a string entry, move the cursor to the desired field. The selected field is highlighted in cyan (light greenish-blue) and the characters are displayed in black. Enter the character string, and press the `Enter` key. The TMS Controller then accepts the string as complete. You may also move the cursor out of a string field using the up or down cursor position (arrow) keys. When the cursor leaves the field, the string is complete.

When you have completed an entry (by pressing the `Enter` key or moving the cursor out of the field) the TMS Controller checks the entry for correctness. A node name, for example, is not accepted if the name has already been used to identify another node. You can, however, apply the same name to two different logical components. A node and a circuit may both be named A, for example.

The editing keys on the keyboard (labeled Insert, Home, Page Up, Delete, End, and Page Down) support editing functions for character strings. While many of these functions are not required for string entry, they may enable greater speed and accuracy in character string entry.

If you enter a character string field and wish to exit it without entering a string, press the key marked Page Up. This key is the Delete Field editing key and deletes all characters in the field. The TMS Controller does not let you exit a string field while an invalid entry remains in the field.

When you highlight a character string field, the number of characters that may be included for that particular entry is indicated. A password may have up to 16 characters.

The number of characters allowed for the fields is:

16	–	Network
8	–	Configuration
16	–	Node
20	–	Circuit (including the ".nnn" extension)
16	–	Group
16	–	Trunk

Limited Range Entry

For many system parameters entered in a routine you must select one of a limited number of entries.

For example, a node type could be either a TMS node or a Universal MM+ V4 node. This particular parameter is selected as a limited range entry. The field displays sequentially each possible entry for the parameter, and you step through the range of entries until the proper choice appears.

To select a limited range entry, move the cursor to the desired field and press the `Enter` key repeatedly until the desired parameter appears. When you move the cursor to a limited range entry field, the field is highlighted in white, and the characters are displayed in blue.

CRT Link

An interactive control port for the TMS Controller may be extended to a remote site. This application uses the CRT link facility to control TMS through a remote operator's CRT.

Connections at the TMS Controller site are made to Serial Port 1 at the back of the controller. Typically, a modem link connects the port to a NETCON I/O or MEGAVIEW port at another site.

Refer to *NETCON CRT Link, GDC 058R675*, for detailed information concerning NETCON CRT Link.

The remote operator terminal supports all functions of the Controller keyboard. Keys F1 through F10 and F12 on the remote keyboard perform operations equivalent to those of the Controller keyboard (when used with the Controller).

The Controller is a single-user system. You cannot use the Controller interface and the CRT Link interface simultaneously.

If you log in through a CRT Link interface while another person is using the Controller console, the screen indicates that the software is busy on tty--.

To ensure that only one user is logged in to the controller at one time, follow these procedures when using the CRT Link to operate the TMS network:

1. Select the Configure Serial Ports routine (found under the Controller Maintenance Menu) and make sure that Port 1 is enabled and the data rate is correct.
2. Make sure that any network operations (such as diagnostics or downloads) have been completed. Return the Network Access menu to the controller CRT screen. Power must remain on in the Controller to operate the CRT Link.
3. Log in through the operator terminal that is being used as the CRT Link by typing gts at the `login` prompt.
4. When finished using the CRT Link interface, make sure that any operations initiated from the CRT Link interface have been completed. Then return to the `Network Access` menu and log out.
5. After you log out using the CRT link, you have three minutes before control is lost and is taken over by the TMS Controller. To cancel this three-minute timer, log into a network on the CRT link interface.
6. Resume operations through the Controller interface. The serial port becomes disabled when returning from the CRT Link to the Controller. With the port disabled, no further operations are initiated through the CRT Link.

Multiport I/O Card

When the Multiport I/O card is installed in the Controller, the I/O Port Configuration screen contains additional field selections that appear.

Port

The number of the I/O port being configured. 00 for Serial Port 0, 01 for Serial Port 1. With the I/O card installed, Ports 00 - 05 appear when using the Digiboard 4e, and Ports 00 - 09 appear when using the 8i or 8i+ card. If only one serial port is installed in the Controller, the Digiboard port numbers begin at 01. Port 01 on the Digiboard cable corresponds to either Port 02 or Port 01 on the screen. If installed, Ports 00 and 01 are used for the TMS Controller and other functions such as VT100, dial backup, TTY login, etc. Digiboard ports are used for other applications.

Application

Defines what the port is being configured for. Port 0 selections are Network I/O or Not in Use. Port 01 selections are Dial Backup, Local TTY, Dialin TTY and Not in Use. The choices you can select for Ports 02-07 are Dial Backup, Local TTY, Dialin TTY, Not in Use, MEGAVIEW, MEGAVIEW DU, Audible Alarm, Sync, and VT100.

Communication Mode

Defines the serial communication parameters of the I/O port. Chooses if this is asynchronous; 7 or 8 data bits; 1 or 2 stop bits; and even, odd, or no parity.

Data Rates

Defines the speed (bits per second) in which the I/O port communicates to an external device. Selections are 300, 1200, 2400, 4800, and 9600 Hz. Ports configured for Network I/O cannot be modified.

Security

This field defines an error checking method the controller uses. You have two methods: CRC 16 (Cyclic Redundancy Check 16-bits) and LRC (Longitudinal Redundancy Check).

More information on configuring the serial I/O ports is found in *Chapter 42 of GDC 036R603-Vnnn*. Installation and configuration of a MEGAVIEW Interface is found in Appendix B.

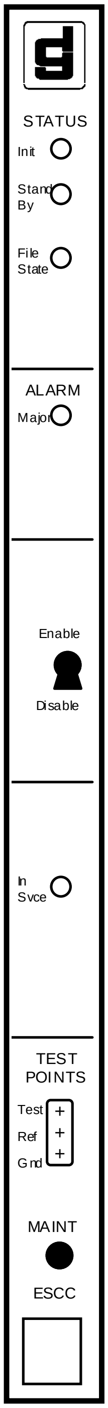
Printer Options

Controller software includes routines that print an entire network configuration, IAR data, Alarm Reports, or individual screens.

These routines are described in *GDC 036R602-nnn* (MSO software) and *GDC 036R603-Vnnn* (GTS software).

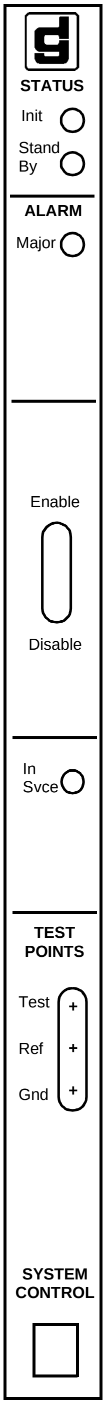
TMSC Front Panel Components

The following pages describe the function of each indicator and test point on each TMSC card. Front panels are shown in *Figure 2-4 through Figure 2-21*.



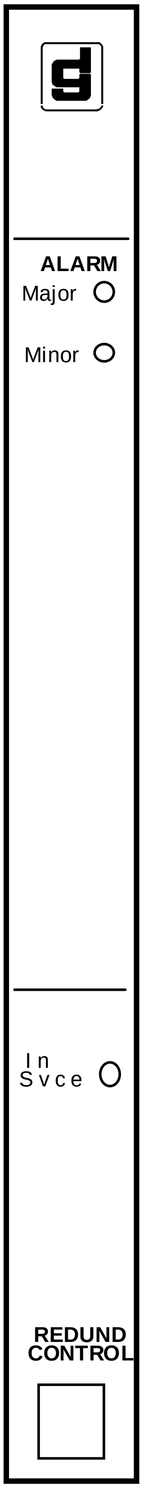
Name	Part	Description
Init	Status LED	Red LED lights during the ESCC initialization sequence (during initialization, the ESCC is not operational).*
Stand By	Status LED	Green LED lights if the ESCC is the idle card of a redundant pair of ESCCs.*
File State	Status LED	Yellow LED lights if the ESCC requires a download of its file system. Flashes when a download of the ESCC file system occurs.*
Major	Alarm LED	Red LED lights if the ESCC experiences a failure that affects its operation. Also lights at power-on reset, but turns off after positive status and self-tests are performed.
Enable-Disable	Switch	Permits installation and removal of the ESCC without disruption of the TMS 3000. Before installing or removing the ESCC into or from a shelf, place the switch in the Disable position. After installation, place the switch in the Enable position after the Init and Major LEDs are lit.
In Svce	LED	Green LED lights when the ESCC is operating.
Test	Test Point	Test point is the 8 kHz clock that is phase-locked to the node reference.
Ref	Test Point	Test point is the incoming reference clock from a master timing source.
Gnd	Test Point	Test point is the ground reference for the other two test points.
Maint	Jack	Connector is used to connect a monitoring device to the ESCC.
		* Refer to *Operation Manual for TMS-3000 Controller, GDC 036R603-Vnnn* for information as to how the Init, Stand By, and File State LEDs interact to provide status information.

Figure 2-4 Enterprise System Control Card, Front Panel



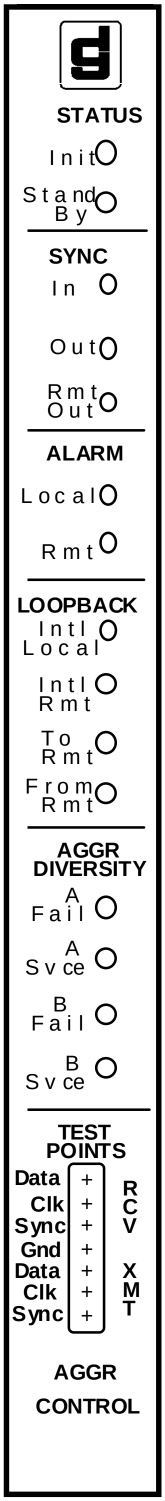
Name	Part	Description
Init	Status LED	Red LED lights during the SCC initialization sequence (during initialization, the SCC is not operational).
Stand By	Status LED	Green LED lights if the SCC is the idle card of a redundant pair of SCCs.
Major	Alarm LED	Red LED lights if the SCC experiences a hardware failure that affects its operation. Also lights at power-on reset, but turns off after positive status and self-tests are performed.
Enable-Disable	Switch	Permits installation and removal of the SCC without disruption of the TMSC. Before installing or removing the SCC into or from a shelf, place the switch in the Disable position. After installation, place the switch in the Enable position after the Init and Major LEDs are lit. Stand By LED should be on.
In Svce	LED	Green LED lights when the SCC is in service.
Test	Test Point	Test point is the 8 kHz clock to which all channels phase lock.
Ref	Test Point	Test point is the incoming reference clock from a master timing source.
Gnd	Test Point	Test point is the ground reference for the other two test points.

Figure 2-5 System Control Card, Front Panel



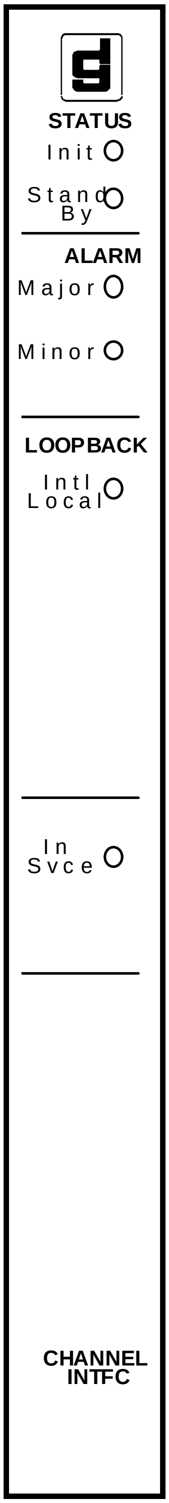
Name	Part	Description
Major	Alarm LED	Red LED lights when there is a hardware failure of one of the common cards.
Minor	Alarm LED	Red LED lights when there is a hardware failure of one of the channel cards.
In Svce	LED	Green LED lights when power is applied to the RCC.

Figure 2-6 Redundancy Control Card, Front Panel



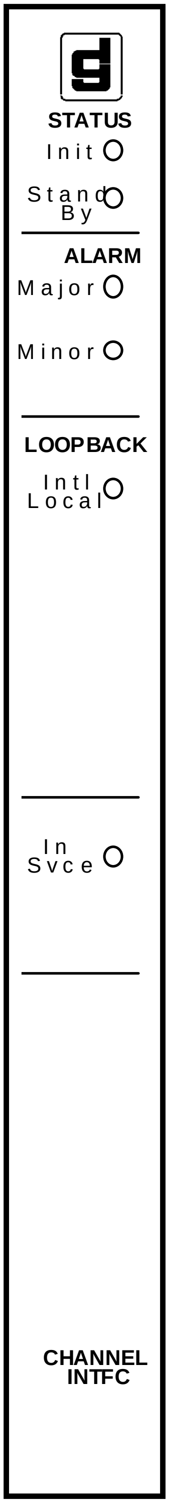
Name	Part	Description
Init	Status LED	Red LED lights during initialization sequence. The board cannot operate during this time.
Stand By	Status LED	Green LED lights if this is the standby card of a redundant pair.
In	Sync LED	Green LED lights when the card is synchronized with received data.
Out	Sync LED	Red LED lights when the card is not synchronized with received data.
Rmt Out	Sync LED	Red LED lights when remote end is not synchronized with its received data.
Local	Alarm LED	Red LED lights if there is a hardware failure in this card. When the LED flashes rapidly, a local software transfer is occuring. When the LED flashes slowly, a remote software transfer is occuring.
Rmt	Alarm LED	Red LED lights if there is a hardware failure in the remote end.
Intl Local	Loopback-LED	Red LED lights if there is an internal local loopback at the aggregate interface (Transmit data is looped back as received data).
Intl Rmt	Loopback-LED	Red LED lights if the remote ACC is in an internal local loopback (Transmit data looped back as receive data at remote aggregate interface).
To Rmt	Loopback LED	Red LED lights when receive data is looped back at the aggregate interface to the remote ACC.
From Rmt	Loopback LED	Red LED lights when data from the local ACC is looped back at the remote aggregate interface.
A(B) Fail	Diversity LED	Red LED lights when the "A (B)" aggregate is not receiving data.
A(B) Svce	Diversity LED	Green LED lights when the "A (B)" aggregate is passing data.
Data (RCV)	Test Point	Receive aggregate data isolated through a 1K ohm resistor.
Clk (RCV)	Test Point	Receive aggregate clock isolated through a 1K ohm resistor.
Sync (RCV)	Test Point	First bit of Frame Receive Not. This bit marks the beginning of each aggregate frame received from the remote aggregate interface (isolated through a 1K ohm resistor).
Gnd	Test Point	Ground Reference Point.
Data (XMT)	Test Point	Transmit aggregate data isolated through a 1K ohm resistor.
Clk (XMT)	Test Point	Transmit aggregate clock isolated through a 1K ohm resistor.
Sync (XMT)	Test Point	End of Frame Not. This bit marks the end of each frame transmitted to the remote aggregate interface (isolated through a 1K ohm resistor).

Figure 2-7 Aggregate Control Card, Front Panel



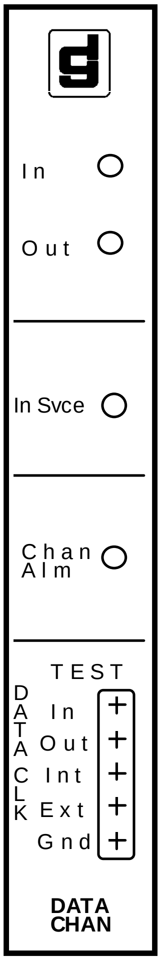
Name	Part	Description
Init	Status LED	Red LED lights during initialization sequence. The board cannot operate during this time. LED blinks when a local or remote software transfer takes place.
Stand By	Status LED	Green LED lights if this is the standby card of a redundant pair.
Major	Alarm LED	Red LED lights if there is a hardware failure on this CIC.
Minor	Alarm LED	Red LED lights if there is a failure in one of the data or voice channel cards interfaced by this CIC.
Intl Local	Loopback LED	Red LED lights if there is an internal local loopback (Data received from a channel card is looped back to the channel card).
In Svce	LED	Green LED lights when card is in service.

Figure 2-8 Channel Interface Card/Digital Bridging Card, Front Panel



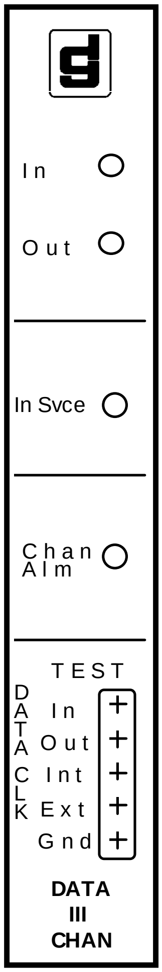
Name	Part	Description
In Svce	LED	In redundant systems, this green LED lights on the Expansion module that currently in operation. In non-redundant systems, this LED should always be lit.

Figure 2-9 Expansion II Module, Front Panel



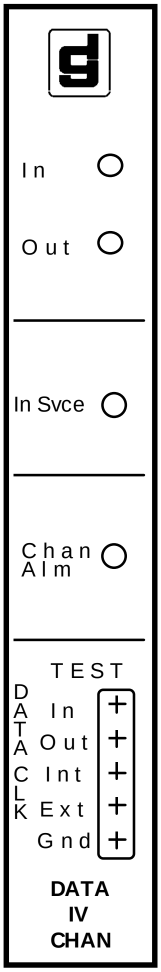
Name	Part	Description
In	LED	Amber LED lights when transmit data into a channel is a space.
Out	LED	Amber LED lights when receive data out of the channel is a space.
In Svce	LED	Green LED lights when the channel is entered in the currently active TMS configuration. This indicates that the card is either operating or prepared to operate according to the parameters entered for that channel in the active configuration.
Chan Alm	LED	Red LED lights when an alarm condition exists in the channel. *Alarm descriptions are in GDC 036R603-Vnnn*.
In	Test Point	Test point for transmit data into the channel. Test point isolated through a 10K ohm resistor.
Out	Test Point	Test point for receive data out of the channel. Test point isolated through a 10K ohm resistor.
Int	Test Point	Test point for internal clock used to process and transfer data between the channel card and the CIC.
Ext	Test Point	Test point for external clock. If DCE interface is selected for the channel, the external timing signal from pin 24 of the channel connector appears here. If DTE interface is selected, the receive timing signal from pin 15 of the channel connector appears here.
Gnd	Test Point	Signal Ground for all measurements.

Figure 2-10 Data II Channel Module Front Panel



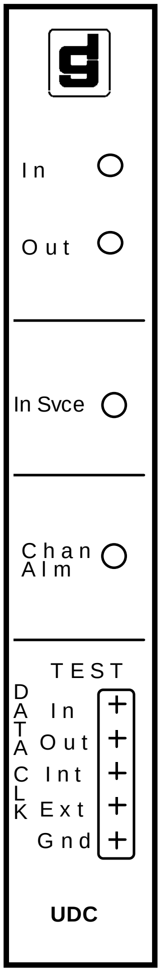
Name	Part	Description
In	LED	Amber LED lights when transmit data into a channel is a space.
Out	LED	Amber LED lights when receive data out of the channel is a space.
In Svce	LED	Green LED lights when the channel is entered in the currently active TMS configuration. This indicates that the card is either operating or prepared to operate according to the parameters entered for that channel in the active configuration.
Chan Alm	LED	Red LED lights when an alarm condition exists in the channel. *Alarm descriptions are in GDC 036R603-Vnnn*.
In	Test Point	Test point for transmit data into the channel. Test point isolated through a 10K ohm resistor.
Out	Test Point	Test point for receive data out of the channel. Test point isolated through a 10K ohm resistor.
Int	Test Point	Test point for internal clock used to process and transfer data between the channel card and the CIC.
Ext	Test Point	Test point for external clock. If DCE interface is selected for the channel, the external timing signal from pin 24 of the channel connector appears here. If DTE interface is selected, the receive timing signal from pin 15 of the channel connector appears here.
Gnd	Test Point	Signal Ground for all measurements.

Figure 2-11 Data III Channel Module, Front Panel



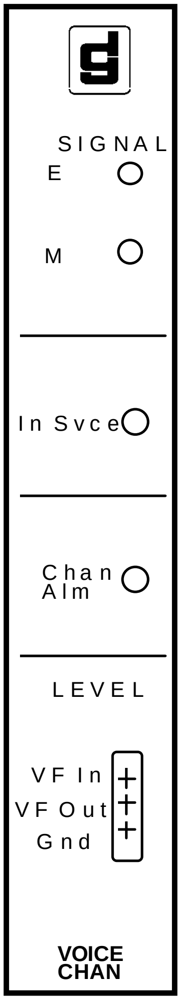
Name	Part	Description
In	LED	Amber LED lights when transmit data into a channel is a space.
Out	LED	Amber LED lights when receive data out of the channel is a space.
In Svce	LED	Green LED lights when the channel is entered in the currently active TMS configuration. This indicates that the card is either operating or prepared to operate according to the parameters entered for that channel in the active configuration.
Chan Alm	LED	Red LED lights when an alarm condition exists in the channel. *Alarm descriptions are in GDC 036R603-Vnnn*.
In	Test Point	Test point for transmit data into the channel. Test point isolated through a 10K ohm resistor.
Out	Test Point	Test point for receive data out of the channel. Test point isolated through a 10K ohm resistor.
Int	Test Point	Test point for internal clock used to process and transfer data between the channel card and the CIC.
Ext	Test Point	Test point for external clock. If DCE interface is selected for the channel, the external timing signal from pin 24 of the channel connector appears here. If DTE interface is selected, the receive timing signal from pin 15 of the channel connector appears here.
Gnd	Test Point	Signal Ground for all measurements.

Figure 2-12 Data IV Channel Module, Front Panel



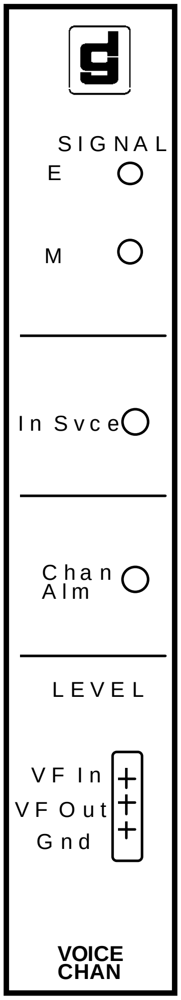
Name	Part	Description
In	LED	Amber LED lights when transmit data into a channel is a space.
Out	LED	Amber LED lights when receive data out of the channel is a space.
In Svce	LED	Green LED lights when the channel is entered in the currently active TMS configuration. This indicates that the card is either operating or prepared to operate according to the parameters entered for that channel in the active configuration.
Chan Alm	LED	Red LED lights when an alarm condition exists in the channel. *Alarm descriptions are in GDC 036R603-Vnnn*.
In	Test Point	Test point for transmit data into the channel. Test point isolated through a 10K ohm resistor.
Out	Test Point	Test point for receive data out of the channel. Test point isolated through a 10K ohm resistor.
Int	Test Point	Test point for internal clock used to process and transfer data between the channel card and the CIC.
Ext	Test Point	Test point for external clock. If DCE interface is selected for channel, the external timing signal from pin 24 of the channel connector appears here. If DTE interface is selected, the receive timing signal from pin 15 of the channel connector appears here.
Gnd	Test Point	Signal Ground for all measurements.

Figure 2-13 Universal Data Channel Module, Front Panel



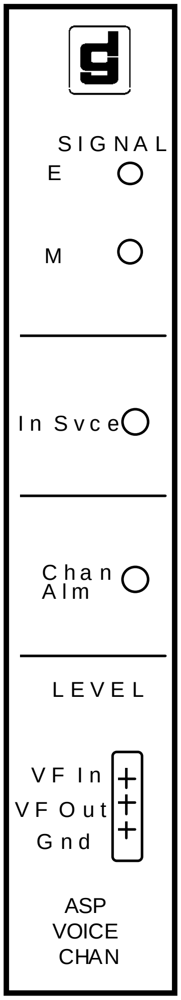
Name	Part	Description
E	Signal LED	Amber LED lights when the E-lead of the voice channel is busy.
M	Signal LED	Amber LED lights when the M-lead of the voice channel is busy.
In Svce	LED	Green LED lights when the channel is entered in the currently active TMS configuration. This indicates that the card is either operating or prepared to operate according to the parameters entered for that channel in the active configuration.
Chan Alm	LED	Red LED lights when an alarm condition exists in the channel. *Alarm descriptions are in GDC 036R603-Vnnn*.
VF In	Test Point	Test point for bridged measurement of Voice Channel VF input level. Test point isolated through a 10K ohm resistor.
VF Out	Test Point	Test point for bridged measurement of Voice Channel VF output level. Test point isolated through a 10K ohm resistor.
Gnd	Test Point	Ground for VF input and VF output measurement.

Figure 2-14 Voice II/CVSD Channel Module, Front Panel



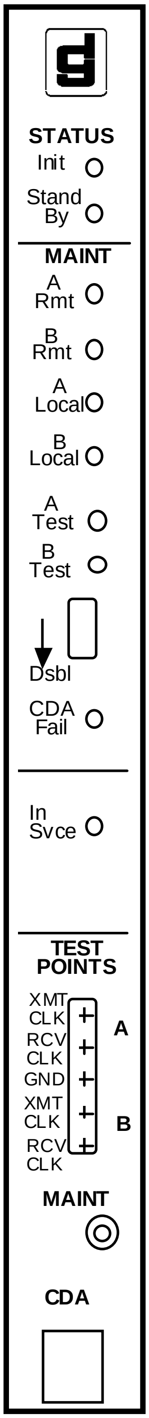
Name	Part	Description
E	Signal LED	Amber LED lights when the E-lead of the voice channel is busy.
M	Signal LED	Amber LED lights when the M-lead of the voice channel is busy.
In Svce	LED	Green LED lights when the channel is entered in the currently active TMS configuration. This indicates that the card is either operating or prepared to operate according to the parameters entered for that channel in the active configuration.
Chan Alm	LED	Red LED lights when an alarm condition exists in the channel. *Alarm descriptions are in GDC 036R603-Vnnn*.
VF In	Test Point	Test point for bridged measurement of Voice Channel VF input level. Test point isolated through a 10K ohm resistor.
VF Out	Test Point	Test point for bridged measurement of Voice Channel VF output level. Test point isolated through a 10K ohm resistor.
Gnd	Test Point	Ground for VF input and VF output measurement.

Figure 2-15 UVC/ASP Channel Module, Front Panel



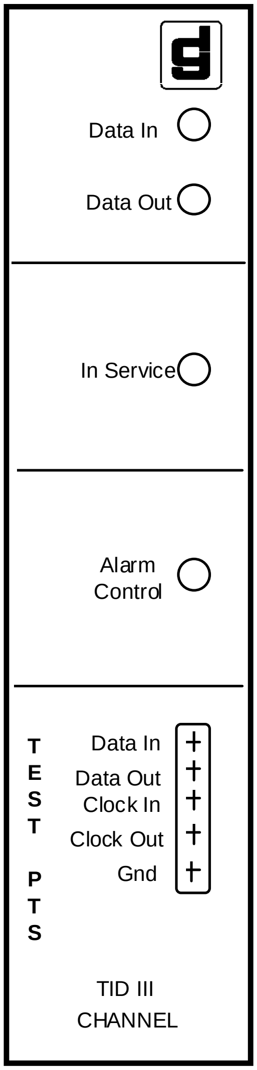
Name	Part	Description
E	Signal LED	Amber LED lights when the E-lead of the voice channel is busy.
M	Signal LED	Amber LED lights when the M-lead of the voice channel is busy.
In Svce	LED	Green LED lights when the channel is entered in the currently active TMS configuration. This indicates that the card is either operating or prepared to operate according to the parameters entered for that channel in the active configuration.
Chan Alm	LED	Red LED lights when an alarm condition exists in the channel. *Alarm descriptions are in GDC 036R603-Vnnn*.
VF In	Test Point	Test point for bridged measurement of Voice Channel VF input level. Test point isolated through a 10K ohm resistor.
VF Out	Test Point	Test point for bridged measurement of Voice Channel VF output level. Test point isolated through a 10K ohm resistor.
Gnd	Test Point	Ground for VF input and VF output measurement.

Figure 2-16 Voice II/ASP Channel Module, Front Panel



Name	Part	Description
Int	Status LED	Red LED lights during the initialization sequence. The board cannot operate during this time.
Stand By	Status LED	Green LED lights when the CDA module is in the standby mode. Mode is entered in the following ways: Module is inserted and used as a redundant mate to an already in-service module or the module is forced from in-service to standby via a software command from the TMS Controller.
A Rmt	Maint. LED	Amber LED lights if Port A link detects the DS1 remote alarm signal on its receive data stream.
B Rmt	Maint. LED	Amber LED lights if Port B link detects the DS1 remote alarm signal on its receive data stream.
A Local	Maint. LED	Red LED lights if Port A link has lost DS1 sync on its receive data stream.
B Local	Maint. LED	Red LED lights if Port B link has lost DS1 sync on its receive data stream.
A Test	Maint. LED	Red LED lights if the Port A link is under test and not in normal operation.
B Test	Maint. LED	Red LED lights if the Port B link is under test and not in normal operation.
Dsbl	Maint. Switch	Allows you to remove module from service without physically removing it from the shelf. If performed on an in-service CDA of a redundant pair, a redundant switch occurs. If performed on a non-redundant in-service module, module still goes into the standby mode. To return to in-service, toggle switch again, or a presettable software timer resets the module.
CDA Fail	Maint. LED	Red LED lights if the CDA has detected an internal hardware failure.
In Svce	LED	Green LED lights to indicate that the card is in-service.
XMT CLK	Test Point	Port A Transmit Clock isolated through a 1K ohm resistor.
RCV CLK	Test Point	Port A Receive Clock isolated through a 1K ohm resistor.
GND	Test Point	Ground
XMT CLK	Test Point	Port B Transmit Clock isolated through a 1K ohm resistor.
RCV CLK	Test Point	Port B Receive Clock isolated through a 1K ohm resistor.
MAINT	Jack	Port for connecting a maintenance terminal.

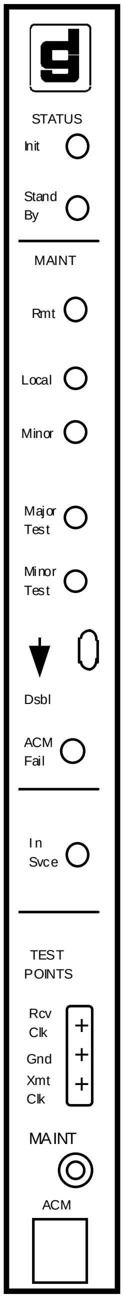
Figure 2-17 CDA Module Front Panel (T1 and E1 versions)



Name	Part	Description
Data In	LED	Indicates data activity is being transmitted by the module. A space (high) lights the amber LED.
DataOut	LED	Indicates data activity is being transmitted by the module. A space (high) lights the amber LED.
In Svce	LED	Green LED lights when the TID-III channel is entered in the currently active TMS configuration. This indicates that the card is either operating or prepared to operate according to parameters entered for that channel in the active configuration.
Alarm Control	LED	Red LED lights when an alarm condition exists in the channel. Alarm messages are described in GDC 036R603-Vnnn.
Data in	Test Point	Transmit data into the channel. Test point is isolated through a 1K ohm resistor.
Data Out	Test Point	Transmit data out of the channel. Test point is isolated through a 1K ohm resistor.
Clock In	Test Point	The clock from the customer interface which is encoded and transmitted to the remote end. Test point is isolated through a 1K ohm resistor.
Clock Out	Test Point	The regenerative receive clock based on timing from the remote channel. Test point is isolated through a 1K ohm resistor.
Gnd	Test Point	Signal ground for all measurements.

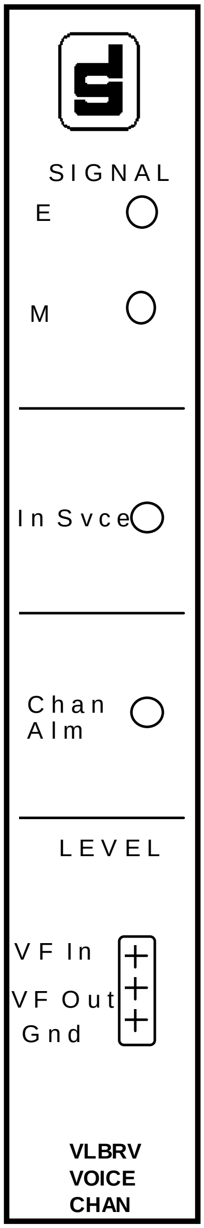
Figure 2-18 TID III Data Channel Module Front Panel Switches and Indicator

Note that any reset condition causes all LEDs to light for about one second.



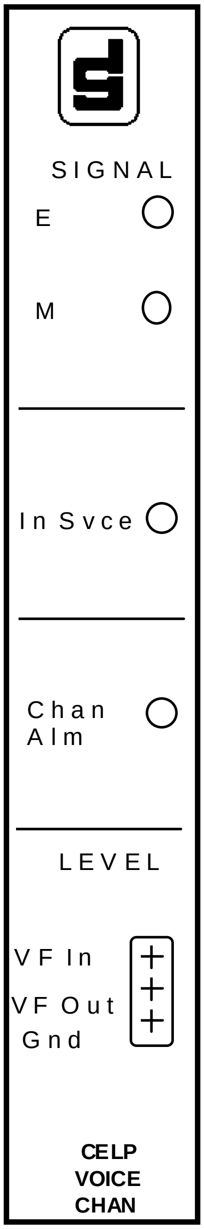
Name	Part	Description
Init	Status LED	Red LED lights when the ACM is executing the boot program.
Stand By	Status LED	Green LED lights during self diagnostic test. If a failure occurs, LED is deactivated making ACM unavailable for automatic redundancy operation. LED also indicates which ACM is attached to the aggregate. LED is active after initialization and is controlled by a microprocessor. *ACM self diagnostic tests are described in Chapter 2*. If lit during a configuration download, it indicates the ACM is unconfigured, or the out-of-service card is ready to go in service.
Rmt	Maint. LED	Yellow LED lights when a receiving ACM has detected a yellow carrier fail alarm signal. The minimum detection time is 335-msec for a superframe format. Maximum detection time is 1-second. LED is disabled when the ACM is not in service. Remote alarm is the equivalent of the yellow CFA alarm.
Local	Maint. LED	Red LED is triggered by continuous loss of framing or by an intermittent out-of-frame condition in an incoming signal. The local alarm is the equivalent of the AT&T red alarm. The LED is disabled when the ACM is not in service during configuration download. When the Stand By LED and Local Alarm LED are both lit, it indicates incorrect configuration loaded due to incorrect hardware, PC board, or software version.
Minor	Maint. LED	Red LED lights when status transitions are reported from various areas in the ACM are detected (e.g., any channel having any type of fault).
Major Test	Maint. LED	Red LED informs you of a power on self-test in progress. The LED flashes during a program download. The flashing persists as long as download packets are received from the node. If packets are not received for two seconds, the flashing stops; if the download resumes within the download failure timeout period, the flashing resumes as the next download packet is received.
Minor Test	Maint. LED	Red LED is on when the ACM is performing channel loopbacks only. The LED goes off when tests are completed.
Dsbl	Maint. Switch	Pressing the switch isolates the ACM from the port and the node. Press the switch before the board is removed from the shelf. This minimizes problems caused by the line drivers on the backplane. If the switch is toggled again before removing the card, the ACM reverts to a boot program. In a redundant system, toggling causes a redundant switch by forcing the ACM out-of-service. When the ACM is disabled, all front panel LEDs are off.
ACM Fail	Maint. LED	Red LED lights when the ACM fails a self diagnostic test or when it is unable to function properly in the boot program.
In Svce	LED	Green LED lights to indicate that the card is in-service.
Rcv Clk	Test Point	Receive Aggregate Clock isolated through a 1K ohm resistor.
Gnd	Test Point	Ground
Xmt Clk	Test Point	Transmit Aggregate Clock isolated through a 1K ohm resistor.
MAINT	Jack	Port for connecting a maintenance terminal.

Figure 2-19 ADPCM Compression Module, Front Panel



Name	Part	Description
E	Signal LED	Amber LED lights when the E-lead of the voice channel is busy. Output from the VLBRV is in the form of a solid state switch. Low resistance equals a busy condition (E-lead to ground).
M	Signal LED	Amber LED lights when the M-lead of the voice channel is busy. E-signal is a product of the remote channels M-signal.
In Svce	LED	Green LED lights when the channel is entered in the currently active TMS configuration. This indicates that the card is either operating or prepared to operate according to the parameters entered for that channel in the active configuration.
Chan Alm	LED	Red LED lights when an alarm condition exists in the channel. Alarm messages are described in GDC 036R603-Vnnn.
VF In	Test Point	For bridged measurement of voice channel VF input level to the transmit section. Isolated through a 10K ohm resistor. Input levels should be 0 dBm or –16.0 dBm.
VF Out	Test Point	For bridged measurement of voice channel VF output level from the receive section. Isolated through a 10K ohm resistor. Input levels should be 0 dBm or +7.0 dBm.
Gnd	Test Point	Analog ground point for VF input and VF output measurement.

Figure 2-20 VLBRV Voice Channel Module, Front Panel



Name	LED	Description
E	Signal LED	Amber LED lights when the E-lead of the voice channel is busy. Output is in the form of a solid state switch. Low resistance equals a busy condition (E-lead to ground). E-signal is a product of the remote channels M-signal.
M	Signal LED	Amber LED lights when the M-lead of the voice channel is busy.
In Svce	Signal LED	Green LED lights when the channel is entered in the currently active TMS configuration. This indicates that the card is either operating or prepared to operate according to the parameters entered for that channel in the active configuration. When off, the channel is out-of-service and the control leads are conditioned.
Chan Alm	LED	Red LED lights when an alarm condition exists in the channel. Alarm messages are described in GDC 036R603-Vnnn.
VF In	Test Point	For bridged measurement of voice channel VF input level to the transmit section. Isolated through a 10K ohm resistor. Input levels should be 0 dBm or –16.0 dBm. This test point is a high impedance input and is not for injection of tones.
VF Out	Test Point	For bridged measurement of voice channel VF output level from the receive section. Isolated through a 10K ohm resistor. Input levels should be 0 dBm or +7.0 dBm.
Gnd	Test Point	Analog ground point for VF input and VF output measurement.

Figure 2-21 CELP Voice Channel Module, Front Panel

Summary

In this chapter we covered the use of the Controller screen and keyboard. Also discussed were the front panels of the TMS cards.

Chapter 3, Principles of Operation

Overview

This chapter describes the general circuit functions of the TMSC (TMSC). The text is organized around the overall unit. See *Figure 3-1* which identifies major circuit functions. Signal flow through the TMSC is described to show the relationship of the hardware and interconnection with external equipment. Topics in this chapter include:

General Description

Figure 3-1 is an overall functional block diagram of the TMSC which illustrates major signal flow between modules. The interface to a data channel is shown on the left, and the high-speed aggregate interface is shown on the right. The TMSC is supplied with up to 58 Data or Voice Channels. A typical group of Common Modules can contain the following common set of modules:

- ADPCM Compression Module (ACM)
- Aggregate Control Card (ACC)
- Channel Interface Card (CIC)
- Combined Digital Aggregate (CDA) Module
- Expansion II Module
- Redundancy Control Card (RCC)
- Enterprise System Control Card/System Control Card (ESCC/SCC)

The TMSC may also have redundant modules that are switched in and out of operation by the Redundancy Control Card. Control of the system network is extended to the operator of the TMSC Controller at the master node. The TMSC Controller performs the following tasks as selected by the TMSC operator through the interface:

- System Configuration
- Activation of a Configuration
- Status Reports
- System Diagnostics
- System Restoral

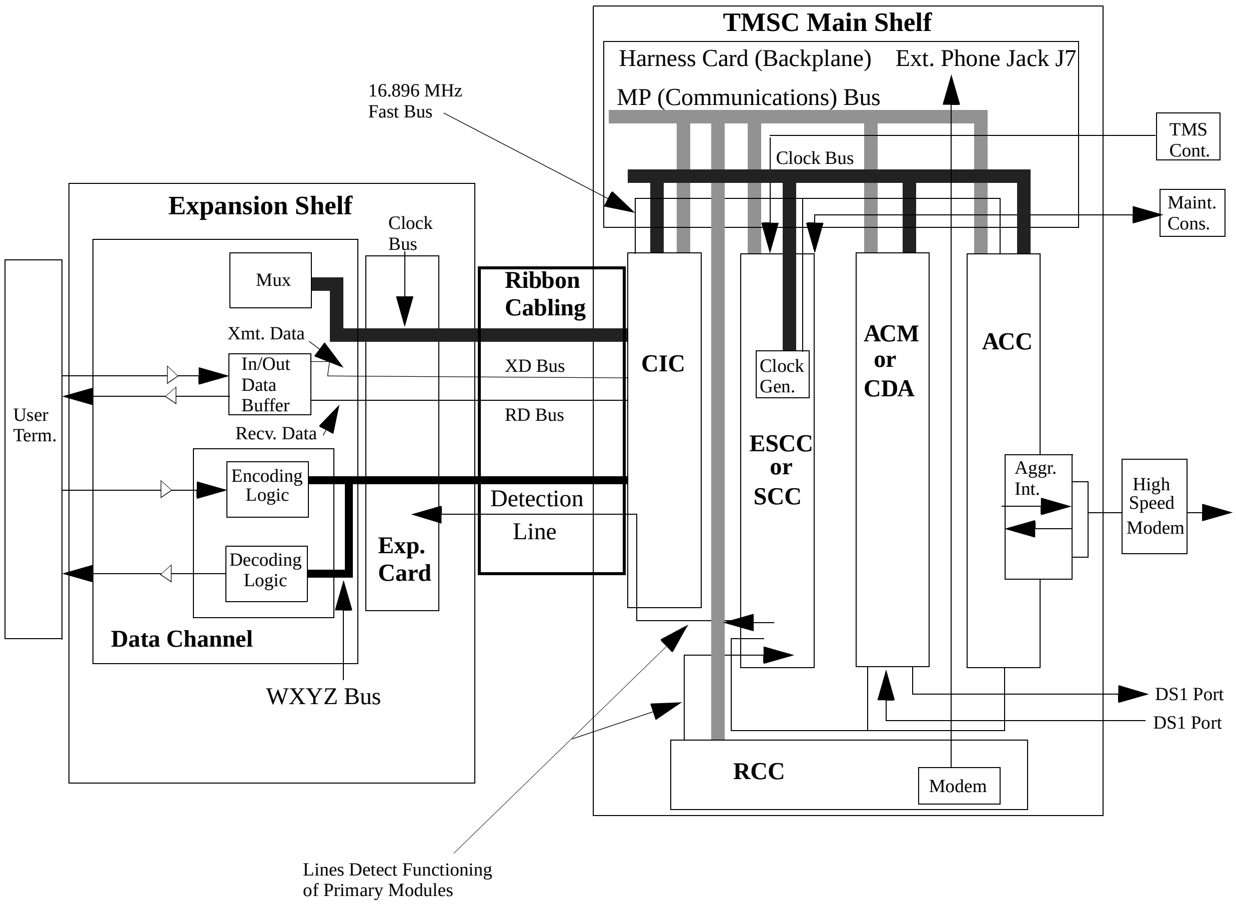


Figure 3-1 TMSC Functional Block Diagram

Passwords exist for different tasks so the user can control who has access to different parts of the system. At the master node, control signals and configuration information are downloaded from the TMSC Controller to the System Control Card. The System Control Card at the master node, in turn, downloads control and configuration information to the remote System Control Card via the aggregate trunk. This continues across aggregate trunks until all System Control Cards in the network have received control signals and configuration information. The System Control Card also generates the clock signals for the clock bus and the 16.896-MHz Fast Bus.

Once the System Control Card has received supervisory information, it downloads control data to all the Common Modules in that node. The MEGAMUX TMS Controller controls the whole network while an individual System Control Card controls only the node where it is located.

The System Control Card sequentially selects the Channel Interface, Combined Digital Aggregate, or an Aggregate Control Module to place a data or control bit on the 16.896-MHz Fast Bus with channel and destination module addresses. The data travels to the addressed Channel Interface, CDA, or Aggregate Control Module. If the addressed module is a Channel Interface Module, the incoming address is replaced with the final destination address (a data or voice channel). If the addressed module is an Aggregate Control or CDA Module, the incoming address is replaced with the address of the next module in the route.

The flow of data through an TMSC is shown in *Figure 3-1* . When the TMSC multiplexes, low-speed data enters from the User Terminal through the Data or Voice II Channel Module. The Expansion Module buffers the data and sends it to the Channel Interface Module in the Main Shelf.

The Channel Interface Module assembles data coming from its (up to) 58 channels and sends the data in serial form across the 16.896-MHz Fast bus to the Aggregate Control or CDA Module, which also multiplexes data coming from the other Aggregate Control or CDA Module. The Aggregate Interface Piggyback mounted on the Aggregate Control Module uses encoding techniques to prepare the data for a trunk's particular interface control signals (for example, RS-422 or V.35). This serial multiplexed data is sent across the aggregate trunk to a remote node.

The Aggregate Control Module has 128 transmitting and 128 receiving FIFO buffers; physically it cannot pass more than 128 channels. 127 of these channels are data or voice channels; 1 of these channels (channel 0) is supervisory information coming from the System Control Card. Each aggregate must send channel 0 to make framing at both ends possible.

Both remote and local Aggregate Control Modules must maintain identical transmit and receive frames. When a MEGAMUX TMS receives aggregate data from another node, it distributes each bit to channels or destinations according to the select codes in the receive frame.

Combined Digital Aggregate-T1 (CDA-T1) Module

The CDA-T1 Module enhances the networking flexibility of the TMSC by providing full compatibility with the public T1 network. A brief look into T1 networking is necessary to understand the requirements for a CDA Module in the TMSC.

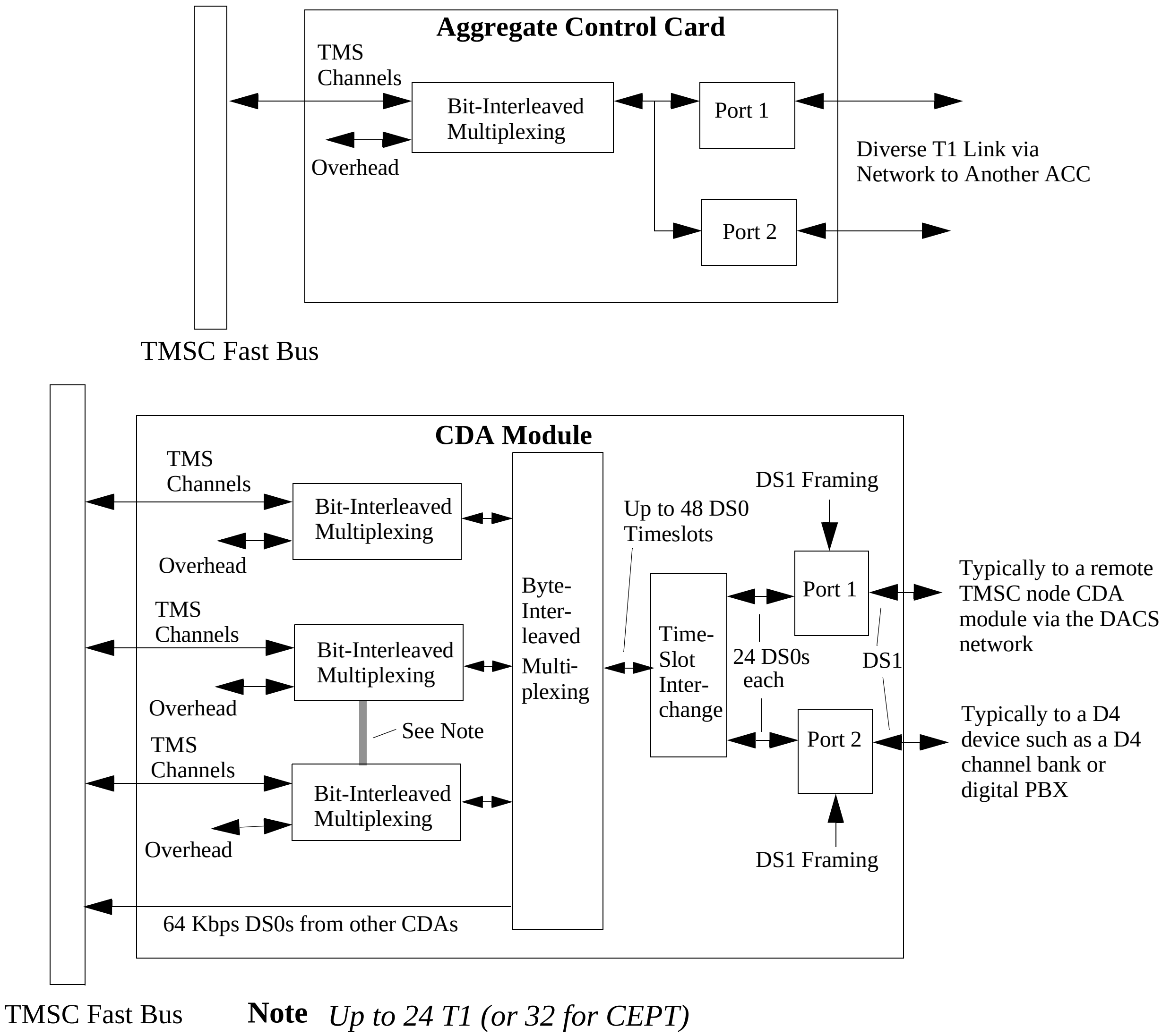
PBX manufacturers have provided up to 24 separate channel outputs from their equipment. Before the T1 interface became available, the TMSC interfaced to a PBX on the channel side only. Each PBX output was treated as an individual channel and combined with data into an aggregate output. The latest generation of PBX equipment combines the individual channels into a single 1.544 Mbps aggregate. The CDA Module provides the opportunity for a TMSC user to access an increasing number of carrier-provided services such as DACS, CCR, and a number of DS1 (digital) formats.

Figure 3-2 shows a conceptual comparison between the CDA Module and an Aggregate Control Module (ACC). The ACC combines TMSC channel data and controls from various TMSC channel modules. Synchronization, overhead, and communication bits are combined into a single high speed aggregate that is carried over a 1.544 Mbps T1 trunk. This T1 trunk line is dedicated to TMSC channel data only.

In contrast to the single level of multiplexing in the ACC, the CDA Module performs two levels of multiplexing. The first level is bit-interleaved multiplexing, similar to the type used in the ACC. Bit-interleaved multiplexing produces a proprietary aggregate, called a subaggregate, which occupies one or more 64 kbps of bandwidth. Up to 24 subaggregates are generated by a single CDA Module.

The second level of multiplexing is unique to a CDA Module. This is a byte-interleaved type that multiplexes the N x 64 kbps subaggregate data with 64 kbps DS0 segments from other CDA Modules (carried over the Fast Bus). The output of this second level of multiplexing is up to 48 DS0s of data. This is passed to the Time-Slot Interchange block which allows the software cross-connect of up to 48 DS0s. DS0 channels may be routed between DS1 ports on a CDA Module or from a DS1 port on one CDA Module through the Fast Bus and out on a DS1 port on another CDA Module.

The CDA Module meets the specifications of DSX-1 interconnections. Line rate is 1.544 Mbps. Pulse density is met by placing a mark bit in the seventh bit position if a byte contains all zeros. This technique protects the robbed bit signaling on PCM channels. Binary Eight Zero Suppression (B8ZS) and bit seven substitution are both selectable for the CDA Module. The CDA Module supports D4, ESF, and CEPT G.704, G.732 frame structures. The basic frame format is per D4 specifications, with 193 bits per frame and 24 sequential time slots of 64,000 bits in each DS0. D4 uses 12 frames per superframe, while ESF uses 24 frames per superframe. CEPT G.704 and G.732 operate at a line rate of 2.048 MHz. The G.732 format uses 32 time slots of 64,000 bits in each DS0.



Note *Up to 24 T1 (or 32 for CEPT) bit-interleaved multiplexing blocks.*

Figure 3-2 Conceptual Comparison Between ACCs and CDA Modules

The CDA Module can be used in several different applications. When a TMSC interfaces with a DACS via DS1 (T1) transmission facilities, the CDA provides a DS0 level aggregate frame structure. Through the process of framing TMSC channels onto a subaggregate within the DS0 frame structure, the CDA Module combines the TMS bit technology with byte technology. This increases efficiency since TMSC bit structures within one or multiple DS0s can carry many channels at various rates, rather than one channel per DS0.

Another application of the CDA Module is to provide an interface with standard D4 compatible products. This allows the use of the same T1 facility. A D4 channel bank can interface to a CDA port and is then mixed with TMSC channels onto the other CDA port. The TMSC channels are multiplexed into specific DS0 segments, while the channel bank occupies other specific DS0 segments as specified by the CDA configuration. This method is referred to as “Drop and Insert.’’ The Drop And Insert technique allows routing the channel bank DS0 through the DACS network while using the same DS1 facilities for TMSC channels.

Assignment of TMSC data and channel bank DS0s to specific time slots in the T1 link is controlled by the TMSC controller. The routing through the DACS network is not controlled by the TMSC controller. DACS control is available through the T1 carrier.

CDA-E1 Module

The CDA-E1 Module allows full duplex access to CCITT structured public networks at 2.048 Mbps. This module performs the following functions in the TMSC:

- Microprocessor and Data Exchange Interface
- 2.048 Mbps Line Interface (E1 duplex)
- Clock and data recovery (from E1 line)
- Frame, CRC and CAS Multiframe Alignment
- Insertion and extraction of signaling bits and framing pattern
- CRC detection and generation
- Alarm detection and generation
- Local and Remote Loopback capability
- Channel Associated Signaling (CAS)
- System clock (SCC) or receive clock (RCLK) selection for transmission of data
- 75-ohm unbalanced or 120-ohm balanced line selection

Common Channel Signaling (CCS) is not selectable as an option on the CDA-E1 Module. CCS is supported transparently by assuming Timeslot 16 is a data channel (network).

The microprocessor performs four basic functions on the CDA-E1 Module. It will initialize the E1 Input/Output plug-in card upon power up, scan for alarm conditions and initiate alarms to be transmitted and perform serial to parallel bus conversion. The board interfaces with the Date Exchange on the CDA basecard via the I/O Bus. This bus is a parallel data bus with each transaction transferring 8 bits of data and 4 coded flag bits for signaling.

The CDA-E1 Input/Output Plug-In card has two major sections, the transmitter and the receiver section.

The transmitter section contains a Time Slot Zero (TS0) data assembly that assembles framing, alarm, and national/international bits, accord-ing to timing information from the Transmit Frame Counter. The framing data is assembled in accordance with G.704 specifications.

A CRC Generator inputs the serial data from the Transmit framer and performs CRC encoding in accordance with G.704 specifications.

The resulting CRC remainder bits (4 per submultiframe), are fed back to the TS0 data assembly for insertion at the appropriate points during the next CRC submultiframe.

An HDB3 Encoder takes serial data from the Transmit framer and encodes it into HDB3 code in accordance with G.703 specifications. The resultant data consists of two TTL level signals representing positive and negative bi-polar pulses. These are fed to the E1 line interface.

Under software command, the transmit serial data from the Transmit Framer, the Transmit Clock, the decoded HDB3 data and the Receive clock can be substituted as inputs to the HDB3 encoder. This allows a remote loopback switch of received data to the remote end.

The HDB3 decoder inputs the TTL signals representing received positive and negative bi-polar pulses respectively, from the E1 line interface. It decodes these according to G.703 specifications into a serial 2.048 Mbps data stream. An input loss detector detects the absence of either received positive and negative bipolar pulses (representing data ones) for nine data periods and generates an alarm if this occurs.

Under software control, a local loopback switch substitutes the unjittered receive data stream and the phase locked clock for the transmit data stream and the transmit clock, respectively, for use by the rest of the receive functions, thus effecting a local data loopback.

A Receive Frame Sync Detector detects framing information in the received serial data stream. Frame sync is achieved when the correct framing sequence information is found. An alarm is generated if the framing sequence is not found.

The CRC Multiframe Sync Detector detects the one multiframe sync signal in the received data stream. The CDA-E1 Module acknowledges multiframe sync when the signal is detected. Loss of multiframe sync raises an alarm. A CRC Analyzer decodes the receive serial data. Any remainder bits are compared with the CRC bits received during the next CRC sub-multiframe and any inequality is registered as a CRC error.

A Signaling Sync Detector detects the signal multiframe sync. The CDA-E1 is in multiframe sync when this signal is detected, otherwise an alarm is raised.

The CDA-E1 Module terminates into a line impedance of 75-ohms (co-axial) or 120-ohms (balanced).

ADPCM Compression Module (ACM)

The ADPCM Compression Module (ACM) provides the means for a single DS1 or CEPT line, containing 24 or 30 (for CCITT) PCM voice circuits, to be brought into the TMSC and compressed via GDC ADPCM compression techniques. After compression, these circuits are transported across an aggregate via an Aggregate Control Module or framed into a TMSC subaggregate, in bit format, of a CDA Module.

The termination of the voice circuit can occur on a GDC Universal Voice Card (UVC), via a Channel Interface Module, MEGAMUX Plus, or MINIMUX. Also, it can be terminated via another ACM, on a Digital PBX. Optionally, 30 PCM voice channels can be accommodated by making use of the CCITT version (ACM/E1).

ACM I/O Interface

Two versions of the ACM are available, the ACM/T1 or the ACM/E1 (for CCITT). The base card may be optioned to support either 24 (DS1 option) or 30 (CCITT option) ADPCM Channels. The ACM may connect to either of two DB-25 connectors on the backplane for link connections. The top connector is designated a "A", the bottom connector is designated as "B". The top connectors are the odd numbered J designations, the bottom connectors are even numbered.

The I/O Plug-ins allow for different interface parameters to be met. The required specifications fall under various organizations.

ACM Theory of Operation

The following paragraphs describes the operation of the ACM. A simple block diagram is provided in *Figure 3-3* . In the following paragraphs, "Transmit" and "Receive" are defined with respect to the I/O interface.

"Transmit" refers to the data/signaling path from the Fast Bus towards the port, and "Receive" is from the port towards the Fast Bus (remote ACM or UVC).

The I/O Interface circuit function is to interface the ACM hardware to the I/O plug-in circuitry. Since the physical I/O interface bus (IOIF) is bi-directional, both receive and transmit functions are performed.

The I/O Plug-in interface circuit function is to receive and transmit data and controls to and from the I/O Interface card. This requires temporary data storage and handshaking with the plug-in and Payload Loopback section.

The Payload Loopback section allows a "loopback to remote" of all DS0 data, while framing and ESF communications are maintained. This section also allows an internal loopback from the transmit circuits towards the Fast Bus and individual channel loopbacks in either direction. The payload loopback section supplies parallel data to the receive code convert section and accepts parallel data from the transmit code converter. This section also stores and supplies the proper con-version code bits to the code converters.

The Code Conversion section is responsible for converting Mu-law data to A-law and vice-versa on a per channel basis. Complementary con-versions are performed in both directions. The receive code converter supplies parallel DS0 data to the Receive parallel to serial converter. The transmit code converter accepts parallel DS0 data from the transmit serial to parallel converter.

The Microcommunications Channel section routes a single DS0 channel to and from the micro plug-in for processing by an HDLC controller IC. This function will also support a CDA compatible communications channel in 8 kbps multiples. This section is bi-directional. The Input/Output to this section comes from the microprocessor via the serial communication bus and the I/O interface section via the parallel IOLB bus.

The Receive PCM Counter keeps track of the address of the receive DS0 channel currently being processed by the receive I/O Interface section. The address is needed by the Payload Loopback, Receive Parallel to Serial and Receive Signaling sections.

A Receive Parallel To Serial Conversion section takes the parallel receive data from the output of the code converter to the serial format required by the ADPCM transcoders. Clocks to the individual trans-coders are also generated by this section based on the Receive PCM counter output.

The Transmit Serial to Parallel Conversion section converts the serial transmit data from the the ADPCM transcoders output to the parallel format required by the code converter. Clocks to the individual transcoders are also generated by this section based on the Transmit PCM counter output.

The Transmit PCM Counter keeps track of the address of the transmit DS0 channel currently being processed by the transmit I/O Interface section. The address is needed by the Payload Loopback, Transmit serial to parallel, and Transmit Signaling sections.

The Transcoder section is the heart of the ACM. This is where the PCM to ADPCM conversion occurs. The receive section of the transcoder is called the encoder. Twenty four or thirty serial PCM data streams and clocks from the receive parallel to serial section are converted to multiple rate ADPCM data before being passed to the scrambler. Passthrough mode is also available.

The receive data is scrambled to prevent false sync from occurring on an idle or constant tone channel. Without a scrambler, constant marks or spaces could easily be synchronized to. The scrambler converts a constant pattern to one which is constantly changing. The algorithm used is the same as on the UVC to allow compatibility. The serial input to the scrambler comes from the transcoder. The data output is in a parallel format which is supplied to the output frame section.

The Output Frame has a twofold pupose. First, the frame inserts sync bits to allow byte boundary recognition at the remote site. The byte boundaries are necessary since the data is byte structured, but it is being sent in a bit serial multiplexed format.

The second function of the output frame is that of an output multiplexer. Since the data enters the output frame as parallel bytes it must be dis-
tributed evenly before being output to the Fast Bus in serial fashion. This is necesary to insure minimal buffer excursions on channel cards or channel FIFOs. Also, control bits "WXYZ"are inserted by the framing mechanism.

The purpose of the data encoder section of the Output Frame is to accept serial data from the output frame, and "WXYZ" information from the receive signaling section, and encode it into the proper format for output to the Fast Bus output section.

The Receive Signaling section is responsible for converting the "A B C D" signaling from the I/O card into the "WXYZ" format needed for the Fast Bus output section, supplying the "A" bits to the Byte Sync section, and generating the MEGAMUX type "Control 1 thru 6" signals required by the UVC card.

Control 6 has been defined as "channel sync loss" and is sent between ACMs to trigger data/ signal conditioning. Also, the microprocessor can perform diagnostic tests or conditioning of the signaling bits by forcing outputs. This section accepts inputs from the payload loopback section, receive PCM counter and is requested for outputs by the output frame. The outputs from this section are: "WXYZ", "A" bits and address which are supplied to the output frame for use as control words and synchronization bits, respectively.

The Routing RAM circuit is a RAM based look-up table used to generate destination addresses for the Fast Bus from channel address inputs.

The input address is supplied by either the Output Frame, for data bits, or the receive signaling section for control words. The routing RAM allows any ACM channel to be soft configured to connect to any other channel in the TMSC node.

The Fast Bus section consists of the line drivers necessary to drive the fast bus. This section also determines, based on the select address from the SCC and the ACM slot address, when the

ACM is to drive the bus. The Fast Bus output circuit has an adjustment for Fast Bus enable and disable times. This allows fine tuning of the ACM Fast Bus output.

The Fast Bus input section is responsible for receiving the Fast Bus data, channel address and slot address from the backplane. This section contains the input FIFOs which are used as rate adapters to smooth out the Fast Bus input bursts to a slower speed. This allows the necessary time for the ACM to process each bit. The input FIFOs supply data/address to the Byte Sync logic and control information with address to the transmit signaling section.

The Byte Synchronization section is responsible for finding and maintaining the byte synchronization of all the ACM channels. Byte sync is needed to identify the MSB-LSB position of the ADPCM or PCM word which has been serialized for compatibility with the MEGAMUX TMS Compact bit multiplexer structure. After synchronization is acquired for a particular channel the overhead byte sync bits are stripped off and supplied to the signaling filtered section as "A" bits. The input for this section is a serial data stream from the input FIFOs. This section outputs data in serial form to the Descrambler.

The Signaling Filter takes the signaling bits (A bits) and filters them. This prevents illegal state changes before being presented to the signaling section for transmission onto the link. The Byte synchronization section passes partially filtered signaling bits to the signaling filtering section with the end of frame bit. This section filters according to the method used by the UVC and passes the filtered "A" bits to the transmit signaling section.

The Descrambler is needed to reverse the process that the scrambler performed on the receive data. The serial data input is supplied from the Byte Sync section. The descrambler outputs parallel data words to the Multichannel FIFO.

The Multichannel FIFO is needed to synchronize the random channel inputs from the fast bus to the transmit frame of the I/O plug-in. The I/O plug-in transmits all channels sequentially to the port, but the input from the Fast Bus will occur in a random fashion depending on the structure and alignment of the receive frames of the card(s) feeding the ACM. The input to this section is in parallel form from the descrambler. The output, also in parallel format, is sent to the Transmit Parallel to Serial converter section.

The Transmit Parallel to Serial section converts the parallel Multi-channel FIFO output data and address into a serial data stream and 30 individual clocks for use by the ADPCM decoders.

The transmit part of the Transcoder is called the decoder. 24 (30) serial ADPCM/PCM data streams and clocks from the transmit parallel to serial section are converted to 64 kbps PCM data before being passed to the transmit serial to parallel section.

The Transmit Signaling section is responsible for storing the 'W X Y Z' control bus information from the Fast Bus input and accepting filtered sync bits (A bits) from the signaling filter section and converting them into the "A B C D" format needed for use by the payload loopback section, Also, the microprocessor can perform diagnostic tests or conditioning of the signaling bits by forcing outputs and monitoring inputs.

The Microprocessor Interface provides all the hardware connections from the microprocessor to the individual hardware sections. These include chip selects for specific RAMs and separate input and output ports.

The Clock Generation and Timing section is responsible for providing all the clocks that are needed by the different ACM hardware sections. The input to this section is the MEGAMUX TMS Compact "SYS CLK" and the ACM's Fast Bus select pulse from the Fast Bus input section. The outputs are multiples of SYS CLK synchronized to the select pulse.

Phase Lock Clocking is also performed by this section. This function allows the ACM to drive or monitor the system clocking source.

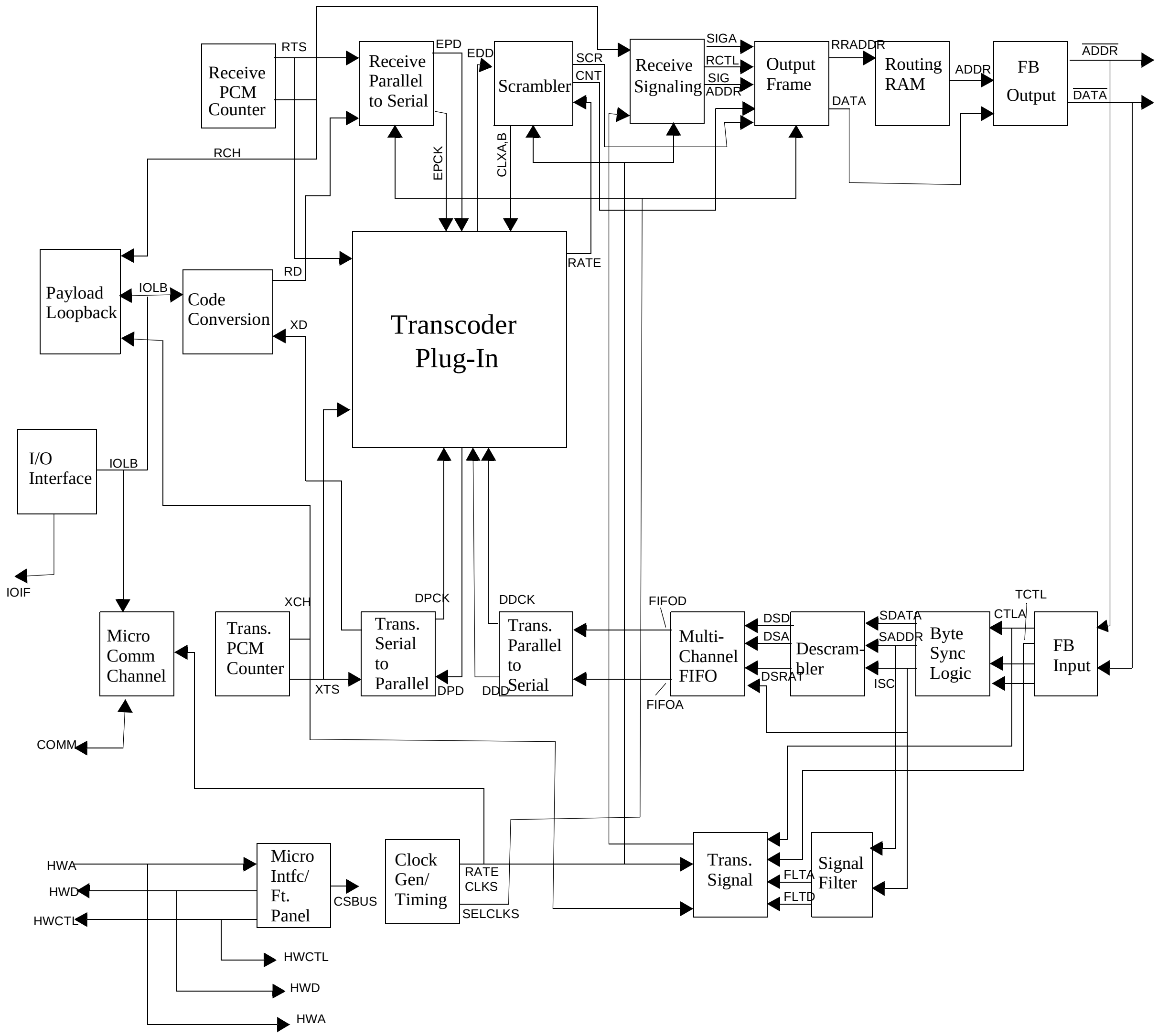


Figure 3-3 ACM Block diagram

Enterprise System Control Card

See Chapter 1.

System Control Card

The System Control Card (SCC) monitors and controls the activities of the Common Modules in a node. It does not perform the multiplexing tasks for the node.

The microprocessor on board the System Control is linked to all other modules in the Main Shelf via the communication bus.

The System Control Card has the following serial links:

- To the TMSC Controller, or alternatively to the Maintenance Console
- To the redundant System Control Card in case the primary System Control Card goes out of service
- To a modem via the Redundancy Control Card. This can be either the domestic 212A modem on board the Redundancy Control Card, or it can be a user provided one which is connected to the node via a 25-pin connector on the backplane.

The System Control Card monitors all the common modules in the Main Shelf. If hardware or software faults are detected, the System Control Card will initiate a fault sequence. An operator alarm is raised and the Redundancy Control Card switches the faulty module into Stand-by.

The System Control Card incorporates an Enable/Disable switch. When placed in the Disable position, this switch temporarily isolates the card from the Main Harness backplane. The card can be temporarily removed and reinserted preventing transients and glitches from affecting the node.

In the Disable position, the System Control Card remains Out of Service during a Power Up Reset of the system.

After the card is installed in the Main Harness Backplane, the switch is placed in the Enable position.

The clock generator on the System Control Card generates the data rate signals used on the backplane clock bus which all common modules use.

System Control of TMSC Timing

TMSC timing is established by the clock generator on the System Control Card. All clock signals must be frequency locked to a master frequency which itself can be an incoming clock or it can be generated on the board.

The clock generator design is based on five analog phase-lock loops. These loops compare two almost identical frequencies and, by fine tuning the feedback frequency, achieve a perfect frequency lock.

Because the phase-lock loop works optimally at 8 kHz the data clocks are prescaled down to 8 kHz before entering the phase detector.

The five phase-lock loop circuits (PLL 1-5) generate these primary frequencies:

18.432 MHz (PLL 1)3.152 MHz (PLL 4)

16.896 MHz (PLL 2)1.544 MHz (PLL 5)

6.312 MHz (PLL 3)

After being sent through divider circuits, these five frequencies are changed into all of the frequencies sent to the TMSC backplane. These frequencies are listed below:

8448 kHz	1544 kHz
6312 kHz	921.6 kHz
3152 kHz	896 kHz
2304 kHz	224 kHz
2048 kHz	100 kHz

In addition, four other frequencies are available using two programmed sequences in dedicated RAM memory. The choices are between Program 1 (PROG 1) or 1.536 MHz and between Program 2 (PROG 2) and 1.344 MHz. One or the other frequency can be chosen using berg jumpers (see Chapter 4).

The Clock Generator provides data rate clocks to all channels via the clock bus. PLL 2 (16.896 MHz) is phase locked to the 16.896-MHz clock driving the Common Equipment Bus on the backplane.

The Aggregate Control Module's clock select circuit receives frequencies from the System Control Card via the clock bus. This circuit selects which frequency will be used for an aggregate clock. Then a clock divide circuit selects the correct divide chain to change the picked frequency into the desired aggregate rate.

Note *Do not use an aggregate running at 24.0 kHz or below for a timing source, since phase locking at these rates is unreliable. To lock to a source at these rates, use a highly stable external clock with a jitter amplitude of less than 1 unit interval maximum, where 1 unit is 1 cycle of the incoming clock.*

Redundancy Control Card

The Redundancy Control Card provides switching between the In-Service and Stand-by Modules in a redundant pair. The System Control Card sends both a hardware and software alarm signal to the Redundancy Control Card.

The Redundancy Control Card activates the relay and alarm light corresponding to the bus in which the alarm occurred (either minor or major alarm bus). The relay triggers an external signaling device.

The early versions (-001 and -002) of the Redundancy Control Card have an on-board domestic 212A Modem. The System Control Card auto-answers incoming calls through this modem. Data transfers are 1200 bps full duplex in the answer mode only. This feature is used to extend supervisory communications to the node when it becomes isolated from the TMS Controller. An external modem can be connected to connector J8 on the backplane if you do not want to use a 212A Modem. The Internal/External modem ports on the backplane can be configured for Dial Backup or the Supervisory Pass-Through feature.

Data Channel Module

Note *For a list of publications that describe data channel modules other than those listed below, refer to the Preface.*

The Data Channel Module provides an interface for any data device communicating through the TMSC. This module operates under the control of the Channel Interface Module which in turn is controlled by software downloaded from the System Control Card.

The System Control Card programs the Data Channel Module to support different data rates and types of data, as required by each configuration. Different interface types are selected by switch and jumper settings and by software controlled resistor networks which select the signal levels required for the interface.

The Data Channel Module exchanges only synchronous data with the Channel Interface Module. If the Data Channel Module operates with asynchronous or some form of isochronous data, the Data Module converts the data to synchronous format. Framing and control information is then inserted into the data stream by the Channel Interface Module in preparation for transmission across an aggregate trunk.

When programmed for asynchronous operation, the module converts the bits of each character to synchronous data. The receiving TMSC or MEGAMUX PLUS node reconstructs the characters and passes the asynchronous data to the asynchronous device connected to the channel.

When programmed for transition-encoding, each bit of isochronous transmit data is converted to three synchronous bits, according to CCITT R.111 standards. The encoded synchronous data is transmitted across the aggregate trunk at four times the maximum data rate of the channel. At the opposite end, the encoded data is restored to the original isochronous format. This technique accurately maintains the timing relationship of isochronous data bits, but consumes more aggregate bandwidth (four times the channel data rate) than any other channel data conversion method.

When programmed for isochronous operation, the module develops a clock signal from each transition in the isochronous data signal. Data is shifted into buffers in the channel module using the data-derived clock.

At the opposite end, the channel module shifts out isochronous receive data using the TMSC system clock. This data conversion method requires aggregate bandwidth equal to the maximum data rate of the device connected to the channel. However, because the timing of the original isochronous transmit data has no fixed relationship to the TMSC timing, errors can result from "phase drift" between the TMSC timing and the timing of the isochronous device connected to the channel.

The Data Channel Module transmits up to four interface control signals to the opposite-end channel module. A program plug (PP2) on the channel module selects the control signals as Input Controls 1-4. At the remote channel, Output Control signals 1-4 are distributed to pins of the channel interface connector, as selected by program plug PP2. See Chapter 4 for additional information.

Off to On transitions of Input Control 1 are transmitted to the remote channel as in-band controls. When the state of Input Control signal 1 changes from Off to On, the transition is encoded as a four-bit code, which is then transmitted to the opposite end as channel data (instead of being sent as a channel control). In-band transmission of the control occurs much faster than transmission through the normal channel control path, allowing the TMSC to support polling operations. However, the channel will not send data through the aggregate trunk until the Off to On transition of Input Control 1 occurs.

All four control signals selected by program plug PP2 are sent through the normal control transmission path. Control signals are supplied to the transmit logic through the WXYZ bus. When a transition of any input control signal occurs, the control is placed on the WXYZ bus. The System Control Card is notified of the signal change, and selects that channel as the next candidate for control signal transmission. The control signals are removed from the WXYZ bus by the Channel Interface Module, and transmitted through the aggregate trunk. At the remote end, the control signals are sent to the receiving channel via the WXYZ bus; the channel module distributes the controls to the channel interface connector as determined by program plug PP2. A diagnostic bit (remote channel loopback) and an alarm bit (local channel alarm) are also transferred from a local Data Channel Module to a remote channel module through the channel control path.

Channel controls are also sent on a regular basis regardless of control transitions. The Channel Interface Module sequentially selects controls from each channel via the WXYZ bus. If a channel indicates a control transition, the Channel Interface Module services that channel as described above, and then returns to the normal sequence of selecting channel controls.

Channel control signals may be forced On or Off according to selections in the active configuration. When a control is forced to a state by a command from the System Control Card, transitions in the interface control signal are ignored.

TID-III Data Channel Module

The TID-III (Time-Independent Data) Channel Module provides a unique solution for isochronous/plesiochronous data communication for the TMSC. The TID-III Data Channel Module accepts RS-422 data and clock inputs at any one of 18 standard rates from 1.0 kbps to 1.024 Mbps. The TID-III can be optioned to accommodate special rates within this range or to automatically track variable rate input clocks up to a specified maximum. Channel features are software-controlled for the TMSC.

The TID-III Data Channel Module utilizes RS-422 clock and data inputs that are time independent from the multiplexer timing and, through a unique bit-stuffing algorithm, converts the isochronous/plesiochronous data to the next higher TDM synchronous data rate. At the remote end of the link, time-independent data is recovered and the channel's Numerical Controlled Oscillator (NCO) generates the appropriate clock for output of data.

Five user-selectable modes provide a variety of operational capabilities. Modes 1 through 3 provide for data bit delay and external receive clock timing and allow tracking of input frequencies that exhibit varying degrees of inaccuracy. Three types of tracking are available on the TID-III Data Channel Module:

- Accuracy Tracking (Mode 1) — When tracking an accurate clock with ±0.001 % rate offset on the transmitting end, the total rate offset through the TID-III on the receiving end is only ±0.003 %.
- Program Tracking (Mode 2) — Allows the user to program the channel to control signal input and output rate offsets and to optimize communications for variable external clock characteristics.
- Input Tracking (Mode 3) — Supports communications where the input frequency may vary up to ±1.5 % due to external clock accuracies.

Mode 4 emulates the operation of an ECH-11 channel. Mode 5 allows automatic tracking for variable rate inputs up to a specified maximum. The TID-III Data Channel Module can be used for the following network applications:

- •A network utilizing satellite communications or multiple satellite hops.
- Systems requiring distribution of telemetry/telecommunications data to independent system users or nodes.
- Interfacing multiple, nonsynchronized clock and data sources (e.g., DDS circuits) to a synchronized GDC TDM.
- Interfacing nonstandard clock and data sources to a GDC TDM.
- Interfacing external communication circuits exhibiting poor or unstable signal quality.
- Interfacing variable rate, nonstandard, and nonsynchronized clock/
data sources.

Voice Channel Modules

The following paragraphs describe the various voice channel modules that are available for use in the TMSC.

Voice II/CVSD

The Voice II/CVSD Channel Module converts full-duplex voice signals to synchronous data for transmission across an aggregate trunk and converts the synchronous data to a voice signal at the remote site. The continuously-variable-slope delta modulation (CVSD) analog-to-digital conversion technique is used to convert the voice signal into data. Synchronous data rates up to 64 kHz may be selected for the module through the TMSC Controller (voice quality improves with the higher data rates).

E and M signaling is supported by the Voice II/CVSD Channel Module. The "Busy" state of the M-lead is encoded and sent through the channel data path as an in-band control. M-lead transitions are also transmitted through the normal channel control path. All transitions of the M-Lead are transferred to the E-Lead by the remote Voice II/CVSD Channel Module. The signal states of the M-Lead (the signaling type) are determined by the positions of option switches and jumpers on the module.

Voice II/ASP Channel

The Voice II/ASP Channel Module provides multiplexing of voice signals through a TMSC at 10, 11, 12, or 16 kbps. Aggregate bandwidth economy is achieved through the use of an Advanced Speech Processing (ASP) voice encoding technique. Each channel requires 10.8, 11.8, 12.8, or 16.8 kbps of aggregate bandwidth because 800 bps is required to support E and M signaling and overhead requirements.

The ASP channel can be configured to operate in a 64 kbps bypass PCM mode; voice data is then multiplexed through the TMSC at 64.8 kbps. 64.8 kbps of aggregate bandwidth is required to support an ASP channel operating in this mode because 800 bps is required to support E and M signaling and overhead requirements.

The Voice II/ASP Channel Module supports all domestic modes of E and M signaling, as well as British Telecomm DC-5 signaling.

Universal Voice Channel

The Universal Voice Channel Modules use a single base card to convert voice signals to 64 kbps PCM voice data. LSI chips may be installed on the base card to achieve quality reduced-rate voice transmission, using ADPCM voice encoding methods.

The UVC/PCM Voice Channel Module consists of the base card only. PCM voice data is transmitted at 64 kbps through the TMSC; with an additional 800 kbps required for overhead, the channel data rate is 64.8 kbps. PCM voice encoding and decoding meets CCITT G.711 coding standards and complies with CCITT G.712 performance standards.

The UVC/ADPCM Voice Channel Module consists of the base card with an ADPCM LSI installed on the base card. Voice-grade signals are converted to 64 kbps PCM, and then converted to ADPCM voice data.

Several modes of 32 kbps ADPCM encoding are selectable through channel configuration. One mode complies with the current joint CCITT G.721 and ANSI ADPCM standards for 32 kbps voice encoding. A GDC-proprietary 32 kbps mode provides superior performance when an analog modem signal is transmitted through the voice channel. 24 kbps or 16 kbps ADPCM modes may also be selected. An additional 800 kbps of overhead is required for each mode, resulting in channel data rates of 32.8 kbps, 24.8 kbps, or 16.8 kbps.

The UVC/ADPCM Voice Channel Module may also be configured to operate in a 64 kbps PCM mode.

All Universal Voice Card Modules are backward-compatible with existing Voice II/PCM and Voice II/ADPCM Voice Channel Modules. When used with a Voice II/PCM or Voice II/ADPCM module at the opposite end of a circuit, a UVC/PCM or UVC/ADPCM module requires 2 kbps of overhead.

All Universal Voice Card Modules support E and M signaling, as well as British Telecomm DC-5 signaling.

Echo Canceller Piggyback

If a significant time delay (50 ms or more) occurs between the two ends of a line (caused by a long terrestrial line or a satellite link), an echo results which interferes with normal voice conversation. This echo may be eliminated by installing an Echo Canceller Piggyback Card on the Universal Voice Card located at each end of the system.

The design of the Echo Canceller is based upon an adaptive digital filter that attempts to model the impulse response of the analog path through the external hybrid circuitry. By passing speech from the far end of the line through this filter, the Echo Canceller is able to generate a "synthetic echo" which is subtracted from the actual echo. In this manner, the actual echo is cancelled.

A Bulk Delay feature enables echo cancellation to be performed on tail circuits with a delay in excess of 16 ms (that is, the delay from the analog output of the CODEC via the hybrid to the analog input of the CODEC exceeds 16 ms). The length of the Bulk Delay is controlled by switches S1-2 and S1-3.

The delay inserted is 0, 7, or 14 ms at the input to the adaptive filter. If the digital transmit and receive levels on the voice channel card are not set up to be the same value, the echo canceller may not function properly. It is essential to adjust the gains and losses in the analog circuitry so that a 0 dBm signal at each end of the link will result in the same signal level (measured in dBm) at the analog input and output of the PCM CODEC. Therefore, the factory default value of the Bulk Delay feature is set to 0 ms.

If the tail circuit delay varies greatly with different call routings, there may not be a single Bulk Delay length that can accomodate the range of possible tail circuit delays. In this case, the "Adaptive Delay" setting can be selected to allow the Bulk Delay to adapt itself to the optimum value for each call.

The Echo Canceller may be disabled or enabled by an external control line connected to the D-type connector located at the rear panel of the multiplexer. This control line can be used by external equipment to disable or enable the Echo Canceller when required. The control line has two states. In one state it is connected to Station Ground; in the other state it is an open circuit. An opto-isolator on the Echo Canceller Card determines whether or not the control line is grounded.

Switches S1-4 and S1-5 control operation of the external Enable/Disable control line. Additionally, these switches permit the control line to be permanently disabled or enabled (that is, the Echo Canceller ignores the external control line state). The Echo Canceller may also be permanently disabled by a jumper on the Universal Voice Card.

VLBRV

The VLBRV (Very Low Bit Rate Voice) Channel Module reduces the effective data bandwidth required by a speech circuit passing through the TMSC network. Three bit rates are offered under software control: 9.6, 4.8 and 2.4 kbps. Signaling will not require overhead bandwidth.

Speech compression is accomplished through proprietary digital signal processing techniques. It will take a standard 4W E&M speech channel and apply speech reduction algorithms to define parameters of the speech. These parameters are transmitted at a lower bit rate to the receiving end where they are reconstituted back into speech again.

VLBRV Base Card Operation

Analog voice information is directed into the transmit section of the VLBRV via a standard 600-ohm transformer coupled telephone interface. This signal is sent to an analog level conditioning circuit.

The standard input level is –16 dBm (with an alternative of 0 dBm) selectable through a DIP switch. This input level can be adjusted by hardware in 0.5 dB steps in the range of –6.0 dB to +1.5 dB. The input level gain is further fine tuned to within ±0.3 dB of nominal in the factory.

This conditioned analog signal then goes through an analog-to-digital conversion process and is sent out as a standard PCM signal (A-law companded) at 64 kbps. This signal is sent to the VLBRV piggyback card for bit rate reduction.

The reduced bit rate signal is received from the piggyback at 9.6, 4.8, or 2.4 kbps and then passed via an elastic buffer to the multiplexer transmit data bus. The elastic buffer absorbs any jitter contained into the data stream by its passage into the multiplexer.

Receive voice data is sent from the multiplexer at the reduced bit rate and passed through a receive elastic buffer (similar to the transmit buffer) on its way to the piggyback card.

The receive data comes from the piggyback as regular PCM data (A-law companded) at 64 kbps. It is sent to the base card and converted to an analog signal. This analog signal passes through a level conditioning circuit, (the output pad) where its level is adjusted before being output to the user via a standard transformer coupled 600-ohm line. The output pad for the receive analog signal consists of three sections.

The standard output level is +7 dBm (with an alternative of 0 dBm) selectable through a DIP switch. The output level can be adjusted through software in 0.5 dB steps in the range –6.0 dB to +1.5 dB. The output level is further fine tuned to within ±0.3 dB of nominal in the factory.

The clock generator for the 64 kbps clock and the 9.6, 4.8 and 2.4 kbps data rate clocks is contained on the base card and initialized through software. All clocks are derived from the multiplexer clock bus rates of 1024 kHz and 921.6 kHz.

Piggyback Card Operation

Serial PCM data (A-law) at 64 kbps is sent from the base card and converted into a low bit rate data stream for transmission to the multiplexer via the base card. Simultaneously, low bit rate encoded voice is received from the multiplexer channel and converted back to serial PCM encoded voice data (using a proprietary algorithm) at 64 kbps and returned to the base card.

The speech compression algorithm selection is based on the speed of the channel rate clock (either 9600, 4800 or 2400 Hz). The piggyback card measures the frequency of this clock and selects the appropriate algorithm. This frequency may change at any time and without warning from one frequency to another.

Two control lines on the hardware interface inform the piggyback card which data rate is current. The piggyback card detects a change in this bit rate and selects the new algorithm. The algorithms used for bit rate reduction are shown below.

Data Rate	Software Algorithm
9600	APC (Adaptive Predictive Coding)
4800	LPC (Linear Predictive Coding)
2400	LPC

The piggyback card can transmit standard PBX signaling tones. The VLBRV supports 2-state (E &M) signaling only.

Note *The timing requirements of the UK SSDC5A signaling system specify that no more than ±2.5 ms of distortion be allowed on pulse widths of signaling pulses.*

Short breaks can occur when in-band signaling information is sent out on the network. This is considered normal operation because voice signals are usually static during a telephone conversation.

VLBRV FAX Operation

Using an optional version of the piggyback card, the VLBRV can continuously monitor and test the voice data for Group 3 facsimile signals (CCITT V.29/27). If the test is positive, then the FAX data is demodulated into a binary stream at the sending end and the FAX data is transmitted through the multiplexer network at the full transfer speed of 9600, 4800 or 2400 bps. At the receiving end, the data will be modulated back into a Group 3 FAX signal on the PCM data stream. A Group 3 FAX machine connection is made at each end of the voice channel. Full bandwidth availability for the FAX is provided.

The operation of the FAX bypass will require no operator intervention. The user establishes an end-to-end voice link and connects the FAX machine at each end. At the end of the FAX session, the FAX machine is turned off. No voice will be transferred during a FAX session.

Power Supply Modules

The GPS-8A, GPS-8B, and DPS-8A Power Supply Modules used to power the TMSC are described in GDC 035R007-000, 035R009-000, and 041R162-000, respectively.

Chapter 4, Installation

Overview

This chapter contains information on the installation of the TMSC. Unpacking, shelf mounting, cable and wire connections, option selection, and system timing are all discussed in this chapter. *Figure 4-1* shows the rear panel of the TMSC shelf.

Many tables and diagrams are required to provide sufficient installation information for the TMSC. To simplify access to particular items of information, most of the tables and diagrams in this chapter have been grouped according to the TMSC module with which they are associated.

Topics in this chapter include:

Unpacking and Inspection

The following steps detail the unpacking and inspection requirements for the TMSC.

1. When you remove this manual from the shipping carton, the TMSC is mostly unpacked. Remove any stray packing material from the unit.
2. Position the TMSC unit for easy access to the front and back of the unit.
3. Remove spare modules from their cartons. Spare modules, if any, are packed in plastic bags and contained in separate cartons.

Note *Do not discard carton or packing material; save for transporting or reshipping if necessary.*

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4. Inspect the components for visible signs of damage. If any damage is evident, notify the shipper immediately.
5. Inventory unit components for agreement with packing list (module types, quantities, etc.).

Note *In GDC Part Numbers, the dash number (last 3 digits of the part number), which represents a revision level of the card, may be different in your system.*

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6. Verify that the unit's components and factory selected options on the various modules are properly configured for your TMSC applications. Use the systems drawing package supplied with your system to determine the proper option selections and card arrangements for your system. In particular, ensure that:

   Each module is in its proper slot in the TMSC shelf. The correct locations are given in your Network Documentation Package. Module locations for a completely filled redundant node are illustrated in *Figure 4-2* . (In a nonredundant system, each slot marked "SEC." on the diagram has a blank filler panel). Check that Data Channel and Voice Channel cards are in the correct channel slots.

   The correct aggregate interface piggybacks or interface cards are installed on the Aggregate Control modules. Chapter 1 lists the different interface piggyback cards.

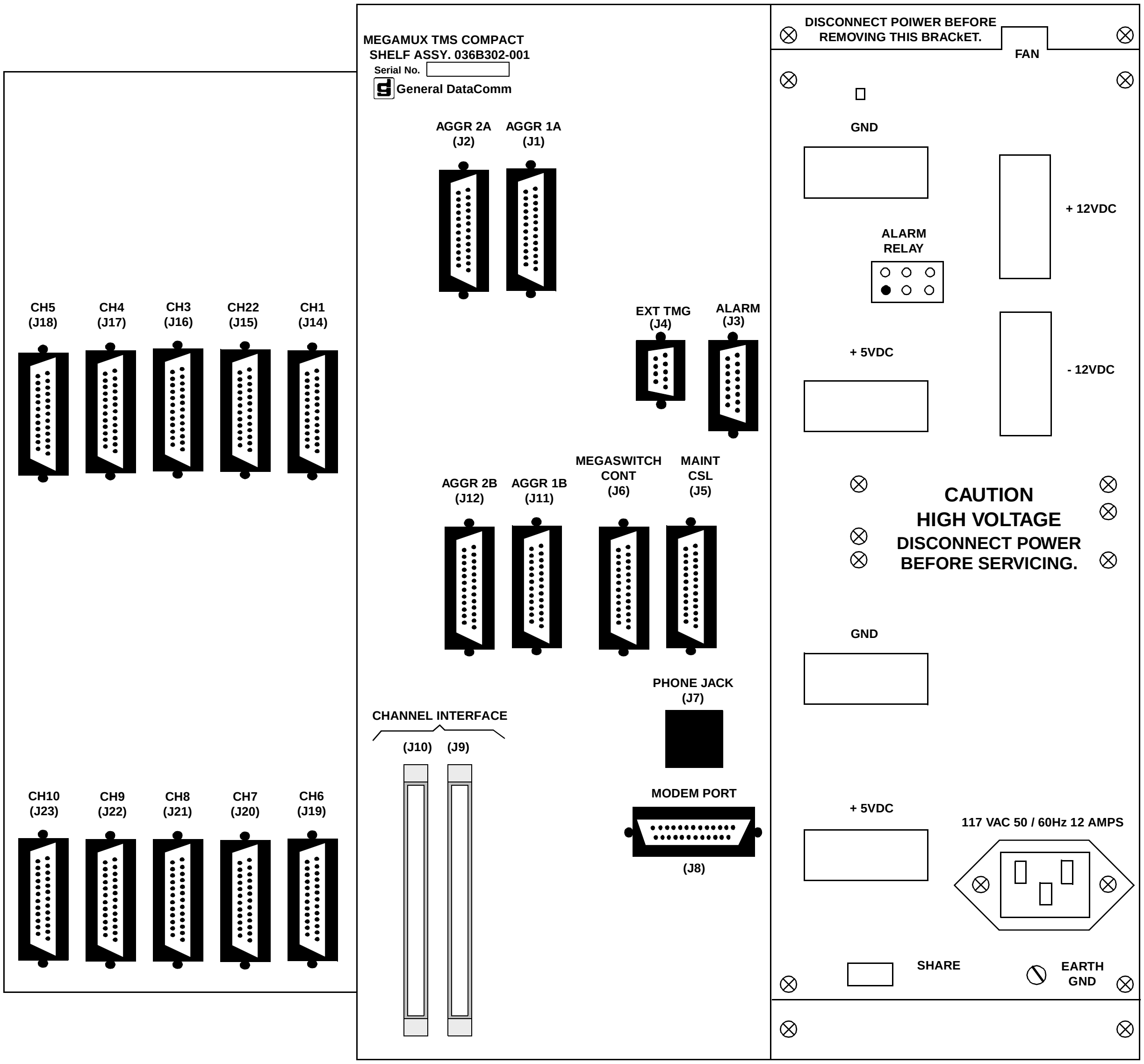

Figure 4-1 TMSC Shelf, Rear Panel

Installation

TMSCs are usually shipped already mounted in GDC EP-2M or EP-4 cabinets. If your TMSC is already mounted, proceed directly to step d below. Otherwise, follow these directions:

1. If the TMSC shelf assembly is not being mounted in a rack, install it in a reasonably well ventilated location. Do not locate directly above other equipment (such as power supplies) which generate large quantities of heat. The ambient temperature should not exceed 122°F (50°C).

2. If the TMSC is being rackmounted, install it in a standard 19-inch rack. Two GDC cabinets are available for that purpose:

   EP2T — 30 in. (76 cm) by 23 in. (59 cm) by 24 in. (61 cm) with 2 fans

   EP4 — 76 in. (193 cm) by 23 in. (59 cm) by 26 in. (66 cm) with blower

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Note *The EP4 cabinet comes wired with a 20-ampere rated line cord and a twist-lock NEMA L5-20P type plug. This mates with a NEMA 20R type receptacle which must be available adjacent to the installation.*

Provide the following vertical rack space for each TMSC shelf component:

GPS-8A, GPS-8B, or DPS-8A — 7 in. (18 cm) (high-current applications only)

TMSC shelf — 14 in. (36 cm)

16-channel expansion shelf — 7 in. (18 cm)

Caution *Air must be forced through the rack. A blower capable of moving 300 cubic feet per minute (CFM) must be installed at the bottom of the shelves. Three exhaust fans capable of moving 100 CFM must be installed at the top of the cabinet. Suitable fans and blowers are required. External ambient temperature ideally is between 25° to 30°C. Operation between 0° and 50°C maximum is an operating specification only when equipment is mounted in GDC EP-2T, EP-2M, and EP-4 cabinets.*

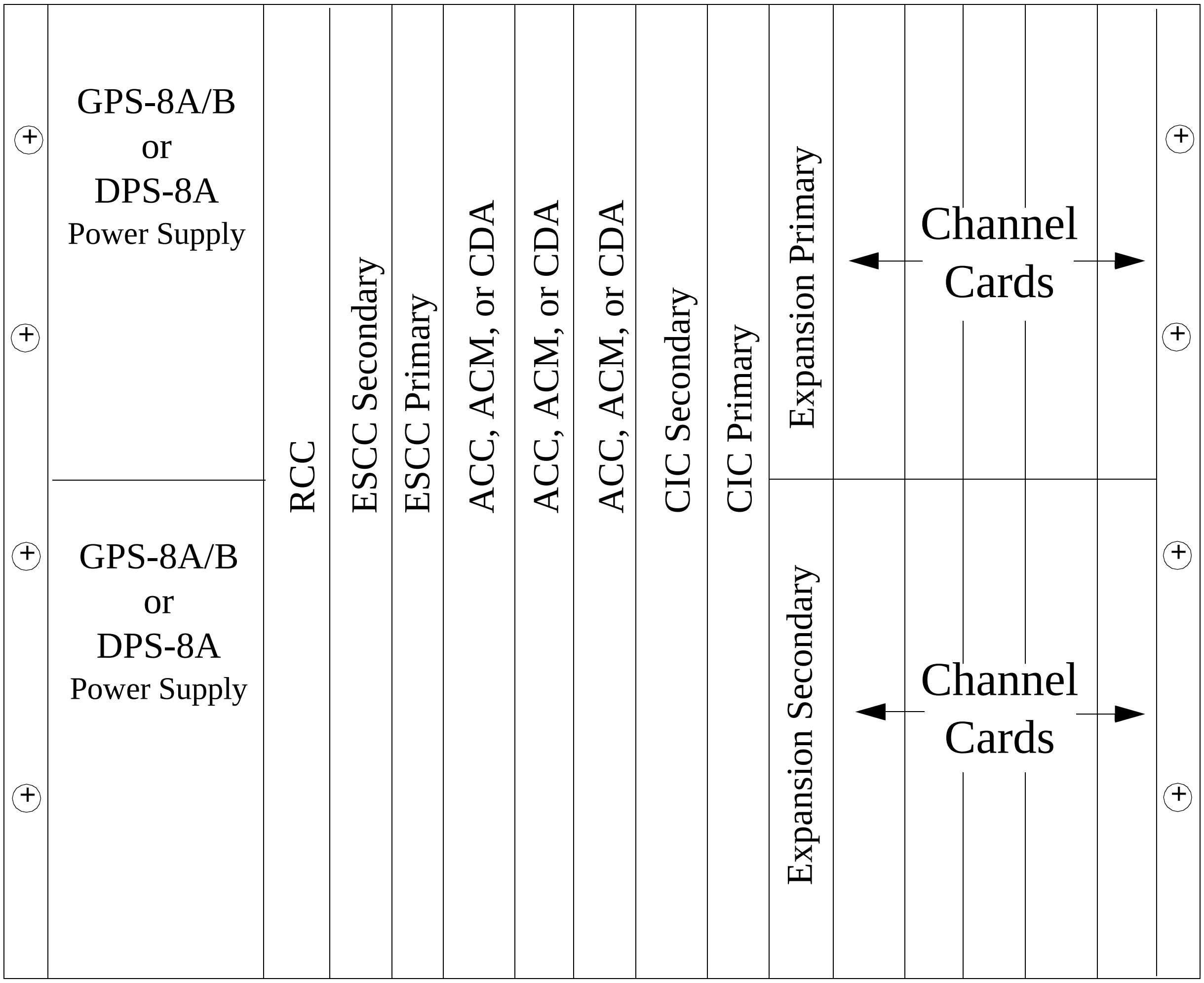


Figure 4-2 TMSC Main Shelf, Module Locations

3. An additional power supply shelf (with power supply) may be used with the TMSC for high-current applications. When additional power supplies are used, connect the dc power harness on the rear of the main shelf assembly to the GPS-8A or DPS-8A. The system's drawing package includes a wire list for the harness, which indicates the terminal connections for each wire. Connections to the power supply are made by inserting the wire into the appropriate power supply terminal, and tightening the screw that fits into the terminal.

   Refer to Chapter 7 for drawings of the main harness card (Figure 7-1) and main shelf channel harness card (Figure 7-3). The GPS-8A and DPS-8A Power Harness Cards for the TMSC are shown in Chapter 7, Figures 7-8 and 7-9, respectively.

4. The location of the power supply connectors on the TMSC Expansion Harness Card are shown in *Figure 4-3*. *Table 4-1* lists the wire color coding for the power supply harness.

5. Check that power supply Power On/Power Off switch is set to Off. If you are using a GPS-8A, connect the power cord to grounded ac outlet; if using a DPS-8A, connect to -48 V battery supply according to instructions in DPS-8A Instruction Manual.

Caution *Do not apply primary power until all connections have been made and all options implemented.*

For more information on the installation and initialization of the TMSC Controller, see Chapter 5 of this manual.

AC Power On/Off Procedure for a TMSC

GDC communications products contain voltage sensing circuits that ensure that proper reset signals are generated during power up/down switching. These circuits are designed to protect the electronics from lock-ups and memory loss for a wide range of known ac transients and power on/off conditions.

Switching power on/off via a branch circuit breaker can generate unpredictable transient conditions due to inductive and/or capacitive loads connected to the branch that impact the voltage on/off sensing circuits. The following procedure is recommended to ensure reliable operation. To turn TMSC Power On:

1. Turn the branch circuit breaker on first. This allows transients due to heavy inductive and capacitive line loads to settle.
2. If the communication product is mounted in a cabinet equipped with a local circuit breaker, such as a GDC EP-4 cabinet, turn the local breaker on next.
3. Turn off the dc power supplies mounted in the node.

To turn TMSC Power Off, reverse the power-on procedure by first turning off the dc power supplies.

Fused Links

Fused links are used in the interface circuits to protect the TMSC from sustaining damage in system applications.

The TMSC should be powered by the same power source as the equipment with which it interfaces, to prevent large circulating currents due to differences in ground potential. If it is not possible to determine whether the equipment is powered by the same power source, it should be confirmed that a potential difference of less than 0.25 V rms (as measured by a high impedance digital multimeter or equivalent) exists between the grounding circuits of the respective power outlets.

Caution *This TMSC unit incorporates internal fused links which may open if the ground potential exceeds 0.25 V rms between this unit and equipment interfaced with this unit. Do not apply power to the TMSC until all connections to peripheral equipment have been completed.*

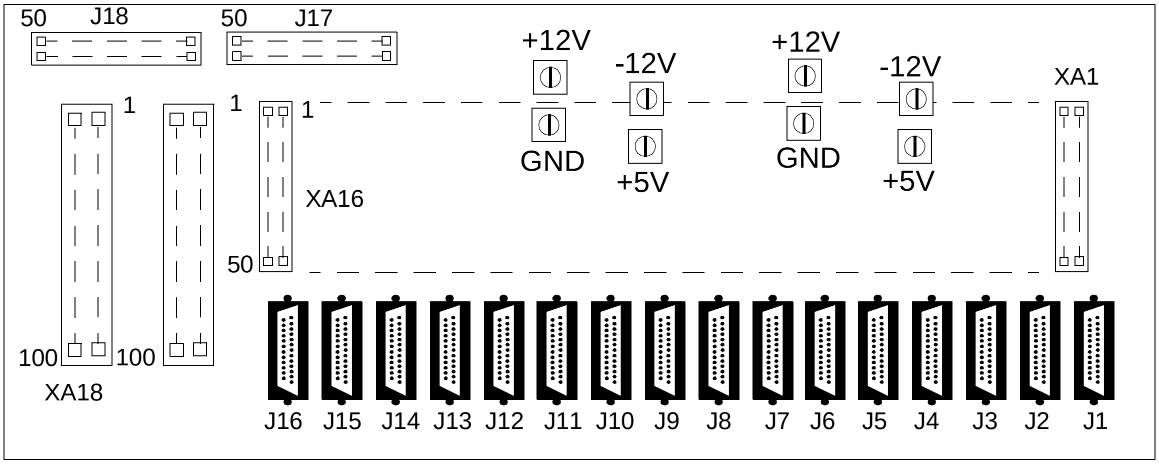


Figure 4-3 Power Supply Connectors on TMSC Expansion Harness Card

Fused links on the TMSC are located on the rear of the harness card. Each interface circuit (both channel and aggregate) contains a fused link between the chassis ground (earth) connector pin (pin 1 of the 25-pin connector) and the chassis ground circuit of the TMSC. Each link is located directly below each 25-pin connector; the link appears as an extremely thin solder line, with one

end connected to the chassis ground plane on the harness card. Fused links that have opened because of excessive ground currents between equipment can be restored as follows:

1. Normalize the potential difference between associated grounding circuits to less than 0.25 V rms (as measured with a high impedance digital multimeter or equivalent).

2. Disconnect all power connections.

3. Restore fused link with a single strand of No. 32 to 40 AWG gauge copper wire (No. 32 is the standard strand of seven-strand No. 24 gauge wire). Solder the single strand to the appropriate terminals on the rear of the harness card.

4. Reconnect power connections and resume normal operations.

Caution *When several cabinets are installed together, use a copper braided ground strap between the cabinets to ensure sufficient grounding.*

Compliance with Subpart J, Part 15 of FCC Rules

For full compliance with subpart J of Part 15 of FCC rules (governing radiated RF energy from computing devices), shielded cables with metal hooded connectors must be used for all TMSC aggregate and channel connections. Each cable hood must make firm contact with TMSC frame ground.

At the end of the cable hood are two screws that must be screwed in firmly to make ground contact. The hooded cable grounding arrangement is illustrated in *Figure 4-4* .

GDC recommends that customers follow this procedure when using customer supplied cables. Use of unshielded cables or failure to properly install shielded cables may cause interference with nearby radio communication devices.

If you use a MEGAMUX PLUS expansion shelf for your data and voice channel modules, follow the cable grounding procedure explained in the MEGAMUX PLUS Instruction manual, GDC Publication No. 036R360.

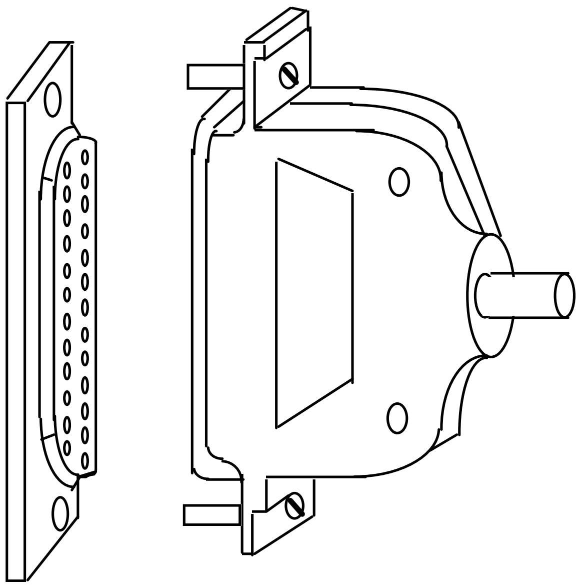


Figure 4-4 Typical Hooded Cable Grounding Arrangement

Table 4-1 Power Supply Harness Color Codes

Power Supply Harness Wire	Terminal Connection
Orange	+12 V dc
Purple	-12 V dc
White/Red	+5 V dc
White/Black	GND

Power Supply To TMSC Alarm Connections

Any TMSC node can report power supply failures (as an alarm condition) to the TMSC Controller. Two separate power supply failures (Primary and Secondary) are reported. Primary power supply alarm connections are hardwired on the TMSC harness card. To enable node reporting of secondary power supply failures, the following connections must be made (the metal backplane shield on the main shelf must be removed to make these connections):

Secondary power supply Alarm Bus connector to TMSC main shelf connector XA201A, pin A2.

In most cases, TMSC shelves are shipped from the factory with these connections pre-wired.

TMSC Node External Timing Connections

Each TMSC node is set through software to receive a master timing reference signal from an external source, or to be the master timing source for the network.

In most cases, a reference timing signal is received from an aggregate, and requires no special cabling. If timing is obtained from channel equipment, a special Y-cable splits timing from the other signals entering the channel interface, and transports the timing signal to external timing connector J4 on the TMSC main shelf backplane. Two cables are available for this purpose:

28H504-001 (for unbalanced signals)

028H505-001 (for balanced signals). Must have the EIA-422 adapter installed.

On the TMSC, 9-pin connector J4 (located on the rear backplane of the main shelf) allows you to use a balanced or unbalanced external clocking source.

Table 4-2 provides pin functions and technical specifications for connector J4. *Figure 4-5* illustrates the J4 connector pins as viewed from the TMS Compact rear backplane.

Table 4-2 External Clock Input (J4) Function

Pin No.	Function	Unbalanced Clock*	Balanced Clock**
1	Protective Ground	Signal Ground	Cable shield
2	External Timing A	Clock input	Clock A input
3	External Timing B	No connection	Clock B input
4-9	—	Not used	Not used

* For an unbalanced clock, the maximum clock frequency allowed is 20 kHz. An unbalanced clock supports EIA/TIA-232-E, V.24, EIA-423, V.10, TTL and sinewave inputs.The input impedance is 3000 ¾/.01µfd to ground. Place jumper X3 on the System Control Module at UNBAL.

** A balanced clock can use all frequencies. A balanced clock supports EIA-422, V.11, V.35 and square wave only inputs. The input impedance is 100¾ between A and B (when using two System Control Modules.) Place Jumper X3 on the System Control Module at BAL.

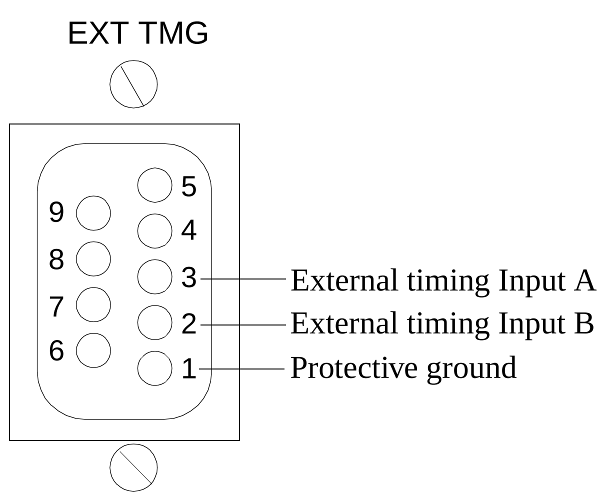


Figure 4-5 External Clock Connector (J4) TMSC Rear Backplane View

The 9-pin connector of the cable connects to J4; the 25-pin connectors mate to a TMSC channel interface connector and to a 25-pin crossover cable, which connects to the data service unit or modem that supplies the reference timing signal.

Select ‘‘External’’ as the timing source for the node when using this arrangement. Any other external timing source connects directly to J4.

Alarm Relay Connections

The Redundancy Control Module in the TMSC system contains relays that allow connections to external equipment. These connections provide visual or sound indications of major or minor alarms. Connections are made to EIA connector J3 on the TMSC harness card. *Table 4-3* lists the J3 pins used to connect the normally open or normally closed sides of the relay to the external equipment.

Any references made here to normally closed contacts suggest the relay is energized. Normally open contacts refers to the relay being deenergized. Do not exceed the maximum ratings of the relay contacts: 3 W, 0.25 A, 28 V.

Table 4-3 Alarm Relay Connections, Rear Panel Connector J3

Pin Number	Function	Relay State	
1	Minor Alarm 2	Common	(CO)
2	Major Alarm 2	Common	(CO)
3	Spare		
4	Spare		
5	Major Alarm 2	Deenergized	(NO)
6	Major Alarm 1	Deenergized	(NO)
7	Minor Alarm 2	Deenergized	(NO)
8	Minor Alarm 1	Deenergized	(NO)
9	Major Alarm 1	Common	(CO)
10	Spare		
11	Minor Alarm 1	Common	(CO)
12	Major Alarm 2	Energized	(NC)
13	Major Alarm 1	Energized	(NC)
14	Minor Alarm 2	Energized	(NC)
15	Minor Alarm 1	Energized	(NC)

NOTE: Any references made here to normally closed contacts (NC) suggest the relay is energized. Normally open contacts (NO) refer to the relay being deenergized.

Caution *The main harness backplane current rating is 1.4 A maximum. Any dc or ac voltage supplied by a power supply through the alarm port connector J3 should be fused accordingly. Failure to fuse the alarm port connector can result in severe damage to the TMSC main harness backplane.*

Selecting Options

The flexibility of the TMSC system is achieved in part by the availability of many options for TMSC modules. By selecting certain options, the TMSC can operate in many unique environments without the need for extensive external interface equipment.

The following paragraphs describe the methods of option selection and the options provided for each TMSC module. Detailed information concerning specific positioning of option selection devices is given in a number of tables in this chapter. To make individual option tables more accessible, the tables for each module and related drawings have been grouped together.

A TMSC node system is shipped from GDC with a specific configuration selected through the devices described below. In most cases, the settings need not be changed during installation.

Use the information provided here to check for correct settings, and to determine the necessary changes required for a change in the hardware configuration. If you are unsure of the correct setting for any device, contact GDC for technical assistance.

Option Selection Devices

You can implement optional configurations on a module with Program Plugs, Switches, jumper plugs, or Resistor Networks. Each item is described below.

Program Plugs

Program plugs select different interface configurations on the Data Channel module and on the RS-422/423 Channel Adapter (if used). Program plugs may also provide nonstandard clock rates on the Clock Generator module. These plugs are factory-installed in accordance with intended system usage, but may be altered on site to change the operating configuration of the TMSC.

A program plug is designated with the letters PP and a number (for example, PP1). The plug fits into a socket identified with the letters XPP and a number (for example, XPP1).

To remove a program plug:

- Gently lift the plug from the socket with the extractor tongs provided with the TMSC.

To install a program plug:

1. Determine the correct pin alignment.
2. Carefully insert the program plug into the socket.

Switches

Switches are used to select various options on most modules. Option tables for each module provide information on the features obtained by each selection. Switches are designated by the letter S and a number (e.g., S2).

Several different types of switches may be used on TMS modules. Each type of switch is illustrated in *Figure 4-6*. A vertical or right angle switch must be set up (Off or Open) or down (On or Closed). A DIP switch must be placed On (Closed) or Off (Open). A double pole latch switch has no On or Off position. Both the DIP switches and the double pole latch switches are set according to silkscreen markings on the pc card; simply move the switches to the marking that indicates the desired function. The option tables indicate the silkscreen marking for each option selection. For vertical or right angle switches, the option tables indicate On (Closed) or Off (Open) positions to select each option.

Jumper Plugs

Jumper plugs complete different circuits when placed over certain pins of headers on a component board. Silkscreen markings on the board indicate the selections made by different jumper plug positions. The option tables for each module provide information on the features obtained by each selection. Jumper plugs are designated by the letter X and a number (e.g., X1).

Resistor Networks

The Data Channel module uses resistor networks to develop the signal voltage levels required by different interface standards. These networks must be changed when a channel is configured for a different interface standard (*Chapter 3* describes the switch, jumper, and resistor network required for each interface).

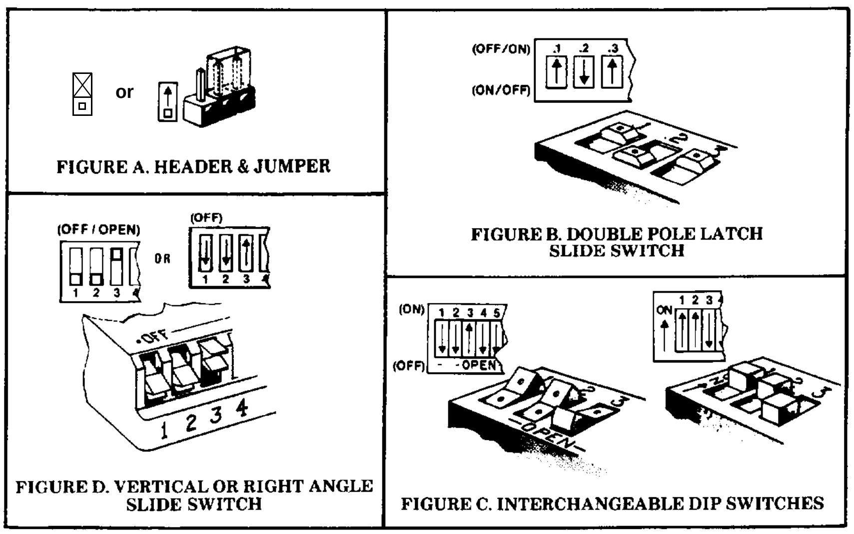


Figure 4-6 Option Switches and Jumpers

Enterprise System Control Card

This section covers ESCC options. Associated tables and drawings provide detailed installation information.

ESCC Option Selection

ESCC options are selected by varying the positions of option Switches S2, S3 and S4 that are located on the ESCC printed circuit board assembly, as illustrated in *Figure 4-7*. Use *Tables 2-5 and 2-6* to determine how to select each option.

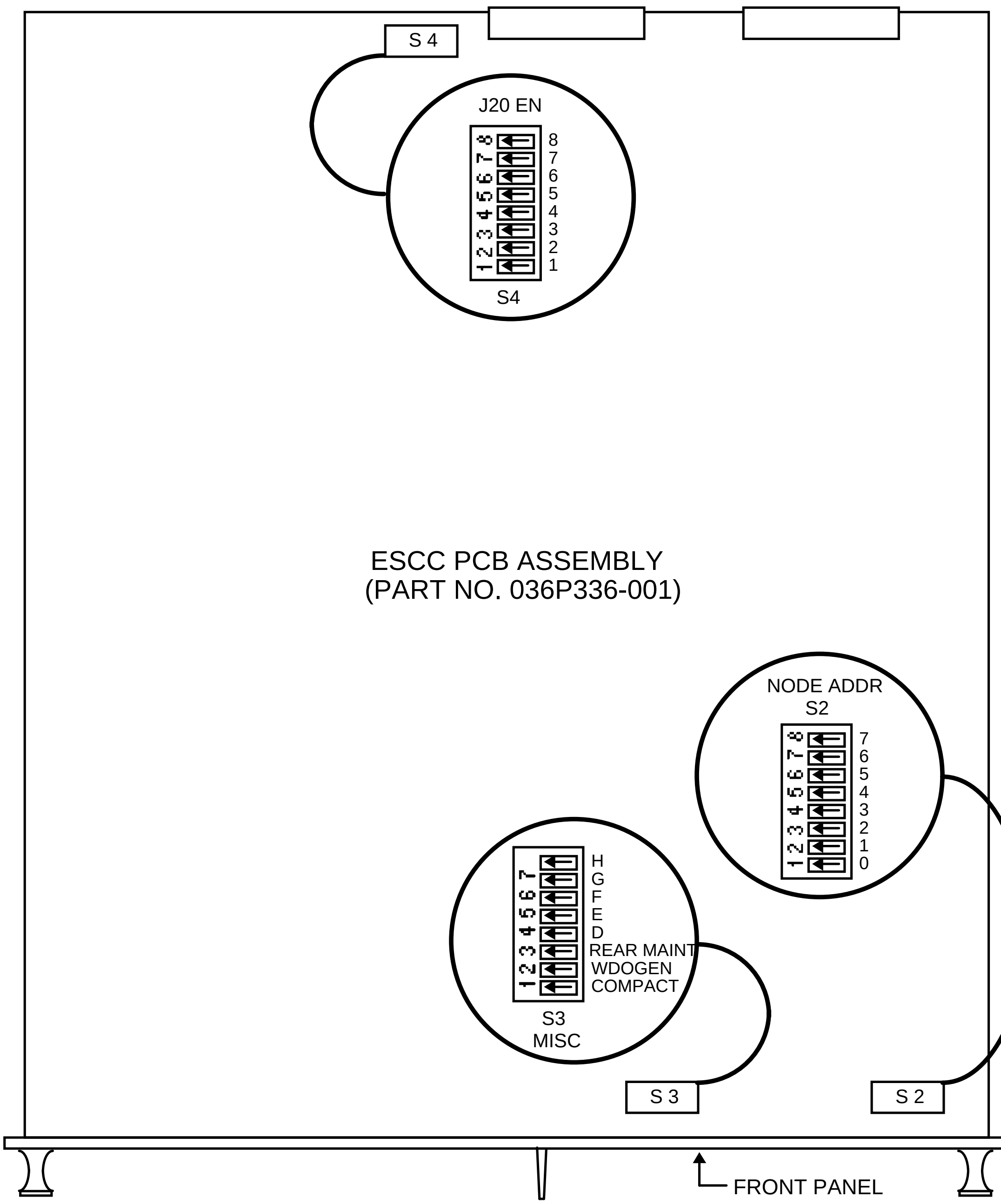


Figure 4-7 Option Switch Locations

Table 4-4 ESCC Options

Option	Selection	Switch	Setting	Description
Node Address	1 thru 126	S2-1 thru S2-7	*See Table 4-5*	Used to select the address for the node (*See Table 4-5).*
Node Type	Compact	S3-1	OFF	Configures ESCC for operation as Compact node.
	TMS-3000	S3-1	ON*	Configures ESCC for operation as TMS-3000 node.
Watchdog	Disabled	S3-2	OFF	Disables watchdog (for testing purposes).
	Enabled	S3-2	ON*	Enables watchdog.
Monitor Port	Back	S3-3	OFF*	Selects back port for maintanance console.
	Front	S3-3	ON	Selects front port for maintenance console.
Clock Bus 6 Frequency	Special Rate (PROG1)	S3-4	OFF	Selects special rate (PROG1) as clock frequency on Clock Bus 6.
	1.536 MHz.	S3-4	ON*	Selects 1.536 MHz as clock frequency on Clock Bus 6.
Clock Bus 7 Frequency	Special Rate (PROG2)	S3-5	OFF	Selects special rate (PROG2) as clock frequency on Clock Bus 7.
	1.344 MHz	S3-5	ON*	Selects 1.344 MHz as clock frequency on Clock Bus 7.
External Timing Source Impedance	Unbalanced	S3-6	OFF	Selects unbalanced impedance for an external timing source, if any, on serial Port J18. Choose unbalanced impedance for EIA-232-D and RS-423 interfaces.
	Balanced	S3-6	ON*	Selects balanced impedance for an external timing source, if any, on serial Port J18. Choose balanced impedance for V.35 and RS-422 interfaces.
J20 RSET	Disabled	S4-1	OFF	Disables signal RSET on serial Port J20.
	Enabled	S4-1	ON*	Enables signal RSET on serial Port J20.
J20 SER1TDATA	Disabled	S4-2	OFF	Disables signal SER1TDATA on serial Port J20.
	Enabled	S4-2	ON*	Enables signal SER1TDATA on serial Port J20.
J20 SER1DTR	Disabled	S4-3	OFF	Disables signal SER1DTR on serial Port J20.
	Enabled	S4-3	ON*	Enables signal SER1DTR on serial Port J20.
J20 TSET	Disabled	S4-4	OFF	Disables signal TSET on serial Port J20.
	Enabled	S4-4	ON*	Enables signal TSET on serial Port J20.
J20 SER1RDATA	Disabled	S4-5	OFF	Disables signal SER1RDATA on serial Port J20.
	Enabled	S4-5	ON*	Enables signal SER1RDATA on serial Port J20.
J20 SER1DSR	Disabled	S4-6	OFF	Disables signal SER1DSR on serial Port J20.
	Enabled	S4-6	ON*	Enables signal SER1DSR on serial Port J20.
J20 LOCKFREQINB	Disabled	S4-7	OFF	Disables signal LOCKFREQINB on serial Port J20.
	Enabled	S4-7	ON*	Enables signal LOCKFREQINB on serial Port J20.
J20 LOCKFREQINA	Disabled	S4-8	OFF	Disables signal LOCKFREQINA on serial Port J20.
	Enabled	S4-8	ON*	Enables signal LOCKFREQINA on serial Port J20.
Not Used	Not Used	S2-8 , S3-7, S3-8	ON*	These option switches must be set in the ON position.
* Default selection				

Table 4-5 ESCC Address Switch

Node Address	Switch Settings							Node Address	Switch Settings						
	S2-1	**S2-2**	**S2-3**	**S2-4**	**S2-5**	**S2-6**	**S2-7**		**S2-1**	**S2-2**	**S2-3**	**S2-4**	**S2-5**	**S2-6**	**S2-7**
1	OFF	ON	ON	ON	ON	ON	ON	35	OFF	OFF	ON	ON	ON	OFF	ON
2	ON	OFF	ON	ON	ON	ON	ON	36	ON	ON	OFF	ON	ON	OFF	ON
3	OFF	OFF	ON	ON	ON	ON	ON	37	OFF	ON	OFF	ON	ON	OFF	ON
4	ON	ON	OFF	ON	ON	ON	ON	38	ON	OFF	OFF	ON	ON	OFF	ON
5	OFF	ON	OFF	ON	ON	ON	ON	39	OFF	OFF	OFF	ON	ON	OFF	ON
6	ON	OFF	OFF	ON	ON	ON	ON	40	ON	ON	ON	OFF	ON	OFF	ON
7	OF	OFF	OFF	ON	ON	ON	ON	41	OFF	ON	ON	OFF	ON	OFF	ON
8	ON	ON	ON	OFF	ON	ON	ON	42	ON	OFF	ON	OFF	ON	OFF	ON
9	OFF	ON	ON	OFF	ON	ON	ON	43	OFF	OFF	ON	OFF	ON	OFF	ON
10	ON	OFF	ON	OFF	ON	ON	ON	44	ON	ON	OFF	OFF	ON	OFF	ON
11	OFF	OFF	ON	OFF	ON	ON	ON	45	OFF	ON	OFF	OFF	ON	OFF	ON
12	ON	ON	OFF	OFF	ON	ON	ON	46	ON	OFF	OFF	OFF	ON	OFF	ON
13	OFF	ON	OFF	OFF	ON	ON	ON	47	OFF	OFF	OFF	OFF	ON	OFF	ON
14	ON	OFF	OFF	OFF	ON	ON	ON	48	ON	ON	ON	ON	OFF	OFF	ON
15	OFF	OFF	OFF	OFF	ON	ON	ON	49	OFF	ON	ON	ON	OFF	OFF	ON
16	ON	ON	ON	ON	OFF	ON	ON	50	ON	OFF	ON	ON	OFF	OFF	ON
17	OFF	ON	ON	ON	OFF	ON	ON	51	OFF	OFF	ON	ON	OFF	OFF	ON
18	ON	OFF	ON	ON	OFF	ON	ON	52	ON	ON	OFF	ON	OFF	OFF	ON
19	OFF	OFF	ON	ON	OFF	ON	ON	53	OFF	ON	OFF	ON	OFF	OFF	ON
20	ON	ON	OFF	ON	OFF	ON	ON	54	ON	OFF	OFF	ON	OFF	OFF	ON
21	OFF	ON	OFF	ON	OFF	ON	ON	55	OFF	OFF	OFF	ON	OFF	OFF	ON
22	ON	OFF	OFF	ON	OFF	ON	ON	56	ON	ON	ON	OFF	OFF	OFF	ON
23	OFF	OFF	OFF	ON	OFF	ON	ON	57	OFF	ON	ON	OFF	OFF	OFF	ON
24	ON	ON	ON	OFF	OFF	ON	ON	58	ON	OFF	ON	OFF	OFF	OFF	ON
25	OFF	ON	ON	OFF	OFF	ON	ON	59	OFF	OFF	ON	OFF	OFF	OFF	ON
26	ON	OFF	ON	OFF	OFF	ON	ON	60	ON	ON	OFF	OFF	OFF	OFF	ON
27	OFF	OFF	ON	OFF	OFF	ON	ON	61	OFF	ON	OFF	OFF	OFF	OFF	ON
28	ON	ON	OFF	OFF	OFF	ON	ON	62	ON	OFF	OFF	OFF	OFF	OFF	ON
29	OFF	ON	OFF	OFF	OFF	ON	ON	63	OFF	OFF	OFF	OFF	OFF	OFF	ON
30	ON	OFF	OFF	OFF	OFF	ON	ON	64	ON	ON	ON	ON	ON	ON	OFF
31	OFF	OFF	OFF	OFF	OFF	ON	ON	65	OFF	ON	ON	ON	ON	ON	OFF
32	ON	ON	ON	ON	ON	OFF	ON	66	ON	OFF	ON	ON	ON	ON	OFF
33	OFF	ON	ON	ON	ON	OFF	ON	67	OFF	OFF	ON	ON	ON	ON	OFF
34	ON	OFF	ON	ON	ON	OFF	ON	68	ON	ON	OFF	ON	ON	ON	OFF
69	OFF	ON	OFF	ON	ON	ON	OFF	98	ON	OFF	ON	ON	ON	OFF	OFF
70	ON	OFF	OFF	ON	ON	ON	OFF	99	OFF	OFF	ON	ON	ON	OFF	OFF
71	OFF	OFF	OFF	ON	ON	ON	OFF	100	ON	ON	OFF	ON	ON	OFF	OFF
72	ON	ON	ON	OFF	ON	ON	OFF	101	OFF	ON	OFF	ON	ON	OFF	OFF
73	OFF	ON	ON	OFF	ON	ON	OFF	102	ON	OFF	OFF	ON	ON	OFF	OFF
74	ON	OFF	ON	OFF	ON	ON	OFF	103	OFF	OFF	OFF	ON	ON	OFF	OFF

Table 4-5 ESCC Address Switch (Continued)

Node Address	Switch Settings						
	S2-1	S2-2	S2-3	S2-4	S2-5	S2-6	S2-7
75	OFF	OFF	ON	OFF	ON	ON	OFF
76	ON	ON	OFF	OFF	ON	ON	OFF
77	OFF	ON	OFF	OFF	ON	ON	OFF
78	ON	OFF	OFF	OFF	ON	ON	OFF
79	OFF	OFF	OFF	OFF	ON	ON	OFF
80	ON	ON	ON	ON	OFF	ON	OFF
81	OFF	ON	ON	ON	OFF	ON	OFF
82	ON	OFF	ON	ON	OFF	ON	OFF
83	OFF	OFF	ON	ON	OFF	ON	OFF
84	ON	ON	OFF	ON	OFF	ON	OFF
85	OFF	ON	OFF	ON	OFF	ON	OFF
86	ON	OFF	OFF	ON	OFF	ON	OFF
87	OFF	OFF	OFF	ON	OFF	ON	OFF
88	ON	ON	ON	OFF	OFF	ON	OFF
89	OFF	ON	ON	OFF	OFF	ON	OFF
90	ON	OFF	ON	OFF	OFF	ON	OFF
91	OFF	OFF	ON	OFF	OFF	ON	OFF
92	ON	ON	OFF	OFF	OFF	ON	OFF
93	OFF	ON	OFF	OFF	OFF	ON	OFF
94	ON	OFF	OFF	OFF	OFF	ON	OFF
95	OFF	OFF	OFF	OFF	OFF	ON	OFF
96	ON	ON	ON	ON	ON	OFF	OFF
97	OFF	ON	ON	ON	ON	OFF	OFF

Node Address	Switch Settings						
	S2-1	S2-2	S2-3	S2-4	S2-5	S2-6	S2-7
104	ON	ON	ON	OFF	ON	OFF	OFF
105	OFF	ON	ON	OFF	ON	OFF	OFF
106	ON	OFF	ON	OFF	ON	OFF	OFF
107	OFF	OFF	ON	OFF	ON	OFF	OFF
108	ON	ON	OFF	OFF	ON	OFF	OFF
109	OFF	ON	OFF	OFF	ON	OFF	OFF
110	ON	OFF	OFF	OFF	ON	OFF	OFF
111	OFF	OFF	OFF	OFF	ON	OFF	OFF
112	ON	ON	ON	ON	OFF	OFF	OFF
113	OFF	ON	ON	ON	OFF	OFF	OFF
114	ON	OFF	ON	ON	OFF	OFF	OFF
115	OFF	OFF	ON	ON	OFF	OFF	OFF
116	ON	ON	OFF	ON	OFF	OFF	OFF
117	OFF	ON	OFF	ON	OFF	OFF	OFF
118	ON	OFF	OFF	ON	OFF	OFF	OFF
119	OFF	OFF	OFF	ON	OFF	OFF	OFF
120	ON	ON	ON	OFF	OFF	OFF	OFF
121	OFF	ON	ON	OFF	OFF	OFF	OFF
122	ON	OFF	ON	OFF	OFF	OFF	OFF
123	OFF	OFF	ON	OFF	OFF	OFF	OFF
124	ON	ON	OFF	OFF	OFF	OFF	OFF
125	OFF	ON	OFF	OFF	OFF	OFF	OFF
126	ON	OFF	OFF	OFF	OFF	OFF	OFF

ESCC Installation

To install the ESCC in the TMSC shelf, proceed as follows:

1. Place the ESCC front panel Enable/Disable switch in the Disable position.
2. Position the ESCC in the receptacle guides (top and bottom) of the slot shown in *Figure 4-8* and carefully slide the ESCC into the receptacle until it stops. Tilt the top ejector knob up and the bottom ejector knob down and gently push the ESCC into the rear connector. The knobs automatically assume their normal position.
3. Place the ESCC front panel Enable/Disable switch in the Enable position.

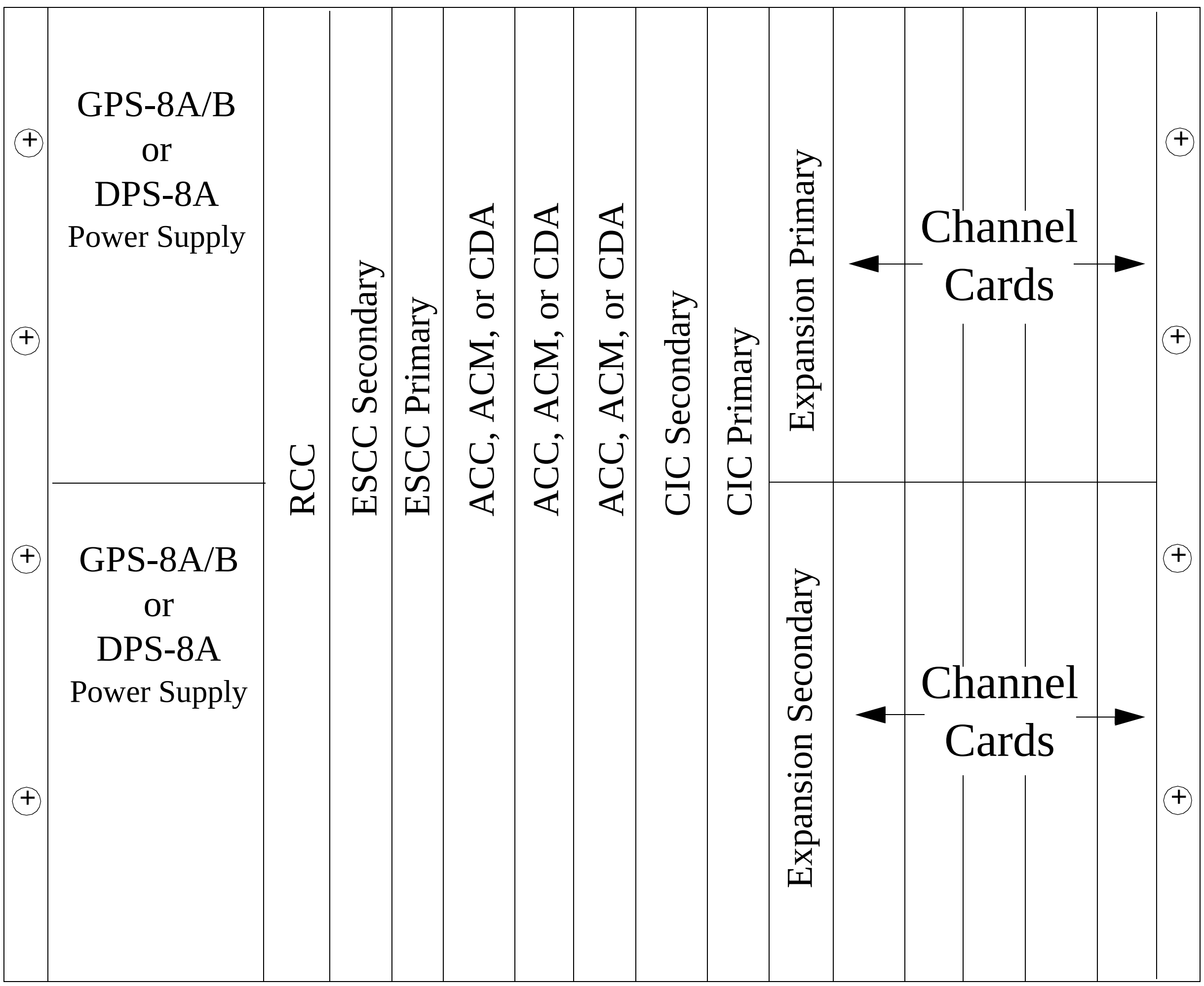


Figure 4-8 TMSC Main Shelf Slot Locations

System Control Card

Note that the SCC is used in older version TMS and TMSC systems that use MSO software.

Before you install the System Control Module make sure the Enable/Disable switch is in the Disabled position. The System Control module is installed in the slot shown earlier in *Figure 4-8*. After the module is securely mounted, place the switch in the Enable position.

The options available on the System Control Module are described in *Table 4-6* and *Table 4-7* . The option locations are shown in *Figure 4-6* .

Table 4-6 SCC Options

Feature	Selection	Switch(S), Jumpers(X) Desig.	Switch(S), Jumpers(X) Position	Application
Watchdog Inhibit	Watchdog Inhibit Watchdog	X4 X4	NORM INHIB W'DOG	This selection is used to inhibit watchdog during testing. This jumper should be left in the NORM position.
Electrical Termination	Unbalanced Balanced	X3 X3	UNBAL BAL	This selection is used if an external timing source is coming into connector J4 on the backplane. The impedance adjustment changes clock signal voltage levels. UNBAL is selected for EIA/TIA-232-E and RS-423. BAL is selected for V.35 and RS-422.
*Programmed Clock 1 Clock Bus 6	Program 1 1.536 MHz	X2 X2	PROG 1 1.536 MHz	This jumper is used to select a clock frequency programmed into RAM or to select a 1.536 MHz frequency. The output of jumper is placed on Clock Bus 6. Use the PROG 1 position when required for TMSC special rates, as indicated on the TMSC Controller display. Otherwise, keep the jumper in the 1.536 position.
*Programmed Clock 2 Clock Bus 7	Program 2 1.344 MHz	X1 X1	PROG 2 1.344 MHz	This jumper is used to select a clock frequency programmed into RAM or to select a 1.344 MHz frequency. The output of the jumper is placed on Clock Bus 7. Use the PROG 2 position when required for TMSC special rates, as indicated on the TMSC Controller display. Otherwise, keep the jumper in the 1.344 position.
*If two special rates require different settings of X1 and X2, the rates may not be used simultaneously on a particular node.				

Table 4-7 SCC Option Switch Settings

SWITCH S2 — MAINTENANCE CONSOLE BAUD RATE								
Enter the rate of the maintenance Console by setting dip switch S2 as shown.								
Maintenance Console Baud Rate	**Switch Setting**							
	S2-1	S2-2	S2-3	S2-4	S2-5	S2-6	S2-7	S2-8
1200 bps	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF
2400 bps	OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF
4800 bps	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF
9600 bps	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
NOTE: DIP Switches S2-3 through S2-8 remain in the OFF (Default) position.								

Table 4-8 SCC Option Switch Settings S1

SWITCH S1 — NODE ADDRESSING SWITCH SETTINGS								
Find the node address of the node you are optioning in the left-hand column, then set the switch as shown.								
	Switch Setting							
Node Address	S1-1	S1-2	S1-3	S1-4	S1-5	S1-6	S1-7	S1-8
1	OFF	ON	ON	ON	ON	ON	ON	ON
2	ON	OFF	ON	ON	ON	ON	ON	ON
3	OFF	OFF	ON	ON	ON	ON	ON	ON
4	ON	ON	OFF	ON	ON	ON	ON	ON
5	OFF	ON	OFF	ON	ON	ON	ON	ON
6	ON	OFF	OFF	ON	ON	ON	ON	ON
7	OFF	OFF	OFF	ON	ON	ON	ON	ON
8	ON	ON	ON	OFF	ON	ON	ON	ON
9	OFF	ON	ON	OFF	ON	ON	ON	ON
10	ON	OFF	ON	OFF	ON	ON	ON	ON
11	OFF	OFF	ON	OFF	ON	ON	ON	ON
12	ON	ON	OFF	OFF	ON	ON	ON	ON
13	OFF	ON	OFF	OFF	ON	ON	ON	ON
14	ON	OFF	OFF	OFF	ON	ON	ON	ON
15	OFF	OFF	OFF	OFF	ON	ON	ON	ON
16	ON	ON	ON	ON	OFF	ON	ON	ON
17	OFF	ON	ON	ON	OFF	ON	ON	ON
18	ON	OFF	ON	ON	OFF	ON	ON	ON
19	OFF	OFF	ON	ON	OFF	ON	ON	ON
20	ON	ON	OFF	ON	OFF	ON	ON	ON
21	OFF	ON	OFF	ON	OFF	ON	ON	ON
22	ON	OFF	OFF	ON	OFF	ON	ON	ON
23	OFF	OFF	OFF	ON	OFF	ON	ON	ON

Table 4-8 SCC Option Switch Settings S1 (Continued)

SWITCH S1 — NODE ADDRESSING SWITCH SETTINGS								
Find the node address of the node you are optioning in the left-hand column, then set the switch as shown.								
	Switch Setting							
Node Address	S1-1	S1-2	S1-3	S1-4	S1-5	S1-6	S1-7	S1-8
24	ON	ON	ON	OFF	OFF	ON	ON	ON
25	OFF	ON	ON	OFF	OFF	ON	ON	ON
26	ON	OFF	ON	OFF	OFF	ON	ON	ON
27	OFF	OFF	ON	OFF	OFF	ON	ON	ON
28	ON	ON	OFF	OFF	OFF	ON	ON	ON
29	OFF	ON	OFF	OFF	OFF	ON	ON	ON
30	ON	OFF	OFF	OFF	OFF	ON	ON	ON
31	OFF	OFF	OFF	OFF	OFF	ON	ON	ON
32	ON	ON	ON	ON	ON	OFF	ON	ON
33	OFF	ON	ON	ON	ON	OFF	ON	ON
34	ON	OFF	ON	ON	ON	OFF	ON	ON
35	OFF	OFF	ON	ON	ON	OFF	ON	ON
36	ON	ON	OFF	ON	ON	OFF	ON	ON
37	OFF	ON	OFF	ON	ON	OFF	ON	ON
38	ON	OFF	OFF	ON	ON	OFF	ON	ON
39	OFF	OFF	OFF	ON	ON	OFF	ON	ON
40	ON	ON	ON	OFF	ON	OFF	ON	ON
41	OFF	ON	ON	OFF	ON	OFF	ON	ON
42	ON	OFF	ON	OFF	ON	OFF	ON	ON
43	OFF	OFF	ON	OFF	ON	OFF	ON	ON
44	ON	ON	OFF	OFF	ON	OFF	ON	ON
45	OFF	ON	OFF	OFF	ON	OFF	ON	ON
46	ON	OFF	OFF	OFF	ON	OFF	ON	ON
47	OFF	OFF	OFF	OFF	ON	OFF	ON	ON
48	ON	ON	ON	ON	OFF	OFF	ON	ON
49	OFF	ON	ON	ON	OFF	OFF	ON	ON
50	ON	OFF	ON	ON	OFF	OFF	ON	ON
51	OFF	OFF	ON	ON	OFF	OFF	ON	ON
52	ON	ON	OFF	ON	OFF	OFF	ON	ON
53	OFF	ON	OFF	ON	OFF	OFF	ON	ON
54	ON	OFF	OFF	ON	OFF	OFF	ON	ON
55	OFF	OFF	OFF	ON	OFF	OFF	ON	ON
56	ON	ON	ON	OFF	OFF	OFF	ON	ON
57	OFF	ON	ON	OFF	OFF	OFF	ON	ON
58	ON	OFF	ON	OFF	OFF	OFF	ON	ON
59	OFF	OFF	ON	OFF	OFF	OFF	ON	ON

Table 4-8 SCC Option Switch Settings S1 (Continued)

SWITCH S1 — NODE ADDRESSING SWITCH SETTINGS								
Find the node address of the node you are optioning in the left-hand column, then set the switch as shown.								
	Switch Setting							
Node Address	S1-1	S1-2	S1-3	S1-4	S1-5	S1-6	S1-7	S1-8
60	ON	ON	OFF	OFF	OFF	OFF	ON	ON
61	OFF	ON	OFF	OFF	OFF	OFF	ON	ON
62	ON	OFF	OFF	OFF	OFF	OFF	ON	ON
63	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON
64	ON	ON	ON	ON	ON	ON	OFF	ON
65	OFF	ON	ON	ON	ON	ON	OFF	ON
66	ON	OFF	ON	ON	ON	ON	OFF	ON
67	OFF	OFF	ON	ON	ON	ON	OFF	ON
68	ON	ON	OFF	ON	ON	ON	OFF	ON
69	OFF	ON	OFF	ON	ON	ON	OFF	ON
70	ON	OFF	OFF	ON	ON	ON	OFF	ON
71	OFF	OFF	OFF	ON	ON	ON	OFF	ON
72	ON	ON	ON	OFF	ON	ON	OFF	ON
73	OFF	ON	ON	OFF	ON	ON	OFF	ON
74	ON	OFF	ON	OFF	ON	ON	OFF	ON
75	OFF	OFF	ON	OFF	ON	ON	OFF	ON
76	ON	ON	OFF	OFF	ON	ON	OFF	ON
77	OFF	ON	OFF	OFF	ON	ON	OFF	ON
78	ON	OFF	OFF	OFF	ON	ON	OFF	ON
79	OFF	OFF	OFF	OFF	ON	ON	OFF	ON
80	ON	ON	ON	ON	OFF	ON	OFF	ON
81	OFF	ON	ON	ON	OFF	ON	OFF	ON
82	ON	OFF	ON	ON	OFF	ON	OFF	ON
83	OFF	OFF	ON	ON	OFF	ON	OFF	ON
84	ON	ON	OFF	ON	OFF	ON	OFF	ON
85	OFF	ON	OFF	ON	OFF	ON	OFF	ON
86	ON	OFF	OFF	ON	OFF	ON	OFF	ON
87	OFF	OFF	OFF	ON	OFF	ON	OFF	ON
88	ON	ON	ON	OFF	OFF	ON	OFF	ON
89	OFF	ON	ON	OFF	OFF	ON	OFF	ON
90	ON	OFF	ON	OFF	OFF	ON	OFF	ON
91	OFF	OFF	ON	OFF	OFF	ON	OFF	ON
92	ON	ON	OFF	OFF	OFF	ON	OFF	ON
93	OFF	ON	OFF	OFF	OFF	ON	OFF	ON
94	ON	OFF	OFF	OFF	OFF	ON	OFF	ON
95	OFF	OFF	OFF	OFF	OFF	ON	OFF	ON

Table 4-8 SCC Option Switch Settings S1 (Continued)

SWITCH S1 — NODE ADDRESSING SWITCH SETTINGS								
Find the node address of the node you are optioning in the left-hand column, then set the switch as shown.								
Node Address	**Switch Setting**							
	S1-1	S1-2	S1-3	S1-4	S1-5	S1-6	S1-7	S1-8
96	ON	ON	ON	ON	ON	OFF	OFF	ON
97	OFF	ON	ON	ON	ON	OFF	OFF	ON
98	ON	OFF	ON	ON	ON	OFF	OFF	ON
99	OFF	OFF	ON	ON	ON	OFF	OFF	ON
100	ON	ON	OFF	ON	ON	OFF	OFF	ON
101	OFF	ON	OFF	ON	ON	OFF	OFF	ON
102	ON	OFF	OFF	ON	ON	OFF	OFF	ON
103	OFF	OFF	OFF	ON	ON	OFF	OFF	ON
104	ON	ON	ON	OFF	ON	OFF	OFF	ON
105	OFF	ON	ON	OFF	ON	OFF	OFF	ON
106	ON	OFF	ON	OFF	ON	OFF	OFF	ON
107	OFF	OFF	ON	OFF	ON	OFF	OFF	ON
108	ON	ON	OFF	OFF	ON	OFF	OFF	ON
109	OFF	ON	OFF	OFF	ON	OFF	OFF	ON
110	ON	OFF	OFF	OFF	ON	OFF	OFF	ON
111	OFF	OFF	OFF	OFF	ON	OFF	OFF	ON
112	ON	ON	ON	ON	OFF	OFF	OFF	ON
113	OFF	ON	ON	ON	OFF	OFF	OFF	ON
114	ON	OFF	ON	ON	OFF	OFF	OFF	ON
115	OFF	OFF	ON	ON	OFF	OFF	OFF	ON
116	ON	ON	OFF	ON	OFF	OFF	OFF	ON
117	OFF	ON	OFF	ON	OFF	OFF	OFF	ON
118	ON	OFF	OFF	ON	OFF	OFF	OFF	ON
119	OFF	OFF	OFF	ON	OFF	OFF	OFF	ON
120	ON	ON	ON	OFF	OFF	OFF	OFF	ON
121	OFF	ON	ON	OFF	OFF	OFF	OFF	ON
122	ON	OFF	ON	OFF	OFF	OFF	OFF	ON
123	OFF	OFF	ON	OFF	OFF	OFF	OFF	ON
124	ON	ON	OFF	OFF	OFF	OFF	OFF	ON
125	OFF	ON	OFF	OFF	OFF	OFF	OFF	ON
126	ON	OFF	OFF	OFF	OFF	OFF	OFF	ON

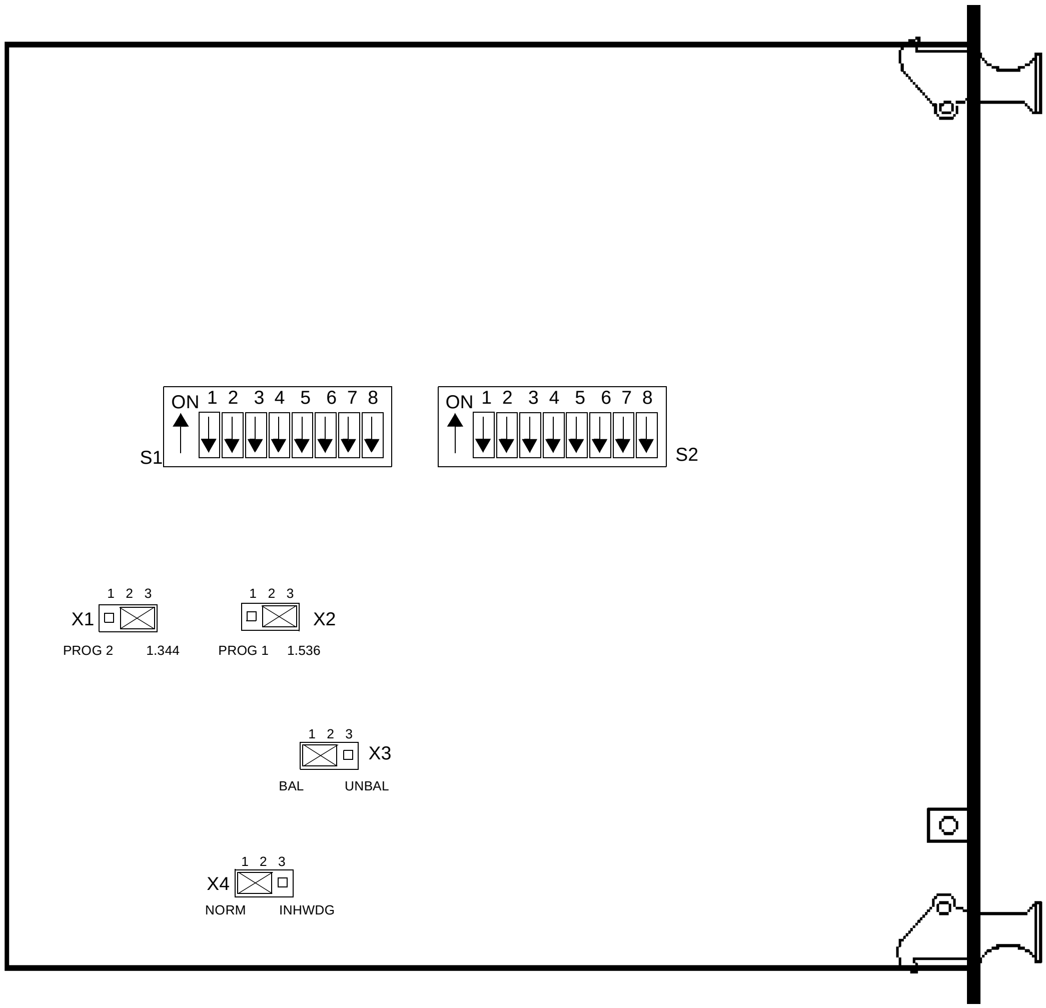


Figure 4-9 SCC Option Locations

Redundancy Control Card

Install the RCC in the slot shown in *Figure 4-8*. The RCC is software controlled and therefore has no option selections.

Aggregate Control Card

This section covers Aggregate Interface part numbers, connections, connector functions, options, and optional plug-in cards as well as associated tables and drawings to provide detailed installation information.

Part Numbers

This section provides information to be used to procure replacement assemblies and pc boards. *Table 4-9* breaks down assemblies into sub-assemblies that form the component.

Table 4-9 Aggregate Control Card Assembly (036M313-006)

Equipment Supplied	Designation	GDC Part No.
PCB Assembly, Aggregate Control II	ACC-II	036P313-003
PCB Assembly Aggregate, Plug-In		036P314-001
Aggregate Interface plug-in cards:		
EIA/TIA-232-E/ITU-T V.28 Aggregate Interface	EIF-E	036P041-001
ITU-T V.35 Aggregate Interface	EIF-V	036P042-001
EIA RS-422/423/MIL-STD-188/ITU-T V.10/V.11 Aggregate Interface	EIF-P	036P043-001
T1/D4 1.544 Mbps Aggregate Interface	T1/D4	036P315-002
T1/D4 1.544 Mbps Aggregate Interface	T1/D4	036P315-003
ITU-T G.703 64 Kbps Codirectional Aggregate Interface	EIF-G	036P064-001
ITU-T G.703 2.048 Mbps 75-ohm Aggregate Interface	EIF-M1	036P065-001
ITU-T G.703 2.048 Mbps 12-ohm Aggregate Interface	EIF-M2	036P065-002
ITU-T G.703 64 Kbps Contradirectional Aggregate Interface	EIF-C	036P066-001
ITU-T G.703 256 Kbps 75-ohm Aggregate Interface	EIF-K1	336P065-001
ITU-T G.703 256 Kbps 120-ohm Aggregate Interface	EIF-K2	336P065-002
ITU-T G.704 2.048 Mbps 75/120 ohm Aggregate Interface	—	036P281-001

Aggregate Interface Connections

Aggregate Interface Cables are connected to the 25-pin connectors J1 and J2 at the rear of the TMSC Main Shelf. A list of Aggregate Interface cables is provided in *Table 4-10* along with a description of the applications for each cable.In the TMSC, aggregate interfaces require a matching Aggregate Interface Piggyback Card mounted on the ACC.

Connectors on the TMSC backplane for the Aggregate interface cables are listed in *Table 4-11*.

Table 4-10 Aggregate Interface Cables

GDC Cable No.	Description	Application
028H502	EIA/TIA-232-E/ITU-T V.28	For all 232-E and ITU-T V.28 aggregate trunks. Available in 5-, 15-, 25-, and 50-foot lengths. Straight through cable.
027H507	ITU-T V.35	For ITU-T V.35 trunks — generally used for domestic applications. Available in 5-, 15-, and 25-foot lengths.
027H508	EIA RS-422/423 ITU-T V.10/V.11 MIL-STD 188C	For EIA RS-422 or 423, ITU-T V.10 or V.11, MIL-STD 188C aggregate trunks. Available in 5-, 15-, and 25-foot lengths, or other lengths up to 500 feet.
027H201	ATT DS (T1)	Standard connector for T1 lines, for connection to CSUs or other devices with F-DB15 connectors.
036H013	ITU-T V.35 (European)	For European V.35 applications. Available in 5-, 15-, or 25-foot lengths.
027H307	T1 or ITU-T G.703 25-pin connector to wire ends	For T1 or ITU-T G.703 connections where connections to trunk equipment are made using wire ends only (no connectors). Available in 25- or 75-foot lengths.
027H408	EIA/TIA-232-E (422 Signals)	Used for connection of RS-422 Aggregate to 422 Data Chan., Submux.
027H517	EIA/TIA-232-E (V.35 Signals)	Used for connection of ITU-T V.35 Aggregate Link to business equipment connector on the DS-1 shelf.
027H531	EIA/TIA-232-E (422 Signals)	Used for connection of RS-422 Aggregate Link to business equipment connector on the DS-1 Shelf.
027H316	T1/D4 to T1/D4 Y-cable	Used for non-redundant pairs of CDA modules in adjacent slots. Provides two T1 lines with DB-25 connectors.

Table 4-11 TMSC Main Shelf Connector Functions

Connector	Function
J1	Aggregate 1
J2	Aggregate 2
J3	Alarm Relay Interface
J4	External Timing Interface
J5	TMSC Maintenance Console Interface
J6	TMSC Controller Interface
J7	VF phone jack for internal modem
J8	Modem port , data connector for external modem
J9	Channel expansion interface (to J17 on Expansion Shelf)
J10	Channel expansion interface (to J18 on Expansion Shelf)
J11	CDA use only
J12	CDA use only

ACC Options

The options available on the ACC are described in *Table 4-12* and option locations are shown in *Figure 4-10*.

Note *ACC (GDC 036P313-001) assembly contains a factory adjustment switch SW3 that should never be changed in the field. It controls a critical factory adjustment option which is set only when the PCB assembly is installed in a specialized test fixture at the factory. The purpose of SW3 is to fine tune the turn-on and turn-off times of the fast bus circuit Improper adjustment of this switch can cause erroneous data transfers between common cards and possible node failure.*

Table 4-12 Aggregate Control Card Options

Feature	Selection	Switch (S), Jumpers (X)		Application
		Desig.	**Pos.**	
Watchdog Inhibit	Watchdog	X1	NORM	This selection is located on the Aggregate Control Piggyback. It is for in-house testing only. It should be left in the NORM position.
	Inhibit Watchdog	X1	INHIB W'DOG	
Redundancy	Redundant	X9	RED	RED is selected if the ACC is part of a redundant pair. $\overline{\text{RED}}$ is selected if the module is not part of a redundant pair.
	Non-redundant	X9	$\overline{\text{RED}}$	
Diversity	Diversity	X8	DIV	TMSC does not support diversity. Select $\overline{\text{DIV}}$
	Single Aggregate	X8	$\overline{\text{DIV}}$	
NOTE: Jumper X1 is located on the Aggregate Control Piggyback Card.				

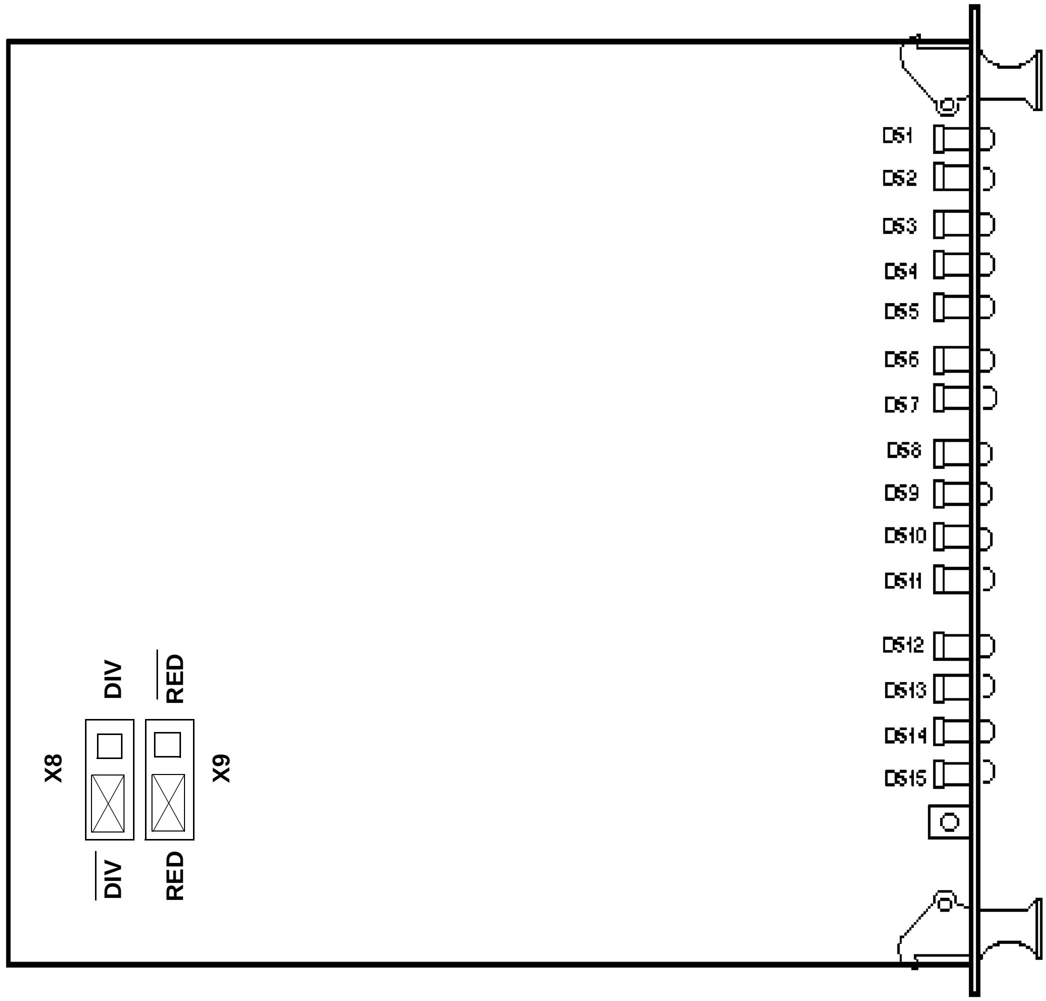


Figure 4-10 Aggregate Control Card Option Locations

Aggregate Interface Plug-In Card Options

Three of the Aggregate Interface Plug-In Cards have hardware option selections. The EIA-RS-422/423 Aggregate Interface Piggyback card requires selection of options to select an RS-422 balanced interface or an RS-423 unbalanced interface. These selections are described in *Table 4-13*. Option locations are shown in *Figure 4-11*. All other Aggregate Interface Piggyback Cards used on the TMSC system do not have hardware options, except the V.35 Aggregate Interface Piggyback, Rev (Revision) J.

A revised V.35 Aggregate Interface piggyback board, Rev J, contains a jumper labeled X2. The positions are not labeled on the pc board but are shown on the reverse side in *Figure 4-12*. The card does not function if the jumper is not installed in either position.

The factory default position for this jumper is the INVERT position. In this position the board is backward compatible with all previous revisions of the board. The NORM position should be used for all applications where a V.35 piggyback is connected to an RS422 piggyback at a remote location.

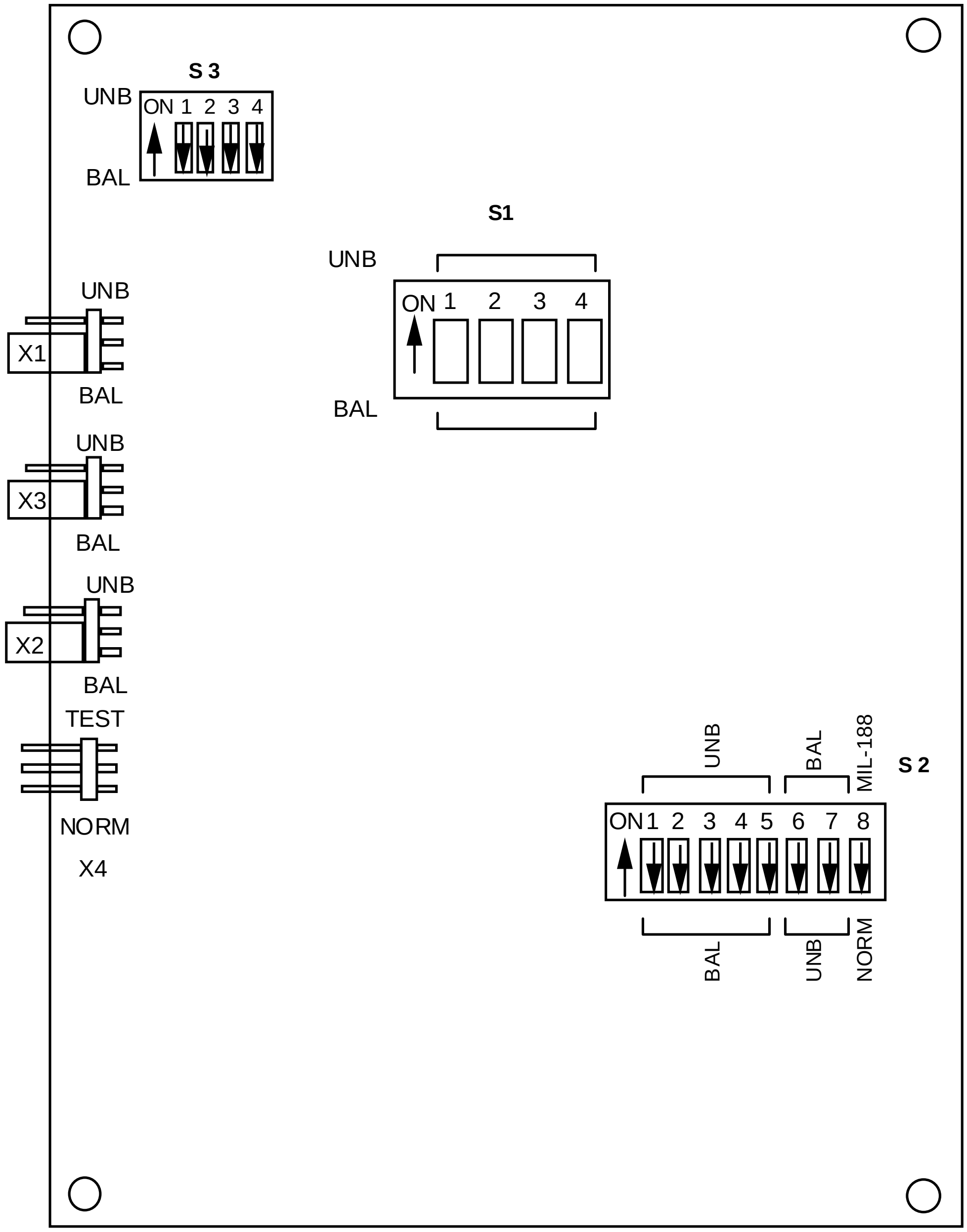


Figure 4-11 RS-422/423 Aggregate Interface Piggyback Option Locations

The purpose of this jumper is to correct a problem with the clocks and data being inverted on older revisions of the piggyback card. Cable number 027H507-XXX compensates for this. If this cable is to be used with Rev J cards, set X2 to the INVERT position for proper operation.

Table 4-13 RS-422/423 Aggregate Interface Piggyback Option Selections

Feature	S1-1 Thru S1-4 Pos.	S2-1,2-5 S3-1,4 Pos.	S2-6,7 Pos.	S2-8 Pos.	X1 Pos.	X2,X3 Pos.	Application
EIA-RS-422 (ITU-T V.11) Balanced Interface	BAL (Off)	BAL (Off)	BAL (On)	NORM (Off)	BAL	BAL	This piggyback may be set to operate in an RS-422 mode (equivalent to ITU-T V.11) balanced mode, or a MIL-STD-188-114 balanced mode.
MIL-STD-188-114 Balanced Interface	BAL (Off)	BAL (Off)	BAL (On)	MIL188 (On)	BAL	BAL	It may be set to operate in an RS-423 mode (equivalent to ITU-T V.10) unbalanced mode or a MIL-STD-188-114 unbalanced mode.
EIA RS-423 (ITU-T V.10) Unbalanced Interface	UNB (On)	UNB (On)	UNB (Off)	NORM (Off)	UNB	UNB	NOTE: Header X4 on this card is used for test purposes only. Do NOT place a jumper in either position on this header.
MIL-STD-188-114 Unbalanced Interface	UNB (On)	UNB (On)	UNB (Off)	MIL188 (On)	UNB	UNB	

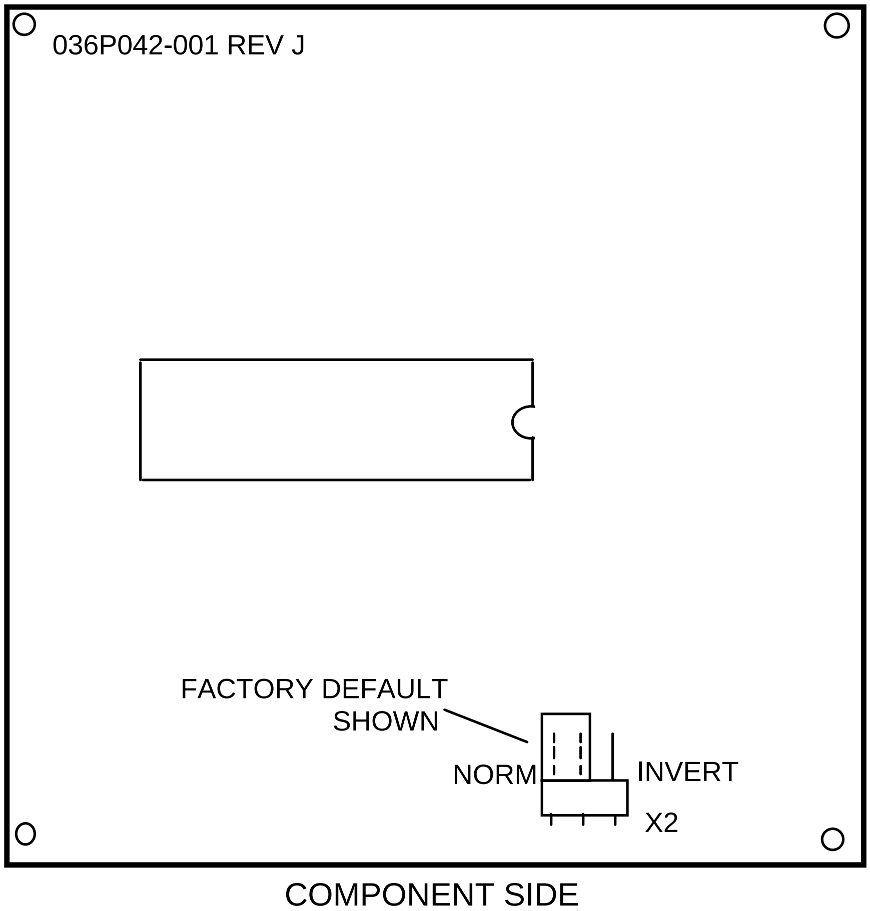


Figure 4-12 V.35 Aggregate Interface Piggyback Card

T1/D4 Aggregate Interface Piggyback

The latest version of the T1/D4 Aggregate Interface Piggyback card (*GDC 036P315-003*) is installed on the ACC of the TMSC shelf. Jumpers provide option selection for each application. Options are described in *Table 4-14*. *Figure 4-13* shows the physical location of the jumpers on the card.

The primary functions of the T1-D4 piggyback include the transmission and reception of the aggregate data stream as well as the insertion and detection of the D4 framing and synchronization patterns. The T1-D4 piggyback is also capable of local and remote alarm status reporting. These alarm status lines are currently monitored on the TMS system.

Table 4-14 T1/D4 Piggyback Card (036P315-003) Option Selections

Feature	Selection	Jumper Desig.	Jumper Pos.	Application
Clock	External Internal	X1 X1	EXT INT	The EXT position selects the external clock supplied directly from the aggregate interface of the ACC. The phase-lock loop of the T1/D4 piggyback card is bypassed in EXT mode. With X1 in the INT position, timing is selected from the output of the phase-lock loop on the T1/D4 piggyback card. When X1 is used in a TMSC, leave X1 in the EXT mode.
Master/Slave Timing	Master Slave	X2 X2	M S	This option selects an input to the phase-lock loop on the T1/D4 piggyback card. At a master timing node, select M, so that the external timing signal from the node is applied to the phase-lock loop. At a slave timing node, select S, so that timing from the aggregate link is applied to the phase-lock loop. When X1 is in the EXT position, the position of X2 does not matter in a TMSC.
Data FIFO Include/Bypass	Include Bypass	X3 X3	INC BYP	The INC position includes FIFO buffers in the data path. BYP bypasses the FIFO buffers. When the T1/D4 piggyback is used in a TMSC node, select BYP for X3.
Clock FIFO Include/Bypass	Include Bypass	X4 X4	INC BYP	The INC position includes FIFO buffers in the timing path. BYP bypasses the FIFO buffers. When the T1/D4 piggyback is used in a TMSC node, select BYP.
MSW/MM+	MSW MM+	X5+X6 X5+X6	MSW MM+	If the T1/D4 piggyback is used in a TMSC node, place X5 and X6 in the MSW position.

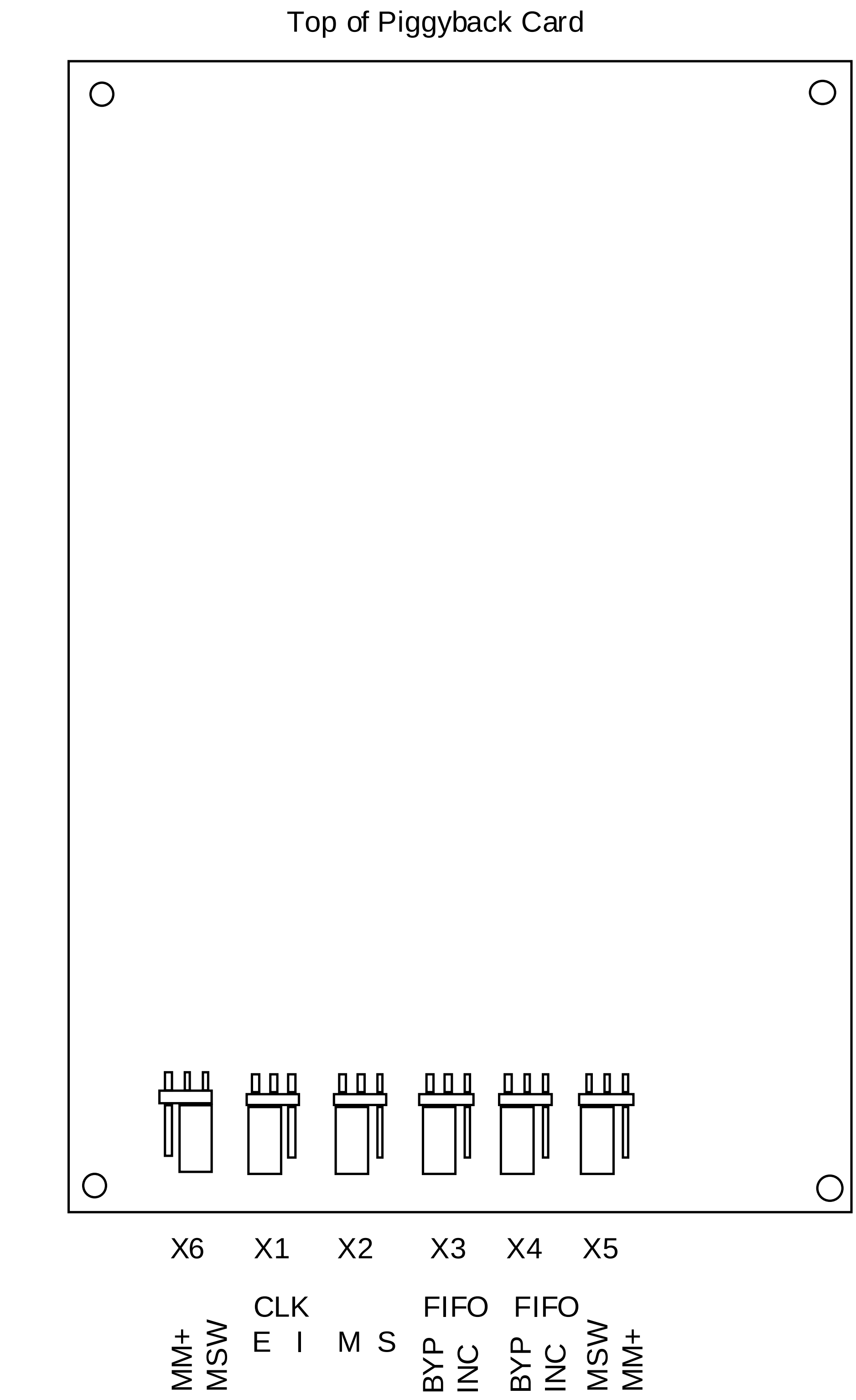


Figure 4-13 T1/D4 Aggregate Interface Piggyback (036P315-003)

T1-DS0 and T1-FT1 Aggregate Interface Piggyback

The T1-DS0 and T1-FT1 Aggregate Interface Piggyback Cards provide a specific electrical and functional interface on the high speed aggregate port of the TMS-3000, TMSC or MINIMUX TDM. The T1-DS0 card (*GDC 036P335-001*) is for use in Canada and the T1-FT1 card (*GDC 036P335-002*) is for use in the USA.

The main difference from other types of T1 interfaces, available from GDC, is that the T1 serial bit stream (at the data rate of 1.544 Mbps) does not have to be fully utilized to carry voice and data information assembled by the associated multiplexer. Fractions of the T1 bit rate (in multiples of 56 or 64 Kbps) can be used by the multiplexer.

The T1-DS0 and T1-FT1 interfaces may be used for TELCO supplied services that are known as fractional T1. In a fractional T1 application, the TDM equipment can be connected to a Digital Access Cross Connect (DACS), to provide routing of individual (56 or 64 Kbps) DS0 channels to various remote locations.

The principal application for the T1-DS0 and T1-FT1 Aggregate Interface Piggyback Cards is to offer a T1 interface that takes advantage of fractional T1 services. Instead of paying for a full T1 line, you pay only for the bandwidth needed by selecting the number (N) of DS0 channels (where $1 \leq N \leq 24$). As bandwidth requirements change, you can change the number of DS0s. This is particularly useful at feeder nodes which typically have smaller bandwidth requirements.

The T1-DS0 (Canada) and T1-FT1 (USA) also provides an aggregate frame structure at 1.544 Mbps in accordance with ATT D4 or Extended SuperFrame (ESF) formats.

Refer to *GDC 036R477-000 and 036R485-000* for complete information on these cards.

G.704 Aggregate Interface Piggyback

Before mounting the G.704 Aggregate Interface Piggyback Card, be certain all the options are configured. The G.704 Aggregate Interface Card contains a 40-pin socket that mates with pins on the ACC. An optional connector, XP2, mates with a later version of the ACC (*GDC 036P313-003*). Line up the pins and gently press the G.704 Aggregate Interface Piggyback onto the ACC.

Using Switches S1 and S2 on the G.704 Aggregate Interface Piggyback Card, CRC4 multiframe, time Slot 16, synchronous/plesiochronous clocking mode and the elastic buffers may be selected in addition to the Transmit/Receive impedance at the aggregate and the line balance. *See Figure 4-14*. *Table 4-15* defines the option selections and describes the application of each. *Table 4-16* shows the buffer size/delay time of the plesiochronous buffers.

The ITU-T requires a provision be made to optionally ground the outer conductor of a coaxial cable (unbalanced) when used with the G.704 interface. Either end of the cable (transmit or receive) may require grounding. Grounding of the aggregate signal DATA B on the G.704 Aggregate Interface Piggyback is performed as follows:

- Receive End — The grounding of signal RCVDATB is achieved by moving DIP Switch S2-8 on the G.704 Aggregate Interface Piggyback card to the UNB or closed (ON) position. This connects RCVDATB to Signal Ground.
- Transmit End — The grounding of signal XMTDATB is achieved by soldering a zero ohm resistor (or a simple wire link) to future use resistor R11 (F/U R11) located on the right hand side of connector XP1 (*Figure 4-14*). This connects XMTDATB to Signal Ground.

Note that on the aggregate 25-pin D Connectors (J1 and J16 on the back of the main shelf), the grounded signals appear on the following connector pins: RCVDATAB (Pin 16) and XMTDATB (Pin 14). Do not ground both ends of the same cable.

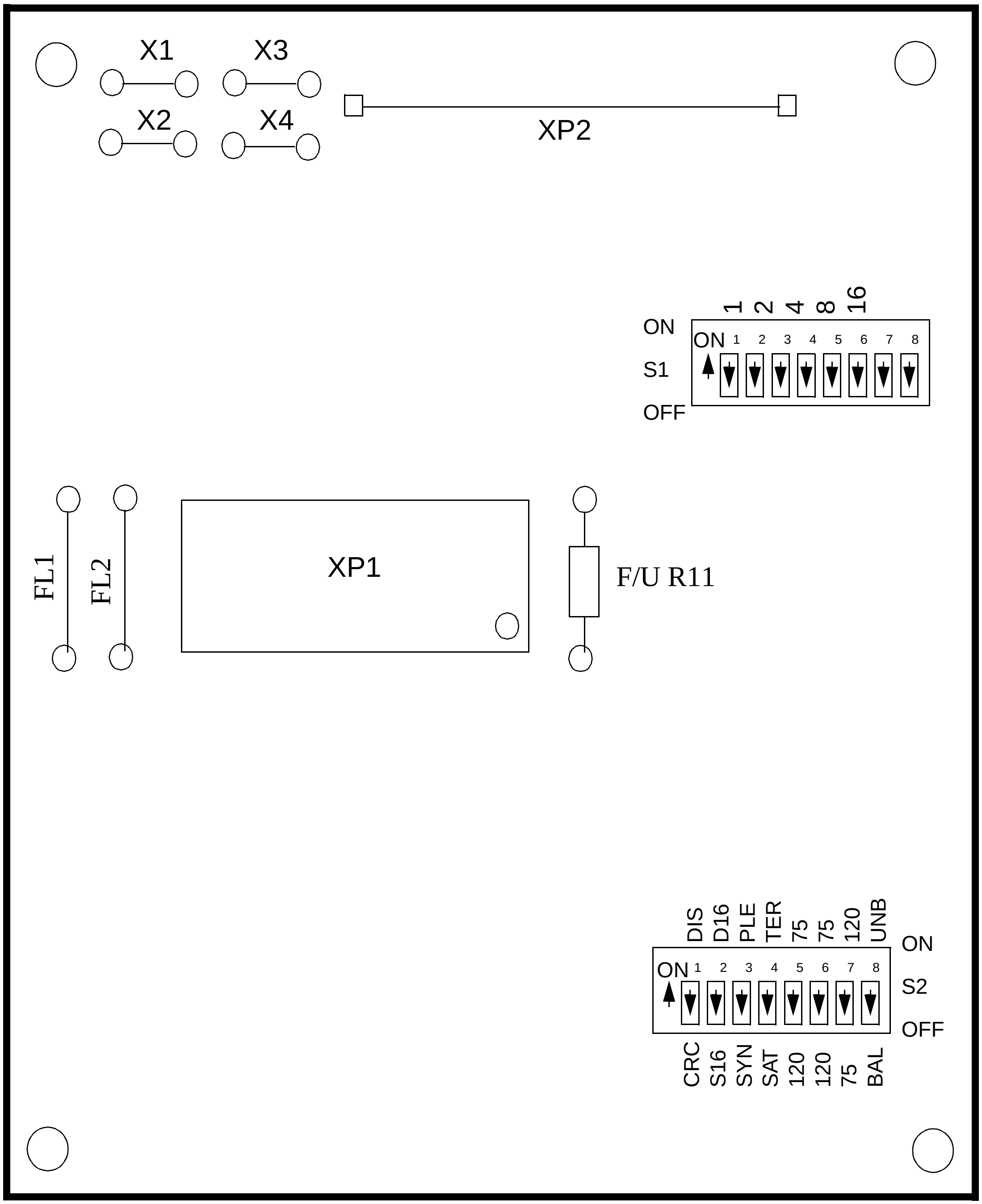


Figure 4-14 G.704 Aggregate Interface Piggyback Card

Table 4-15 G.704 Aggregate Interface Piggyback Card Option Selections

Switch No.	Desig.	Position	Function	Application
S1-1	1	On Off	Value of 1 No value	Switch S1-1 through S1-5 define the value of N in N x 64. Add the values of the five switches together for the value of N. The switch setting affects the elastic buffer size for the synchronous buffer mode only.
S1-2	2	On	Value of 2	
		Off	No value	
S1-3	4	On	Value of 4	
		Off	No value	
S1-4	8	On	Value of 8	
		Off	No value	
S1-5	16	On	Value of 16	
		Off	No value	
S1-6through S1-8		Off	Not used	Leave Switches S1-6 through 8 in the Off position.
S2-1	DIS	On	CRC4 multiframe disabled	CRC4 multiframe is not used.
	CRC	Off	CRC4 multiframe enabled	The CRC4 multiframe mode is enabled.
S2-2	D16	On	D16 Time slot	Time Slot 16 carries data.
	S16	Off	S16 Time slot	Time Slot 16 is skipped by data.
S2-3	PLE	On	Plesiochronous Clocking Mode	Place the G.704 in the Plesiochronous Clocking Mode if clocks at either end of an aggregate link are synchronized by two different master clocks or communicating via a satellite link. The elastic buffer depth is set by the TER/SAT (S2-4) switch operation.
	SYN	Off	Synchronous Clocking Mode	Place the G.704 in the Synchronous Clocking Mode if at both ends of the aggregate link the transmit and receive clocks are synchronized to the same master clock. The elastic buffer depth is set by hardware.
S2-4	TER	On	Terrestrial Elastic Buffer	Only used in the plesiochronous clocking mode. Selects ±256-bit elastic buffer.
	SAT	Off	Satellite Elastic	Used in the plesiochronous clocking mode. Selects ±2048-bit elastic buffer
S2-5	75 120	On Off	75Ω Impedance 120Ω Impedance	Setting to 120 provides a receive data line impedance of 120 ohms for the G.704. Setting at 75 provides a receive line impedance of 75 ohms.
S2-6	75	On	75Ω Impedance	Same as S2-5.
	120	Off	120Ω Impedance	
S2-7	120 75	On Off	120Ω Impedance 75Ω Impedance	Setting to 120 provides a transmit data line impedance of 120 ohms for the G.704. Setting at 75 provides a receive line impedance of 75 ohms.
S2-8	UNB	On	Unbalanced	Setting to UNB provides an unbalanced line condition.
	BAL	Off	Balanced	Setting to BAL provides a balanced line condition.

Table 4-16 G.704 Aggregate Interface Buffer Size

Mode	Value of N	Buffer Size(bits)	Max. Delay (Bit times)	Max. Delay (µsec)
Plesiochronous (Satellite)	—	±2048	4096	2000
Plesiochronous (Terrestrial)	—	±256	512	250
Synchronous	1	±16	32	16
Synchronous	2-3	±32	64	31
Synchronous	4-7	±48	96	47
Synchronous	8-31	±80	160	78

Combined Digital Aggregate (CDA) Module

The following paragraphs apply to both CDA-T1 and CDA-E1 unless otherwise specified.

Insert the CDA Module into the shelf by pressing it in firmly. To remove the CDA Module, first press the Dsbl (disable) switch on the front panel once. All front panel LEDs should go off. The module is now in a low power mode and may be removed from the shelf in the usual manner. If the module is not removed, pressing the Dsbl switch once more reactivates the module and the INIT LED lights.

Part Numbers

The CDA Module consists of four cards — the CDA base card, the CDA-T1 or CDA-E1 microprocessor plug-in card, and two CDA-T1 or CDA-E1 I/O cards. The CDA-T1 I/O card is the interface between the CDA base card and a T1 line, while the CDA-E1 I/O card provides the interface with CEPT G.732 and G.704 transmission formats. Each I/O plug-in card is a 6.25 X 6.75 inch printed circuit board and contains three connectors that mate with the base card. *Refer to Tables 2-17 and 2-18*.

Table 4-17 CDA-T1 Module (036M309-003)

Equipment Supplied	Designation	GDC Part No.
PCB Assembly, Base Card	—	036P309-001
PCB Assembly, I/O Piggyback (T1)	—	036P310-001
PCB Assembly, Micro Piggyback	—	036P316-001
PCB Assembly, I/O Piggyback (G.732 CEPT 2.048 MHz)	—	036P282-001

Table 4-18 CDA-E1 Module (036M328-002)

Equipment Supplied	Designation	GDC Part No.
PCB Assembly, Base Card	—	036P309-001
PCB Assembly, Micro Piggyback	—	036P316-001
PCB Assembly, I/O Piggyback (G.732 CEPT 2.048 MHz) (Qty. 2)	—	036P282-001

CDA Option Selections

The CDA base card contains a hardware jumper (X15) for redundancy. This jumper should be set to RED when using a redundant CDA pair or when using a non-redundant 256 CDA. It should be set to NRED when using a non-redundant 128 CDA. Note that when using a non-redundant 256 CDA, its paired slot must be empty. The CDA base card also contains Switch S2, which is a factory adjustment switch. Use of this switch may cause erroneous data transfers or complete node failure.

Note *Switch S2 should never be changed in the field. It controls a critical factory adjustment option which is set only when the PCB assembly is installed in a specialized test fixture at the factory. The purpose of Switch S2 is to fine tune the turn-on and turn-off times of the fast bus circuit. Improper adjustment of this switch can cause erroneous data transfers between common cards and possible node failure.*

The CDA I/O cards operate in two modes, hardware and software. On power-up, the I/O card comes up in the hardware mode. The DIP Switch S1 on the I/O card establishes the configuration of the card. The I/O card continues to operate in hardware mode until the CDA receives configuration data from the Controller. At that time, the I/O card switches to software mode, using the settings defined in the configuration. *Figure 4-15* shows the location of DIP Switch S1 on the T1 I/O card, and *Table 4-19* defines the switch settings for the T1 I/O. *Figure 4-16* and *Table 4-20* show the base card options, and *Figure 4-17* and *Table 4-21* show redundant and non-redundant cable connections. The E1 I/O card also provides the means to select the line impedance of the aggregate at either 75- or 120-ohms (Jumpers X1–X4). The TMSC does not supply a coaxial connection to provide a 75-ohm unbalanced interface. *Figure 4-18* shows the location of DIP Switch S1 and Jumpers X1–X4 on the E1 I/O card, and *Table 4-22* defines the settings.

The CDA microprocessor card contains one Jumper, X9. This is the watchdog enable/disable and should always be set to enable.

CDA-T1/E1 Aggregate Interface Cable Connections

The CDA Module has two Input/Output cards. Each Input/Output card contains one port. Each port is dedicated to a specific backplane connector using a specific pinout arrangement. Since the ports are separate, they do not provide a diverse backup to each other. *Refer to Table 4-21*.

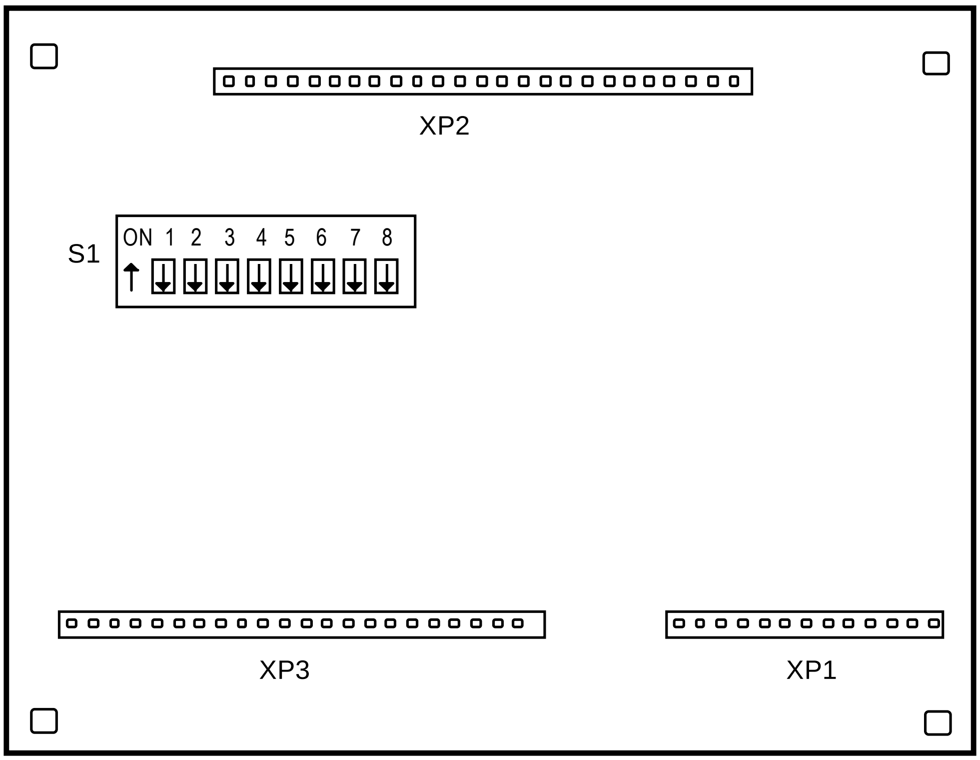


Figure 4-15 CDA-T1 I/O Plug-In Card, Option Locations

Table 4-19 CDA-T1 I/O Plug-In Card (036P310-001) Option Selections

Switch Number	Switch Position			Function	Application
S1-1 B8ZS/Dis	Off On			Enables B8ZS line coding Disables B8ZS line coding	Bit 8 Zero Suppression (B8ZS) is a technique designed to meet the spectral density specification. This technique creates an intentional double Bipolar violation at the transmitting end when 8 consecutive zeros are detected. Bipolar return to zero is the modulation technique used in T1 which requires subsequent marks of polarity opposite to the previous marks. The bipolar violation is detected and removed at the receive end of the network.
S1-2 Bit 7/ Trans	Off On			Bit 7 Substitution Enabled Transparent	In B7 substitution, ones density is implied. This means that bit (7) for select DS0 frames is set to one. When B7 is enabled, the bandwidth available for type subaggregates varies with each DS0 slot selecting “Trans’’ bypasses this technique on the DS0 frame format.
S1-3 ESF/D4	Off On			Selects ESF Framing Selects D4 Framing	Two methods of framing exist in a DS1 data stream. A D4 frame consists of twelve 193-bit frames called a Superframe. An ESF retains the structure of D4, but consists of twenty-four 193-bit frames instead of twelve. ESF is known as Extended Superframe.
S1-5 (LEN2) S1-6 (LEN1) S1-7 (LEN2)	S1-5	S1-6	S1-7	Selects line length	Clock and data extraction are improved by cable length transmit equalization. This feature allows line lengths of up to 655 feet to be used without the customary line build-out networks. With line transmit equalization, the pulse shape and amplitude at properly terminated receiving equipment conforms to AT&T standards. The line length selections support a three partition arrangement for MAT and ICOT, and a five partition arrangement for ABAM, PULP and PIC cables. Configure S1-5, 6, 7 to the proper length and cable type.
	On	Off	Off	0-220 ft.	
	On	On	Off	220-440 ft.	
	On	Off	On	440-655 ft.	
	On	Off	Off	0-133 ft.	
	Off	On	On	266-399 ft.	
	Off	On	Off	399-533 ft.	
	Off	Off	On	533-655 ft.	
	Off	Off	Off	G.704, G.732	
	On	On	On	2.048 MHz (CEPT)	
NOTE: S1-2 should always be in the ON position. Only B8ZS or Bit 7 substitution can be enabled at a time. Selecting both functions simultaneously is not allowed. **NOTE:** S1-8 is not used and should remain in the OFF position.					

Table 4-20 CDA Base Card Options

Feature	Selection	Switch (S), Jumpers (X)		Application
		Desig.	Position	
Redundant/ Non-Redundant CDA Module	Redundant Non-Redundant	X15 X15	RED NON-RED	Proper system operation requires that the CDA module knows whether it is redundant or not prior to program or configuration download. If using the CDA as a redundant pair, set this jumper to RED. If using the CDA as a non-redundant pair, set this jumper to NON-RED.

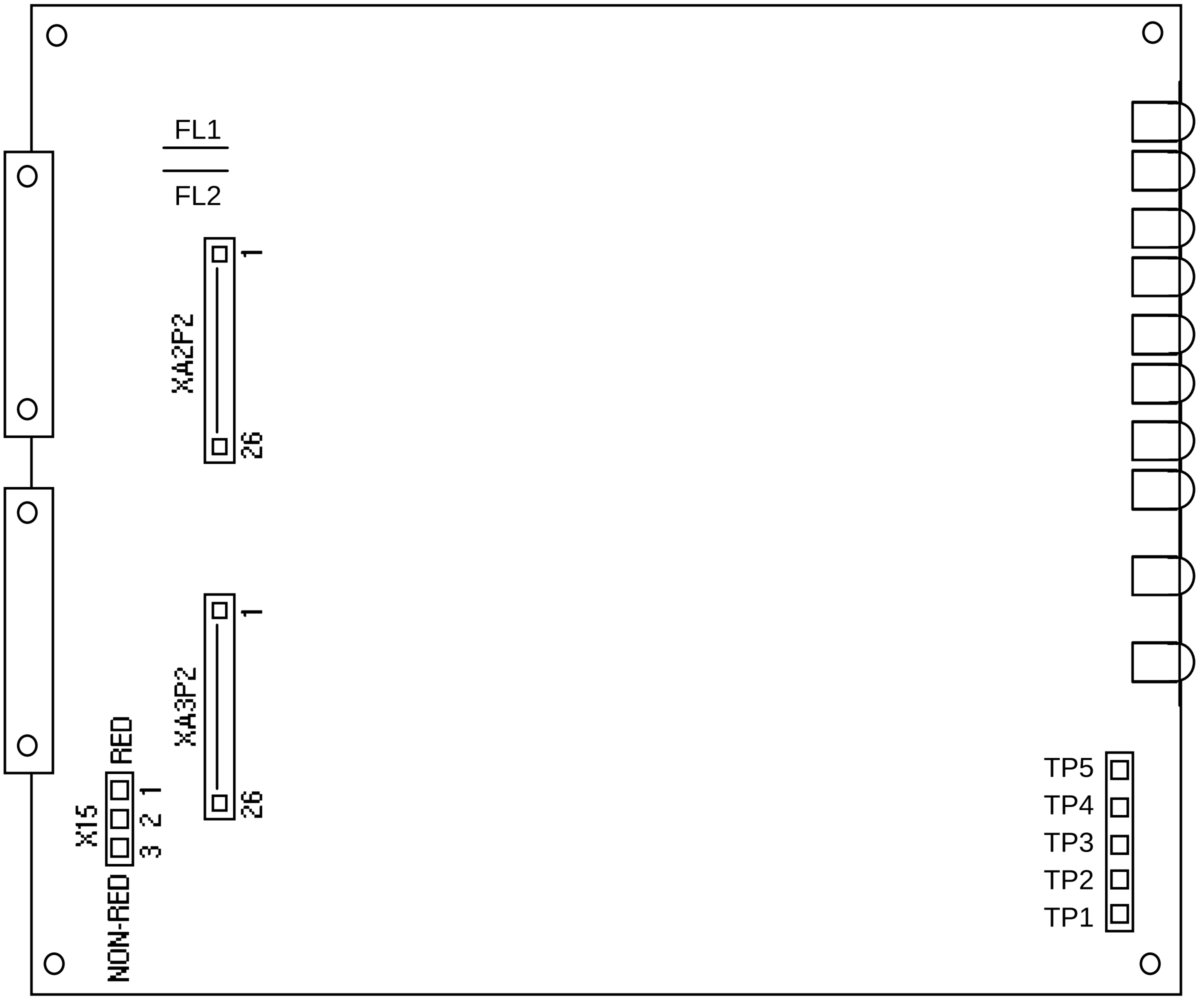


Figure 4-16 CDA Base Card Option Locations

In a redundant situation the CDA Module Input/Output ports are dedicated to one of the DB25 connectors on the backplane. Port 1 goes to the upper connector of the backplane, Port 2 to the lower connector. Use *GDC 027H201* which provides a standard connection to T1 lines.

If non-redundant CDA Modules are used in adjacent slots, the Input/Output ports of each module use different pins of the same DB25 connector. They split externally through a "Y cable" (*GDC 027H316*) attached to the backplane. The module in the primary slot uses the upper portion of the upper connector for Port 1 and the upper portion of the lower connector for Port 2. The module in the secondary slot uses the lower portion of the lower connector for Port 1 and the lower portion of the upper connector for Port 2.

DB25 Pinout Configuration for a Redundant CDA Module is given in *Figure 4-17*, along with configuration for a non-redundant CDA Module in adjacent slots. *Table 4-21* contains the CDA aggregate cable connections.

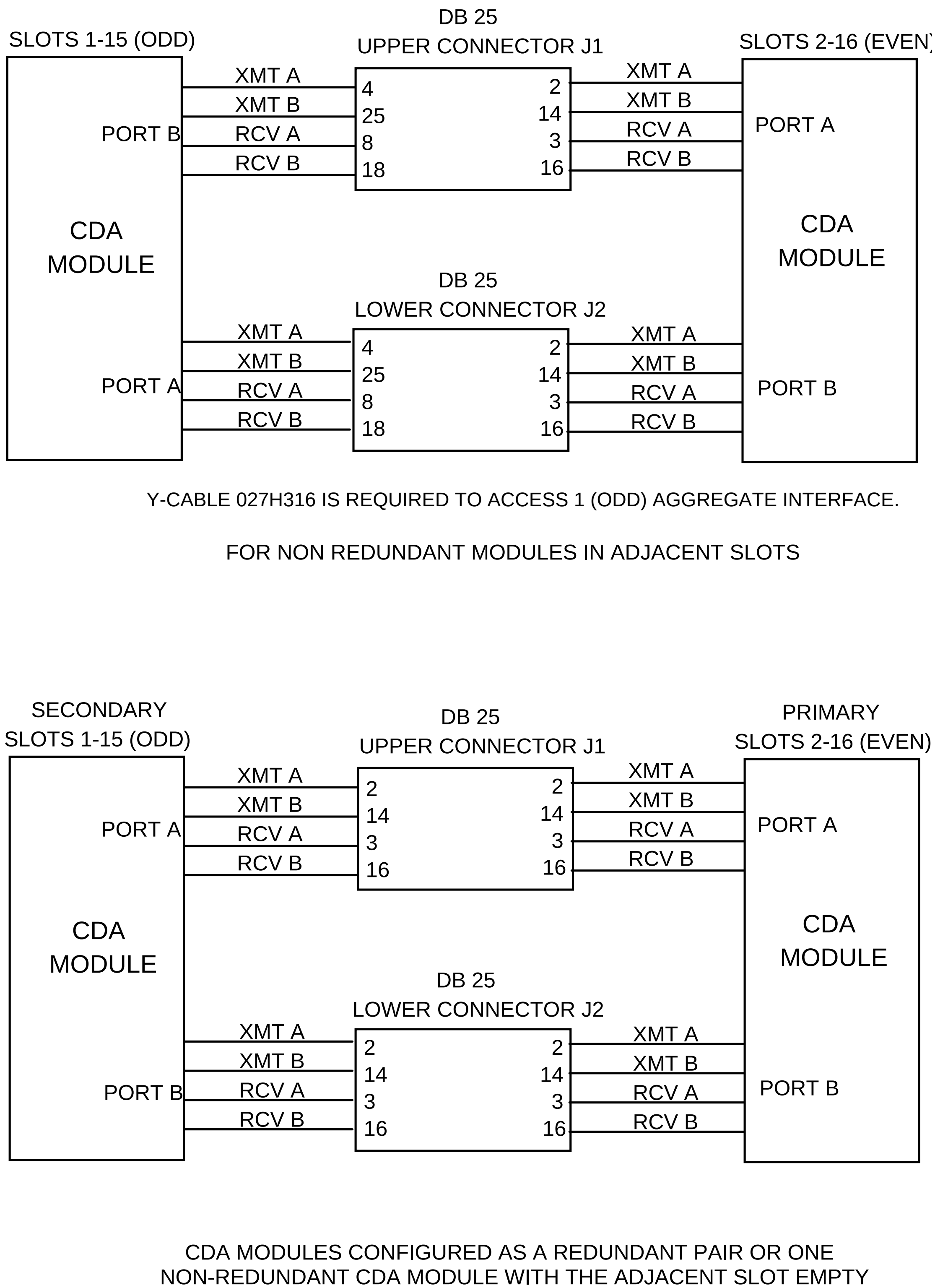


Figure 4-17 DB25 Backplane Connections for CDA Module

Table 4-21 CDA Aggregate Cable Connections

Configuration	*Connector	Pins	Y Cable	CDA Port
Redundant	Upper DB-25	2,14,3,16	Not Used	Even or Odd Slot Port A
	Lower DB-25	2,14,3,16	Not Used	Even or Odd Slot Port B
Non-redundant	Upper DB-25	2,14,3,16	P2	Even Slot Port A
	(Odd number)	4,25,8,18	P3	Odd Slot Port B
	Lower DB-25	2,3,14,16	P2	Even Slot Port B
	(Even number)	4,25,8,18	P3	Odd Slot Port A

NOTE: Generally, Port A of either CDA Module in a redundant pair comes out on the upper DB-25 connector and Port B comes out on the lower DB-25 connector. When non-redundant modules are used in adjacent slots, Port A and Port B of the even-numbered slot come out on the upper and lower connectors as before, but Port A and Port B of the odd-numbered slot come out on alternate pins of these connections. The different ports are then split externally using a special Y-cable (*GDC 027H316*).

* This connector is located on the backplane of the main shelf. If a Y-cable is used, connect P1 of the Y-cable to this connector.

Table 4-22 CDA-E1 (G.732) I/O Plug-In Card Options

Feature	Selection	Switch(S), Jumpers(X) Desig.	Position	Function
Receive Line Impedance	75 ohms 120 ohms	X1	75 120	Setting at 75 provides a line impedance of 75 ohms for the G.732. Setting at 120 provides a line impedance of 120 ohms.
Receive Line Impedance	75 ohms 120 ohms	X2	75 120	Setting at 75 provides a line impedance of 75 ohms for the G.732. Setting at 120 provides a line impedance of 120 ohms.
Transmit Line Impedance	75 ohms 120 ohms	X3	75 120	Setting at 75 provides a line impedance of 75 ohms for the G.732. Setting at 120 provides a line impedance of 120 ohms.
Receive Shield Ground	75 ohms 120 ohms	X4	75 120	Setting at 75 provides a ground reference on the Recv B lead for unbalanced interfaces (normally used with 75 ohm coaxial interfaces). Setting at 120 provides for a balanced Recv input (normal setting).
Transmit Shield Ground	Ground Open	X9	GND OPEN	GND selection provides a ground reference on the output port as recommended by G.703 for use with 75 ohm interfaces. OPEN selection is for use with a 120 ohm interface and provides a balanced interface at the output port.
CAS Signaling (TS16) Enabled. CRC-4 Disabled.		S1-1 On	S1-2 On	Switches S1-1 and S1-2 selects CAS, CRC-4, or both for use on the G.732 I/O plug-in card.
CAS Signaling (TS16) Disabled. CRC-4 Disabled.		Off	On	
CAS Signaling (TS16) Enabled. CRC-4 Enabled.		On	Off	
CAS Signaling (TS16) Disabled. CRC-4 Enabled.		Off	Off	

NOTE: Switches S1-3 and S1-4 remain in the OFF position.

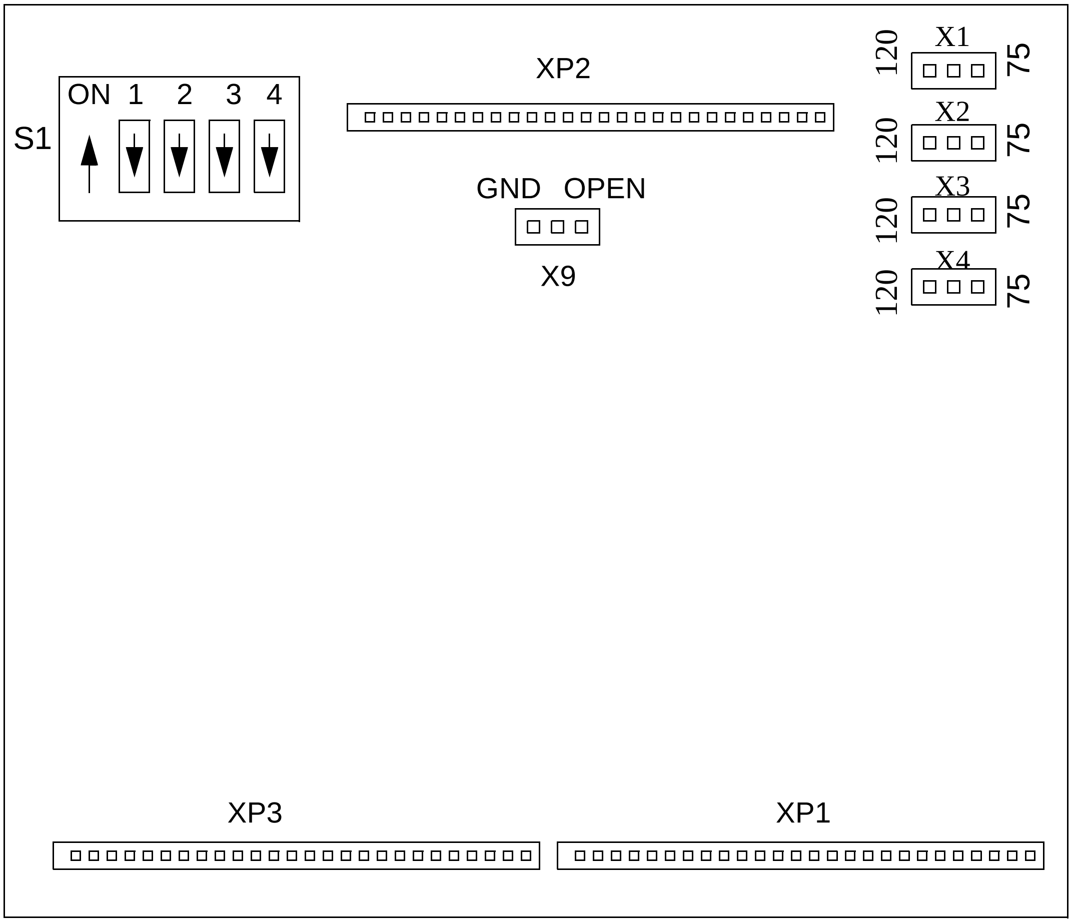


Figure 4-18 CDA-E1 I/O Plug-In Card Option Locations

ADPCM Compression Module (ACM)

Insert the ACM into the shelf by pressing it in firmly. To remove the ACM, first press the Dsbl (disable) switch on the front panel once. All front panel LEDs should go off. The module is now disabled and may be removed from the shelf in the usual manner. If the module is not removed, pressing the Dsbl switch once more resets the module. When the ACM is plugged in, it performs a reset.

Part Numbers

This section provides information to be used to procure replacement assemblies and pc boards. *Tables 2-23* and *2-24* break down assemblies into sub-assemblies that form the component.

Table 4-23 ACM/T1 Module (036M335-002)

Equipment Supplied	Designation	GDC Part No.
PCB Assembly, Base Card	—	036P332-001
PCB Assembly, Micro Piggyback	—	036P316-001
PCB Assembly, I/O Piggyback	—	036P310-001
PCB Assembly, ADPCM SMT Plug-In	—	036P333-001

Table 4-24 ACM/E1 (ITU-T) Module (036M335-001)

Equipment Supplied	Designation	GDC Part No.
PCB Assembly, Base Card	—	036P332-001
PCB Assembly, Micro Piggyback	—	036P316-001
PCB Assembly, I/O Piggyback	—	036P282-001
PCB Assembly, ADPCM SMT Plug-In	—	036P333-002

ACM Option Selections

The ACM consists of four cards: the base card, one I/O plug-in card, a microprocessor plug-in card and an ADPCM SMT plug-in card. Available hardware options are located on the I/O plug-ins and base card. An Input/Output card is the interface between the ACM base card and the T1 line. It is a removable module so that different interfaces can be easily installed. The I/O Plug-in card allows for different interface parameters to be met.

The ACM connects to either of two DB-25 connectors on the backplane for link connections. The top connector is designated as "A", the bottom connector is designated as "B". The top connectors are the odd numbered J designations, the bottom connectors are even numbered.

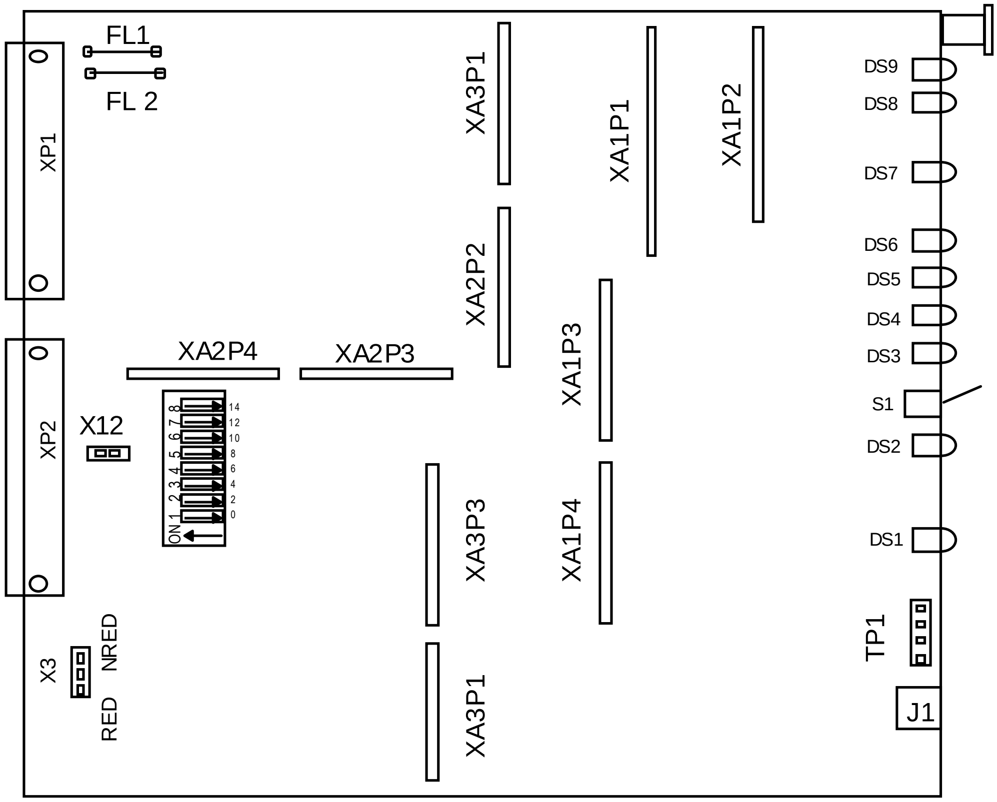
An ACM in Slot N, where N is odd, has its ports at DB-25 connector N+1. When the slot is even, the associated connector is N-1.

An ACM/E1 Module is used on the ITU-T network (2.048 Mbps). Refer to the CDA-E1 Module section to configure the ACM/E1 I/O card.

Configure most ACM options through the Controller software screens. *Refer to GDC 036R602-nnn or GDC 036R603-Vnnn* for more information on ACM software options.

Jumper X3 is set on the base card for redundancy. Select the option for redundant or non-redundant operation on both ACM Modules. *Table 4-25* shows how to configure Jumper X3 on the ACM base card for redundant or non-redundant operation. *Figure 4-19* shows the location of Jumper X3. Switch S2 on the ACM base card sets the Fast Bus Timing. This switch is factory set and should not be adjusted.

Table 4-26 shows how to configure ACM (T1) I/O plug-in card DIP Switch S1. The location of S1 on the ACM (T1) I/O plug-in card is shown in *Figure 4-20.*



NOTE: Jumper X12 and Switch S2 are factory set. Do not change.

Figure 4-19 ACM Option Locations

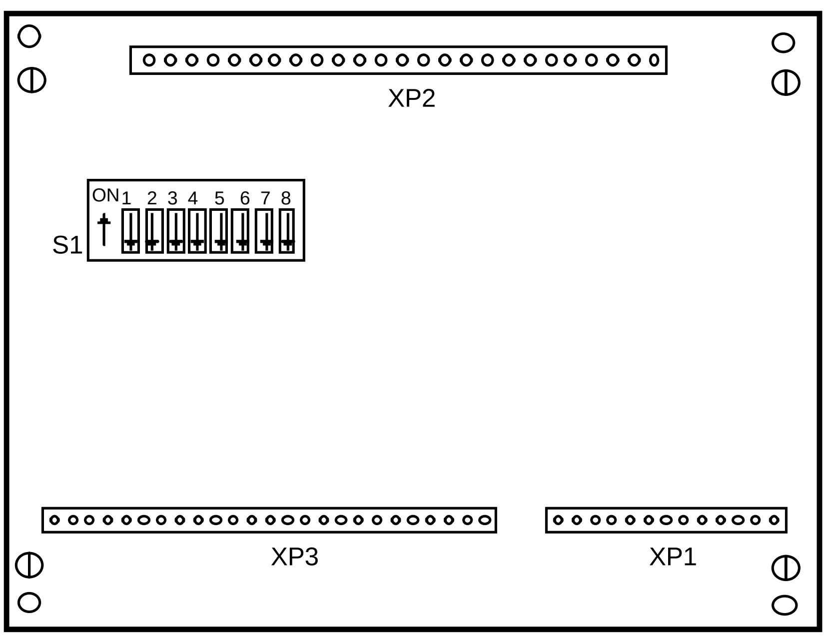


Figure 4-20 ACM/T1 I/O Plug-In Card, Option Locations

Table 4-25 ACM Option Selections

Feature	Selection	Switch (S), Jumpers (X) Desig.	Position	Application
Redundant/ Non-Redundant ACM	Redundant	X3	RED	Proper system operation requires that the ACM knows whether it is redundant or not prior to program or configuration download. If using ACM as a redundant pair, set this jumper to RED. If using ACM as a non-redundant pair, set this jumper to NON-RED.
	Non-Redundant	X3	NON-RED	

Table 4-26 ACM/T1 I/O Plug-In Card Option Selections

Switch Number	Switch Position			Function	Application
S1-1 B8ZS/Dis	Off			Enables B8ZS line coding	Bit 8 Zero Suppression (B8ZS) is a technique designed to meet the spectral density specification. This technique creates an intentional double bipolar violation at the transmitting end when 8 consecutive zeros are detected. Bipolar return to zero is the modulation technique used in T1 which requires subsequent marks of polarity opposite to the previous marks. The bipolar violation is detected and removed at the receive end of the network.
	On			Disables B8ZS line coding	
S1-2 Bit 7/ Trans	Off			Bit 7 Substitution Enabled*	In B7 substitution, ones density is implied. This means that bit (7) for select DS0 frames is set to one. When B7 is enabled, bandwidth available for type subaggregates varies with each DS0 slot. Selecting “Trans’’ bypasses this technique on the DS0 frame format.
	On			Transparent	
S1-3 ESF/D4	Off			Selects ESF Framing	Two methods of framing exist in a DS1 data stream. A D4 frame consists of twelve 193-bit frames called a Superframe. An ESF retains the structure of D4, but consists of twenty-four 193-bit frames instead of 12. ESF is known as Extended Superframe.
	On			Selects D4 Framing	
S1-5 (LEN2)	S1-5	S1-6	S1-7	Selects line length	Clock and data extraction are improved by cable length transmit equalization. This feature allows line lengths of up to 655 feet to be used without the customary line build-out networks. With line transmit equalization, the pulse shape and amplitude at properly terminated receiving equipment conforms to AT&T standards. The line length selections support a three partition arrangement for MAT and ICOT, and a five partition arrangement for ABAM, PULP, and PIC cables. Configure S1-5, 6, 7 to the proper length and cable type.
S1-6 (LEN1)	On	Off	Off	0-220 ft.	
S1-7 (LEN2)	On	On	Off	220-440 ft.	
	On	Off	On	440-655 ft.	
	On	Off	Off	0-133 ft.	
	Off	On	On	266-399 ft.	
	Off	On	Off	399-533 ft.	
	Off	Off	On	533-655 ft.	
	Off	Off	Off	G.704, G.732	
	On	On	On	2.048 MHz (CEPT)	

*Bit 7 substitution is not used. Switch S1-2 should always be in the ON position.

NOTE: S1-8 is not used and should remain in the OFF position.

ACM Interface Cable Connections

The ACM has one Input/Output Card. This card contains two ports. Each port is dedicated to a backplane connector using a specific pinout arrangement. Since these ports are separate, they do not provide a diverse backup to each other. The TMSC can contain:

- One redundant pair of ACMs and one nonredundant ACM
- Two nonredundant ACMs
- One nonredundant ACM

Redundant ACM pairs should be installed in the PRI-1 and B/U slot in the shelf. The PRI-2 slot can remain empty or contain either a nonredundant ACM, CDA, or ACC. For ACM installation, the PRI-2 slot is used as the secondary module as a backup for the ACM in PRI-1.

To connect the ACM to aggregate lines, use DB25 connectors J1 (AGGR 1A) and J11 (AGGR 1B). A standard connection to a T1 line can be provided using cable GDC 027H201.

Note *An ACM in the PRI-2 slot cannot be backed up by an ACM in the B/U slot. The ACM base card is designed for only one I/O card and does not support the B/U function.*

Table 4-27 ACM Aggregate Cable Connections

Configuration	*Connector	Pins	Y Cable	ACM Port
Redundant	Upper DB-25	2,14,3,16	Not Used	Even or Odd Slot Port A
Non-Redundant	Upper DB-25	2,14,3,16	Not Used	Even slot
	Lower DB-25	2,14,3,16	Not Used	Odd slot
*This connector is located on the backplane of the main shelf. If a Y-cable is used, connect P1 of the Y-cable to this connector.				

ACM Signaling

Once the ACM is properly installed in the main shelf, the user must establish signaling and conditioning parameters through software. Signaling refers to a means of conveying call set-up and tear-down information between the customer's equipment. On-hook (idle), off-hook (busy), and ring, are examples of signaling messages. In order to maintain compatibility in both the domestic and international public networks the following signaling types are supported.

- Robbed Bit Signaling
- G.704 Channel Associated Signaling (CAS) Channel 16
- Message Oriented Common Channel Signaling (CCS)
- In Band Signaling (SF, Tone type)

Due to various requirements of different types of customer equipment and to allow a wide range of network configurations, several methods for transporting signaling are required.

The following types of channel signaling are supported by the ACM:

- Inband or Common Channel Signaling

- 2 State Signaling (A or E/M (ACM or UVC))
- 4 State Signaling (A,B to ACM)
- 16 State Signaling (A,B,C,D to ACM only)

Different types of channel signaling can be selected per channel, based on specific needs of the existing equipment at the channels termination point.

ACM Conditioning

Conditioning provides known and acceptable data and signaling outputs during a failure. There are different types of conditioning dependent on the external equipment connected to the port and the channels. The differences are in both signaling and data.

In data conditioning, the 64 kbps data path may be conditioned to allow acceptable and known patterns to be transmitted for data and suppressed outputs for voice.

Several types of conditioning are available for data and voice circuits:

- A0+B0, A0+B1, and A0/1+B0/1
- A1/0/1+B1/0/1
- A1+B1
- A1/0+B1
- Signal Freezing

For more information on configuring the Signaling and Conditioning parameters for the ACM, refer to *GDC 036R602-nnn or GDC 036R603-Vnnn.*

ACM Self Diagnostic Tests

Self diagnostics are performed to insure that the hardware and software are operating properly. The ACM has three levels of diagnostic tests. The first does a preliminary integrity check of the module upon power up. This is performed by the Boot program. The second level is performed by the full feature program upon invocation.

These diagnostics will perform a more thorough check of the ACM hardware than the boot program did. The third level operates continually in the background checking the module for failures.

In the case of redundancy, the standby module performs self diagnostics so as to improve confidence in it. These tests are similar to the on-going diagnostic tests. Upon failure detection, the ACM FAIL LED will be activated. Because of this, the STANDBY LED will be deactivated making the module unavailable for auto-redundancy operation.

The following LEDs are affected by the self diagnostic tests:

- MAJOR TEST LED
- ACM FAIL LED
- STANDBY LED
- INIT LED

Boot Self Diagnostics

The following tests are performed by the boot software upon ACM power-up. These tests are referred to as Power On Self Tests (POST). During these tests the INIT LED will be lit. This may occur when system power is applied or when the ACM is plugged into a powered up system. They will not be performed when the ACM is performing a soft reset.

A failure of a self-test results in a failure indication sent to the ESCC/SCC, if possible. The ESCC/SCC informs the TMS Controller of these failures and to take corresponding actions to correct them. The TMS Controllers will then display these failures on its console. When the POST has completed, the MAJOR TEST LED will be activated. If the POST fails, then the ACM Fail LED will be activated, if possible. It should be noted that the boot diagnostics will test only portions of the hardware which insure proper operation of the Boot program. The following paragraphs decribe the areas to be tested.

Front Panel LEDs — Upon power up of the module, all LEDs should be activated for five seconds so a visual check of the LEDs can be made. After five seconds, all LEDs except INIT should be lit.

Test LEDs should be de-activated. Although this test is not essential for proper operation of the ACM boot program, it is a convenient place to perform this. This is only a visual test.

RAM Tests — The microprocessor data RAM used for stack and temporary storage in the boot will be checked for proper operation. Next, the boot section of Dual Port RAM will be checked since all subsequent pass or failure status to the ESCC/SCC must pass thru this. If these tests fail, an attempt will be made to inform the ESCC/SCC of the failure and the ACM FAIL LED will be activated.

Full Feature Start-up Diagnostics

Full feature diagnostics perform a more thorough test of the ACM hardware before the card is placed in service. Upon any failure, the ESCC/SCC will be informed via Dual Port RAM status so an appropriate action may be taken. Also, the ACM FAIL LED will be activated to give a visual indication of the failure. The following sections describe the diagnostic tests performed before the ACM is placed into service. During these tests, the MAJOR TEST LED is lit.

RAM — A thorough check of the data RAM will be performed to insure its integrity. This will be similiar to the boot program's test except it will only check the remaining portion of RAM not tested by the boot. A thorough check of the Dual Port RAM section used by the Full Feature will be performed to insure its integrity. Also, any other RAMs or FIFOs on the ACM board will be tested.

I/O Ports — The ACM will check any microprocessor I/O ports that are able to be checked.

Full Feature On-going Diagnostics

These tests will be performed in the background so as to give an integrity check of this module. Failures of these tests are reported to the ESCC/SCC who reports to the TMS Controller.

Program Memory CRC — CBRAM CRCs will be checked and upon a failure detection, control will be passed to the boot program so a program download can be attempted. At this point the ESCC/SCC can make a decision to enable the redundant board.

Hardware Integrity Checks — A parity or CRC check will be done on the signaling, routing, synchronization RAMs and FIFOs to insure that the devices are working correctly. If it is determined that the data in the devices is incorrect, an attempt will be made to correct the problem. If the problem cannot be solved after a predetermined time, then the ACM FAIL LED will be activated and status will be updated. This allows the ESCC/SCC to take appropriate action.

During the Program Memory CRC and Hardware Integrity Checks the ACM Fail LED will be activated for approximately five seconds and its status posted in dual port RAM for the System Control Module to read. The ACM will then return to its boot program.

The ongoing tests will also check for failures in some of the synchronization circuits and control output and receive circuits for blocking failures. Also, the ongoing test will monitor the clock, ADPCM devices, general hardware failure, and I/O status for failures. These failures will be reported to the TMS controller through status updates. A determination will also be made as to when these may cause a possible redundancy switch.

There are no software or hardware configurable parameters for the self diagnostic section. Configuration data such as "Type of Link" may determine what types of testing can occur. The following status will be affected by the self diagnostics:

- ACM Fail
- An indication of what failed
- Operating mode of the ACM
- Channel Failures

The ESCC/SCC monitors the status of the ACM and takes appropriate action if one of the ACM fails. The TMS Controller will monitor and display the status of the ACM on the Equipment Status screens.

The Standby and ACM Fail LEDs report configuration errors or no configuration for an equipment slot.

Note *For additional diagnostic information, refer to the associated software manuals, O36R602-nnn (mso software) and 036R603-Vnnn (gts software). MSO software is used in networks that use all SCCs or a mixture of SCCs and ESCCs. GTS software is used only in all ESCC networks.*

Channel Interface Connections

If a MEGAMUX TMS Compact Node uses more than 10 channels (in other words, if the node uses channel expansion shelves), ribbon cabling is required to carry signals between the main shelf and each expansion shelf. There are two 50-pin channel interface ribbon connectors, J10 and J9, located at the lower left corner of the MEGAMUX TMS Compact Main Shelf backplane. Ribbon cables extend from 50-pin connector J10 on the main shelf to the 50-pin connector J18 on the expansion shelf backplane, and from 50-pin connector J9 on the main shelf backplane to connector J17 on the expansion shelf backplane (see *Figure 4-21* for expansion shelf connector locations).

The number of expansion shelves at a node determines which ribbon cables are required for the node. If a node includes more than one expansion shelf, the ribbon cable must have enough connectors on it to reach each expansion shelf. *Table 4-28* lists the ribbon cable numbers for 1, 2, or 3 expansion shelves; *Figure 4-22* illustrates the cable requirements.

A cable filter plug-in board (GDC Part No. 036P340) must be installed on the top Expansion Shelf Backplane. The female connector on the filter board must be connected to the right (as seen from the rear) 50-pin connector (J17) on the Expansion Shelf. The board should be installed on the first Expansion Shelf in a set of one to three shelves connected by a ribbon cable. The locating pin should be screwed into the standoff hole located on the backplane board to make sure the board has not been installed upside down. After the board is installed on the shelf, plug the ribbon cable into the male connector on the filter board.

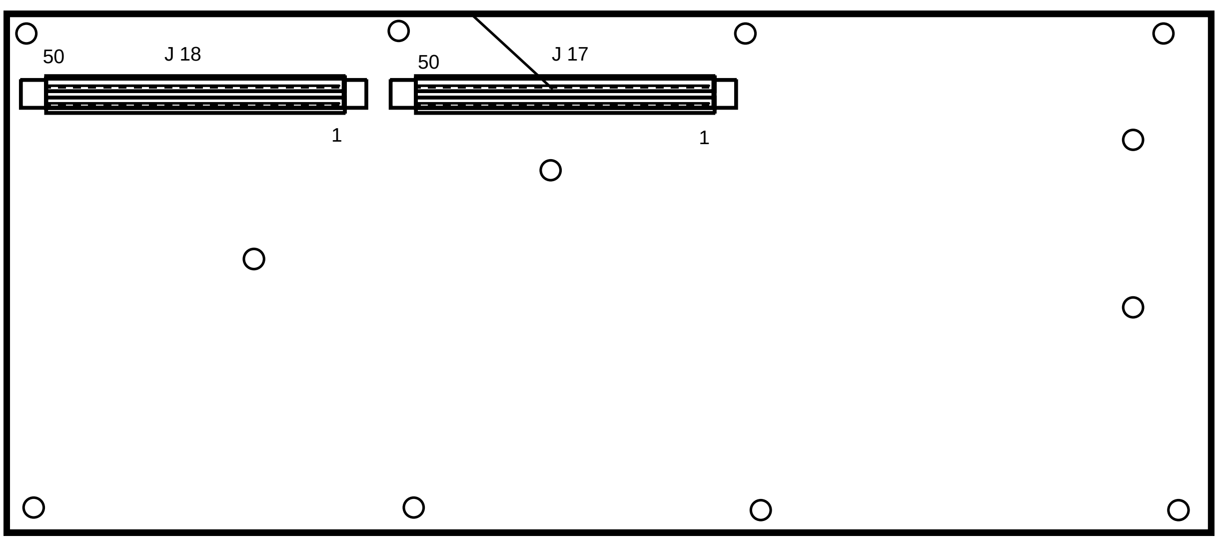


Figure 4-21 Expansion Shelf Backplane 50-Pin Ribbon Cable Connectors (Rear View)

When connecting the ribbon cable to the Main Harness Backplane, pin 1 should be up. Pin 1 is identified by a colored tracer on one edge of the ribbon cabling.

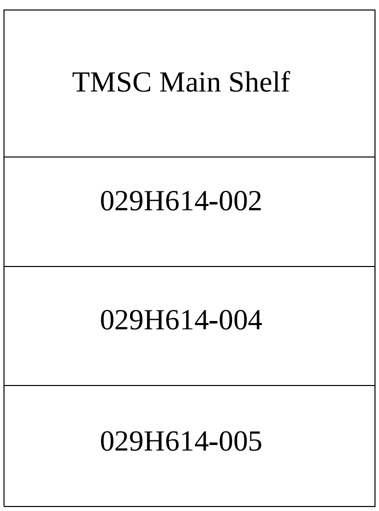
The ribbon cable connectors are equipped with special latches that lock the cable into place. They are used to unseat rather than eject the cable. The cable must be removed by hand after it is unseated. Also, when inserting the cable, be sure to close the latches slightly before pushing the cable into locked position, otherwise the latches can be damaged.

In place of ribbon cables, current models of the MEGAMUX TMS Compact are equipped with Flex Cards that interconnect the Channel Module Expansion Shelves. Each Flex Card is an actual pc board with the necessary connectors required to interconnect the expansion shelves. A typical Flex Card is shown in *Figure 4-23* . The Flex Cards are supplied in different lengths to accommodate different expansion shelf configurations. Several ferrite beads are mounted on the card to reduce the amount of reflection interference from the last shelf to the first. The Flex Card configuration instructions and installation are shown in *Figure 4-24* and *Figure 4-25*.

When connecting the ribbon cable to the Main Harness Backplane, pin 1 should be up. Pin 1 is identified by a colored tracer on one edge of the ribbon cabling.

Table 4-28 TMSC Ribbon Cable Numbers

Number of Expansion Shelves	Ribbon Cable Number
1	029H614-002
2	029H614-004
3	029H614-005



The number of expansion shelves at a node determines the part number of the ribbon cable used. The cable number shown for the lowest expansion shelf will reach that shelf as well as shelves between it and the main shelf.

Figure 4-22 TMSC Ribbon Cable Numbers

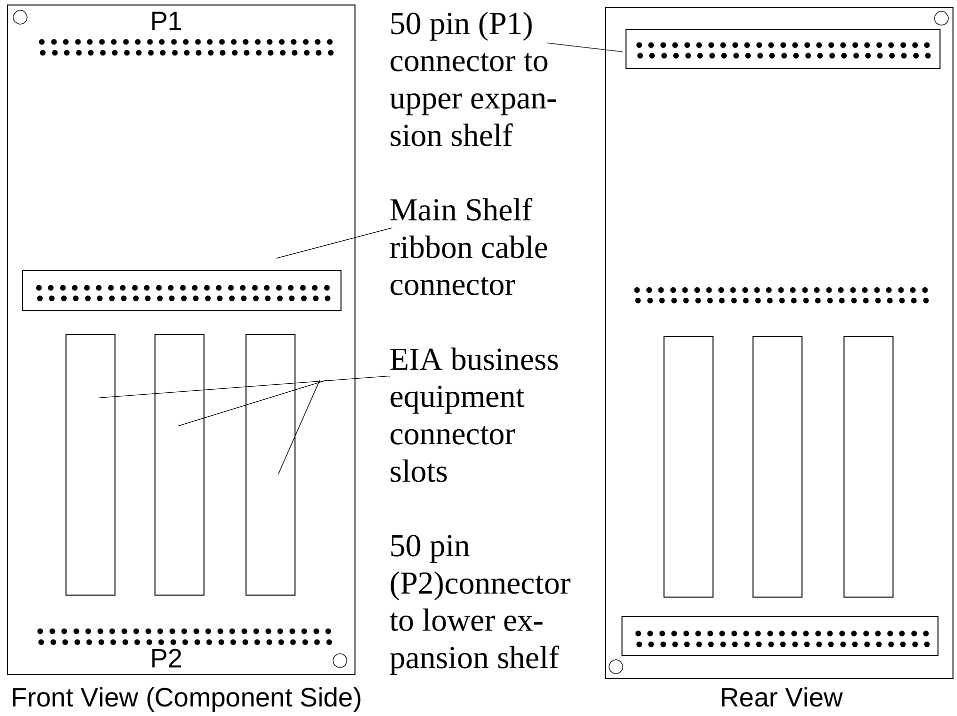
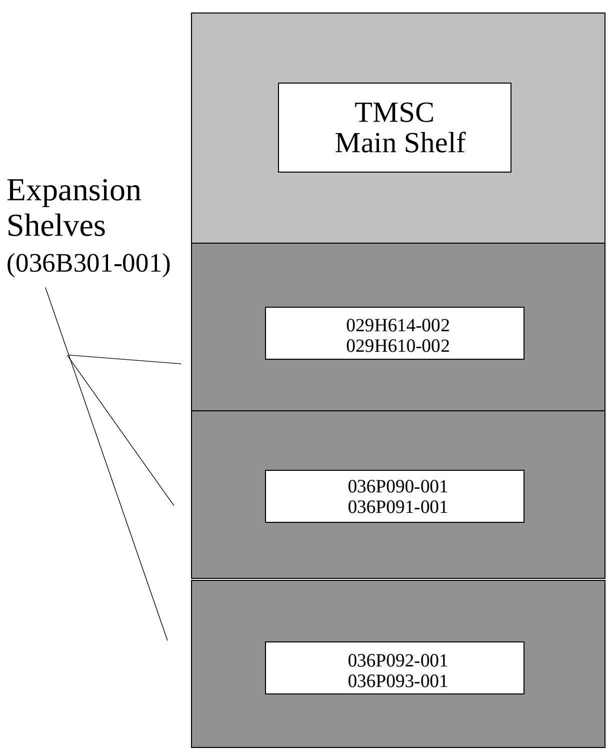


Figure 4-23 Flex Card (036P091-001), Front and Rear View



This diagram is a front view of a TMSC with three expansion shelves in a cabinet.

To connect Expansion Shelves in the main cabinet: Find the expansion shelf in the diagram that corresponds to the one you are installing. The part numbers in the top box are GDC cable numbers. Pairs of flat ribbon cables are required to connect the main shelf to the first expansion shelf. The numbers below the first expansion shelf are flex card part numbers. When connecting two expansion shelves, use GDC 036P090-001 and 036P091-001. When connecting three expansion shelves, use GDC 036P092-001 and 036P093-001.

Figure 4-24 TMSC Flex Card Configuration

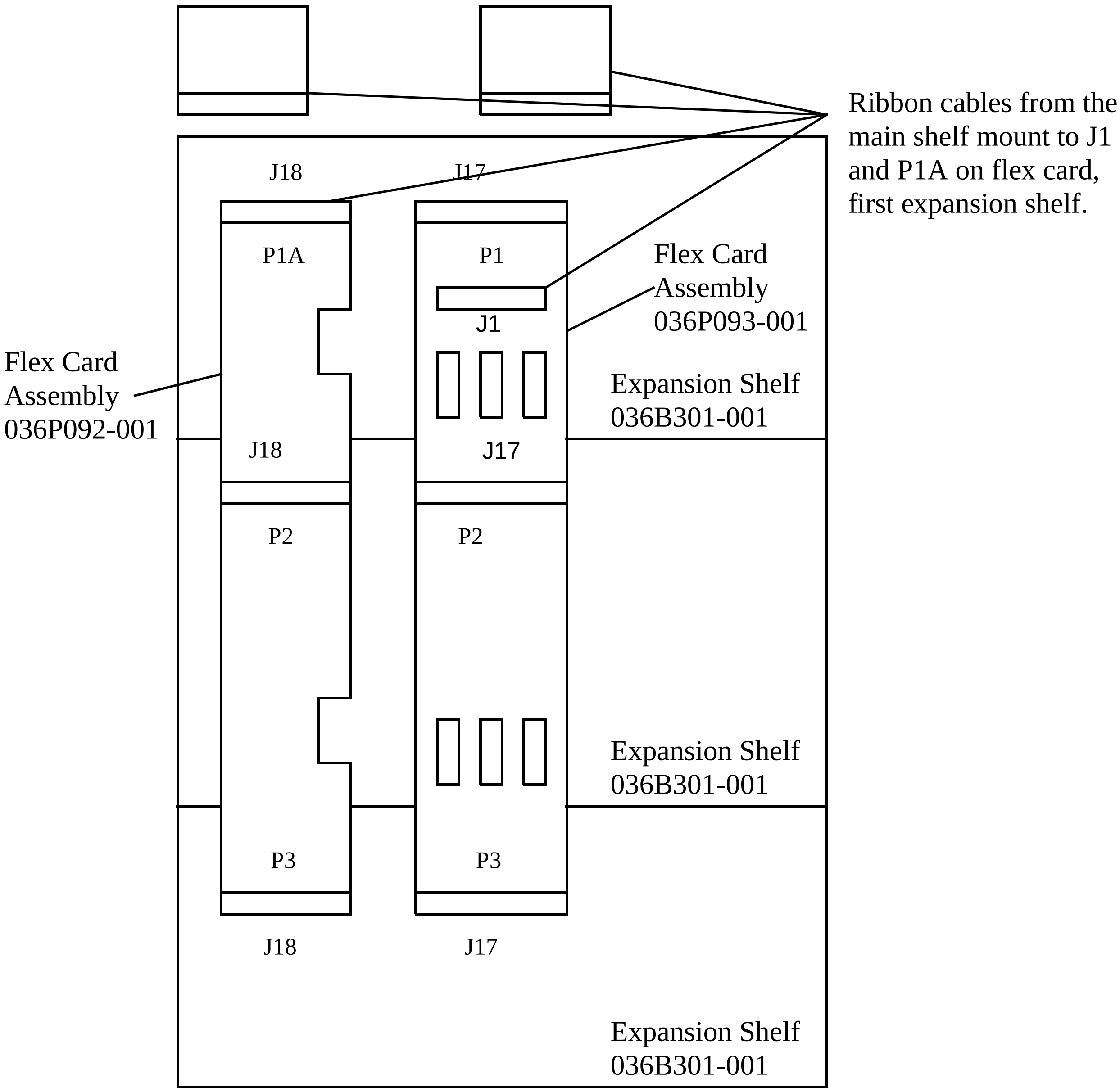


Figure 4-25 Flex Cards Connecting Three TMSC Expansion Shelves

Channel Interface Card Options

CIC options are described in *Table 4-29* and option locations are shown in *Figure 4-26*.

Table 4-29 CIC Options

Feature	Selection	Switch (S), Jumpers (X) Desig.	Position	Application
Watchdog	Watchdog	X1	NORM	This selection is located on the Aggregate Control Piggyback. It is for in-house testing only. It should be left in the NORM position.
Inhibit	Inhibit Watchdog	X1	INHBT WDOG	
Frame Switching (for frame required software changes). See note below.		S1-7 S1-8	don't care Factory set*	CIC cannot switch at end of frame.
		S1-7 S1-8	Off Factory set*	CIC can switch at end of frame, but this capability has been disabled.
		S1-7 S1-8	On Factory set*	CIC can switch at end of frame.
—	—	S1, 1-6	—	These switches are reserved for future use. Leave all switches in the OFF position.

Note: S1-7 should be On if using GTS V2.2.0 or later, Off if using an earlier version.
* For -2 version cards, the factory setting is Off. For -3 version cards, the factory setting is On.

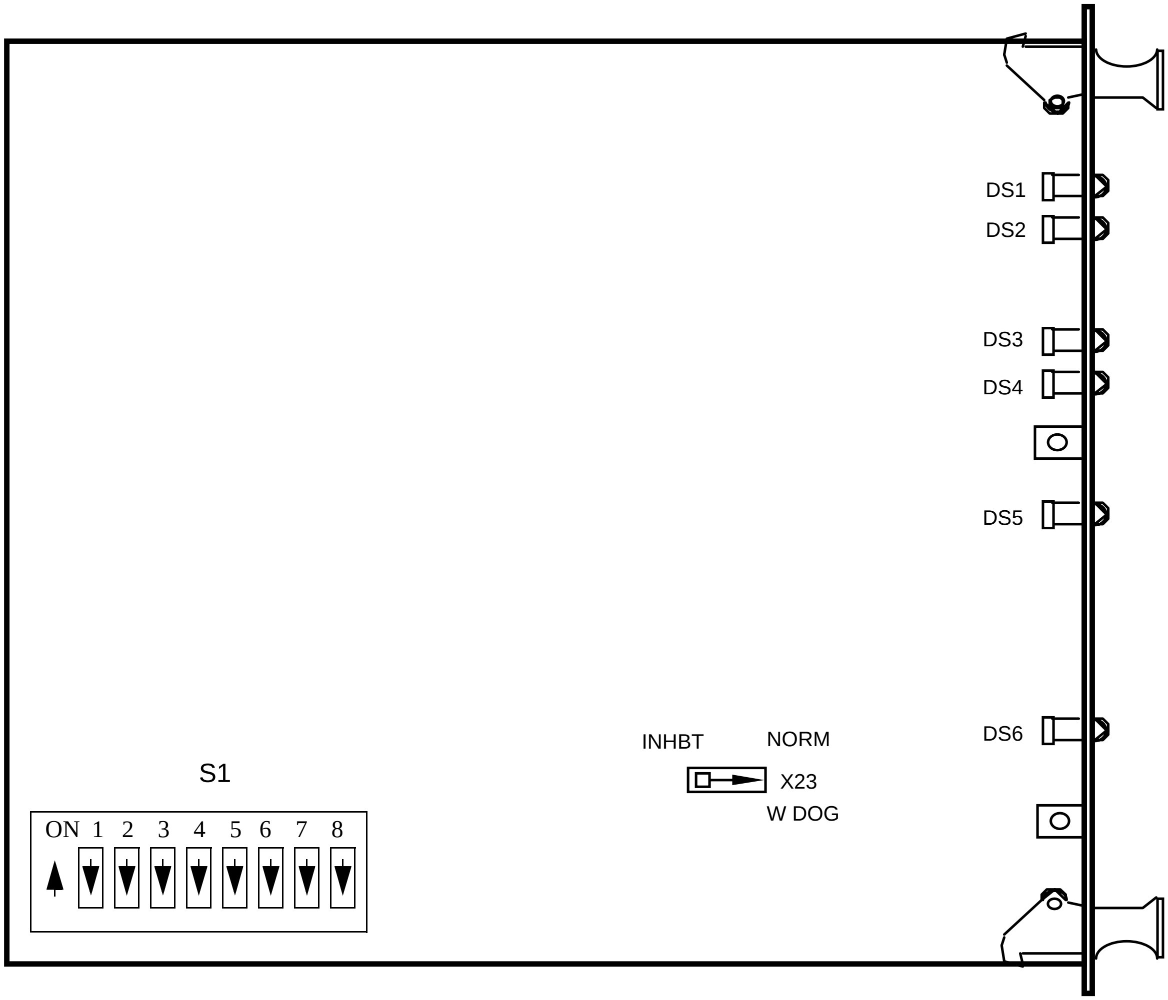


Figure 4-26 Channel Interface Card Option Location

The CIC (*GDC 036P304*) assembly contains a factory adjustment Switch S2 that is used only for production testing. Use of the S2 may cause erroneous data transfers or complete node failure.

Note *Switch S2 should never be changed in the field. It controls a critical factory adjustment option which is set only when the PCB assembly is installed in a specialized test fixture at the factory. The purpose of Switch S2 is to fine tune the turn-on and turn-off times of the fast bus circuit. Improper adjustment of this switch can cause erroneous data transfers between common cards and possible node failure.*

Channel Module Installation

The first ten data or voice channel modules are installed in the ten channel slots in the TMSC Main Shelf. Connections for these channels are made to 25-pin connectors J14 through J25 at the left rear of the main shelf.

All other data and voice channel modules are installed in Expansion Shelves. Channel connections are made to 25-pin channel connectors J1 through J16 at the rear of the expansion shelf. Refer to the Network Documentation Package supplied with your system to determine the placement of each channel module in the Expansion Shelf.

Expansion Module

The Expansion Module has one option that selects which shelf the Expansion Module is on. There are four selections which are described in *Table 4-30* . The location of this option is shown in *Figure 4-27* .

Table 4-30 Expansion Module Options

Feature	Selection	Switch(S), Jumpers(X)		Application
		Desig.	**Pos.**	
Shelf Selection	EXP1	X1	EXP1	EXP1 is selected if the Expansion Module being addressed is located in the MEGAMUX TMS Compact with channels 1-10.
	EXP2	X1	EXP2	EXP2 is selected if the Expansion Module being addressed is located in the first MEGAMUX TMS Compact Expansion shelf with channels 11-26.
	EXP3	X1	EXP3	EXP3 is selected if the Expansion Module being addressed is located in the second MEGAMUX TMS Compact Expansion shelf with channels 27-42.
	EXP4	X1	EXP4	EXP4 is selected if the Expansion Module being addressed is located in the third MEGAMUX TMS Compact Expansion shelf with channels 43-58.

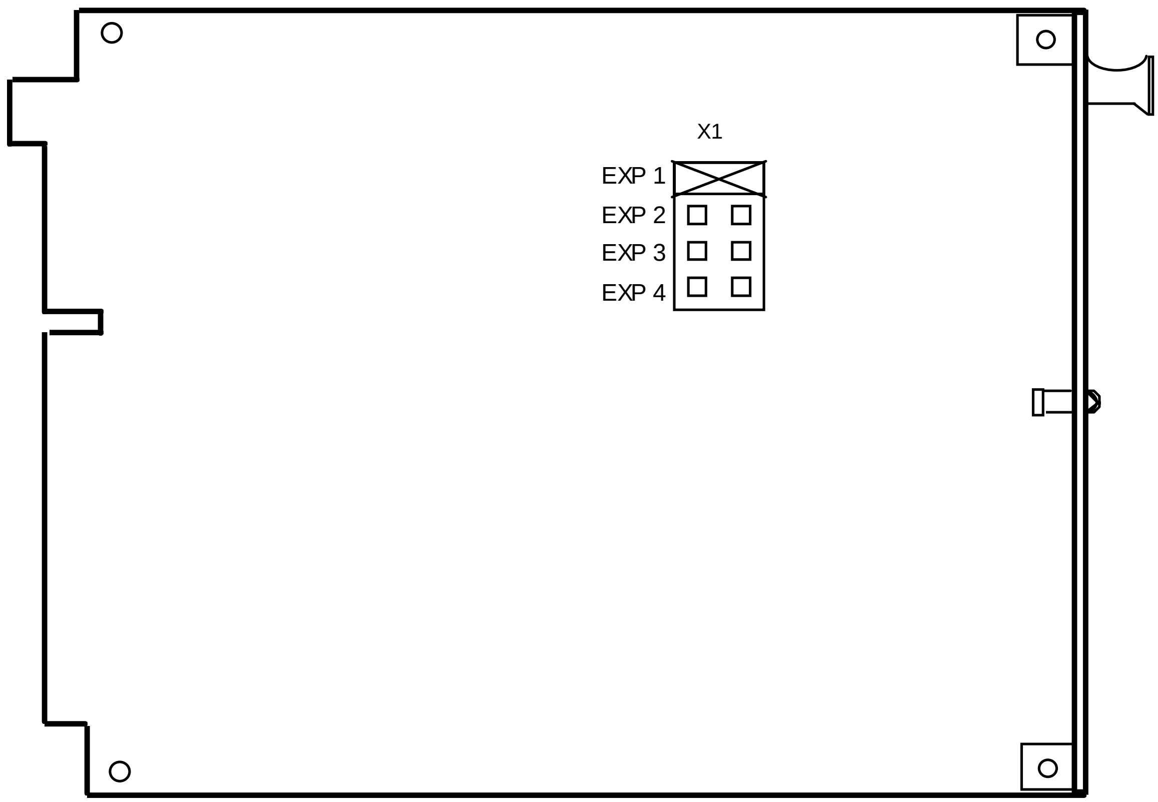


Figure 4-27 Expansion Module Option Locations

Other Cards

Other technical manuals contain detailed information on some of the common cards. Refer to *the Preface*. *For OCM common cards refer to GDC 036R340-000 and its associated addendums*.

Channel Card Installation

The first ten data or voice channel modules are installed in the ten channel slots in the MEGAMUX TMS Compact Main Shelf. Connections for these channels are made to 25-pin connectors J14 through J25 at the left rear of the main shelf.

All other data and voice channel modules are installed in Expansion Shelves. Channel connections are made to 25-pin channel connectors J1 through J16 at the rear of the expansion shelf. Refer to the Network Documentation Package supplied with your system to determine the placement of each channel module in the Expansion Shelf.

Data Channel Modules

Data Channel Module interface connections, options, and the TID-III module are presented in the following paragraphs, figures, and tables.

Part Numbers

Connections for data channels vary according to the type of interface required for that channel (i.e., EIA/TIA-232-E, RS-422, RS-423, V.35, etc.). *Table 4-31 through Table 4-48 lists the assembly part numbers for the different interfaces. Table 4-49 lists the cables provided for each interface type.*

Table 4-31 Data II Channel Module with EIA/TIA-232-E Interface (036M048-001)

Equipment Supplied	Designation	GDC Part No.
Interface Set, RCV/XMT, EIA/TIA-232-E	—	036M047-001
Data II Channel PC Assembly	—	036P236-001

Table 4-32 Data II Channel Module with RS-422 Interface (036M048-002)

Equipment Supplied	Designation	GDC Part No.
Interface Set, RCV/XMT, RS-422	—	036M047-002
Data II Channel PC Assembly	—	036P236-001

Table 4-33 Data II Channel Module with RS-423 Interface (036M048-003)

Equipment Supplied	Designation	GDC Part No.
Interface Set, RCV/XMT, RS-423	—	036M047-003
Data II Channel PC Assembly	—	036P236-001

Table 4-34 Data II Channel Module with V.35 Interface (036M048-004)

Equipment Supplied	Designation	GDC Part No.
Interface Set, RCV/XMT, V.35	—	036M047-004
Data II Channel PC Assembly	—	036P236-001

Table 4-35 Data III Channel Module with EIA/TIA-232-E Interface (036M058-001)

Equipment Supplied	Designation	GDC Part No.
Interface Set, RCV/XMTR, EIA/TIA-232-E	—	036M047-001
Data III Channel PCB Assembly	—	036P236-004

Table 4-36 Data III Channel Module with RS-422 Interface (036M058-002)

Equipment Supplied	Designation	GDC Part No.
Interface Set, RCV/XMTR, RS-422	—	036M047-002
Data III Channel PCB Assembly	—	036P236-004

Table 4-37 Data III Channel Module with RS-423 Interface (036M058-003)

Equipment Supplied	Designation	GDC Part No.
Interface Set, RCV/XMTR, RS-423	—	036M047-003
Data III Channel PCB Assembly	—	036P236-004

Table 4-38 Data III Channel Module with V.35 Interface (036M058-004)

Equipment Supplied	Designation	GDC Part No.
Interface Set, RCV/XMTR, V.35	—	036M047-004
Data III Channel PCB Assembly	—	036P236-004

Table 4-39 Data IV Channel Module with EIA/TIA-232-E Interface (036M079-001)

Equipment Supplied	Designation	GDC Part No.
Interface Set, RCV/XMT, EIA/TIA-232-E	—	036M047-001
Data IV Channel, PCB Assembly	—	036P236-007

Table 4-40 Data IV Channel Module with RS-422 Interface (036M079-002)

Equipment Supplied	Designation	GDC Part No.
Interface Set, RCV/XMT, RS-422	—	036M047-002
Data IV Channel, PCB Assembly	—	036P236-007

Table 4-41 Data IV Channel Module with RS-423 Interface (036M079-003)

Equipment Supplied	Designation	GDC Part No.
Interface Set, RCV/XMT, RS-423	—	036M047-003
Data IV Channel, PCB Assembly	—	036P236-007

Table 4-42 Data IV Channel Module with V.35 Interface (036M079-004)

Equipment Supplied	Designation	GDC Part No.
Interface Set, RCV/XMT, EIA/TIA-232-E	—	036M047-004
Data IV Channel PCB Assembly	—	036P236-007

Table 4-43 UDC Module with EIA/TIA-232-E Interface (036M078-001)

Equipment Supplied	Designation	GDC Part No.
Interface Set, RCV/XMT, EIA/TIA-232-E	—	036M047-001
Data IV Channel, PCB Assembly	—	036P236-007

Table 4-44 UDC Module with RS-422 Interface (036M078-002)

Equipment Supplied	Designation	GDC Part No.
Interface Set, RCV/XMT, RS-422	—	036M047-002
Data IV Channel, PCB Assembly	—	036P236-007

Table 4-45 UDC Module with RS-423 Interface (036M078-003)

Equipment Supplied	Designation	GDC Part No.
Interface Set, RCV/XMT, RS-423	—	036M047-003
Data IV Channel, PCB Assembly	—	036P236-007

Table 4-46 UDC Module with V.35 Interface (036M078-004)

Equipment Supplied	Designation	GDC Part No.
Interface Set, RCV/XMT, EIA/TIA-232-E	—	036M047-004
Data IV Channel PCB Assembly	—	036P236-007

Table 4-47 UDC Module with X.21 (X.27) Interface (036M078-007)

Equipment Supplied	Designation	GDC Part No.
Interface Set, XMT/RCV-422	—	036M047-002
Data Sync Channel PCB Assembly	—	036P236-010
Conn. Program Plug	—	209-014-116

Table 4-48 TID-III Data Channel (18607-201)

Equipment Supplied	Designation	GDC Part No.
TID-III	TID-III	18607-201
Transmitter Card	TX	18601-201
Receiver Card	RX	18602-200
NCO Card	NCO	18603-200

Table 4-49 Data Channel Interface Cables

GDC Cable No.	Description	Application
028H502	EIA/TIA-232-E	Used for all standard EIA/TIA-232-E applications. Available in 5-, 15-, 25-, 50-foot lengths.
027H408	RS-422/423 Cascade	Used to cascade RS-422/423 channel to aggregate interface of another TMS-3000 or TDM for mux to submux application. Available in 5-, 15-, 25-, 100-, 250-, or 500-foot lengths.
027H511	EIA/TIA-232-E to RS-422-423 adapter	Used when RS-422/423 interface is required, but with EIA/TIA-232-E controls only. Cable is one foot long.
027H407	RS-422/423 Tandem ITU-T G.703	Used for back-to-back RS-422/423 or ITU-T G.703 channels (where channels of two tandem TDMs or TMSs are directly connected). Available in 5-, 15-, 25-, or 50-foot lengths.
027H513	ITU-T V.35 to DB-25 cable (Male-Male)	Used for ITU-T V.35 channels. Available in 15-, 25-, or 50-foot lengths.
027H514	ITU-T V.35 to DB-25 adapter	Used for ITU-T V.35 channels, when V.35 cable is customer-supplied. Available in 1-foot length..
028H311	EIA/TIA-232-E	Crossover Cable — used to connect EIA/TIA-232-E channel to a modem.
027H410	ITU-T V.35	Crossover Cable — used to connect V.35 channel to business equipment connector on DS-1 Shelf.
027H518	RS-422	Crossover Cable — used to connect an RS-422 channel to business equipment connector on DS-1 Shelf.
027H521	ITU-T V.35	Crossover Cable — used to connect V.35 channel to a modem. Connects to 027H514 adapter.
028H415	V.54 unbalanced	Used for V.54 modem application with 54M8 interface.
G023H004	V.28 (M-M)	Used for data sync channel. Male-to-male connector.
G023H010	1-19 Way D (M-M)	1-19 Way D-cable. Male-to-male connector.
G023H019	V.28 Sync (M-M	V.28 Sync Channel Crossover Cable. Male-to-male connector
G024H015	Data II, V.35-DTE	Data Channel II, V.35 DTE applications. Male-to-male connector.
G024H016	Data II, V.35-DTE	Data Channel II, V.35 DTE applications. Male-to-female connector.

Interface Options

Option selections required to support each interface type are discussed in *Table 4-50 and Table 4-51*.

The following interfaces may be selected (not applicable to G.703 channel card):

- EIA/TIA-232-E/ITU-T V.28
- MIL-STD-188C
- RS-423/MIL-STD-188-114 Unbalanced
- RS-422/MIL-STD-188-114 Balanced (no cable termination)
- RS-422/MIL-STD-188-114 Balanced (Transmit Data and Clock cable termination)
- V.35 Balanced Double Current

A DCE interface may be selected for connection to data terminal equipment; a DTE interface may be chosen for connection to data communication equipment. *Table 4-51* describes the selections.

Table 4-50 Data Channel Interface Options

Interface Selection	S1-1 Pos.	S1-2 Pos.	S1-3 Pos.	X21 Pos.	XRN7 (XMT) Resistor Network	XRN8 (RCV) Resistor Network	Application
EIA/TIA-232-E MIL-STD-188-114, V.28	NORM	OPEN	OPEN	NORM	RS-232 XMT 331-001-006	RS-232 RCV 331-002-006	The channel interface operates according to any of the interfaces shown in the table. To select an interface, you must set Switches S1-1 through S1-4 and Jumper X21 in the positions shown.
MIL-STD-188C	188	OPEN	OPEN	NORM	RS-232 XMT 331-001-006	RS-232 RCV 331-002-006	S1-1 selects either a MIL-STD-188C or a normal interface.
EIA-RS-423/ MIL-STD 188-114 Unbalanced	NORM	OPEN	OPEN	NORM	RS-423 XMT 331-001-005	RS-423 RCV 331-002-004	S1-2 and S1-3 select 100-ohm cable termination for the Transmit Data and Transmit External Timing signals respectively, in an RS-422 interface arrangement.
EIA-RS-422/ MIL-STD-188-114 Balanced (No cable termination)	NORM	OPEN	OPEN	422	RS-422 XMT 331-001-004	RS-422 RCV 331-002-005	The RS-422 arrangement is used with or without cable termination, as required by data equipment connected to the channel. Selection of termination provides increased noise immunity.
EIA-RS-422/ MIL-STD-188-114 Balanced (With cable termination)	NORM	422/ TER	422/ TER	422	RS-422 XMT 331-001-004	RS-422 RCV 331-001-005	Only one device can be connected to the terminated interface. Up to ten devices can be connected to the unterminated interface. Jumper plug X21 selects the RS-422 interface, with or without cable termination.
V.35 Balanced Double Current	NORM	OPEN	OPEN	NORM	Dual V.35 XMT 331-002-002	Dual V.35 RCV 331-002-003	For each type of interface, resistor networks RN7 and RN8 provide the voltage levels required by the associated interface standard (You must set all switches and jumpers as shown for each interface).

Table 4-51 Data Channel DCE/DTE Interface Option Selection

Feature	S1-4 Position	PP1 Position	Application
DCE (Data Communication Equipment) Interface	DCE	DCE	The Data Channel module communicates with data terminal equipment (CRTs, printers, CPU ports, etc.) by presenting a DCE interface; the module communicates with data communications equipment (modems, multiplexers, etc.) by presenting a DTE interface. Switch S1-4 selects the DCE or DTE interface. Program plug PP1 must also be positioned to select the proper signal interfacing. DTE and DCE markings are visible on opposite sides of program plug socket XPP1. When PP1 is positioned so that a notch (or pin 1) on the plug points to DTE, the DTE interface is selected. When PP1 is positioned so that the notch (or pin 1) points to DCE, the DCE interface is selected.
DTE (Data Terminal Equipment) Interface	DTE	DTE	In the DCE position PP1 passes data, timing and control signals straight through between equipment connected to the channel and circuitry on the Data Channel module. In the DTE position, signals are “crossed over’’ to permit the proper communication between the module and data communication equipment connected to the channel. The crossovers are as follows: XMT DATA to RCV DATA RCV DATA to XMT DATA CA (Request to send) to CF (Carrier Detect) CF to CA RCV TMG (Receive Timing) to EXT TMG (External Timing) EXT TMG to RCV TMG RDY IN (Ready In) to RDY OUT (Ready Out) RDY OUT to RDY IN **NOTE:** If the system uses an EIA/TIA-232-E or RS-423 interface, and a synchronous modem is connected to a data channel interface, select the DTE positions for S1-4 and PP1. Also, disconnect the lead connected to pin 15 of the data channel connector. If the system uses a balanced RS-422 or V.35 interface, and a synchronous modem is connected to a Data channel interface, select the DCE positions for S1-4 and PP1. Additionally, a crossover cable must be used to complete the interface connections to the modem. The crossover cable serves to cross the data, timing, and control signals for compatibility with the synchronous modem pins, thereby eliminating potential timing problems.

Note *For the Data Channel Module, DTE/DCE component board designations are usually the opposite of the equipment to which the channel is connected. If you are connecting data terminal equipment (CRTs, printers, etc.) to the channel (with a straight through cable), place switches and program plugs in the DCE position. If you are connecting data communication equipment (modems, multiplexers, etc.) to the channel, place switches and program plugs in the DTE position.*

When RS-422 or RS-423 is selected for a channel, the Data Channel module supplies only the data and timing signals at RS-422 or RS-423 specified voltage levels. The control signals operate at EIA/TIA-232-E levels. If your channel application requires RS-422 or RS-423 level control signals, you need an external Channel Interface Adapter. Option selections for the Channel Interface Adapter are described in *Table 4-52*.

Table 4-52 EIA RS-422/423 Channel Interface Adapter Option Selection

Feature	Selection	Switch(S)/Jumper(X) Desig.	Switch(S)/Jumper(X) Position	Application
Data Communication Equipment (DCE) or Data Terminal Equipment (DTE) Connections	Adapter Connected to Data Communication Equipment	S1-1 S1-2	DCE DCE	When this adapter is connected to data communication equipment (modems, multiplexers, etc.) Switches S1-1 and S1-2 must be set in the DCE position. When the adapter is connected to data terminal equipment (CRTs, printers, CPUs, etc.) Switches S1-1 and S1-2 are set in DTE position.
	Adapter Connected to Data Terminal Equipment	S1-1 S1-2	DTE DTE	**NOTE:** *These designations are the reverse of the DTE and DCE designations for the Data II Channel module.* Program plug PP1 must also be positioned for DTE or DCE. This is done by positioning the plug so that the notch in the plug is adjacent to the DTE or DCE silkscreen markings on the card. The Data Channel module must be set for a DTE interface.
EIA-RS-422 or EIA-RS-423 Interface	RS-422	S1-3 S1-4 X1	422 422 422	To select an EIA RS-422 standard bal-anced interface, set S1-3, S1-4 and X1 in the 422 position. To select an EIA RS-423 standard unbalanced interface, set S1-3, S1-4, and X1 in the 423 position.
	RS-423	S1-3 S1-4 X1	423 423 423	Program plug PP2 in the adapter card must also be positioned for an RS-422 or 423 interface. This is done by positioning the plug so that the notch on the plug is adjacent to the 422 or 423 silkscreen markings on the card. The Data Channel module must also be set for an RS-422 or RS-423 interface.

Note *The following interface sets (Table 4-53 to Table 4-56) are available to change the interface type as required on existing Data II, Data III, Data IV, UDC, and G.703 modules.*

Table 4-53 Interface Set, RCV/XMT EIA/TIA-232-E (036M047-001)

Equipment Supplied	Designation	GDC Part No.
Resistor Network	RN8	331-002-006
Resistor Network	RN7	331-001-006
Resistor Network	—	036C010-001

Table 4-54 Interface Set, RCV/XMT RS-422 (036M047-002)

Equipment Supplied	Designation	GDC Part No.
Resistor Network	RN7	331-001-004
Resistor Network	RN8	331-002-005

Table 4-55 Interface Set, RCV/XMT RS-423 (036M047-003)

Equipment Supplied	Designation	GDC Part No.
Resistor Network	RN7	331-001-005
Resistor Network	RN8	331-002-004

Table 4-56 Interface Set, RCV/XMT V.35 (036M047-004)

Equipment Supplied	Designation	GDC Part No.
Resistor Network	RN7	331-002-002
Resistor Network	RN8	331-002-003

Digital Line Driver Adapter

A digital line driver adapter is available for applications where a channel device is separated from the TMS-3000 by some distance. All adapters mount in a CP-12 mounting panel and are connected to the back of the TMS-3000 shelf. The Data Channel uses a 16-bit transmit and receive buffer.

Data Channel Module Options

The following options may be selected for the Data Channel module (*Figure 4-28).* (*Refer to Chapter 8, Connector Pin Assignments,* for Channel Connector Pin assignments).

Note *Data IV and UDC channel modules contain several features that are available in later releases of TMS software.*

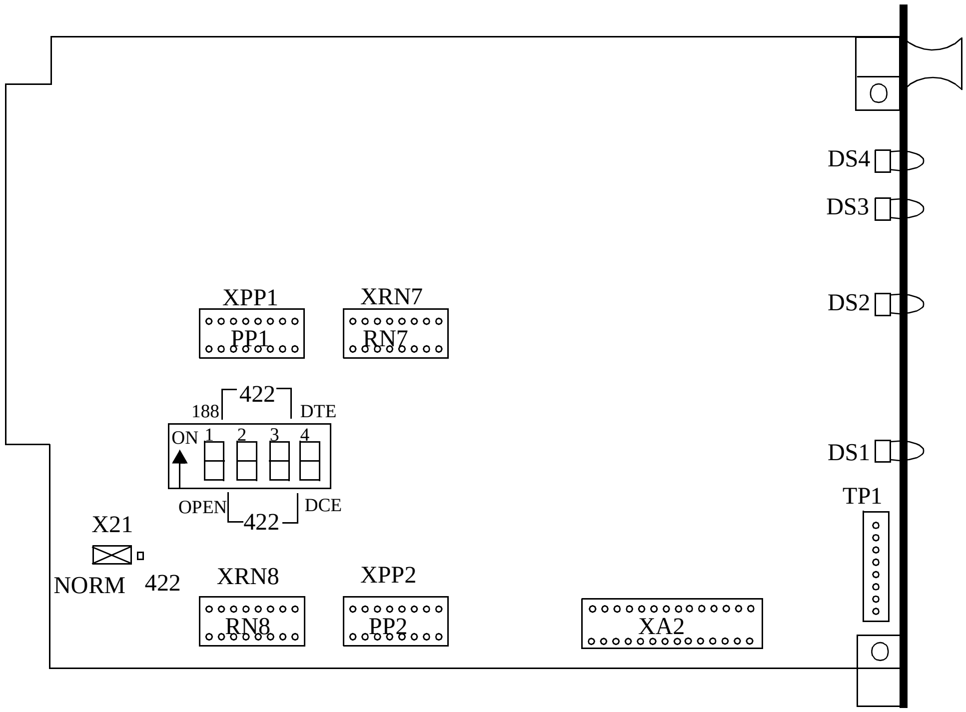


Figure 4-28 Data Channel Module Option Locations (GDC 036P236-007)

For the G.703 channel (*Figure 4-29*), there are two option jumpers. X1 is OCTETALM, which allows bipolar violations to be discontinued when the receive level signal is dropped. X2 is CHSNCLK, which allows enabling of an external clock for system phase locking. Both options are shown in their normal (option disabled) position.

Figure 4-30 shows the option and program plug locations for the Data Sync Channel and *Figure 4-31* shows the option and program plug locations for the UDC, X.21.

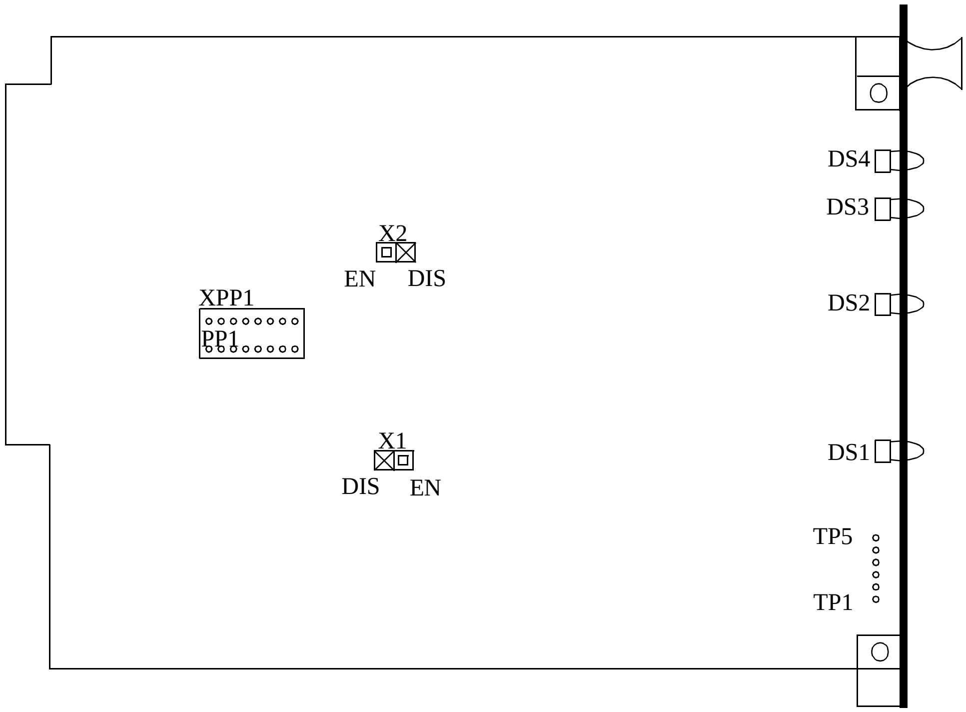
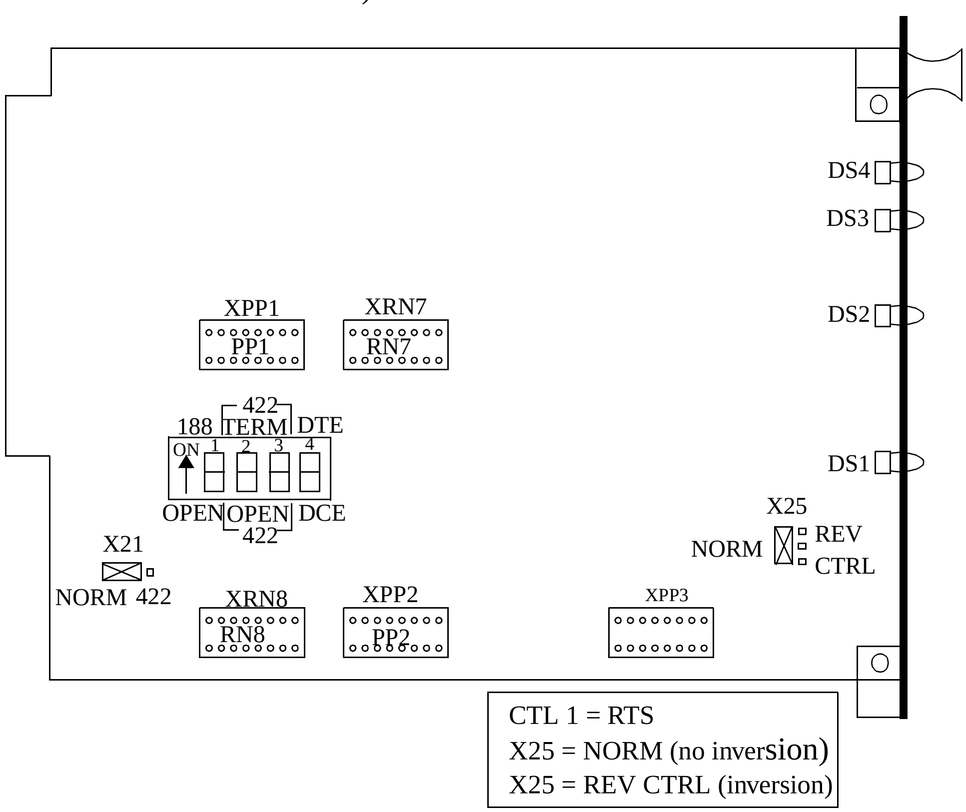


Figure 4-29 Data Channel Module Option Locations (G.703 Data Channel Card, GDC 036P243-001)



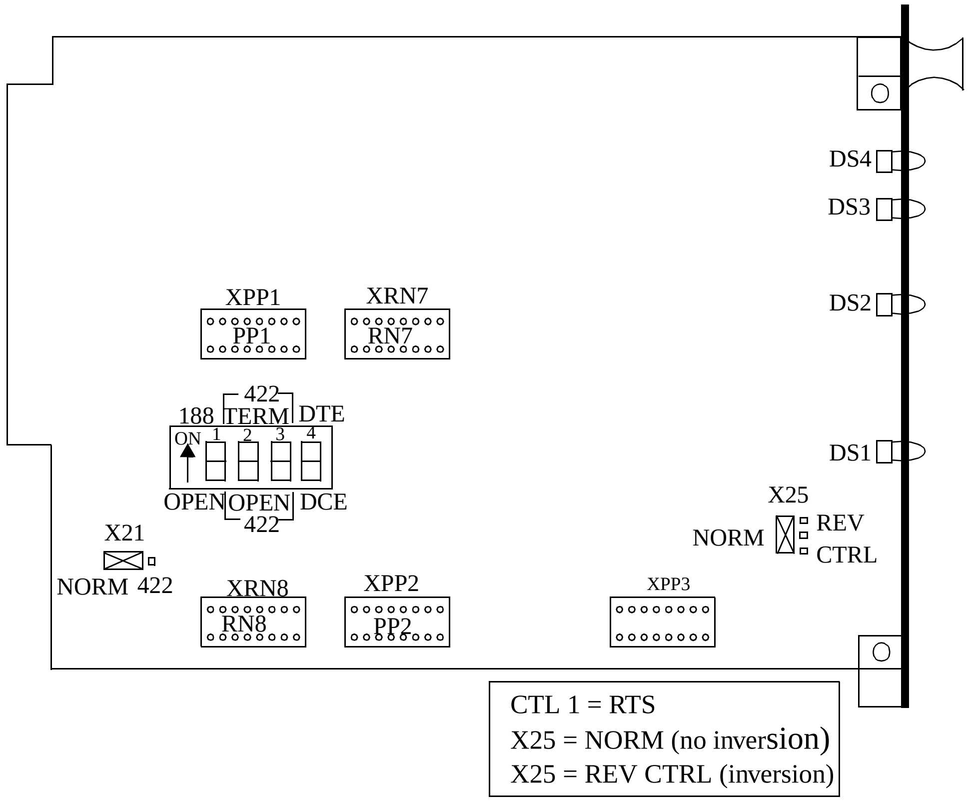


Figure 4-30 Data Sync Channel Card Option Locations (GDC 036P236-010)

Figure 4-31 UDC, X.21(GDC 036M078-007)

Controls

Program plug PP2 (PP1 on G.703 Data Channel card, PP3 for X.21) selects interface control signals to be multiplexed by the TDM and passed to the remote channel interface. Different plugs are used to support the control signal requirements of various communication circuits. *Figure 4-32* illustrates program plug PP1 positions (not applicable to G.703 channel card) while *Figure 4-33* illustrates PP3 positions. *Figure 4-34 (A-E)* shows each control plug and the channel interfaces implemented by installation of the plug. *Table 4-57* lists the part numbers for the program plugs.

Table 4-57 Program Plugs

Equipment Supplied	Designation	GDC Part No.
Resistor Network Special MM-01	PP2	331-001-010
Resistor Network Special MM-02	PP2	331-001-016
Resistor Network Special MM-05	PP2	331-001-015
Resistor Network Special V.54 MM-08	PP2	331-001-017
Resistor Network Special X.21	PP3	209-014-116

Note *Control signals for a data channel may be forced On or Off through the Controller interface. In some channel control arrangements, the channel configuration selected through the Controller holds control signals On or Off as part of the channel control scheme.*

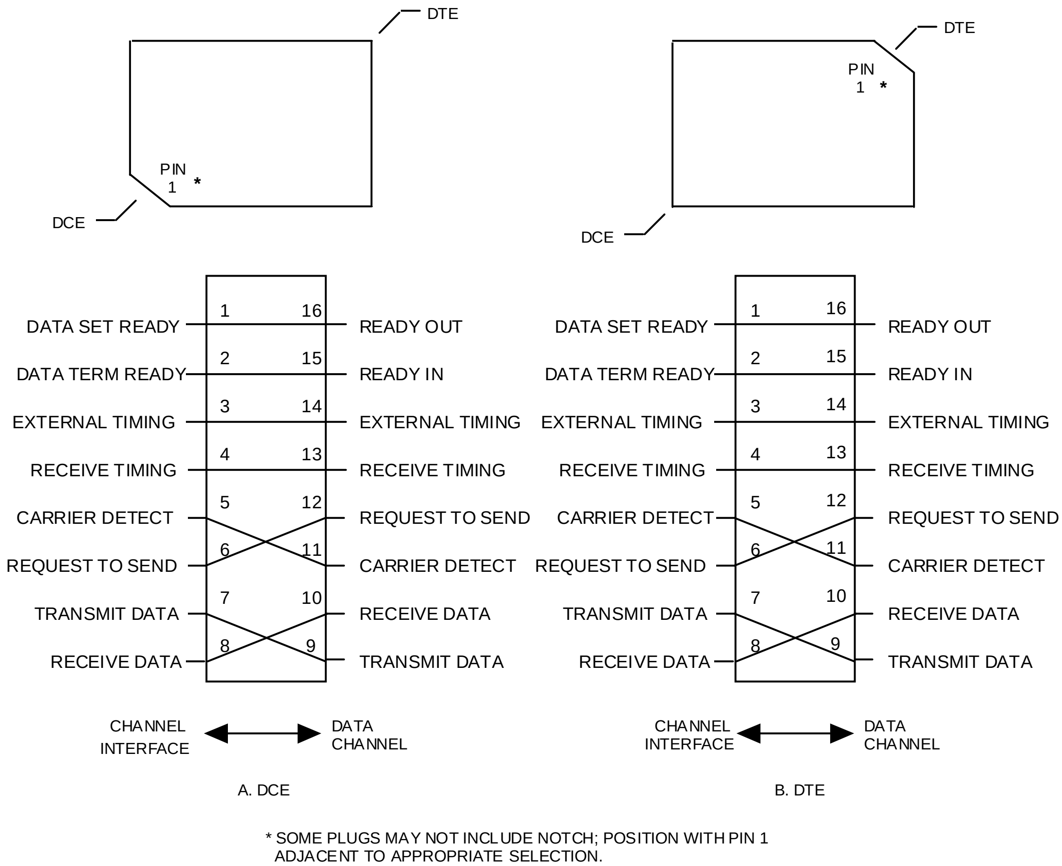


Figure 4-32 Data Channel Program Plug PP1 Positions (DCE/DTE)

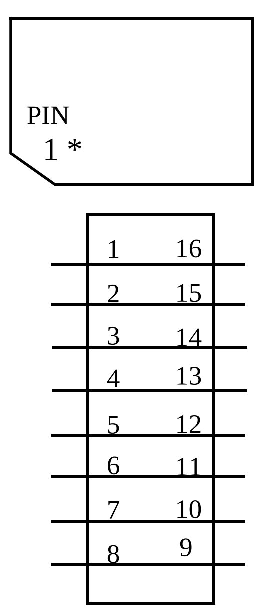
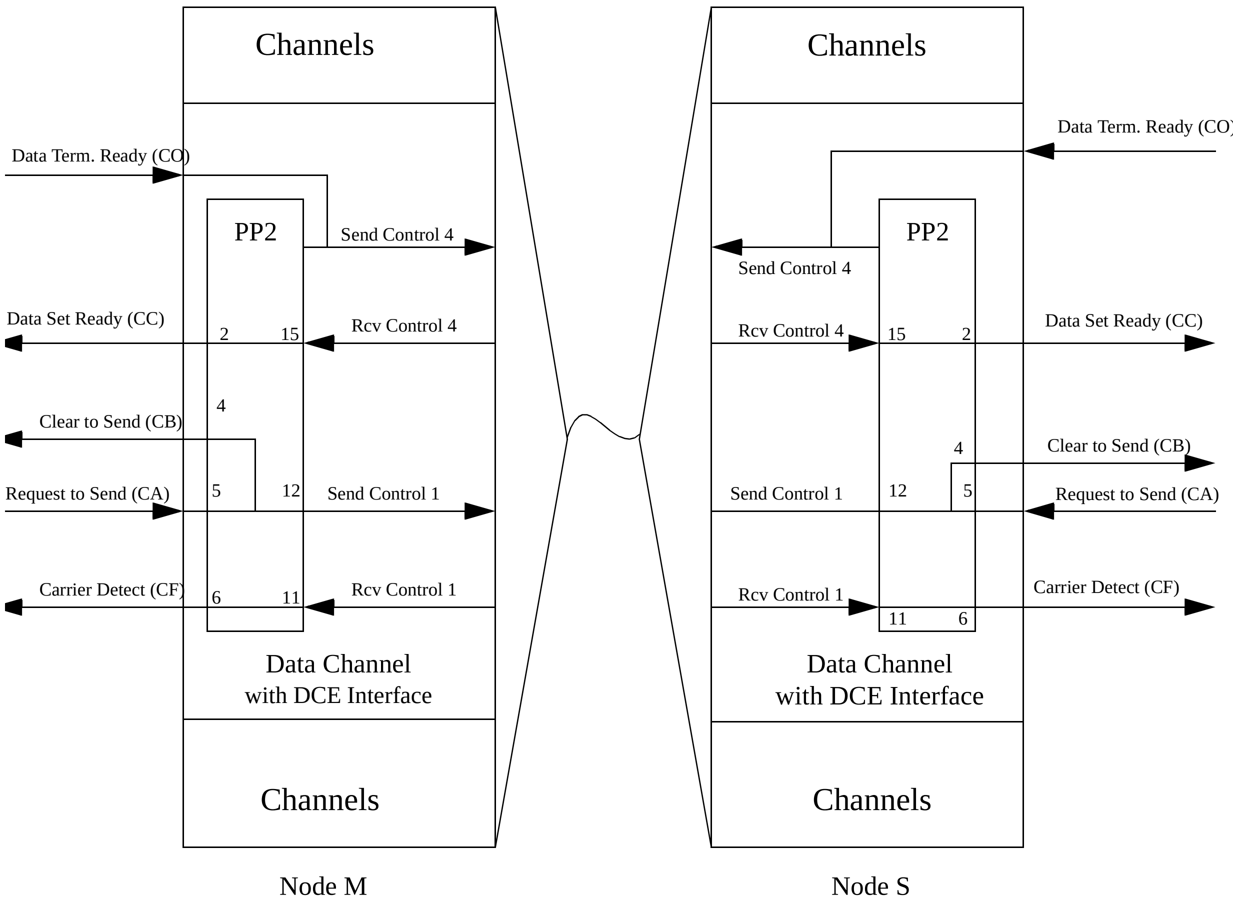


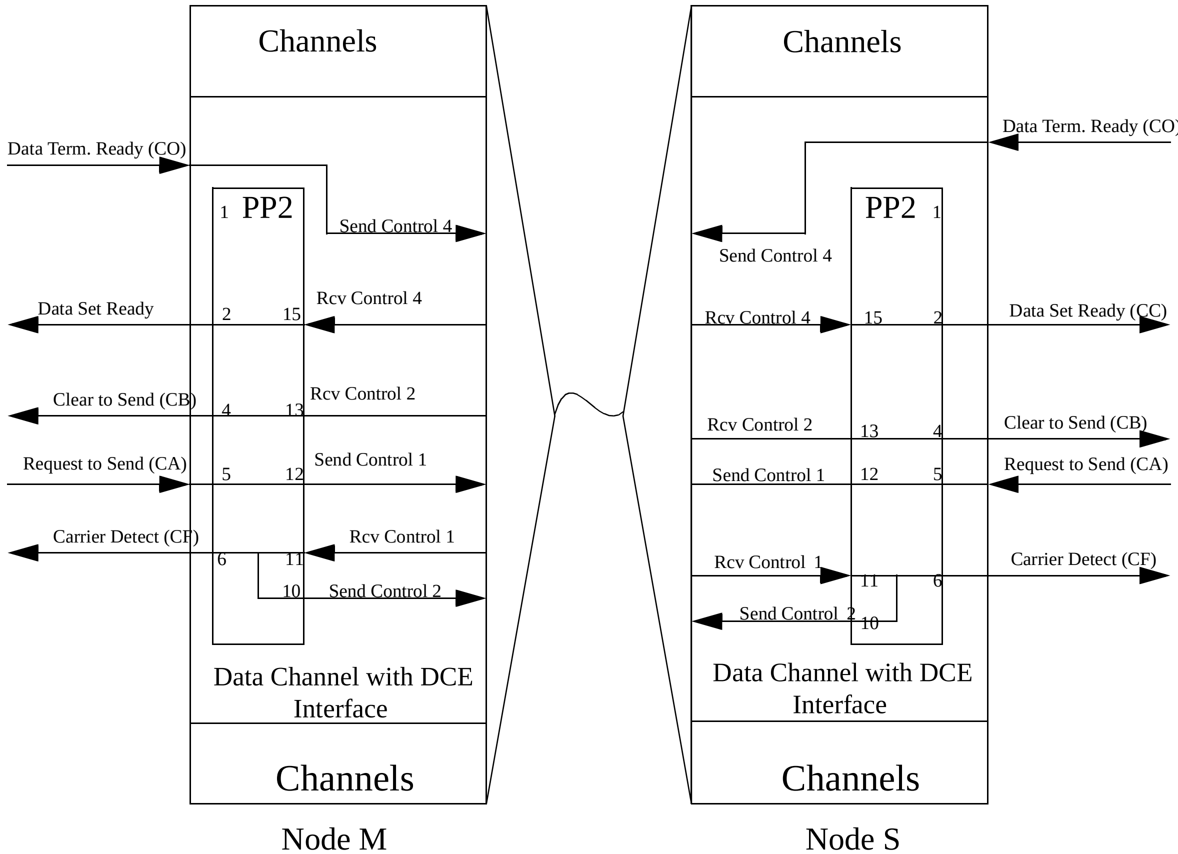
Figure 4-33 Plug PP3 Positions



A send control at one node becomes a receive control at the opposite node. For example, Request to Send is selected as Send Control 1 at Node M. Send Control 1 is transmitted across the link and becomes Receive Control 1 at the Node S data channel. PP2 at the Node S channel interface selects Receive Control 1 and sends it through the channel interface as Carrier Detect.

A. MM01 — CPU to Terminal — Local CTS Wrap

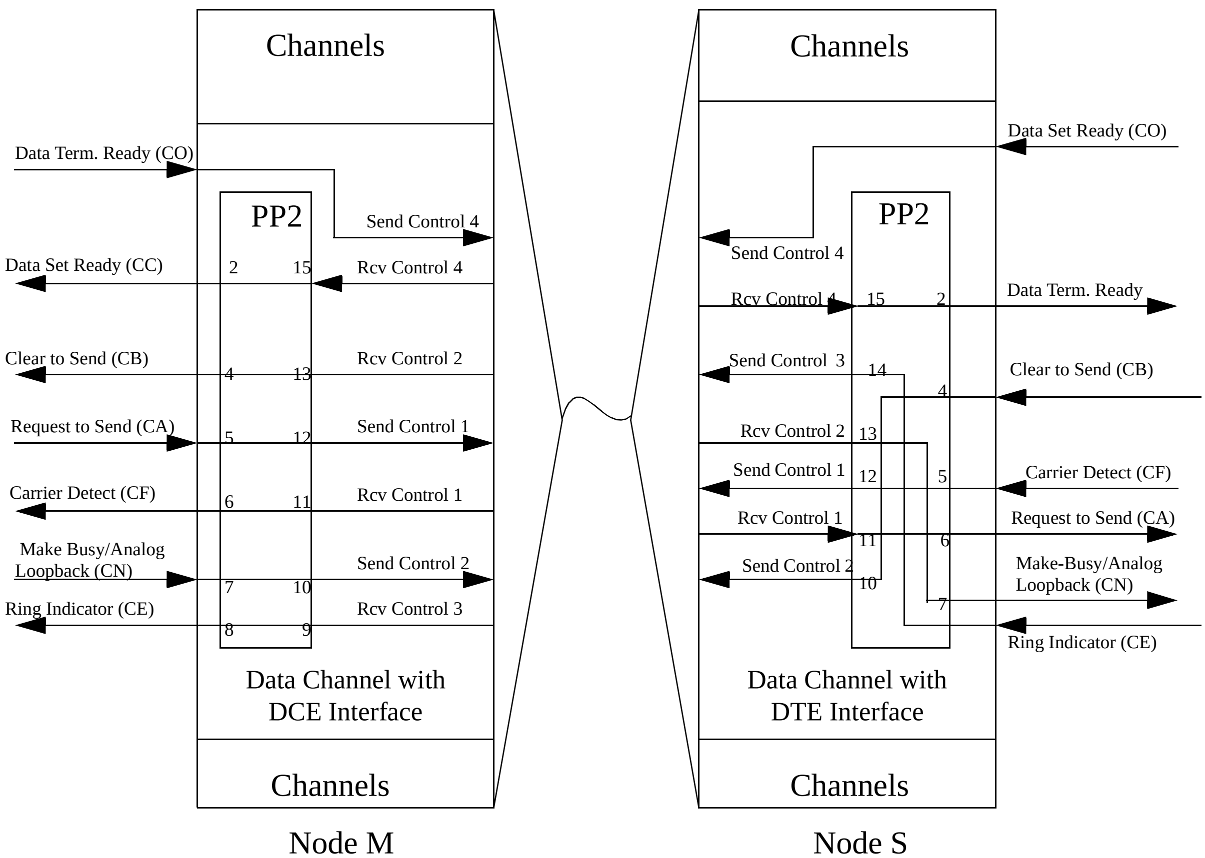
Figure 4-34 Data Channel Control Program Plugs (PP2) (Sheet 1 of 5)



A send control at one node becomes a receive control at the opposite node. For example, Request to Send is selected as Send Control 1 at Node M. Send Control 1 is transmitted across the link and becomes Receive Control 1 at the Node S data channel. PP2 at the Node S channel interface selects Receive Control 2 and sends it through the channel interface as Carrier Detect. MM02 is hand wired at GDC.

B. MM02 — CPU to Terminal — Remote CTS Wrap

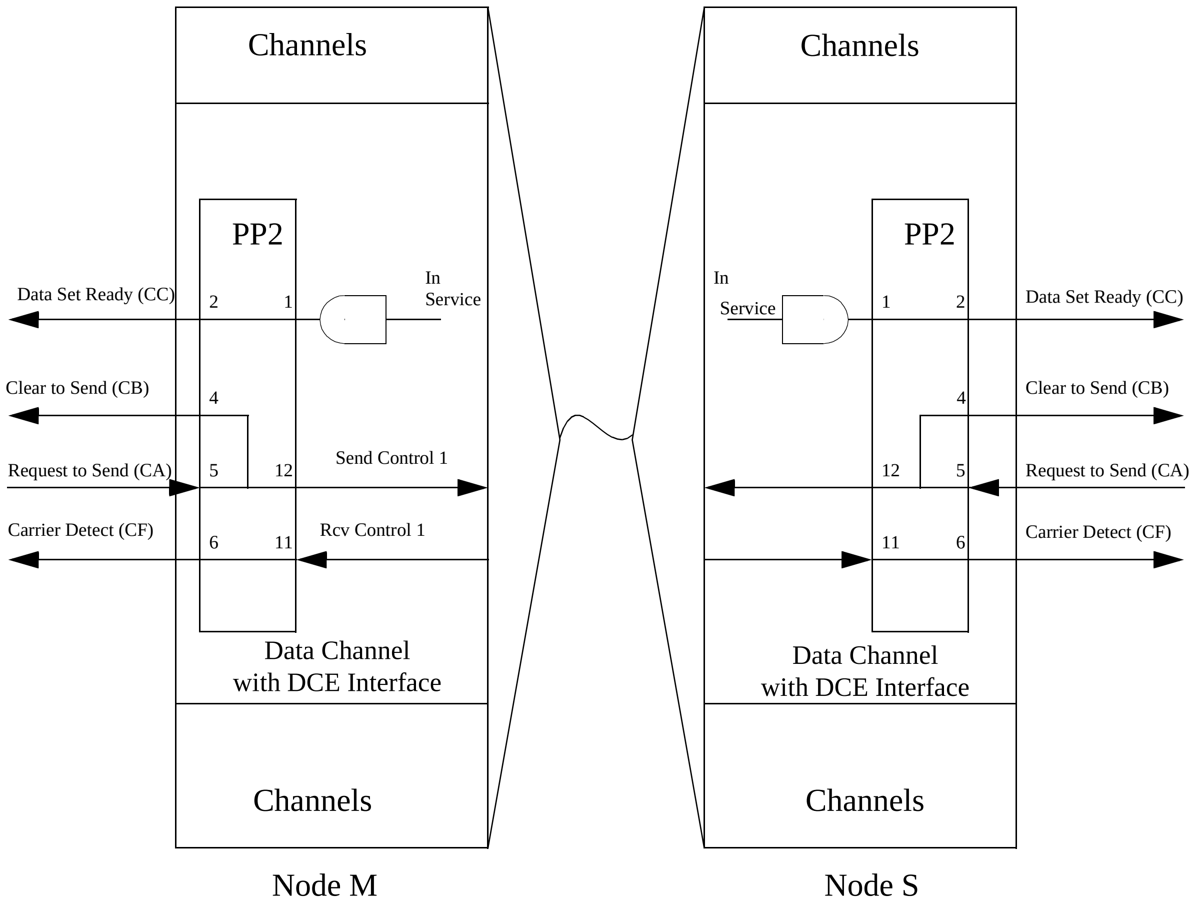
Figure 4-34 Data Channel Control Program Plugs (PP2) (Sheet 2 of 5)



A send control at one node becomes a receive control at the opposite node. For example, Data Terminal Ready is selected as Send Control 4 at Node M. Send Control 4 is transmitted across the link and becomes Receive Control 4 at the Node S data channel. PP2 at the Node S channel interface selects Receive Control 4 and sends it through the channel interface as Data Set Ready. MM02 is hand wired at GDC.

C. MM03 — CPU to Modem

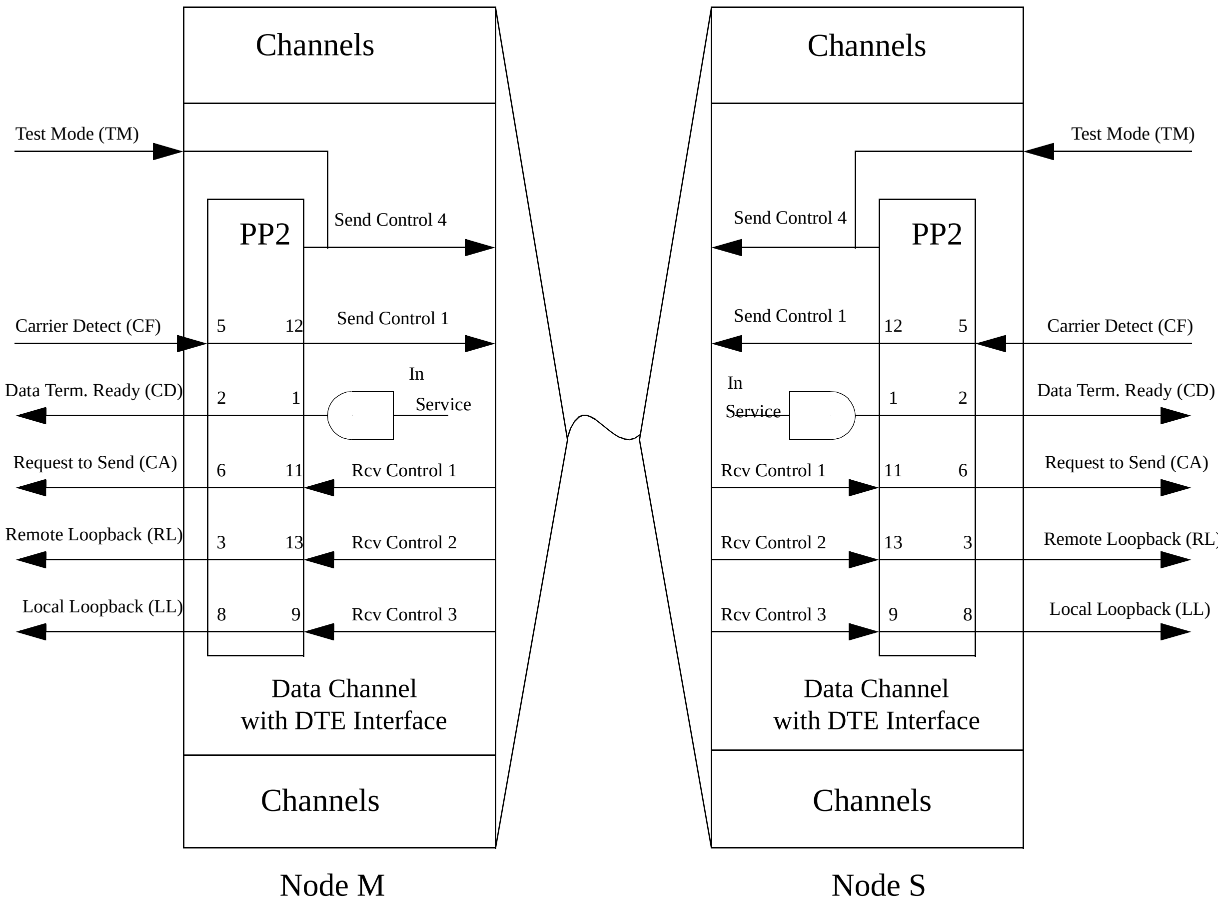
Figure 4-34 Data Channel Control Program Plugs (PP2) (Sheet 3 of 5)



A send control at one node becomes a receive control at the opposite node. For example, Request to Send is selected as Send Control 1 at Node M. Send Control 1 is transmitted across the link and becomes Receive Control 1 at the Node S data channel. PP2 at the Node S channel interface selects Receive Control 1 and sends it through the channel interface as Carrier Detect. The MM05 plug is basically the same as the MM01 plug except that Data Set ready (CC) is held high locally whenever the channel card is in service.

D. MM05 — CPU to Terminal — Local CTS Wrap

Figure 4-34 Data Channel Control Program Plugs (PP2) (Sheet 4 of 5)



A send control at one node becomes a receive control at the opposite node. For example, Carrier Detect is selected as Send Control 1 at Node M. Send Control 1 is transmitted across the link and becomes Receive Control 1 at the Node S data channel. PP2 at the Node S channel interface selects Receive Control 1 and sends it through the channel interface as Request to Send.

E. MM08 — V.54 Modem to V.54 Modem

Figure 4-34 Data Channel Control Program Plugs (PP2) (Sheet 5 of 5)

RS-422/423 Channel Adapter Options

If you use the RS-422/423 channel adapter (*Figure 4-35*) to obtain full RS-422 or RS-423 controls, you must select the 422 or 423 interface; Configure the interface to DTE or DCE devices (*See Figure 4-28 and Table 4-51*).

Note *For the RS-422/423 channel adapters, DTE/DCE component board designations always refer to the equipment to which the adapter is connected. If you are connecting data terminal equipment (CRTs, printers, etc.) to the adapter, place switches and program plugs in the DTE position. If you are connecting data communication equipment (modems, multiplexers, etc.) to the adapter, place switches and program plugs in the DCE position.*

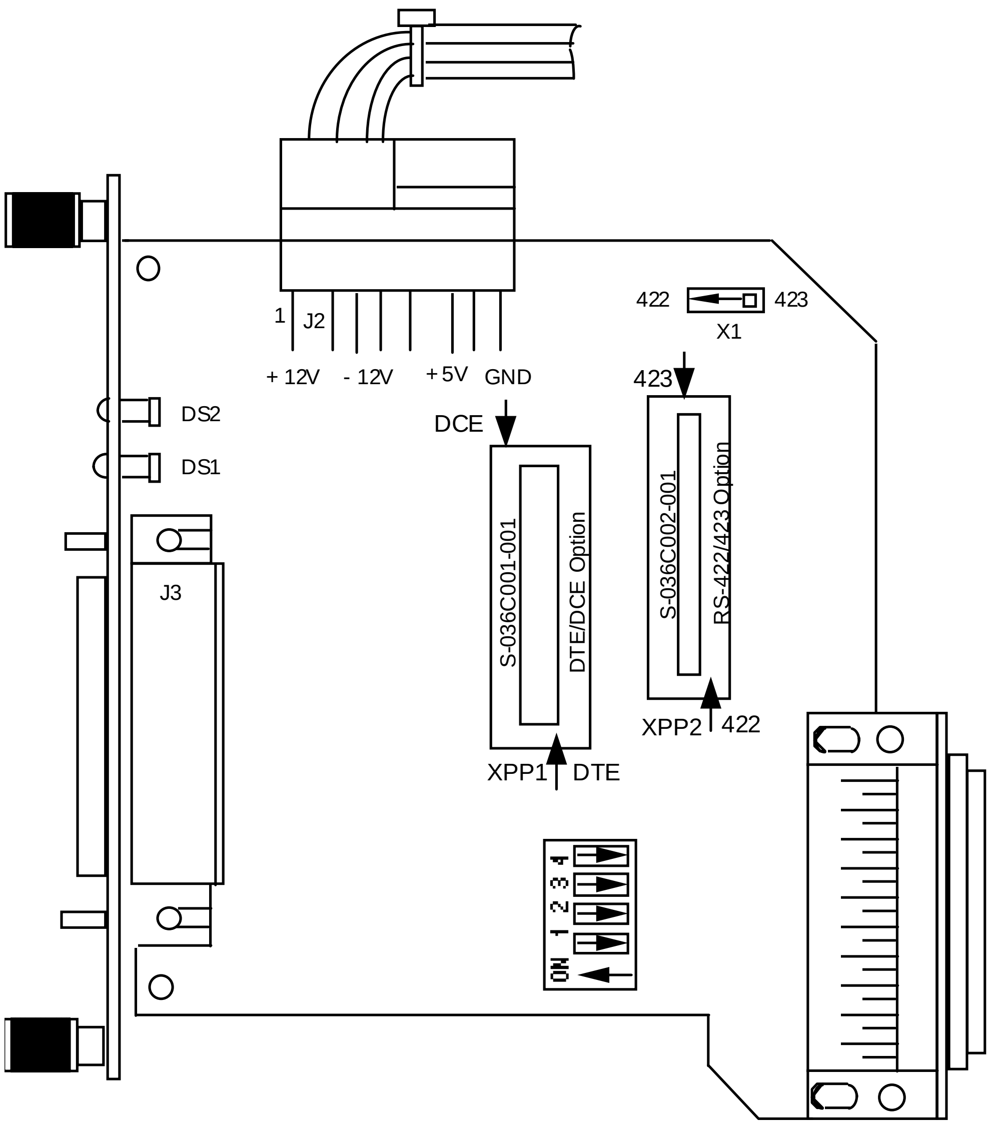


Figure 4-35 RS-422/423 Channel Interface Adapter Option Locations

TID-III (Time-Independent Data III) Module

Before attempting to set up or operate the TID-III Data Channel Module, you must first select a system application mode number. Five application modes, dependent upon your system requirements, are available to you .

TID-II (ECH-2) Emulation Mode (Modes 1-3)

These modes are applicable when you need TID-II performance characteristics over a communications link between two TID-III Data Channel Modules. The TID-II Emulation Mode gives you three (sub)modes, so that you can optimize communications depending upon channel rate and the characteristics of the channel input clock. These three operation modes are:

- Accuracy Tracking (Mode 1)

  This mode gives you extremely accurate input clock rates and when you want to track and output the clock rate with lowest possible offset. In this mode, the TID-III Data Channel Module tracks an input clock with accuracies as high as ± 0.006% depending upon the input rate.

- Program Tracking (Mode 2)

  This mode allows you to program the TID-III Data Channel Module to control signal input and output rate offsets and data delays within specified ranges, thereby optimizing communications for variable external clock characteristics.

- Input Tracking (Mode 3)

  This mode is similar to the ECH-11 emulation mode described below. This mode allows you to support communications where the input frequencies may vary ± 1.5% from the reference frequency due to external clock inaccuracies. When input clock inaccuracies are expected to exceed this threshold, select operation in Mode 4 (TID-I Emulation Mode).

TID-I (ECH-11) Emulation Mode (Mode 4)

This mode is applicable when you require TID-I performance characteristics over a communications link between two TID-III Data Channel Modules. Select Mode 4 when the channel input rate offsets are expected to be in the excess of ±1.5 % from the reference frequency due to the clock inaccuracies or instability. To select TID-I Emulation Mode, configure the TID-III Data Channel Module for Mode 4.

Automatic Tracking Mode (Mode 5)

Operation in the automatic tracking mode supports communications where input rates are subject to change in response to system configuration requirements. To operate in the automatic mode, select a maximum predetermined input rate, and the TID-III Data Channel Module supports all channel rates up to this pre-selected maximum. Operation in the automatic mode is supported only by the TID-III Data Channel Module; therefore, the remote end of the link must also be a TID-III Data Channel Module. To select Automatic Tracking Mode, configure the TID-III module for Mode 5.

The TID-III Data Channel Module can support special interface applications via an optional interface or data conversion requirement can be accommodated to customer specifications. Contact GDC with your specific requirements.

TID-III Configuration Requirements

With the variety of features and operation flexibility available with the TID-III Data Channel Module, it is important to review system communications requirements and constraints before attempting module set-up. Factors to consider are:

- Which type of TID-III Data Channel Module is on the remote end of the link (e.g., TID-I, II, or III)? The answer to this question directs you to one of the system application modes. If there are TID-III Data Channel Modules at both ends of the link, you can select any of the five application modes or three operating (sub)modes.
- What are the characteristics of the input and output clocks? Since all clocks exhibit varying degrees of inaccuracy, this answer allows you to select a mode/submode which optimizes communications with respect to clock accuracy and stability.
- Are there any special communications requirements, such as nonstandard rates or automatic alternate rates, on system configuration changes? If there are, consider the applicability of the automatic mode of operation.
- Are there any special module interface requirements (for example, a requirement to convert encoded data from one standard to another before channel input)? If there are, consult GDC regarding the applicability of our optional interface adapter piggyback.

Having reviewed the system application requirements and options, proceed with TID-III Data Channel Module setup.

TID-III Module Setup

Configure the TID-III Data Channel Module with both hardware and software options. The TID-III Data Channel Module is first configured by setting DIP switches on the transmitter board and several jumpers on the receiver board. The location of these devices is shown in *Figure 4-36 and Figure 4-37. Also refer to GDC 036R469-000, Instruction Manual for TID III*.

Application and operation mode settings are accomplished through software for the TMS-3000. A TID-III Control/Status screen is provided in software and is comparable to existing channel screens. For more information on configuring the TID-III Data Channel Module applications modes, *refer to the Operation Manual for TMS-3000 Controller, GDC 036R603-Vnnn*.

By properly configuring the program settings, the TID-III Data Channel Module is set up for the desired operating mode, isochronous channel input rate, and a corresponding TDM synchronous clock rate.

Note *For the RS-422/423 channel adapters, DTE/DCE component board designations always refer to the equipment to which the adapter is connected. If you are connecting data terminal equipment (CRTs, printers, etc.) to the adapter, place switches and program plugs in the DTE position. If you are connecting data communication equipment (modems, multiplexers, etc.) to the adapter, place switches and program plugs in the DCE position.*

For operation in Modes 1 through 4, Jumper E1-E2 on the receiver board is installed. This jumper provides automatic module reset for conditions of FIFO buffer overflow/underflow. This jumper is not installed for operation in Mode 5, the automatic tracking mode.

On the receiver board, a jumper is configured between E3 and E5 (normal). In this position, the transmit clock is derived from encoded information in the data received from a remote TDM.

If the jumper is configured between E3 and E4 (optional), the transmit clock is the same as provided on the external clock inputs (EIA pins 4 and 5).

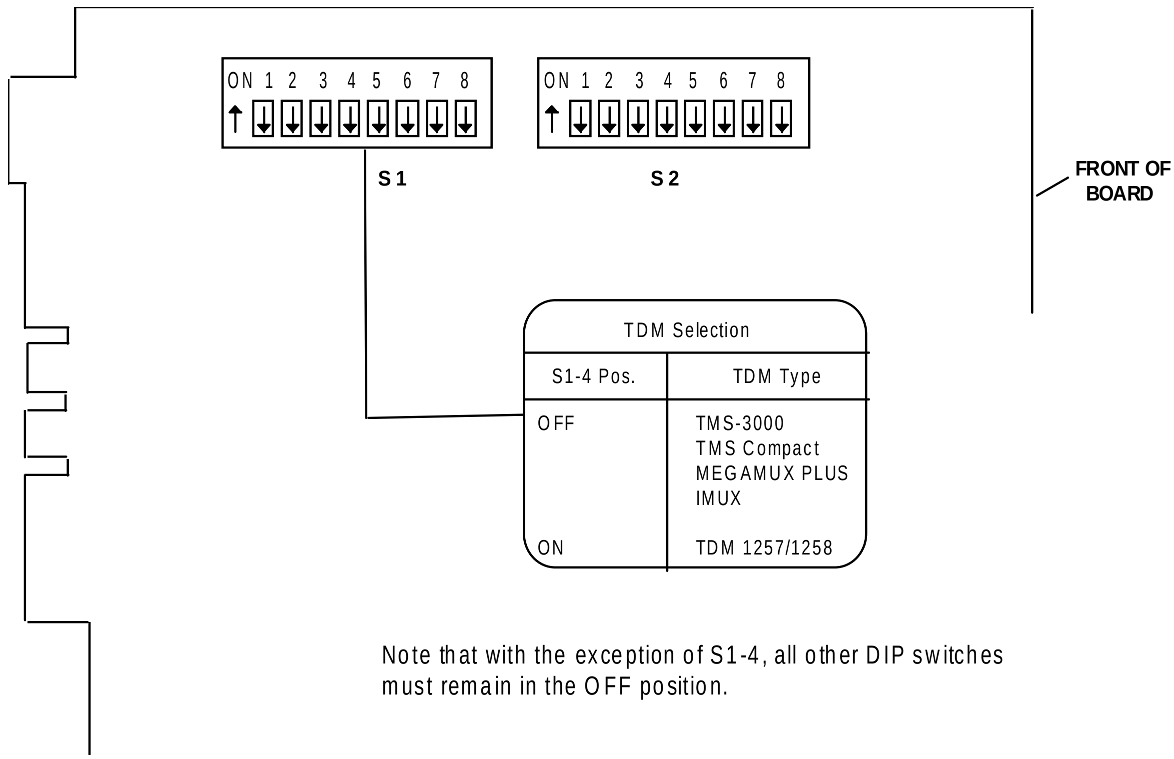


Figure 4-36 TID-III Data Channel Module Transmitter Assembly Option Locations

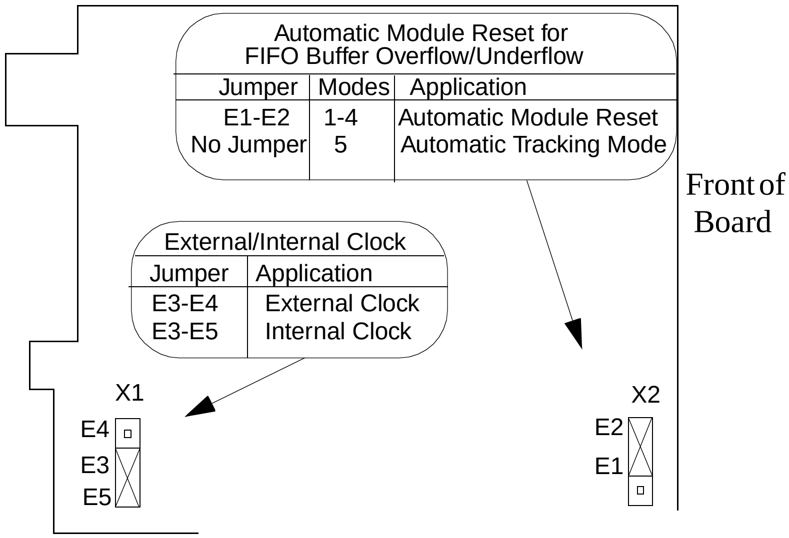


Figure 4-37 TID-III Data Channel Module Receiver Assembly Option Locations

Hyper Plug-In Card

The Hyper Plug-In Card is a plug-in option that mounts onto a Data III Channel, Data IV Channel or Universal Data Channel (UDC) Module. In the TMS, the Hyper Plug-In Card option allows data channels to operate error free in the presence of up to 32 bits of frame jitter.

If an application exists for a Hyper Plug-In Card on a circuit which is configured between two TMSCs, a Hyper Plug-In Card should be installed on the Data III Channel, Data IV Channel, or UDC Module at both ends.

If an application exists for a Hyper Plug-In Card on a circuit which is configured between a TMSC node and a MINIMUX TDM, a Hyper Plug-In Card should only be installed on the Data III Channel, Data IV Channel, or UDC Module in the TMS-3000 node.

Note *Because of increased delay time and translocation of data/control signals, do not use the Hyper Plug-In Card in low speed channel applications or in a polling environment.*

All software parameters for the Hyper Plug-In Card (configuration, card type, status, alarms, diagnostics, etc.) are the same as for the synchronous Data III Channel, Data IV Channel, or Universal Data Channel Module.

The Controller cannot identify the need for this card nor can it read of its presence in the network. To the Controller, and a user, a Data III, IV or UDC Module with the Hyper Plug-In option appears exactly as a standard Data III Channel, Data IV Channel, or Universal Data Channel Module.

Part Numbers

Part numbers for the Hyper Plug-In card for use on a UDC module are listed in *Table 4-58*.

Table 4-58 Hyper-UDC Module, Parts List

Equipment Supplied	GDC Part No.
Hyper-UDC Module, RS-422	036M078-005
Hyper-UDC Module, V.35	036M078-006

Installation Procedures

Use the following procedures to install the Hyper Plug-In Card onto a Data III Channel, Data IV Channel or Universal Data Channel Module in the field:

⚠ *This equipment contains electrostatic sensitive devices. Use ESD precautionary procedures when removing or inserting parts or printed circuit (pc) cards. Keep parts and pc cards in their anti-static packaging material until ready to install.*

You should use an antistatic wrist strap, connected to the grounded equipment frame or chassis, when handling pc cards during installation, removal, or setting of on-board option switches. Do not use a conductive tool, such as a screwdriver or paper clip, to set the position of the option switches.

---

1. Remove IC chip U14 (40-pin sync LSI) from its socket on the Data III Channel, Data IV Channel or Universal Data Channel Module. See *Figure 4-38* for location of the sync LSI chip. Store the sync LSI chip in conductive foam for future use.

2. Remove the two mounting screws from the threaded standoffs on the Hyper Plug-In card.

3. Place the Hyper Plug-In card with the component side facing down towards the Data III Channel, Data IV Channel, or Universal Data Channel Module. Carefully align Pin 1 (of A1P1) on the Hyper Plug-In Card with Pin 1 of the 40-pin U14 IC socket (the vacated sync LSI chip). With all pins aligned, carefully press the Hyper Plug-In Card onto the Data III Channel, Data IV Channel or Universal Data Channel Module. *See Figure 4-39*.

4. The mounting holes on the Hyper Plug-In Card should align with the holes on the Data III Channel, Data IV Channel or Universal Data Channel Module.

5. Re-install the two mounting screws into the threaded standoffs located on the Hyper Plug-In Card.

6. Attach the label over the existing “Data Channel” or “UDC” marking located at the bottom of the Data III Channel, Data IV Channel, or Universal Data Channel Module.

The Hyper Plug-In Card contains no option settings. Once installed, it functions transparently. A Data III Channel, Data IV Channel or Universal Data Channel Module with the Hyper Plug-In Card is configured similar to a standard Data Channel Module.

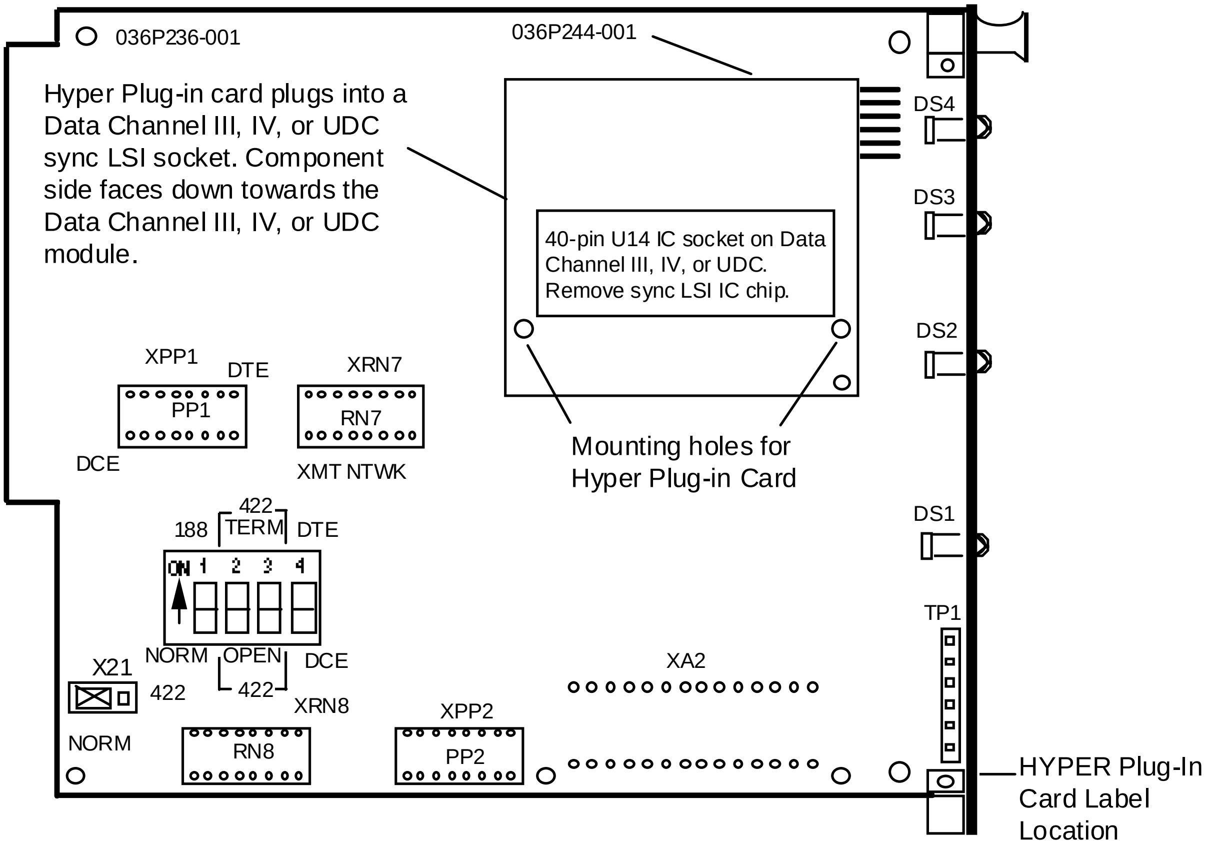


Figure 4-38 Data Channel Module with Hyper Plug-In Card Mounted

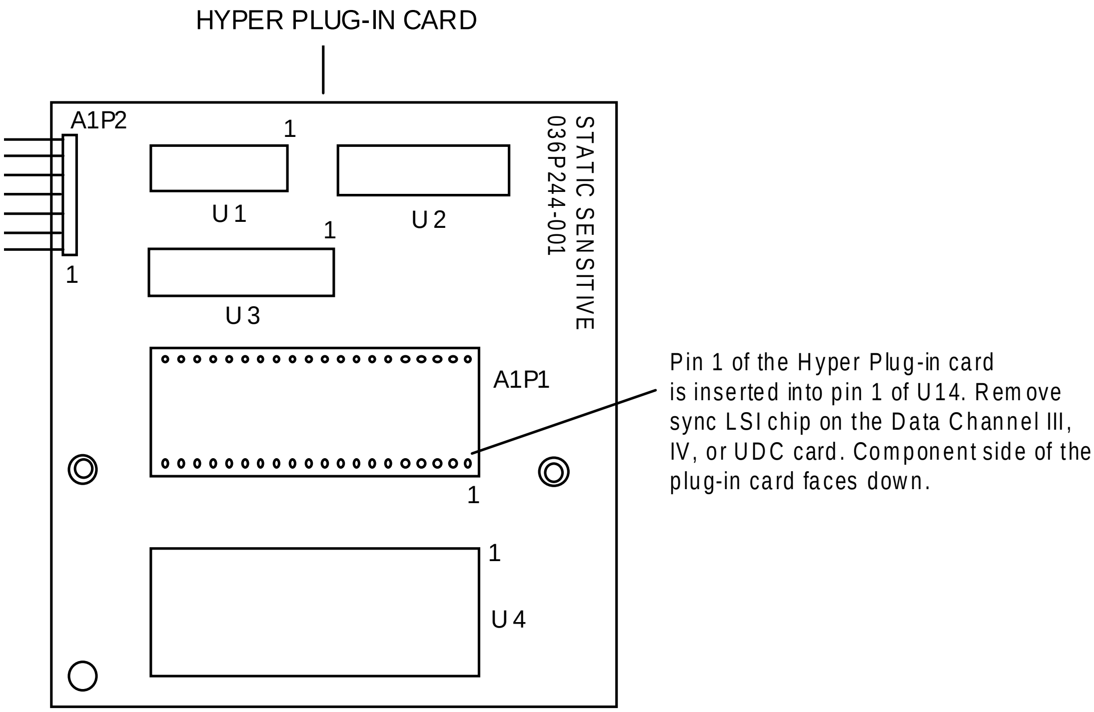


Figure 4-39 Hyper Plug-In Card

Hyper Plug-In Card Upgrade Kit

An upgrade kit allows you to mount the Hyper Plug-In card onto an existing Data III Channel, Data IV Channel or Universal Data Channel Module. The kit number is given in *Table 4-59*. The Hyper Plug-In Card kit can only be used with the Data Channel Module assemblies listed in *Table 4-60*.

Table 4-59 Hyper Plug-In Card, Upgrade Kit

Equipment Supplied	GDC Part No.
Hyper Plug-In Card Kit Contains the following:	036K244-001
Hyper Plug-In Card	036P244-001
Hyper ID label	036N023-001

Table 4-60 Upgradable Equipment List

Equipment Supplied	GDC Part No.
Data III Channel Module	036M058-002, -004
Data IV Channel Module	036M079-002, -004
Universal Data Channel Module	036M078-002, -004
NOTE: Do not use the Hyper Plug-In Card on Data Channel Modules with the EIA/TIA-232-E or RS-423 Interface set or with Data I/Data II Channel Modules.	

Voice Channel Modules

Voice II/CVSD, PCM, ADPCM, and ASP Channel Interface connections, options, and E and M signaling are covered in this section, as well as the Universal Voice Card and Echo Canceller Card.

Part Numbers

Tables 3-31 through 3-34 are parts listings for voice channel modules.

Table 4-61 Voice II/ADPCM (036M200-004)

Equipment Supplied	Designation	GDC Part No.
ADPCM-2 PCB Assembly	ADPCM-2	036M251-002
PCM-2 PCB Assembly	PCM-2	036P250-002

Table 4-62 Voice II/ADPCM (With E And M) (036M201-004)

Equipment Supplied	Designation	GDC Part No.
ADPCM-2 PCB Assembly	ADPCM-2	036M251-002
PCM-2 PCB Assembly	PCM-2	036P250-002
EAM-1 PCB Assembly	EAM-1	036P252-001

Table 4-63 Voice II/ASP/16K (036M259-001)

Equipment Supplied	Designation	GDC Part No.
ASP Base Card	—	036P255-002
ASP Piggyback	—	036P259-001

Table 4-64 Voice II/ASP/Multi (036M259-002)

Equipment Supplied	Designation	GDC Part No.
ASP Base Card	—	036P255-002
ASP Piggyback	—	036P259-002

Voice II/CVSD and ASP Channel Interface Connections

Connections for voice channels are determined by the type of telephone equipment with which the voice channel interfaces. The requirements of various voice termination systems are too detailed to be covered thoroughly by this manual; use information from the Network Documentation Package and manuals for associated telephone equipment to determine the connection requirements of your system. In this manual, telephone equipment that connects to voice channels falls into three basic categories:

- Automatic Ringdown Circuits
- Direct Connections to PBX Circuits
- Tellabs and Other Voice Termination Systems (Tellabs is the standard voice termination system supplied by General DataComm).

Various standard cables supplied by GDC for voice channel connections are listed in *Table 4-65*. The options available for the Voice II/CVSD, Voice II/PCM and Voice II/ASP Channel modules are described in *Table 4-66 through Table 4-78*. *Refer to Chapter 8*, for channel connector pin assignments.

Voice II/CVSD Channel Module Options

The following options may be selected for the Voice II/CVSD Channel Module (*See Figure 4-40* for the location of each option selection device on the module).

Input and Output Signal Levels

Nominal levels may be selected for voice input and output, as described in *Table 4-66*. Attenuation or amplification of the input level (to compensate for cable losses or other irregularities) may be selected, as described in *Table 4-67*.

E and M Signaling Interfaces

By selecting various options, the Voice II/CVSD Channel module can be configured to support all E and M signaling types, as described in *Table 4-68*. *Figure 4-41* depicts the M-lead signaling interface circuits created by jumper plug positions. E-lead responses to loss of power and service interruption may also be selected, as described in *Table 4-69 and Table 4-70*.

Filter Clock

The filter clock of the voice channel helps determine the bandwidth of the voice output. Two sources may be selected for the filter clock: a clock signal at four times the data rate of the voice channel, or a 128-kHz clock signal. The criteria for selecting one clock or the other are discussed in *Table 4-66*.

Table 4-65 Voice II/CVSD And ASP Channel Connection Cables

GDC Cable No.	Description	Application
027H306	Voice Channel, DB-25 connector to spade lugs	Single channel connection; tip, ring, E-lead, M-lead, and ground brought out to spade lugs. Available in 5-, 15-, and 25-foot lengths.
027H409	Voice Channel, DB-25 connector to punch-down wire leads	Single channel connection; tip, ring, E-lead, M-lead, station battery, signal and station ground brought out to wire ends for punch-down applications. Available in 5-, 15-, and 25-foot lengths.
326H024	TMS-3000 to PBX; DB-25 connector to 50-pin Amphenol connector. Up to 8 voice channels	Used to connect up to eight voice channels to private branch exchange. 5-foot length only; requires 021H605-025 extension cable.
326H025	8-channel harness; DB-25 connector to 50-pin Amphenol connector	Used to connect up to eight voice channels to facility. Transmit and receive leads crossed over. Available in 5-foot length only. Requires 021H605-025 extension cable.
326H026	6-channel harness; DB-25 connector to 50-pin Amphenol connector	Used to connect up to six voice channels to facility.
326H021	TMS-3000 to Tellabs 266R shelf (6 voice channels)	Used to connect up to six voice channels to Tellabs 266AR shelf. Available in 5- or 15-foot lengths.
326H023	TMS-3000 to Tellabs 2366R shelf (12 voice channels)	Used to connect up to 12 channels to Tellabs 266AR shelf. Available in 5- or 15-foot lengths.
830-002S008	50-pin Amphenol male to male extension cable (25 pairs)	Used to connect 50-pin cables above to customer voice termination point (demark), (voice channel to PBX).
830-002S007	50-pin Amphenol male to female extension cable (25 pairs)	Used to connect Tellabs shelf to customer voice termination point (demark), (Tellabs Shelf to PBX).
G024H012	Voice Channel and E & M	Used for Voice Channel CVSD and ASP module types. Also used in E&M signaling applications.

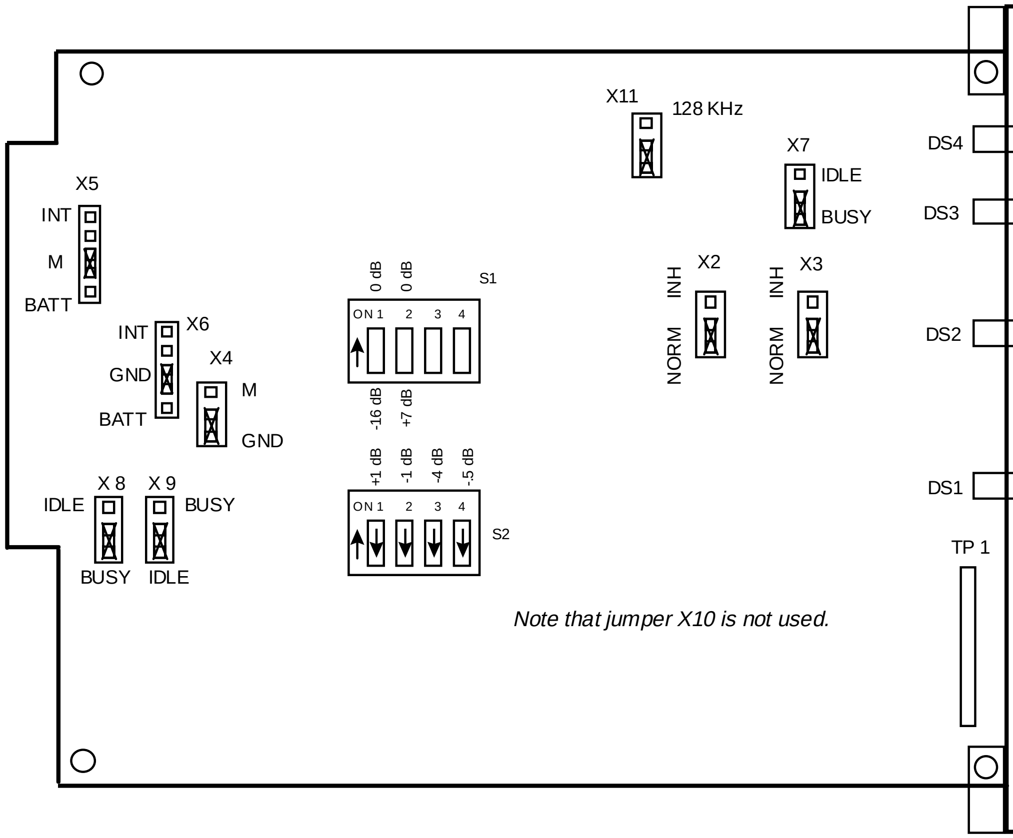


Figure 4-40 Voice II/CVSD Channel Module Option Locations

Table 4-66 Voice II/CVSD Channel Option Selection

Feature	Selection	Switch(S) Jumper(X) Desig.	Position	Application
Nominal Input Level	0 dBm	S1-1	0	The nominal input level is determined by the nominal output level of the telephone equipment connected to the channel.
	–16 dBm	S1-1	–16	Most systems specify either 0 dBm or –16 dBm as their nominal output. PBX systems generally require selection of 0 dBm; automatic ringdown or Tellabs and other voice termination systems generally require selection of –16 dBm. If actual output levels of connected equipment vary from the nominal levels of 0 dBm or –16 dBm, Switch S2 may be set to achieve some level of compensation.
Nominal Output Level	+7 dBm	S1-2	+7	The nominal output level for the Voice II Channel is either 0 dBm or +7 dBm.
	0 dBm	S1-2	0	This selection depends on the nominal input level specified for the telephone equipment connected to the channel. PBX systems generally require selection of 0 dBm; automatic ringdown or Tellabs and other voice termination systems generally require selection of +7 dBm. Adjustments to the actual measured output level of the voice channel may be made through the CRT interface by setting a degree of attenuation or amplification. The output selected by S1-2 may be varied from +1.5 dB above the nominal level to –6 dB below the level in 0.5 dB steps.
Filter Clock	128 kHz	X11	128 kHz	This selection should be made whenever the data clock for the voice channel (selected through the supervisory port interface in the Configuration routine) is greater than 32 kHz. The 128 kHz selection ensures that the frequency range of the voice output does not exceed telephone line limits.
	4X Data Clock	X11	4XDATA	This selection should be made whenever the data clock for the voice channel (selected through the supervisory port interface in the Configuration routine) is less than 32 kHz. When the data clock is 32 kHz, either position is acceptable.

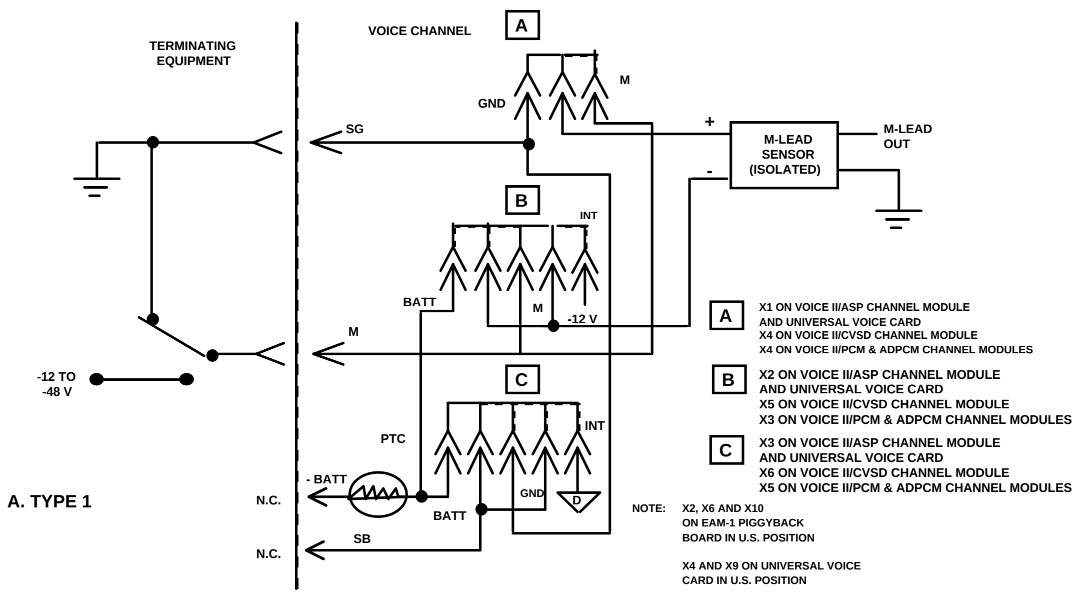
Table 4-67 Voice II/CVSD Channel Input Level Adjustment Option

S2-1 (+1 dB)	S2-2 (–2 dB)	S2-3 (–4 dB)	S2-4 (+0.5 dB)	Input Compensation	Application
ON	OFF	OFF	ON	+1.5 dB	Switches S2-1 through S2-4 select attenuation or amplification for the voice input level. This compensates for cable losses or improper output levels from connected telephone equipment. The switch selects a level of compensation from +15 dB to –6.0 dB, in 0.5 dB steps. Each segment of Switch S2 selects a level of attenuation or amplification; the individual steps are added to produce a particular level. A level is selected to compensate for some measured deviation of the output level of equipment connected to the channel. The deviation is the difference between the actual level and the nominal level of 0 dBm and –16 dBm selected on Switch S1-1. For example, if the nominal level is 0 dBm, and the actual level is +2 dBm, selection of –2 dB would compensate for the difference between the nominal and measured input values.
ON	OFF	OFF	OFF	+1.0 dB	
OFF	OFF	OFF	ON	+0.5 dB	
OFF	OFF	OFF	OFF	0 dB	
ON	ON	OFF	ON	–0.5 dB	
ON	ON	OFF	OFF	–1.0 dB	
OFF	ON	OFF	ON	–1.5 dB	
OFF	ON	OFF	OFF	–2.0 dB	
ON	OFF	ON	ON	–2.5 dB	
ON	OFF	ON	OFF	–3.0 dB	
OFF	OFF	ON	ON	–3.5 dB	
OFF	OFF	ON	OFF	–4.0 dB	
ON	ON	ON	ON	–4.5 dB	
ON	ON	ON	OFF	–5.0 dB	
OFF	ON	ON	ON	–5.5 dB	
OFF	ON	ON	OFF	–6.0 dB	

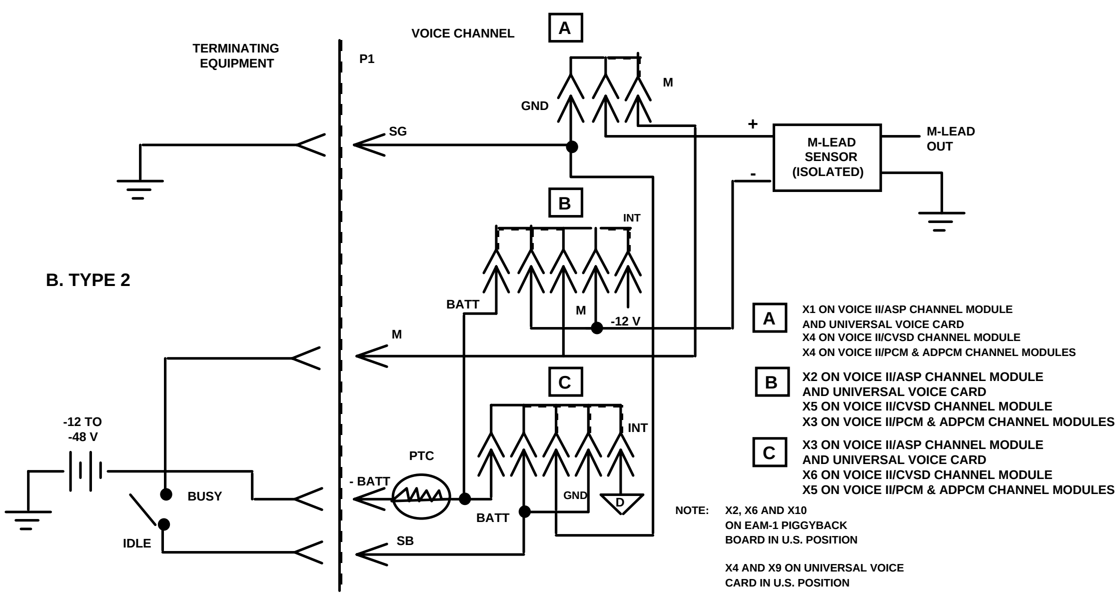
Table 4-68 Voice II/CVSD Channel E And M Signaling Option Selection

Type	Berg Jumper Positions			Signaling States		Application
	X4	X5	X6	Idle	Busy	
1	GND	M	GND	0 Vdc	–12 to –48 Vdc	X4, X5, and X6 select the proper interface for different E & M signaling types. The jumper positions selected depend entirely on the E & M signaling type used by the voice equipment connected to a Voice Channel module. For most applications, the selections shown for Signaling Type 1 are used.
2	GND	M	BATT	Open	–12 to –48 Vdc	
3	GND	M	BATT	0 Vdc	–12 to –48 Vdc	
4	M	BATT	GND	Open	0 Vdc	
5	M	BATT	GND	Open	0 Vdc	
2*	M	INT	INT	Open	0Vdc	

* Back to back; i.e., when the VF interfaces of two voice II Channel modules are connected directly together.

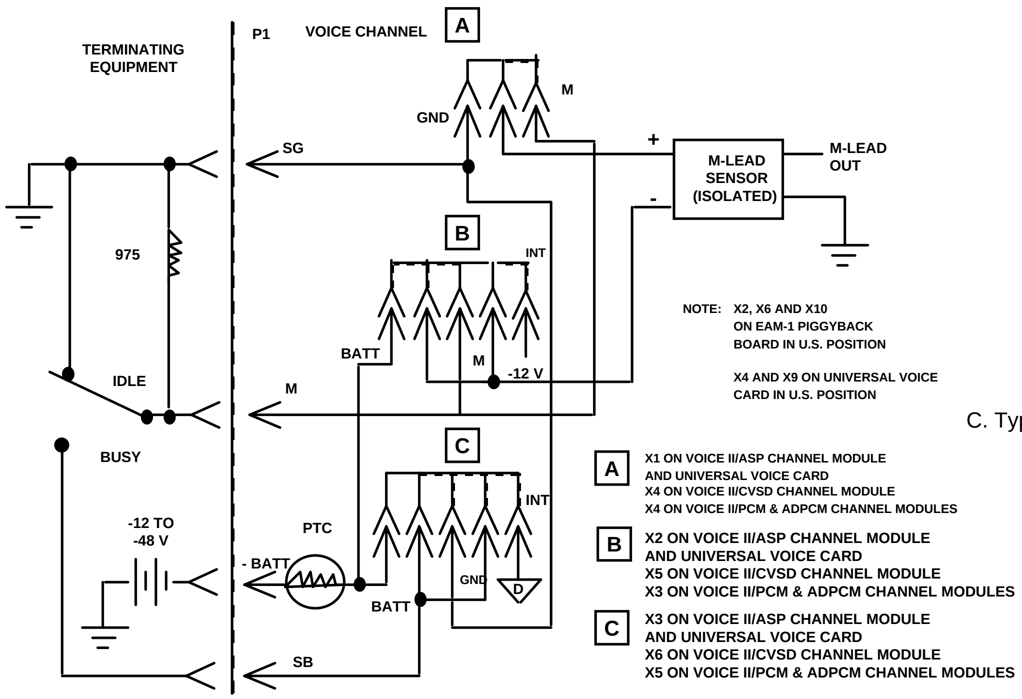


NOTE : For Type I interface, the ground of the Signalling CKT and the ground of the Trunk CKT must be referenced to the same place for reliable operation. The GDC Type I interface is correctly pictured as:

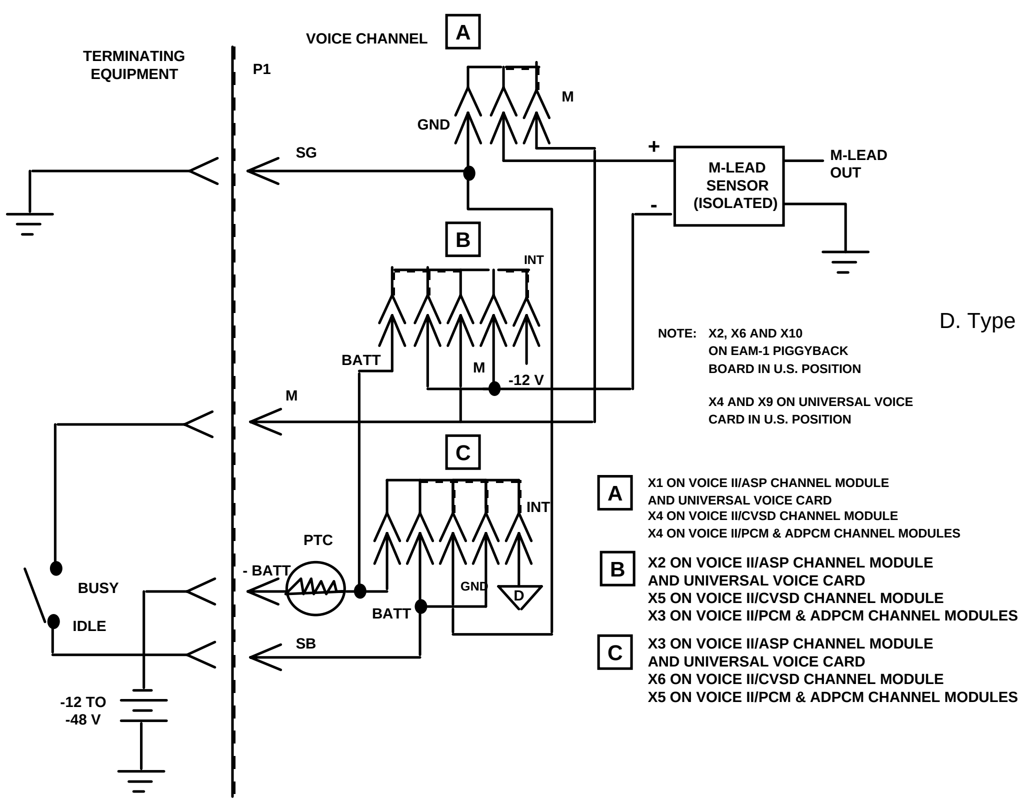


NOTE : The additional external signal for -BATT may be common for multiple PCM cards and are not related to the Trunk CKT. 48 Volts is not presently available in the TMS and so an external source is required.

Figure 4-41 M-Lead Signaling Interfaces (Sheet 1 of 4)



C. Type 3



D. Type 4

Figure 4-41 M-Lead Signaling Interfaces (Sheet 2 of 4)

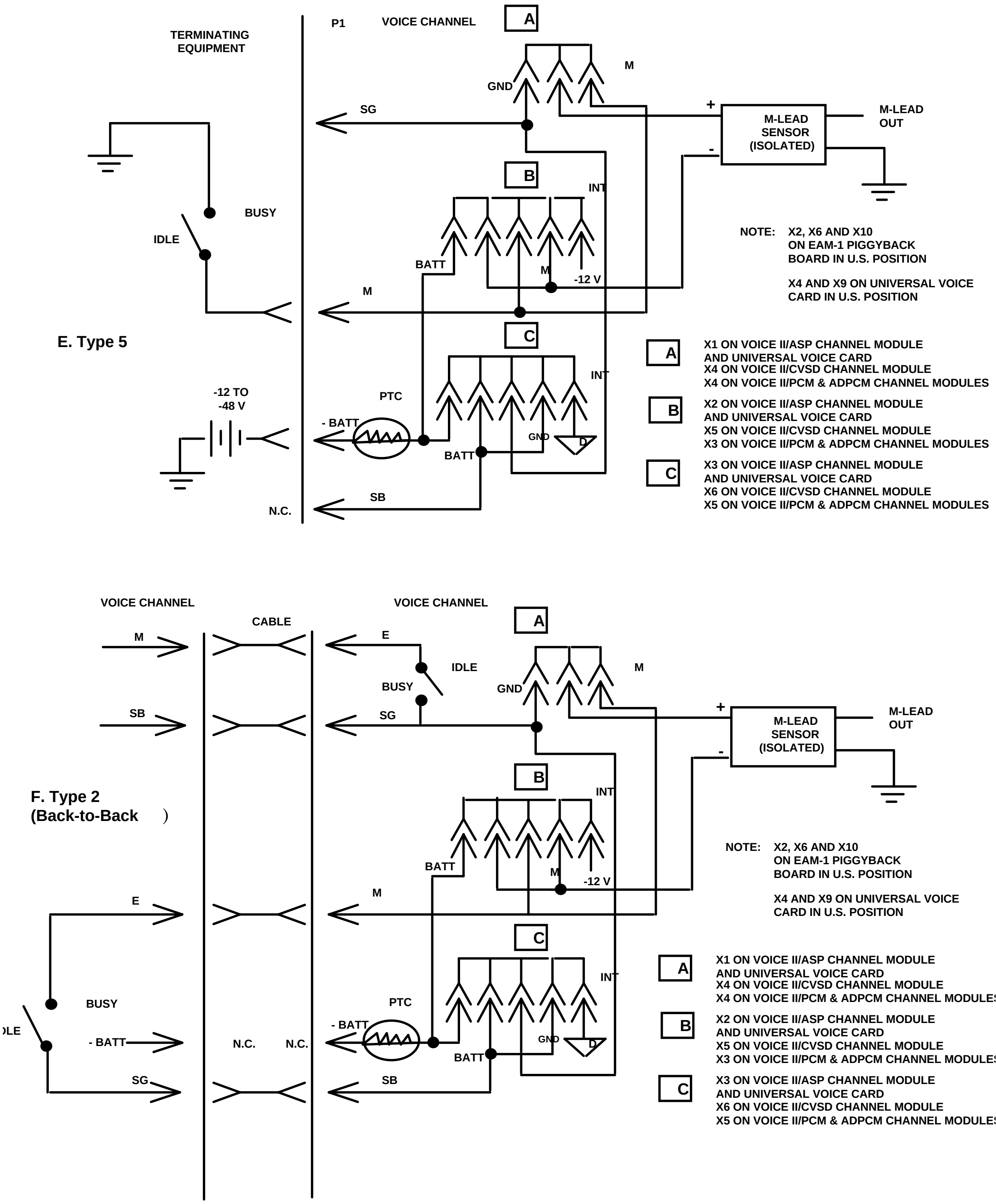
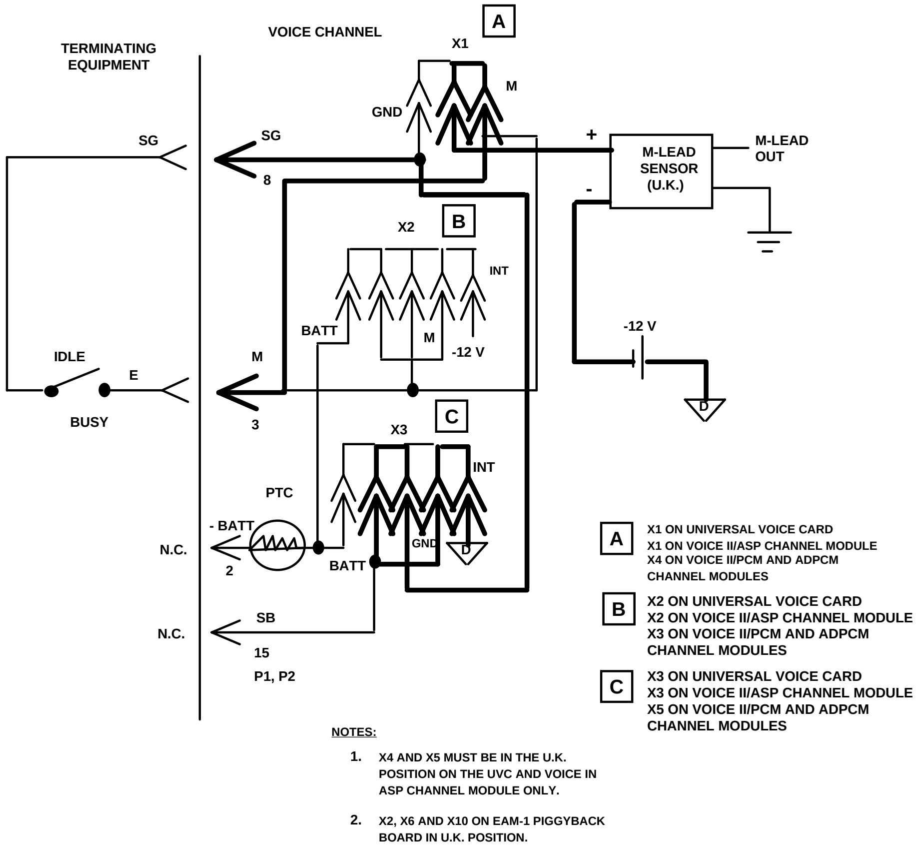


Figure 4-41 M-Lead Signaling Interfaces (Sheet 3 of 4)



G. U.K. OPERATION (SSDC5)

Figure 4-41 M-Lead Signaling Interfaces (Sheet 4 of 4)

Table 4-69 Voice II/CVSD Channel E-Lead Relay State Option Selection

Feature	X7 Position	X8 Position	X9 Position	Application
Loss of Power E-Lead Signal-ing State	Busy	Idle	Idle	With these three jumpers set in the position shown, the E-Lead (pin 24 on the DB-25 EIA connector) is in an Idle state during loss of power. The E' lead (pin 11 on the DB-25 EIA connector) is in a Busy state during loss of power. This selection is generally made for connections between the voice channel and automatic ringdown circuits.
	Idle	Busy	Busy	With these three jumpers set in the position shown, the E-Lead (pin 24 on the DB-25 EIA connector) is in a Busy state during loss of power. The E' lead (pin 11 on the DB-25 EIA connector) is in an Idle state during loss of power. This selection is generally made for connections between the voice channel and PBX systems, or Tellabs and other voice termination systems.

Table 4-70 Voice II/CVSD Channel E-Lead Out-of-Service Option Selection

Feature	X2 Position	X3 Position	Application
Service Interruption/ Loss of Sync Signaling Response	NORM	NORM	If TMS-3000 synchronization is lost or the channel is placed out of service, the E-Lead is forced to the Idle state for 2.5 seconds, and then reverts to the Busy state.
	INH	NORM	If TMS-3000 synchronization is lost or the channel is placed out of service, the E-Lead is forced to the Busy state 2.5 seconds after synchronization is lost.
	NORM	INH	If TMS-3000 synchronization is lost or the channel is placed out of service, the E-Lead is forced to the Idle state immediately.
	INH	INH	The E-Lead state is not changed due to loss of synchronization or channel placed out-of-service.

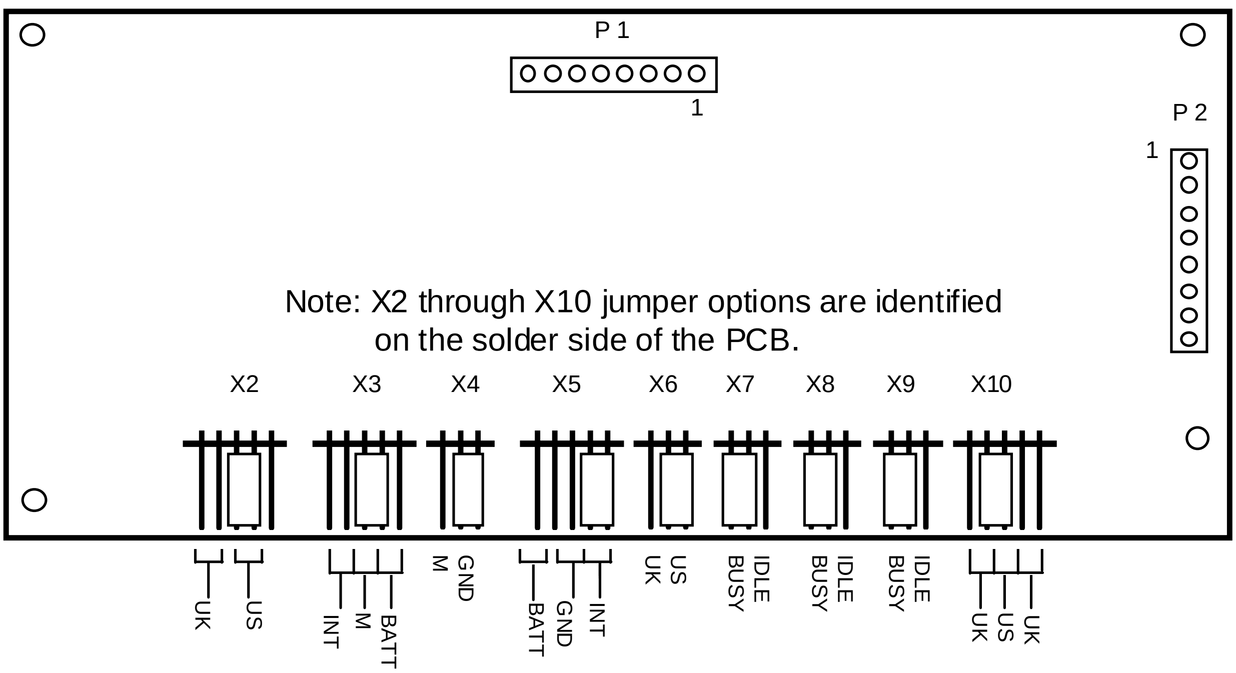
Table 4-71 E And M Signaling Option Selections (EAM-1 Board)

	Berg Jumper Positions			Signaling States		Berg Jumper Positions
Signaling Type	**X4**	**X3**	**X5**	**IDLE**	**BUSY**	**X2, X6, X10**
1	GND	M	GND	0 V dc	–12 to –48 V dc	U.S.
2	GND	M	BATT	OPEN	–12 to –48 V dc	U.S.
3	GND	M	BATT	0 V dc	–12 to –48 V dc	U.S.
4	M	BATT	GND	OPEN	0 V dc	U.S.
5	M	BATT	GND	OPEN	0 V dc	U.S.
2*	M	INT	INT	OPEN	0 V dc	U.S.
U.K.**	M	INT	INT/GND	OPEN	0 V dc	U.K.

* For back-to-back signaling with no external battery.

Application: X2-X5 and X10 select the proper interface for different E and M signaling types. The jumper positions selected depend entirely on the E and M signaling type used by the voice equipment connected to the Voice II/PCM or Voice II/ADPCM module.

** For SSDC5 signaling, two jumper plugs are required on X5, in both the INT and GND positions.



Note: The card is configured for U.S. operation.

Figure 4-42 E and M Signaling Piggyback Card (EAM-1) Option Locations

Table 4-72 Idle/Busy E-Lead Option Selection (EAM-1 Board)

Jumper	Selection	Application
X7 X8 X9	BUSY BUSY BUSY	When the E-Lead is used for signaling, loss of TDM power results in a BUSY E-Lead.
X7 X8 X9	IDLE IDLE IDLE	When the E-Lead is used for signaling, loss of TDM power results in an IDLE E-Lead.
NOTE: The E'-Lead (P1-54) is the inverted state of the E-Lead (P1-56).		

Voice II/ASP Channel Module Options

The following options can be selected for the Voice II/ASP Channel Modules (*See Figure 4-43* for the location of each option selection device).

Input and Output Signal Levels

Nominal levels may be selected for voice input and output as described in *Table 4-73*. Attenuation of the input level (to compensate for cable losses or other irregularities) may be selected as described in *Table 4-74*.

E and M Signaling Interfaces

By selecting various options, the Voice II/ASP Channel Module can be configured to support all E and M signaling types, as depicted in *Table 4-75*. *Figure 4-41 (shown earlier in chapter)* depicts the M-lead signaling interface circuits created by jumper plug positions. E-lead polarity selection and E-lead responses to loss of power and service interruption can also be selected as described in *Table 4-76 through Table 4-78*.

Table 4-73 Voice II/ASP Channel Option Selection

Feature	Selection (dBm)	Switch(S), Jumper(X) Desig.	Position	Application
Nominal Input Level	0 –16	S1-1 S1-1	OFF ON	The nominal input level is determined by the nominal output level of the telephone equipment connected to the channel. If actual output levels of connected equipment vary from the nominal levels, Switch S1 may be set to achieve some level of compensation.
Nominal Output Level	0 +7	S1-3 S1-3	OFF ON	The nominal output level for the ASP Channel is either 0 dBm or +7 dBm. This selection depends on the nominal input level specified for the telephone equipment connected to the channel. Adjustments to the actual measured output level of the voice channel may be made through the Controller by setting a degree of attenuation or amplification. The output selected by S1-3 may be varied from +1.5 dB above the nominal level to –6 dB below the level in 0.5 dB steps. *Refer to GDC 036R603-Vnnn*, for information on the output level.

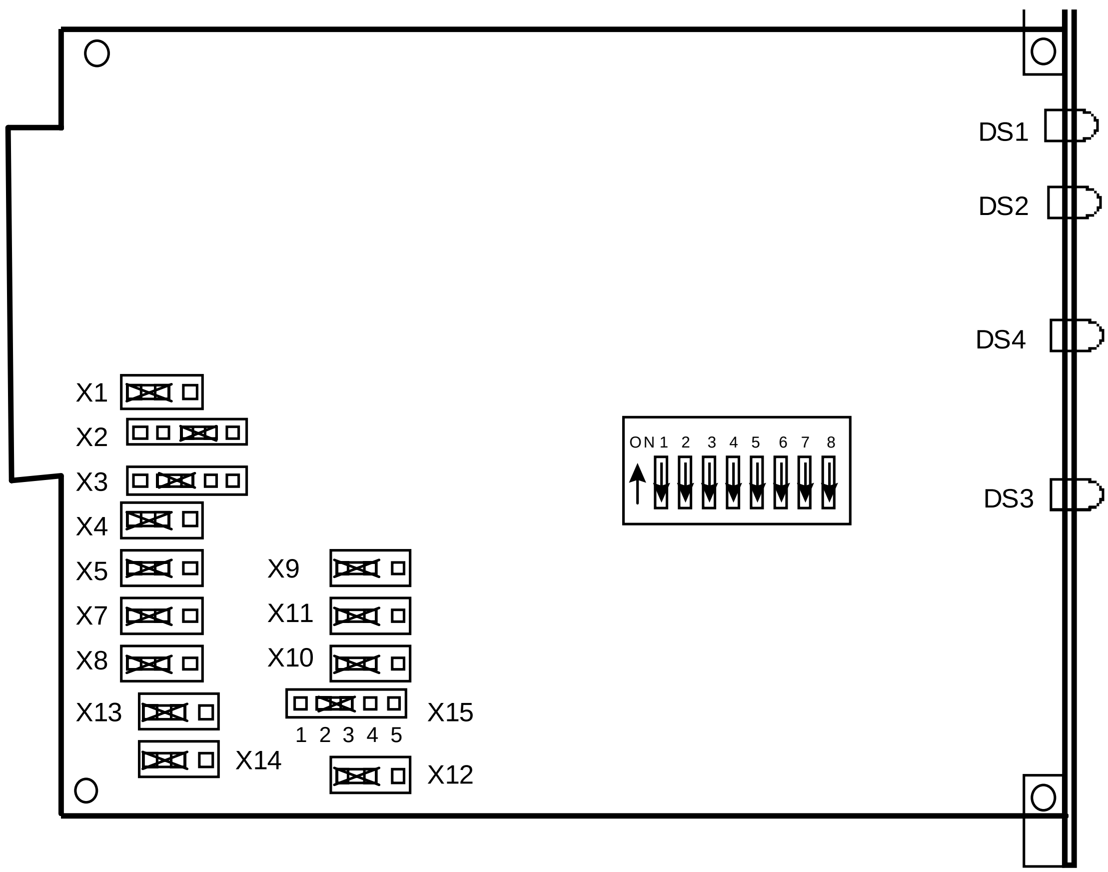


Figure 4-43 Voice II/ASP Channel Module Option Locations

Table 4-74 Voice II/ASP Channel Input Level Adjustment Option

S1-5 (+1 dB)	S1-6 (+0.5 dB)	S1-7 (–2 dB)	S1-8 (–4 dB)	Input Compensation (dB)	Application
ON	ON	OFF	OFF	+1.5	Switches S1-5 through S1-8 select attenuation or amplification for the voice input level. This compensates for cable losses or improper out-put levels from connected telephone equipment. The Switch selects a level of compensation from +1.5 dB to –6.0 dB in 0.5 dB steps. Each segment of Switch S1 selects a level of attenuation or amplification; the individual steps are added to produce a particular level. A level is selected to compensate for some measured deviation of the output level of equipment connected to the channel. The deviation is the difference between the actual level and the nominal level (selected on Switch S1-1).
ON	OFF	OFF	OFF	+11.0	
OFF	ON	OFF	OFF	+0.5	
OFF	OFF	OFF	OFF	0	
ON	ON	ON	OFF	–0.5	
ON	OFF	ON	OFF	–1.0	
OFF	ON	ON	OFF	–1.5	
OFF	OFF	ON	OFF	–2.0	
ON	ON	OFF	ON	–2.5	
ON	OFF	OFF	ON	–3.0	
OFF	ON	OFF	ON	–3.5	
OFF	OFF	OFF	ON	–4.0	
ON	ON	ON	ON	–4.5	
ON	OFF	ON	ON	–5.0	
OFF	ON	ON	ON	–5.5	
OFF	OFF	ON	ON	–6.0	

Table 4-75 Voice II/ASP VF Channel E And M Signaling Type Selection

Signaling Type	Berg Jumper Positions					Signaling States	
	X1	X2	X3	X15	X9,X10,X11,X12	IDLE	BUSY
1	2-3	2-3	2-3	2-3	1-2	0 Vdc OPEN	–12 to –48 Vdc
2	2-3	2-3	1-2	2-3	1-2	0 Vdc	–12 to –48 Vdc
3	2-3	2-3	1-2	2-3	1-2	OPEN	–12 to –48 Vdc
4	1-2	4-5	2-3	2-3	1-2	OPEN	0 Vdc
5	1-2	4-5	2-3	2-3	1-2	OPEN	0 Vdc
U.K.	1-2	4-5	2-3, 4-5	1-2, 3-4	2-3		0 Vdc

Table 4-76 Voice II/ASP Channel E-Lead Polarity Option Selection

Feature	Selection	X13, X14 Position	Application
E-Lead Polarity	Negative Polarity	1-2	Jumpers X13 and X14 select polarity for the E-Lead. These jumper positions depend on the requirements of the equip-ment connected to the ASP channel interface. Normally, the M-Lead detector of the channel equipment provides only a negative voltage and requires a negative polarity E-Lead setting. But if the M-Lead detector provides a positive voltage, the E-Lead polarity should be set to positive.
	Positive Polarity	2-3	

Table 4-77 Voice II/ASP Channel E-Lead State During Loss Of Power Option

Feature	E-Lead State	X4 Position	X5 Position	Application
Loss of Power E-Lead Signaling State	Idle	2-3	2-3	With this selection, the E-Lead is in an Idle state during loss of power.
	Busy	1-2	1-2	With this selection, the E-Lead is in a Busy state during loss of power.

Table 4-78 Voice II/ASP Channel E-Lead Service Interruption Options

Feature	ASP	Jumper Positions	Application
E-Lead State Upon Loss of Sync/Service Interruption	X7 X8	1-2 1-2	The E-Lead is forced Idle 0.5 seconds after sync loss, and then reverts to the Busy state after two seconds.
	X7 X8	2-3 1-2	The E-Lead is forced Busy two seconds after sync loss.
	X7 X8	1-2 2-3	The E-Lead is forced to the Idle state 0.5 seconds after sync loss.
	X7 X8	2-3 2-3	The E-Lead is not affected by loss of sync.

Universal Voice Card Channel Options

Option selection switches and headers are used to configure the various Universal Voice Card configurations to provide the desired voice encoding techniques, input and output levels, signaling types, and service interruption requirements. Voice encoding options, unique to each type of Universal Voice Card, are selected using Switch S1 on the card (*See Figure 4-44*). *Table 4-79* defines the switch positions, the corresponding part number of the Universal Voice Card, and the application of each voice type. Option selections for input and output levels, signaling types, and service interruption requirements are common for all versions of the card and are selected using Switch S2 and Headers X1 through X12 (*See Figure 4-44* and *Table 4-80 through Table 4-84*).

PCM Voice Encoding

Universal Voice Card P/N 036P265-002 is used for PCM voice encoding. This card furnishes PCM voice encoding at a synchronous data rate of 64 Kbps. Either U.S. or U.K. signaling types can be accommodated. PCM voice encoding with either 2 kHz or 800 Hz may be selected (*See Table 4-79*).

ADPCM Voice Encoding

Universal Voice Card P/N 036P265-003 is used for ADPCM voice encoding. The ADPCM option provides ADPCM voice encoding with 800 Hz overhead and software controlled variable synchronous data rates of 32 Kbps, 24 Kbps, or 16 Kbps with PCM-T (64 Kbps) fallback mode (*See Table 4-79*).

Input and Output Signal Level Option Selections

The PCM and ADPCM versions of the Universal Voice Card accept nominal input levels of –16 dBm and 0 dBm and provide nominal output levels of 0 dBm and +7 dBm. You can choose nominal input and output levels for the voice input and output as described in *Table 4-80*. Nominal input level may be adjusted (to compensate for cable losses or other irregularities) as described in *Table 4-81*. The nominal output level may also be adjusted to achieve additional compensation, but the adjustments are software selectable only. The output level adjustments have the same dBm range as the input level adjustments.

E and M Signaling Options

The E and M signaling subsystem gives you a means of supervisory pulse communications between local and remote telephone networks. The signaling data is transmitted over the same path as the voice data. But additional bandwidth is used for the E and M signaling information.

By selecting various options, the PCM or ADPCM versions of the Universal Voice Card can be configured to support seven types of E and M signaling as described in *Table 4-82*. The M-Lead signaling interface circuits created by the jumper plug positions were previously shown in *Figure 4-41 (A-G)*.

Idle/Busy E-Lead and Voltage Polarity Options

E-Lead inversion and loss of power states are selected by Jumpers X5 and X6 on the Universal Voice Card. These options select the state (BUSY or IDLE) that the E-Lead reverts to when TMS-3000 power is lost. Jumpers X7 and X8 on the Universal Voice Card select the voltage polarity for the E-Lead. The option selections are shown and described in *Table 4-83*.

Service Interruption Options

Four options are available for E-lead operation following either a loss of synchronization or an out-of-service condition. The available options are shown in *Table 4-84*.

Echo Canceller Option

Header X12 (*See Figure 4-44*) is provided for use with the Echo Canceller Piggyback Card. Header X12 allows selection between the incoming transmit PCM from the Codec NORM, or the PCM with echo cancellation from the Echo Canceller Piggyback Card (ECH). Place Jumper X12 in the ECH position if you are using the Echo Canceller Piggyback Card, otherwise it should be left in the NORM position.

Voice Channel Configuration Selections

The Universal Voice Card voice channel software configuration parameters are selected using the Controller for the Transport Management System. The available selections are:

- VF/dB Levels
- ADPCM — Selection of a reduced rate, or the PCM-T (64 Kbps) pass-through mode

Detailed configuration instructions are provided in *GDC 036R603-Vnnn*.

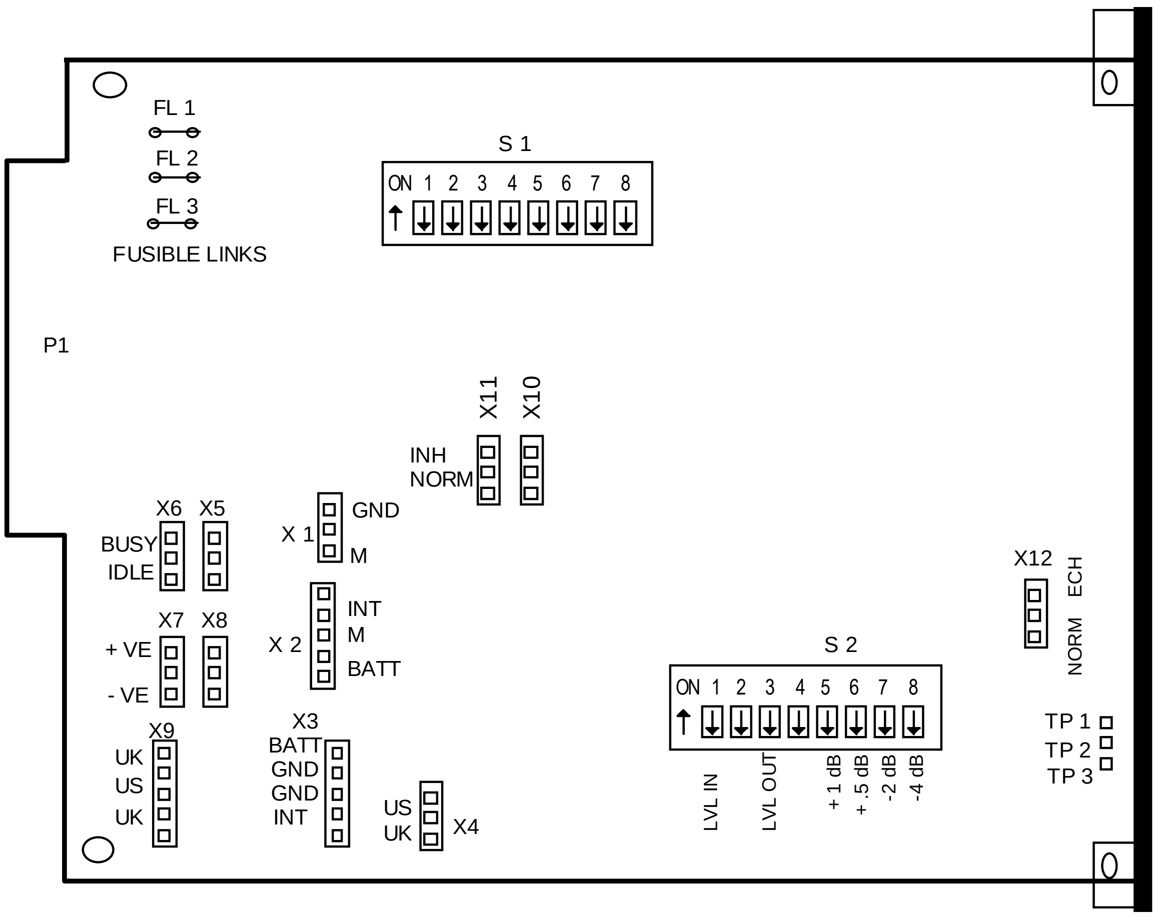


Figure 4-44 Universal Voice Card, Option Switch and Jumper Locations

Table 4-79 Universal Voice Card Voice Encoding Option Selections

Modu-lation	Voice Card Type	Switch Positions									
		S1-1	S1-2	S1-3	S1-4	S1-5	S1-6	S1-7	S1-8	GDC Part No.)	Application
PCM	PCM	ON	ON	ON	OFF	ON	ON	OFF	ON	036P265-002 036P265-003	Provides PCM encoding at 64 Kbps with-2 kHz overhead (for compatibility with P/N 036P250 Voice II/ PCM cards).
PCM-T	LO-HPCM-VF	OFF	ON	OFF	ON	ON	ON	OFF	OFF	036P265-002 036P265-003	Provides PCM encoding at 64 Kbps with 800-Hz overhead.
ADPCM	ADPCM	ON	ON	ON	ON	ON	ON	ON	OFF	036P265-003	Provides ADPCM encoding at 32-KHz with 2 kHz overhead (for compatibility with P/N 036M200 and 036M201 cards).
UADPCM	UADPCM IF	OFF	ON	OFF	ON	OFF	ON	ON	OFF	036P265-003	Provides ADPCM voice encoding with variable rates and 800-Hz overhead.
ASP	ASP	OFF	ON	ON	OFF	ON	ON	OFF	OFF	036M265-001	Provides ASP encoding at a rate of 16-KHz, A-law, PCM with PCM-T fallback mode.
ASP	MASP	OFF	ON	OFF	OFF	ON	ON	OFF	OFF	036M265-001	Provides variable rate ASP.
TOR	TOR VF	OFF	ON	ON	OFF	OFF	ON	OFF	OFF	036P265-002 036P265-003	Provides TOR encoding
CADM	CADM VF	OFF	ON	ON	ON	ON	ON	OFF	ON	036P265-012	Provides CADM encoding, Mu-law PCM at 16-KHz.

Table 4-80 Universal Voice Card Input/Output Level Option Selections (Switch S2)

Feature	Selection (dBm)	Switch (S) Desig.	Switch (S) Position	Application
Nominal Input Level	–16 0	S2-1 S2-1	ON OFF	The nominal input level is determined by the nominal output level of the telephone equipment connected to the channel. If actual output levels of connected equipment vary from the nominal levels, Switch S2 may be set to achieve an additional level of compensation.
Nominal Output Level	0 +7	S2-3 S2-3	OFF ON	The nominal output level for the channel is either 0 dBm or +7 dBm. This selection depends on the nominal input level specified for the telephone equipment connected to the channel. Adjusting output level to get more compensation is a software option.
Note: Switch S2 is located on the Analog Universal Voice Card.				

Table 4-81 Universal Voice Card Input Level Adjustment Options (Switch S2)

S2-5 (+1 dB)	S2-6 (+0.5 dB)	S2-7 (–2 dB)	S2-8 (–4 dB)	Input Compensation (dB)	Applications
ON	ON	OFF	OFF	+1,5	Switches S2-5 through S2-8 select attenuation or amplification for the voice input level. This compensates for cable losses or improper output levels from connected telephone equipment. The switch selects a level of compensation from +1.5 dB to –6.0 dB in 0.5 dB steps. Each segment of Switch S2 selects a level of attenuation or amplification; the individual steps are added to produce a particular level. A level is selected to compensate for some measured deviation of the output level of equipment connected to the channel. The deviation is the difference between the actual level and the nominal level (selected on Switch S2-1).
ON	OFF	OFF	OFF	+1.0	
OFF	ON	OFF	OFF	+0.5	
OFF	OFF	OFF	OFF	0	
ON	ON	ON	OFF	–0.5	
ON	OFF	ON	OFF	–1.0	
OFF	ON	ON	OFF	–1.5	
OFF	OFF	ONB	OFF	–2.0	
ON	ON	OFF	ON	–2.5	
ON	OFF	OFF	ON	–3.0	
OFF	ON	OFF	ON	–3.5	
OFF	OFF	OFF	ON	–4.0	
ON	ON	ON	ON	–4.5	
ON	OFF	ON	ON	–5.0	
OFF	ON	ON	ON	–5.5	
OFF	OFF	ON	ON	–6.0	

Table 4-82 Universal Voice Card E And M Signaling Option Selections

Signaling Type	Jumper Positions				Signaling States	
	X1	X2	X3	X4, X9	IDLE	BUSY
1	GND	M	GND	U.S.	0 V dc	–12 to –48 V dc
2	GND	M	BATT	U.S.	OPEN	–12 to –48 V dc
3	GND	M	BATT	U.S.	0 V dc	–12 to –48 V dc
4	M	BATT	GND	U.S.	OPEN	0 V dc
5	M	BATT	GND	U.S.	OPEN	0 V dc
U.K. (SSDC5)	M	BATT	INT/GND	U.K.	OPEN	0 V dc
2*	M	INT	INT	U.S.	OPEN	0 V dc

* For back-to-back signaling with no external battery.

NOTE: Headers X1, X2, X3, X4, and X9 are located on the Universal Voice Card.

Table 4-83 Idle/Busy E-Lead And Voltage Polarity Option Selections

Jumper	Jumper Position	Application
X5 X6	BUSY BUSY	When the E-Lead is used for signaling, loss of TMS-3000 power results in a BUSY E-Lead.
X5 X6	IDLE IDLE	When the E-Lead is used for signaling loss of TMS-3000 power results in an IDLE E-Lead.
X7 X8	+VE +VE (Positive Polarity)	Jumpers X7 and X8 select polarity for the E-Lead. These jumper positions (+ or –) depend on the requirements of the interface. Normally, the M-Lead detector of the channel equipment will provide only a negative voltage and requires a negative (–) polarity E-Lead setting. But if the M-Lead detector provides a positive voltage, the E-Lead polarity should be set to positive (+).
X7 X8	–VE –VE (Negative Polarity)	

NOTE: Headers X5, X6, X7, and X8 are located on the Universal Voice Card.

Table 4-84 E-Lead Service Interruption Options

X10	X11	Application
NORM	NORM	The E-lead is forced to IDLE 0.5 seconds after a service interruption and reverts to BUSY after an additional 2.5 seconds.
NORM	INH	The E-Lead is forced to BUSY 3.0 seconds after a service interruption.
INH	NORM	The E-Lead is forced to IDLE 0.5 seconds after a service interruption.
INH	INH	The E-Lead is not affected by a service interruption.

NOTE: Headers X10 and X11 are located on the Universal Voice Card.

Echo Canceller Card

The Echo Canceller Piggyback Card is a double-sided, printed circuit card assembly with physical dimensions of 4.4 inches by 3.95 inches. It mounts on the Universal Voice Card and is supported by four standoffs. Electrical connections are made by means of a 13-pin header. The Echo Canceller Card contains one right-angle DIP switch mounted near its upper edge, enabling options to be selected without removing the card from the Universal Voice Card.

Echo Canceller Options

The Echo Canceller Card options are selected using Switches S1-1 through S1-5 on the Echo Canceller Card.

In the TMS-3000, the Residual Echo Suppressor option on the Echo Canceller Card is no longer supported. The use of this option may cause the Universal Voice Card to synchronize incorrectly after a loss of sync due to link errors. The Adaptive Bulk Delay feature now has a factory default value of 0 dBm .

Figure 4-45 locates option selection Switch S1. *Table 4-85* defines the option selections.

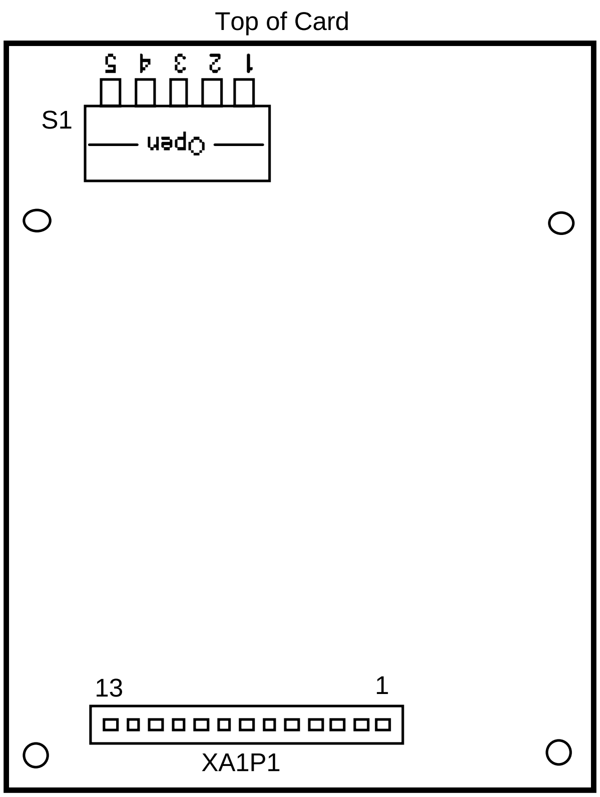


Figure 4-45 Echo Canceller Card Option Switch Location

Table 4-85 Echo Canceller Card Option Selections

Feature	Selection	Switch (S) Desig.	Switch (S) Position	Application
Bulk Delay	0 ms fixed delay	S1-2 S1-3	Closed (Down) Closed (Down)	These switch positions control the length of the bulk delay. The bulk delay is required to enable echo cancellation on tail circuits with a delay in excess of 16 ms. In most situations, the bulk delay value can be determined by trying the three possible settings (0 ms, 7 ms and 14 ms) and then selecting the setting that provides the best results. In cases where the length of the tail circuit varies greatly with different call routings, then the "Adaptive Delay'' setting should be selected to allow the length of the bulk delay to adapt itself to the optimum value for each call. The Echo Canceller Adaptive Bulk Delay Algorithm may not function properly if the digital transmit and receive levels on the voice channel card are not set to be the same and the Echo Canceller may not converge to this situation. It is essential to adjust the gains and losses in the analog circuitry so that a 0 dBm signal at each end of the link results in the same signal level (measured in dBm) at the analog input/output of the PCM CODEC. Therefore, the factory default setting of Bulk Delay option is now 0 ms.
	7 ms fixed delay	S1-2 S1-3	Closed (Down) Open (Up)	
	14 ms fixed delay	S1-2 S1-3	Open (Up) Closed (Down)	
	Adaptive Delay (0 ms initially)	S1-2 S1-3	Open (Up) Open (Up)	
External Line Enable/Disable	Disable Always	S1-4 S1-5	Closed (Down) Closed (Down)	These switch positions control the operation of the external control line. The control line is used by external equipment to enable or disable the Echo Canceller, when required. With the switches set to the external control line. "Disable'' or "Enable'' position, the Echo Canceller is either disabled or enabled when the external control line is grounded.
	Enable Always	S1-4 S1-5	Open (Up) Open (Up)	
	Disable when external control line is grounded	S1-4 S1-5	Closed (Down) Open (Up)	
	Enable when external control line is grounded	S1-4 S1-5	Open (Up) Closed (Down)	With the switches set to the "Disable Always'' or "Enable Always'' position, the Echo Canceller is permanently disabled or enabled regardless of the state of the external control line.

NOTE: Switch S1-1 is to remain in Open (Up) position at all times.

The residual echo suppresser option on the Echo Canceller Card may cause the Universal Voice Card to synchronize incorrectly after a loss of sync due to link errors. The Adaptive Bulk Delay has a factory default of 0 dBm.

Variable Rate ASP Piggyback Card

Either a fixed or variable rate ASP Piggyback card may be installed on the Voice II/ASP or UVC/ASP Channel Module. With the *ASP Piggyback Card GDC 036P259-001* installed, fixed rate ASP at 16 Kbps is provided. With *ASP Piggyback Card, GDC 036P259-002* installed, variable rate ASP rates of 10, 11, 12, and 16 Kbps may be selected by means of the software. The location of option Switch S1 on the ASP Piggyback Card is shown in *Figure 4-45*. The option selections for fixed or variable rate ASP are described in *Table 4-86*.

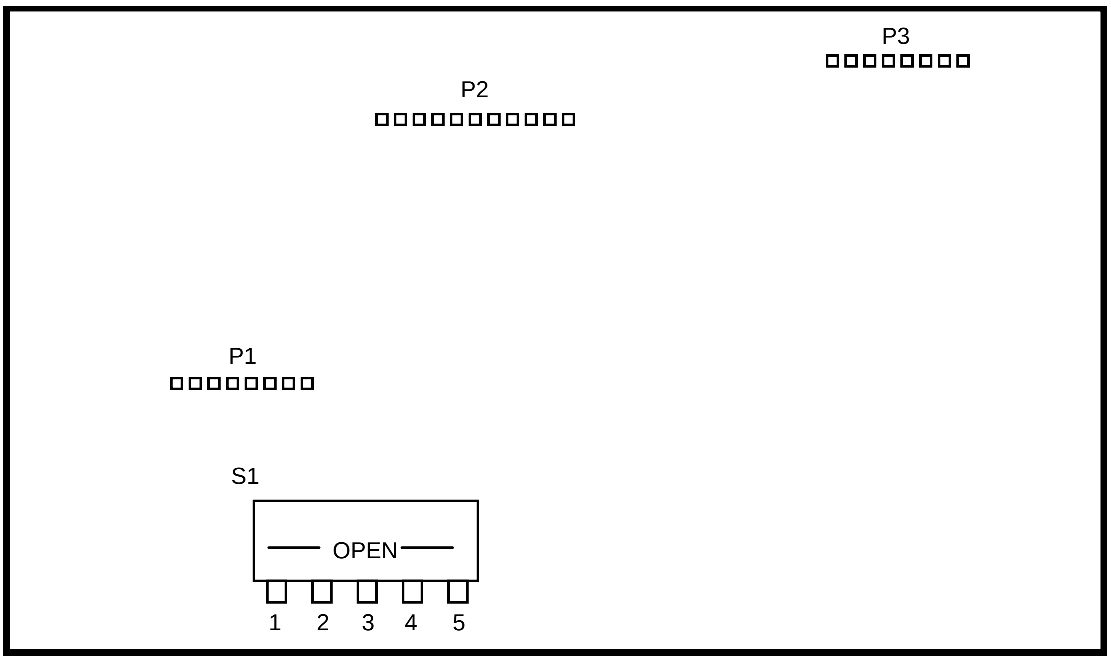


Figure 4-46 Fixed or Variable Rate ASP Piggyback Card, Option Switch S1 Location

Table 4-86 Fixed or Variable Rate ASP Piggyback Card, Option Switch S1 Selection

Switch	Fixed Rate ASP (ASP Piggyback Card 036P259-001)	Variable Rate ASP (ASP Piggyback Card 036P259-002)	Application
S1-1	ON	ON	Fixed rate ASP switch positions provide fixed rate ASP at 16 Kbps.
S1-2	OFF	OFF	
S1-3	OFF	OFF	
S1-4	ON	OFF	Variable rate ASP switch positions provide software selectable, variable rates of 10, 11, 12, or 16 Kbps.
S1-5	OFF	OFF	
		OFF	

Other Channel Cards

There are several other channel cards that can be used in the TMSC. The technical manuals that contain detailed information about these cards are listed in *the Preface*. *For OCM channel cards refer to GDC 036R340-000*.

Summary

This chapter provided information on the installation and optioning of the TMSC channel cards. Part numbers and option selection were discussed in this chapter.

Chapter 5, System Initialization

Scope

Topics in this chapter include:

Overview

This chapter covers the procedures for the initial setup of your controller.

Initial Setup for TMS Controllers (GTS V2.2 and earlier)

The following procedure should be followed only when you first receive your controller or after moving it.

1. Set up your PC Controller in accordance with the instructions from the manufacturer.
2. Connect cable *GDC 028H303* to Serial Port 1 of the Controller and connector J6 of the TMSC backplane. You may need to add a *GDC shielded EIA/TIA-232-E extension cable (GDC 028H506-XXX or other)* that carries Pins 2, 3, and 7. The two cables are combined in *GDC 028H004-XXX*.

Note *The TMS Controller can be connected directly to a modem through which it can communicate with a NETCON at a remote node. A NETCON-CRT link is described in GDC 058R675 and Chapter 4 of this manual. When the PC is connected to the TMS through Serial Port 0, Serial Port 1 can be used to link a modem on NETCON to the PC only if the PC monitor and keyboard are not used to operate Controller software and you are logged off of the controller. Serial Port 1 on the back of the PC is the leftmost I/O port. Serial Port 0 is to the right of Serial Port 1.*

---

3. Apply power to the Controller when all previous controller component connections are completed (*See Steps 1 and 2*).

- Move the ON/OFF switch located in the back of the system unit to ON.
- Turn on the color monitor by pushing the ON/OFF button located at the bottom of the monitor to ON. A green LED indicates that the power is on.

Note *In most cases, SCO XENIX and TMS software is loaded at General DataComm before your system is shipped.*

The procedures in this manual are for loading SCO XENIX, INFORMIX, and GTS V2.2.0 software. If you are loading an earlier version of software, refer to the appropriate GDC 036R602-nnn or GDC 036R603-Vnnn manual.

Initial Loading of Software

Circumstances may occur when you need to initialize a system that does not already have proper software.

The procedures needed to install SCO XENIX SYSTEM V for use with the Controller follow. To install the XENIX operating system, approximately seven disks are loaded onto the hard disk. This procedure may take up to several hours to complete.

Note *When responding to prompts from the computer, use all lowercase letters except where uppercase letters are specifically required (e.g., Serial and activation key numbers).*

What You Need

To install the XENIX System you need:

- A Model 486 or better computer containing a minimum of 5 Megabytes of RAM (*8 megabytes recommended*).
- One hard disk with a minimum of 80 megabytes of storage is required (*200 megabytes recommended*).
- If *not* using an ESDI, IDE (Intelligent Drive Electronics) computer, a copy of the list of bad tracks located on top of the hard disk drive (if your disk supplies such a list)
- One double-sided 1.44 Mb (3.5-inch) floppy drive
- XENIX Operating System floppy disks (version 2.3.4)
- Software serial number supplied with the XENIX disks
- Software activation key supplied with the XENIX disks

To install the Informix data base you need the hardware listed above with the XENIX operating system loaded, plus the Informix Runtime diskette, Informix serial number, and Activation Key.

Setup procedures are given for the Pentium 100, Pentium 90, Intel 486-66, Zenith 386, Zenith 486SX 25MHz, Zenith 486DX 33MHz, Zenith 433Dh 33MHz PCs and Zenith 486DX Z-Select 100. Use the procedure that is appropriate for your PC.

Using Large Hard Drives

SCO XENIX cannot recognize hard drives that are larger than 1023 cylinders or 16 heads. To use PCs with these larger drives, you must reconfigure the hard drive parameters in your CMOS or ROM setup utility to use 1023 cylinders or less. Unfortunately, doing so renders otherwise usable disk space unusable. On the Intel Pentium 100 the setup we recommend is as follows:

1022 cylinders, 16 heads, 63 sectors

Using Other PCs Not Listed

Because of the extremely large variety of PCs on the market, GDC cannot possibly test all PC configurations for XENIX compatibility. If you wish to use other PCs, you should be aware that they may or may not work with SCO XENIX.

SCO has attempted to test as many PC makes, models, and hardware configurations as possible. There are many models that work, but some do not. Please record the exact model number of your prospective PC and contact General DataComm Service to ensure it is supported by SCO XENIX. There are some models that require special XENIX boot disks (n1) and special GDC GTS kernel disks.

The best approach is to try loading the XENIX software. If you encounter problems with the loading procedure, contact technical support. In general, most 486 or Pentium PCs should be compatible. The main points to follow are:

1. Avoid using SCSI hard drive adapters as they are troublesome to SCO XENIX.

2. Ensure that the number of hard drive cylinders is less than 1024 and the number of heads does not exceed 16.

Pentium 100 Setup Procedures

For the Intel 100 MHz Pentium to function properly, the BIOS must be configured as follows:

1. Re-boot the machine.
2. Press `F1` when the message `Press F1 key` appears on the screen.
3. Select the top menu-line item `Main` with the left or right arrows.

```
System Date <date>
System Time <time>
```

```
Floppy Options <Press Enter here for sub-menu>
```

(Select your floppy configuration if different from display)

```
Primary IDE Master <Press Enter here for sub-menu>
```

IDE device configuration: (Select either `User Definable` or `Auto Configure`)

Note *This setting depends on the hard drive installed. If the drive has less than 1024 cylinders, you may select* `Auto Configure`*. If it does not, then the drive settings must be manipulated from the original settings to make the drive appear that is less than 1024 cylinders. This is necessary for XENIX to recognize the hard drive. If these changes have been made, the parameters appear below this field.*

Below is a suggested setup. These settings allow XENIX to recognize the drive, but give you about 503 Mbytes of useable space on a 1 Gigabyte hard drive.

Number of cylinders: 1022

Number of heads: 16

Number of sectors: 63

Maximum capacity: 503

Press `ESC` to return to `MAIN` menu.

After returning to the main menu, the following drives should be listed as `Not Installed`:

```
Primary IDE Slave

Secondary IDE Master

Secondary IDE Slave


Language: English <Grayed Out>
```

```
Boot Options <Press Enter here for sub-menu>
```

```
First Floppy

Second Hard drive
```

```
All others Disabled

System prompt Enabled
Type-matic programming rate Default

Hit <ESC> to return to the MAIN menu
Video Mode EGA/VGA
Mouse Not installed

Base Memory  640KB
Extended Memory 15360KB *(May Differ)
```

4. Press the right arrow and highlight ADVANCED on the top menu line.

Check the following fixed entries:

```
Processor type  Pentium Family
Processor speed 100 MHZ.
Cache size 256K
Peripheral configuration <Press enter here for sub-menu>
Configuration mode Auto
```

The following six entries are grayed out:

```
PCI IDE interface Enabled
Floppy Interface Enabled
Serial port 1 Address COM1 3F8 IRQ4
Serial port 2 Address COM2 2F8 IRQ3
Serial port 2 IR MODE Disabled
Parallel Port Address LPT1 378 IRQ
Parallel port mode Compatible
```

Press <ESC> to return to ADVANCED main menu.

```
Advanced Chip-set configuration <Press enter here for sub-menu>

Base memory size 640KB
ISA LFB size Disabled
Video Palette snoop Disabled
Latency timer 66
```

```
PCI burst Enabled
```

Press <ESC> to return to ADVANCED main menu.

Check the following entries:

```
Power management cnfg. <Press enter here for sub-menu>


Advanced power management Disabled
```

Press <ESC> to return to ADVANCED main menu.

```
Plug and Play <Press enter here for sub-menu>
  Configuration Mode Use setup Utility
  ISA shared memory size 64KB
  ISA shared memory base address D0000h
  IRQ5 Used by ISA card
  all others Available
```

Press <ESC> Save changes, re-boot.

Note *In certain pentium platforms, if a DIGIBOARD card is installed, when exiting the BIOS configuration, you see this Digiboard error when booting XENIX:*

CMDMAX-CMDSTART

After XENIX restarts, log in as `root` *and at the # type:*

etc/shutdown 0

Press `enter` *to re-boot the machine again.*

Pentium 90 Setup Procedures

Use the following procedures to set up the parameters needed to run GTS software on a Pentium 90 machine.

1. While the machine is booting up, after the memory check, press F1 when prompted.
2. You see the following display. If necessary, change your settings to correspond to the ones below.

```
      Main   AdvancedSecurityExit
System Date:YYYY DD MMM
System Time:HH:MM:SS


Floppy A type:1.44 MB, 3.5 Inch
Floppy B type:Disabled
```

```
Hard disk type:c:  <type of drive installed>
      d:  not installed
      e:  not installed
      f:  not installed
Language:English

Boot Options:<PRESS ENTER>
```

3. Press `Enter`. You see the following sub-menu:

```
Boot sequenceA:  first then C:

System Cacheenabled
Boot speedturbo
Num lockOFF

Setup Promptenabled
Hard disk pre-delay3 seconds
Type-matic rateprogramming refresh
```

4. Press <Esc> to return to the previous menu. The following fields are fixed:

   `Video mode:EGA / VGA`

   `Mouse:not installed`

   `Base memory:640KB`

   `Extended memory:15360K` (may differ)

5. Press the right arrow key to display the advanced setup screen.

6. Highlight `Peripheral Configuration` and press `Enter`. You should see the following fields. Correct if needed:

```
(Fixed Fields)
Configuration modeAuto
PCI IDE InterfaceEnabled
Standard IDE InterfaceEnabled
Floppy InterfaceEnabled

(Fixed Fields)
Serial Port 1 Address COM13F8H
Serial Port 2 Address COM22F8H
```

```
Parallel Port Address LPT1378H


Parallel Port ModeCompatible


(Fixed Fields)

Serial Port 1 IRQ4

Serial Port 2 IRQ3

Parallel Port IRQ7
```

7. Press <Esc> to return to the previous menu.
8. Highlight `Advanced Chipset` and press Enter. You should see the following fields. Correct if needed:

```
Base memory size:640KB

ISA Bus speed:  Compatible

Byte merging:   Enable

PCI IDE prefetch buffersEnabled

ISA LFB size    Disabled

Latency timer (PCI Clocks)66
```

9. Press <Esc> to return to the previous menu.
10. Highlight `Power management configuration` and press `Enter`. You should see the following field. Correct if needed:

```
Advanced power management Disabled
```

11. Press <Esc> to return to the previous menu.
12. Highlight `Plug and play configuration` and press `Enter`. You should see the following fields. Correct if needed.

```
Configuration mode:Use setup utility


ISA shared memory size 64KB

ISA shared memory base address D000h


IRQ 5 used by ISA card

IRQ 9 available (fixed field)

IRQ 10 available (fixed field)

IRQ 11 available (fixed field)
```

Note *The optional Digiboard card will not function properly unless the ISA shared memory size and and shared mamory base address are set correctly.*

---

13. Press <Esc> to return to the previous menu. Press F10 (save and exit).

Continue with the procedure *Starting XENIX From the Boot Floppy Set*.

INTEL 486-66 Setup/Configuration Program

When loading software on a 486, be aware that this computer has an IDE (Intelligent Drive Electronics) hard drive. The drive is low level formatted at the factory by the manufacturer.

A DOS "Prep" or any other "low level format" utility must not be used on this or any other IDE hard drives. Doing so erases all preconfigured information that was factory installed and renders the drive unbootable and unusable.

You don't have to do a XENIX badtrack scan as the badtracks have already been identified and flagged at the factory. To bypass this step, type: Q

The Setup/Configuration Program lets you tell the computer how your system is configured. The following procedure is *only* for an Intel 486-66. To set up the Intel, follow these steps:

1. Reboot the machine.
2. When the number `135` appears in the upper left hand corner of the screen, hit the F1 key.
3. Ensure that all of the following parameters are set as indicated:

```
Onboard diskette:Enabled
Diskette A: 3.5" 1.44 MB  (may vary)
Diskette B:Not Installed
Onboard IDE:Enabled


Hard Drive 1: Type 2 CYL HD PRE LZ SEC SIZE
                      723 13  0  0  51  234 (may vary)
             2: Not Installed

      User definable drives 2 & 3
      Boot Device Diskette or hard drive
      Post memory test promptDisable
      Post setup promptDisable
      Scan flash user areaDisable
      Speaker     Enable
      On board mouseDisable
      Keyboard    [Installed]
      Numlock on at bootNo
      Password    Not installed
```

```
(Hit Page Down key for next page)

Base memory [640Kb]   (may vary)
Extended Memory[7168Kb]  (may vary)
Base memory above 512K Enable
Parallel portAddress 378H:Output only
Serial Port1:Address 3F8H
Serial Port2:Address 2F8H
Video Type  [VGA/EGA]
Video Horizontal refresh 31.5 - 37.8 Hz
VGA mode refresh rate60 Hz
On board BIOS mappingTo E0000H

(Hit Page Down key for next page)
CPU Speed   Fast
Cache       Memory only
Refresh modeSynchronous
Shadow      disable all ranges)
.
.
Power save modeNone
Screen blankDisabled
Hard drive spin down Disabled
```

Continue with the procedures *Starting XENIX From The Boot Floppy Set*.

Hardware Checkout Using ROM Monitor Program (16MHz Zenith)

A special test program (the monitor program) is contained in a ROM on the CPU card. The CPU card is located in the system unit. The ROM monitor program provides the following advantages:

- Automatically tests various circuits every time you turn the computer on.
- Allows you to select tests from the keyboard to check various functions of the computer
- Lets you enter configuration data from the keyboard
- Displays a color bar pattern used to adjust the video display
- Selects a video/scroll mode required by your video monitor and video card
- Contains a debugging routine for machine language programmers.

To access the monitor program, press the Ctrl (control) and Alt (alternate) keys, and then press the Insert key. Depending on the configuration of your particular Zenith system, there is a time delay. The following message appears on the screen:

```
MFM-300 Monitor, Version X.X

Memory Size: 640 K

Enter "?" for help.

_>
```

Press the question mark (?) key and ENTER. A summary of the ROM monitor commands appears and their syntaxes are displayed. Here are six commands used most frequently:

?: Help

B: Boot

C: Color bar

V: Set Video/Scroll

TEST

SETUP

The "?" command displays the Help menu.

The "B" command manually boots any drive installed in your system. The syntax involved in the boot command follows:

```
B[{F/W}] [{0/1/2/3}] [:<partition>] <Enter>
```

where B stands for Boot, F for Floppy, and W for the Winchester hard disk drive. Reference numbers 0, 1, 2, or 3 refer to the drive numbers to boot from. Partition function (:) specifies the partition number from the hard drive.

To boot from the hard disk drive, type BW. The computer boots from the default partition. To boot from a hard disk drive partition, type BW followed by 0 (or 1 if you have more than one hard disk drive), a colon (:), and the partition number you want to boot from.

The "C" command displays a 16-bar color pattern to adjust the contrast and brightness of the display. To access this program, type C and press `Enter`.

The "V" command is used to set both the video mode and scroll mode. The video mode determines the number of characters per line and the number of lines per screen and whether the display is color or monochrome. The scroll mode determines how information is scrolled, or moved, on and off the screen. To access, type **V** and press `Enter`.

The "TEST" command runs a series of built-in tests that diagnose problems you may be having with your computer. To access, type TEST and press `Enter`.

The SETUP command accesses the Setup/Configuration Program. To access this program, type **SETUP** and press `Enter`.

To access the rest of the ROM monitor commands, follow the same syntax procedure as discussed in the SETUP command.

Zenith 386 Setup/Configuration Program

The Setup/Configuration Program lets you tell the computer how your system is configured. The following procedure is *only* for a Zenith 386.

You can set the time and date, enter the amount of memory installed in your computer, choose the drive you want your computer to boot from when you first turn it on, enter the type of video card you have, and tell the computer the number and type of floppy and hard disk drives you have so it recognizes them. You can slow down the computer for special applications. You can enter all this information from the keyboard instead of setting switches and installing jumpers like on earlier computers.

Once you use the Setup/Configuration Program to configure your computer, the only time you need to use it again is if you change the configuration for your computer or if you replace the battery on the backplane board.

Accessing the Program

To access the Setup/Configuration Program:

1. At the "Boot" prompt,

   :

   press and hold the Ctrl (control) and Alt (alternate) keys down, then press the **Insert** key. After a short delay, you see the Monitor prompt on the screen.

2. Type Setup and press `Enter`.

The reverse-video images you see on the display are the factory selections in each field or group of options.

Directions for proceeding through the program are located at the bottom of the display. These directions change as you go through the program.

Time and Date

When you enter the time and date, use:

- The number keys to type in the time and date
- The `Enter` key to lock in the selection
- The Backspace key to return to a position if you make a mistake.

The time is entered in a 24-hour format as shown below. It is not necessary to type the colons, they are entered automatically.

XX:XX:XX

hour (01-24) minutes past the hour (00-59) seconds into the minute (00-59)

The date is entered in the following format. It is not necessary to type the slashes, they are entered automatically.

XX/XX/XXXX

month (0-12) day (01-31) year (199X)

The rest of the Setup/Configuration Program reflects settings that were entered at the factory. If these settings agree with your system configuration, there is no reason to change them. Change only the reverse-video selections that do not reflect your system configuration. Also, if you add to your system, these settings must be changed to reflect the additions. In the remaining fields, use:

- The arrow keys to move from one field to another.
- The Space Bar and Backspace keys to make a selection in the field. Your selection is locked in when you move to a new field.
- The Esc (escape) key to exit from the program when you are finished.

These are the choices you can make:

DST (Daylight Savings Time) — Select Enabled.

Base Memory Size — Choose 640K of base memory.

Expansion Memory — Choose 4096K of expansion memory.

Floppy Drive 0 — Indicates the size of the first floppy drive. Your computer is shipped from the factory with a 1.44 Megabyte 3.5-inch drive.

Floppy Drive 1 — Optional, an extra drive can mount here.

Boot Drive — Choose Floppy, then Hard Disk.

Video Display — Select Enhanced Graphics.

Video Refresh Rate — Select the entry that describes the power line frequency in your area. In the United States, it is typically 60 Hz. If you have the wrong setting, the video screen flickers.

Speed — Select Fast mode.

Hard Disk Drive 0 — This section of the Setup/Configuration Program menu reflects the specifications of your high-capacity hard disk drive.

Continue with the procedure *Starting XENIX From The Boot Floppy Set*.

Zenith 486SX 25 MHz and 486DX 33 MHz Setup Procedures

When loading software on a Zenith 486, be aware that these computers are equipped with IDE (Intelligent Drive Electronics) hard drives. The drives are low level formatted at the factory by the manufacturer.

You don't have to perform a XENIX badtrack scan as the badtracks have already been identified and flagged at the factory. To bypass this step, type: Q

The Zenith 486 PCs have an EISA bus or an ISA bus. To identify which you have, look at the disks supplied with your 486. The Configuration Utilities Disk is marked as ISA or EISA. There is no longer a "ROM" setup screen available to configure the computer from the ALT-CTRL-INS key sequence. To configure the computer, you now must use the EISA or ISA configuration utility disk that is supplied with the instruction manual (Exception: Zenith

486DX-66MHz Z-Select 100). The following is a brief description of how to use this configuration utility. (*This must be done before SCO XENIX is loaded on the hard drive)*:

1. Turn PC off.
2. Insert the Configuration Utilities Disk into the boot drive.
3. Turn PC on.
4. At the EISA Screen press `Enter` to continue.

Note *Throughout this manual, the designation* `Enter` *refers to the key that is labelled* `Enter.`

---

5. At the `Welcome` window, press `Enter`.
6. At the `Main Menu` screen use the arrow keys to highlight `Configure Computer` and press `Enter`.
7. At the `Configure Computer` window, use the arrow keys to highlight `Configure Computer — Advanced Method` and press `Enter`.
8. A screen `System Configuration Overview` appears, then a window saying `Loading Configuration Files`.
9. When the files are loaded from the floppy into memory, a window appears with the message: `Configuration Files Loaded – Z-486 System Version 1.nn, Continue`, Press `Enter`.
10. At this point, a screen appears showing you the boards installed in the system, e.g., System board, monitor card and hard/floppy drive controller. Use the arrows and highlight `Z486 System Board` and press `Enter`. You do not have to enter through each slot separately. No matter where you enter you can configure the entire system since it is only a starting place. So if you start at the system board, you start at the beginning.
11. Using the arrow keys scroll downward and verify that each entry of each installed option board is the same as the following lists.

Z 486 System Board

```
SYSTEM BOARD INTERNALVersion n.nn
  Speed            Fast
  Slow Speed OptionAT Compatible for 25 MHZ CPU
CACHE: QUEUE
  Cache Options   Cache : ONQueue : 0
BOOT DEVICE
  Boot Device     Floppy, Then Hard Disk
SYSTEM VIDEO PARAMETERS
  Default Video TypeEnhanced Graphics
```

```
    Video Refresh Rate :  Slushing  60 Hz :  Non-Slushed
  SYSTEM BOARD MEMORY
    System Board Base Memory Base:  640K
    System Board Extended Memory Extended:   3072K
    System Board EMS MemoryEMS:224K
```

Note that this memory configuration may differ from other units.

```
  NON-SYSTEM BOARD MEMORY
    Non-Configurable Additional Base memory      Base: 0K
    Non-Configurable Additional Extended memory  Base: 0K
  SERIAL PORTS
    Serial Port 1COM1
    Serial Port 2COM2
  PARALLEL PORTLPT1
  Cachability of Slushed ROMsOEM and BIOS Enabled
```

IDE/Floppy Controller Board Mass Storage Device

```
  IDE SUB-SYSTEM
    IDE Controller        Enabled
    IDE Drive 0           IDE Auto-Configure
    IDE Drive 1           No Drive Present
  FLOPPY SUBSYSTEM
    Floppy Drive Controller    Enabled
    Floppy Drive 0 3 1/2 1.44M Floppy Present
    Floppy Drive 1No Floppy Present
    SCSIDisable
```

Z649 Video Adapter Board

```
  Host IRQ                      IRQ10
  Host Ports                    Ports 290-29F
  Video Daughter Card           Installed
```

The video information may vary depending on your video type installed.

1. These entries should be "factory defaults" but it is possible that they are incorrect or have inadvertently been changed at some point. If you need to change any of these selections, just highlight the selection using the arrow keys and press `Enter`. Use the arrows to highlight the corrected selection. If you have to move left to right to multiple selections, you need to use the TAB key. In some selection lists (like the memory

screen), you may need to scroll up and down using the arrow keys. After highlighting the entry you want, press `Enter`.

2. After all changes have been made, press the F10 key. At the top of the screen use the arrow keys to highlight `System`, and press `Enter`. At the exit window, highlight `Exit` using the arrow keys and press `Enter`. Highlight `Save Configuration and Exit` and press `Enter`. If you were satisfied with all the selections and did not change anything, exit through the `Exit, no change` menu selection to be safe.
3. At the yellow window press `Enter` to reboot. If no configuration error messages appear at the top of the screen, place the SCO XENIX N1 boot disk in Drive 0 and reboot.

Additional Notes:

- If an optional DIGIBOARD/4E is installed, it is not seen by the EISA configuration utility. When you boot up after installing GTS software, you see a message that the board is or is not installed.
- It is a good idea to make a copy of this disk and use that copy to configure the system. Use the DOS diskcopy utility.

Continue with the procedure *Starting XENIX From The Boot Floppy Set*.

Zenith 433Dh 33 MHz Setup Procedures

The Zenith 433Dh comes with only one serial port. For an additional serial port (Com 2), you must add the HP24540B Serial/Parallel Interface Card. This card also supports an additional printer port. Before inserting the card, verify that the following jumpers are set correctly:

Jumpers P1-P4 set for SER-B

Jumpers P1-P2 set for PAR-B

Mode jumper set for AT

When loading software on an IDE or ESDI hard drive, be aware that these computers are equipped with IDE (Intelligent Drive Electronics) hard drives. The drives are low level formatted at the factory by the manufacturer.

You do not have to perform a XENIX badtrack scan as the badtracks have already been identified and flagged at the factory. To bypass this step, type: Q

The Zenith 433Dh PC has an ISA bus. The Configuration Utilities Disk is marked as ISA. There is no longer a ROM setup screen available to configure the computer from the ALT-CTRL-INS key sequence. To configure the computer, you must use the ISA configuration utility disk that is supplied with the instruction manual. Here is a brief description of how to use this configuration utility. *This must be done before SCO XENIX is loaded on the hard drive*:

1. Power off the PC.
2. Insert the ISA Configuration Utilities disk into the boot drive and apply power to the PC.
3. The Zenith Logo screen comes up; press `Enter`.
4. When the list of configurations appears, select it and press `Enter`.
5. The configuration screen appears. Ensure that each parameter is set as described below. To change settings, highlight the setting you wish to change with the cursor and press

`Enter`. This brings you to a sub-menu. Use the tab and arrow keys to change the selections. When changes are completed, press <Esc> (Escape key) and then F10. Select Save Configuration and reboot the PC.

Settings:

```
System BoardV1.07 (may differ)

Speed       Fast

Cache       Cache On

Boot Device Floppy then Hard Drive

System Board VideoVideo Enabled

Video SettingsEGA/VGA:60HZ:Slushed

System Board Memory8m => 640K + 7 (may differ)

*Hard Drive SystemController Enabled
```

(Sub Menu)

```
      ControllerDrive 0Drive 1

      *Enabled    *Auto IDE  None

Floppy Drive SystemFloppy Drive Controller Enabled

LAN SystemDisabled

Windows AcceleratorNot Present

SCSI PortSCSI Disabled

Serial PortCOM1

Parallel PortLPT1

PS/2 MouseDisabled

Optional Serial Port*Disabled
```

* Note that if a second serial port is added, it should always be disabled.

Continue with the procedures *Starting XENIX From The Boot Floppy Set*.

Zenith 486DX-66MHz Z-Select 100 Setup Procedures

When loading software on a Zenith 486, be aware that these computers are equipped with IDE (Intelligent Drive Electronics) hard drives. The drives are low level formatted at the factory by the manufacturer.

You do not have to perform a XENIX badtrack scan as the badtracks have already been identified and flagged at the factory. To bypass this step, type: Q

Following are the setup parameters needed to run GTS software on the Z-Select 100 486. These must be performed before loading XENIX on the PC. To start the procedure, press CTRL-ALT-S.

```
Standard System Parameters

System Time:xx:xx:xx    Numlock on at boot?
```

```
System Date:xx/xx/xx          [yes]  (your preference)
Diskette A: 3.5" 1.44 Mb
Diskette B: Not Installed
Hard Disk 1:Auto-Type 1
Hard Disk 2:Not Installed
Base Memory:640K
Extended Memory:7296K (may be different)
Video Type: VGA/EGA
Keyboard:   Installed
(Hit Page Down key for next page)

      Advanced CMOS Setup
 *1.  Serial Port 2/Modem Port[COM] [IRQ3]
       Serial Port 1:[COM1][IRQ4]
       COM3/COM4 Base:[3e8/2e8]
**2.  Parallel Port:[LPT3]   [OUTPUT ONLY]
      Hard Disk 1:[Standard PIO]
      Hard Disk 2:[Standard PIO]
      Floppy Controller:[Enabled]
      IDE Controller:   [Enabled]
      Password:         Not Installed
      Power Management: IDE Power Down[Disabled]
                        Video Power Down [Disabled]
```

* If additional serial port is installed.

** If additional parallel port is installed.

Continue with the procedure *Starting XENIX From The Boot Floppy Set*.

Starting XENIX From the Boot Floppy Set

Follow the steps below, remembering to press `Enter` after you type your responses on the keyboard.

If you are installing SCO XENIX on an ESDI hard drive, first initialize the hard drive with a low level format. But *you must not do this with a Zenith 486 or 433 or newer models (See earlier descriptions for 486 and 433)*. The low level format may be accomplished with Zenith's DOS PREP or any other commercially available low level formatting software.

Note *If you are using an IBM PS/2, ensure that you have the correct version of SCO XENIX for the PS/2 (SCO XENIX 386mc 2.3.4).*

If you are using an IBM Value Point, you may need to order from GDC a special software package that includes a special N1 disk. The IBM Value Point does not use the XENIX 386mc version. Newer versions of the Value Point may not need this special N1 disk. If you are not sure of the requirements of your Value Point, contact General DataComm Service.

1. Insert the `BOOT/N1` diskette into the top drive. If you have more than one floppy drive, use the primary drive (sometimes called the boot drive). Check your computer hardware manual if you are not sure which drive is the primary drive.

2. Turn on your computer.

3. The computer loads the XENIX bootstrap program from the diskette and executes it. In the upper left corner of the screen, the computer may display the total amount of memory installed. Next, you see:

   ```
   XENIX System V

   Boot

   :
   ```

4. Press `Enter` to boot from the floppy drive.

5. You see this message:

```
fd(64)xenixroot=fd(64)swap=ram(0)pipe=ram(1)swaplo=0nswap=1000 ronly
```

   Leave the BOOT/N1 floppy in the drive.

Note *During the loading procedure, using a 3.5 inch floppy drive and loading XENIX version GT, you may be asked to install the disk labelled FILE SYSTEM. At that time, remove the N1 disk and install the N2 disk.*

---

6. After XENIX is loaded in memory, the system displays information concerning memory allocation along with other system information.

   The system now performs a self-check to determine if there are any problems with the hardware.

   The letters A-Z appear in succession. Note that the letters overwrite each other as they appear.

7. After the letter Z is displayed, the following message appears:

   ```
   No single-user login present

   Entering System Maintenance Mode
   ```

   If the letters stop appearing before the letter Z is reached, run hardware diagnostics as explained in your computer manual, correct any identified problems, and start the installation procedure again from the beginning. If the letters stop again, call the Support Center listed on the information card and be prepared to tell them at what letter the display ended. The self-check using letters A-Z occurs every time you bring up your XENIX system.

8. Once the system begins to run, the following menu appears:

   ```
   Keyboard Selection

   1.  American
   ```

```
2.  British
3.  French
4.  German
5.  Italian
6.  Spanish
```

Use the Numeric Keypad if present, using <NUM LOCK> if necessary, to select one of the above options:

Select the option that corresponds to your keyboard.

9. The following message is displayed:

```
XENIX System V Hard Disk Initialization

What type of disk controller will be supporting this disk?

1. Standard disk support (ST506, MFM, RLL, ESDI, IDE)

2. OMTI 8620 or OMTI 8627

3. SCSI
```

Respond to this question by pressing 1, 2 or 3 and the `Enter` key. Most approved TMS Controllers use a standard disk (1). If you are using a SCSI interface, you must select 3. Additionally, you must ensure that the interface card is an Adapter 1540, the only SCSI adapter supported by SCO XENIX. For some newer machines that use a SCSI-2 board for increased speed, this interface is not recognized by SCO XENIX. You must also ensure that your hard drive does not use more than 1,024 cylinders. SCO XENIX cannot address cylinders => 1024. To get around this problem, you must adjust the sectors/heads information to change the number of cylinders. By doing this, a small amount of storage space may be lost.

Preparing the Hard Disk

The following steps describe how to initialize the hard disk. This includes mapping bad tracks (bad spots) on the disk so that they are avoided by the operating system and creating one disk partition and one file system.

1. You see the message:

```
During installation you may choose to overwrite all or part of the
present contents of your hard disk. Do you wish to continue? (y/n)
```

If you want to save any files, enter n and press `Enter`. If you do not have any files you want to save, enter y and press `Enter.`

Note *If you have files on the hard disk that you wish to save, respond n and the installation is aborted and the system shut down automatically. You should then reboot the computer, back up any files you want to save, and restart the XENIX installation procedure from the beginning.*

---

2. When you respond "yes," you see information about your hard disk and this menu:

```
Hard Disk Drive 0 Configuration

1.  Display current disk parameters
2.  Modify current disk parameters
3.  Select default disk parameters
Enter an option or "q" to quit:
```

You, at this point, should select option 3 (Select default disk parameters) and press `Enter`.

If you have a standard hard disk, one that is supported by your computer hardware or special basecard ROM, enter **q** followed by `Enter` to continue the installation.

Entering q at this point selects the default parameters for your hard disk. Unless you know that your disk is nonstandard, assume that it is standard and enter **q** to continue your installation. Skip to Step 6.

If your disk is nonstandard, you must input information that overrides the ROM disk configuration information, replacing it with new information. If you are unsure of what parameters to enter for your nonstandard disk, contact your disk manufacturer for this information.

3. If your disk is nonstandard, select option 1 to view the current disk parameters. Next, select option 2 to modify them as necessary. When you enter either "1" or "2" you see the following display:

```
Disk Parameters     Values
------------------------------------
1.    Cylinders        value
2.    Heads            value
3.    Write Reduce     value
4.    Write Precomp    value
5.    Ecc              value
6.    Control          value
7.    Landing Zone     value
8.    Sectors/track    value
```

In the actual display, value is replaced with the default value for that variable.

Note *The "Cylinders" value refers to the number of cylinders on the entire hard disk and should not be confused with the number of cylinders allocated (or intended to be allocated) to a given partition.*

---

4. If you entered a "1", you now see the first menu again. If you entered a "2", you are now prompted:

```
Enter a parameter to modify or q to return to the main menu:
```

Enter a number, 1-8, to change the disk parameters, or q to return to the previous menu.

```
Enter the new value or press Enter to use the existing value:
```

If you wish to change the value, enter a new value now, or press `Enter` to use the existing value.

5. After you finish changing the disk parameters, enter **q** to return to the main menu. Next, enter q again to save the changes you made (Exiting by entering **q** overwrites any parameters you have changed with the new values). To restore the default parameters after making modifications, enter **3** from the first menu.

6. The installation program prepares to partition the hard disk.

   After a moment, you see this partitioning menu:

   ```
   1.  Display Partition Table
   2.  Use Entire Disk for XENIX
   3.  Create XENIX Partition
   4.  Activate Partition
   5.  Delete Partition
   Enter your choice or q to quit:
   ```

   Select option 2 and press `Enter`.

   The following partitioning table displays.

   `Current Hard Disk Drive: /dev/"XYZ"`

Partition	Status	Type	Start	End	Size

   `Total disk size: nnnn tracks` (m reserved for masterboot and diagnostics)

   If you have previously installed an operating system on your disk, the partitioning table contains information. If not, it is empty.

   If any other operating systems were previously installed on your system, you also see the following warning message:

   ```
   Warning! All data on your disk will be lost!
   Do you wish to continue? (y/n)
   ```

   Enter **y** and press `Enter`. This ensures that there is one partition on the whole disk for XENIX. The new partitioning table is then displayed.

7. Press `Enter` and you see the partitioning menu. You have now set up the XENIX partition on your hard disk. To continue with the next step in the installation procedure, enter **q** and press `Enter`.

8. Now you see a menu for verifying disk integrity. Using this menu, you can scan your hard disk for defective tracks. Any flawed locations are mapped to good tracks elsewhere on the disk. It also creates a bad track table, which is a list of all the bad tracks on your hard disk (You should also have a bad track list from the top of your hard disk drive).

   The main badtrack menu looks like this:

   ```
   1.  Print Current Bad Track Table
   ```

```
2.  Scan Disk (You may choose Read-Only or Destructive later)

3.  Add Entries to Current Bad Track Table by Cylinder/Head Number

4.  Add Entries to Current Bad Track Table by Sector Number

5.  Delete Entries Individually from Current Bad Track Table

6.  Delete All Entries from Bad Track Table

Please enter your choice or q to quit:
```

If using a Zenith 486 or newer model or any PC with an IDE hard drive, press q, and go to Step 16.

Enter 2, then press `Enter`.

9. You see the following submenu:

```
1.  Scan entire XENIX partition

2.  Scan a specified range of tracks

3.  Scan a specified file system
```

Select option 1.

10. After you select the area you want scanned, you are given the choice:

```
1.  Quick scan (approximately 7 megabytes/min)

2.  Thorough scan (approximately 1 megabyte/min)
```

Select option 2.

11. You are prompted:

```
Do you want this to be a destructive scan? (y/n)
```

Enter **y**. You are warned:

```
This will destroy the present contents of the region you are
scanning.

Do you wish to continue? (y/n)
```

Enter **y** and press `Enter`. You see the following message:

```
Scanning in progress, press q to interrupt at any time.
```

12. After you respond to the above prompts, the program scans the XENIX partition for flaws. The larger your disk, the longer the scanning process takes (a 40 megabyte disk takes approximately 40 minutes for a thorough scan if the disk has never been initialized before).

As the disk is scanned, the number of each track is examined, and the percentage of the disk already scanned is displayed:

```
Destructively scanning track nnn/n, xx% of scan completed.
```

Pressing the **q** key at any time interrupts the scan. If you press **q** to interrupt the scan, you do not need to press `Enter`. You are asked whether to continue scanning or press `Enter` to return to the main menu.

Whenever a defective track is found, the location of that track is listed using both the sector number and cylinder/head conventions.

Defective track information is entered into the bad-track table and appears on the screen. An example of a bad track might be:

```
wd: ERROR: on fixed disk ctrl=0, dev=0/47, block=31434, cmd-
=00000020, status=00005180, sector=62899, cylinder/head = 483/4
```

13. When the scan is complete, the menu reappears. Select option **1** to see the results of the scan. Your bad track table might look like this:

    `Defective Tracks`

	Cylinder	Head	Sector Number(s)
1	818	5	83521-83537

Press `Enter` to continue.

Press `Enter` to return to the main menu.

Note *If there is a flaw in the first few tracks of the XENIX partition, you must return to the previous installation step. Repartition the disk so that the XENIX partition no longer includes the defective tracks. You have to experiment to determine how many tracks to exclude. Leave these defective tracks unassigned to any operating system. When you finish repartitioning the disk, check the disk integrity again and scan the disk for further flaws. Repeat this process until you find no flaws in the first few tracks.*

Because most flaws are marginal or intermittent, your disk flaw map probably lists more bad tracks than the scanning process reveals. If so, you should now add these defective tracks to the bad tracks table (If you are using an ESDI hard disk/controller, it is not possible to enter additional bad tracks to this table. The low level format from Step 1 and XENIX bad track scan automatically flags any bad tracks).

Select either option **3** or option **4** depending upon the format of the flaw map furnished with your disk. Enter the defective tracks, one per line. Do not worry about entering a number that has already been found by the scanning process or accidentally entering a number twice. Duplicate entries are ignored. If you make a mistake, enter **q** and press `Enter`. You can always delete accidental entries from the bad-track menu.

14. If your disk is not furnished with a flaw map, or you are finished making changes to the bad track table, enter **q** and press `Enter`.

15. You are next prompted for the number of tracks to allocate as replacements for those tracks that are flawed. You should allocate at least as many as the recommended number. The default number of replacement tracks is based on the number of bad tracks currently in the table, plus an allowance for tracks that may go bad in the future. If you ever exceed the number of allocated bad tracks, you must reinstall XENIX. The following appears:

    ```
    Enter the number of bad tracks to allocate space for (or
    press Enter to use the recommended value of n):
    ```

    Accept the default by pressing `Enter`.

16. Next, the installation program allocates portions of your partitioned disk for the root and swap areas. It also allocates a small portion of the disk for a recover area that is used during autoboot. First you are prompted for the swap space allocation:

    There are nnnnn blocks in the XENIX area.

```
Between xxxx and yyyy blocks should be reserved for the swap area.
```

```
Please enter the swap space allocation, or press Enter to get the
default allocation of zzzz blocks.
```

    The actual numbers we recommend for swap space vary depending upon the size of your disk. If your hard disk is between 80 and 100 megabytes, enter 8000 and press `Enter`. If your disk is between 120 and 200 megabytes, enter 16000 and press `Enter`. If your disk is over 200 megabytes, enter 30000 and press `Enter`.

    If you have enough disk space for a /u (user) file system, you see the prompt:

```
Do you want a separate /u filesystem? (y/n)
```

    Respond **n**.

    You see the statement:

```
The layout of the file systems and swap area is now prepared.
```

17. You are asked:

```
Do you wish to make any manual adjustments to the sizes or names of
the filesystems or swap area before they are created on the hard
disk? (y/n)
```

    Enter **n** and press `Enter`.

    On older versions of XENIX, Step 18 appears. Newer versions of XENIX bypass Step 18 (especially when the Autologin feature is enabled).

18. If you have a large root file system, you may be asked if you want to allocate an additional, small portion of the disk as scratch space for the fsck program. This scratch space is needed for temporary storage when checking large file systems. Respond **y** and press `Enter`.

19. The system now loads a rudimentary XENIX file system onto your hard disk. This takes several minutes. You see the message:

```
Making filesystems
```

20. The Restricted Rights Legend is displayed, followed by the message:

```
Operating system serialization

Enter your serial number and press Enter:
```

    Enter your XENIX Operating System serial number exactly as shown on your serialization card and press `Enter`. Then you see the message:

```
Enter your activation key and press Enter:
```

    Enter your XENIX Operating System activation key exactly as it is shown on your serialization card and press `Enter`.

21. When the file system is made, the message is displayed:

```
Hard disk initialization procedure completed
```

The system then shuts down and displays instructions on booting the newly initialized hard disk. Make note of these instructions.

You then see:

```
**    Normal System Shutdown    **
**      Safe to Power Off       **
            - or -
**    Hit Any Key to Reboot     **
```

Starting XENIX on the Hard Disk

The following steps explain how to start the XENIX system using the hard disk.

1. Remove the BOOT/N1 disk. Next, press any key to continue.
2. At the Boot: prompt, press `Enter`.
3. Follow the screen prompts.
4. Next you see some copyright information and information about the memory configuration of your system.

   As before, the system performs a self-check to determine where any problems exist with the hardware. The letters A-Z appear successively on screen. If the letters appearing stop before the letter Z is reached, run hardware diagnostics as explained in your computer manual. Correct any identified problems and start the XENIX installation procedure. If the letters stop again, call the Support Center listed on the support information card and be prepared to tell them the last letter displayed.
5. Now the installation program checks the root file system on your hard disk. In this case, it checks only the root file system.
6. At this point you are prompted to insert the Operating System (Basic Utilities) volume B1 floppy diskette.
7. Follow any additional screen prompts for floppies. Note that you are not prompted to insert all the volumes in your distribution at this time.

   If you insert a floppy in the wrong order, you see this prompt:

   ```
   Error: incorrect volume in drive!
   ```

   Make sure you are using the correct diskette. Make certain the door of the floppy drive is completely closed. Enter **y** and press `Enter`.

   If there is an error with the extraction procedure, you see the message:

   ```
   Extraction error: try again? (y/n)
   ```

   Remove the floppy from the drive, insert the correct volume, and press `Enter`.

   Continuous extraction errors on the same disk may indicate that you either have a defective SCO XENIX disk or your floppy drive is malfunctioning.

Setting the Root Password

To set a new password, proceed as follows:

1. When the last of the "B" diskettes is installed, you see:

```
Please assign a password for the super-user account, "root".

Enter new password (minimum of 5 characters)

Please use a combination of upper and lowercase letters and
 numbers.

New password:
```

The new password can be any combination of letters, numbers, and punctuation marks, but should be at least five characters long (e.g., meansquare). Enter the new password and press `Enter`.

The system does not display the password as you enter it, so type carefully. After you press `Enter`, the system displays the message:

```
Re-enter new password:
```

2. Enter the new password once more (as a verification step) and press `Enter`. Make sure you enter it correctly, otherwise the program prompts you to enter the password again. When you have entered the password correctly, you see some information about XENIX passwords and how to change your super-user password in the future.

The super-user password is now in place. From now on, the password is required whenever you attempt to access the system as super-user. The super-user password keeps the system safe from unauthorized use.

It is important that you create a super-user password during system initialization to ensure maximum protection of the system and to prevent unnecessary use of the super-user (also known as "root") account.

Note *It is very easy to make errors when you are logged in as super-user that could destroy files. Log in as super-user only to install programs, do system maintenance tasks, and change the super-user password.*

Do not forget the super-user password. To restore a forgotten super-user password you must reinstall the XENIX system. If necessary, keep a copy of the super-user password in a safe place.

Proceed to *Establishing the Time Zone*.

Establishing the Time Zone

The procedure is simple if you are in North America. In countries in other areas, read this entire section carefully and obtain the necessary information before continuing.

1. The first thing you see is:

```
Time zone initialization
```

You then see:

```
Are you in North America? (y/n)
```

If you are not in North America, enter n and proceed to Step 3.

If you are in North America, enter y. You see the following menu:

1.	NST	-	Newfoundland Standard Time
2.	AST	-	Atlantic Standard Time
3.	EST	-	Eastern Standard Time
4.	CST	-	Central Standard Time
5.	MST	-	Mountain Standard Time
6.	PST	-	Pacific Standard Time
7.	YST	-	Yukon Standard Time
8.	HST	-	Hawaiian/Alaskan Standard Time
9.	NST	-	Nome Standard Time

Enter the number that represents your time zone:

If, for example, your time zone is Nome Standard Time, you would enter the number **9** and press `Enter`.

2. You see the following:

```
Does daylight savings time (summer time) apply at your loca-
tion? (y/n)
```

If daylight savings/standard time changes occur in your area, enter **y**. If not, enter **n**. In either case, skip Steps 3 through 8 and proceed to Step 9.

3. You see the following:

```
What is the abbreviation of your standard time zone?

Enter 1-9 characters or enter q to quit:
```

Enter the abbreviation of your time zone (*See above, for instance, EST*).

4. For areas not in North America, you see:

```
How many hours west of Greenwich Mean Time are you?

Enter hh[:mm:ss] (e.g. 10:30:00 or 10:30, use negative numbers
or locations east of GMT) or enter q to quit:
```

Enter a number.

5. You see:

```
Does summer time (daylight savings time) apply at your loca-
tion? (y/n)
```

If summer time does not apply, enter **n**. Proceed to Step 9.

If summer time does apply, enter **y**. You then see:

```
What is the summer abbreviation of your time zone?

Enter 1-9 characters or enter q to quit:
```

Enter the summer abbreviation of your time zone.

6. You see:

```
1.  Week of the year (1-52).
```

```
2.  Week of a specific month (e.g., 1st week of April).

3.  Day of the year, ie, Julian date (1-365).
```

Select the method your time zone uses to convert from standard time to summer time (daylight saving time) or enter **q** to quit:

Select 1, 2, or 3.

7. You see:

```
At what time of day is the conversion made (use 24 hour
clock)?

Enter hh[:mm:ss] or press Enter for default value of 2 am or
enter q to quit:
```

Enter a number.

8. Depending upon which method your time zone uses, you see the following prompt:

```
How many hours does your time zone adjust for summer time
(daylight savings time)?

Enter hh[:mm:ss] or press Enter for the default value of 1
hour or enter q to quit:
```

Enter a number or press `Enter`.

9. Your time zone is now set. You see the message:

```
Setting up system directories
```

10. Next, information about your file system(s) appears, including the number of blocks currently used.

You also see another menu that gives you the option of stopping or continuing with the installation.

```
1.    Stop installation

2.    Continue installation
```

So far you have installed the minimal XENIX system, the Run Time System. To install Operating System packages, select option 2 and press `Enter`. You can now proceed to the next subject, "Installing the XENIX Distribution."

Installing the XENIX Distribution

This stage involves "customizing" your system, adding only those parts of the Operating System distribution that are useful to you.

Choosing Packages to Install

The BASE, LPR, LINK, and DOS packages are required for the TMS installation.

Note *When choosing the TERMINF package, you are prompted as to whether you want the terminfo data base compiled at this time (a somewhat lengthy process). If you choose to defer this until later, you are given instructions for doing so. This process takes approximately five to ten minutes to complete..*

Installing Your Packages and Applications

To install your XENIX packages, proceed as follows.

1. The main custom menu is displayed.

```
1.  Operating System
2.  Development System
3.  Text Processing System
4.  Add a Supported Product
```

   Select a set to customize or enter **q** to quit:

2. Select option 1, Operating System. The following messages appear:

```
Installing custom data files . . .
```

   Insert Operating System (extended utilities) Volume X1 and press `Enter` or enter q to quit:

   Remove diskette B1 (if not already done) and insert the diskette X1 as instructed and press `Enter`.

3. The following submenu appears:

```
1.  Install one or more packages
2.  Remove one or more packages
3.  List the available packages
4.  List the files in a package
5.  Install a single file
6.  Select a new set to customize
7.  Display current disk usage
8.  Help
```

   Select an option or enter q to quit:

   Select option **1**. A list appears. Using uppercase letters, type

   `BASE LPR DOS LINK`

   Press `Enter`. The installation program prompts for the necessary volume numbers. Insert the appropriate diskettes and follow the screen prompts.

4. After the last package is loaded, select option 3 to list the packages that have been installed. Verify that all three packages were successfully loaded. If one or more are missing, try reinstalling the appropriate packages.

   Complete your hard-disk initialization by entering **q** at the main menu. A message appears about booting the system. You then see

```
**     Normal System Shutdown     **
**       Safe to Power Off        **
```

   - or -

```
**     Hit Any Key to Reboot      **
```

   The system shuts down. Remove any floppy that is in the drive. If you have engaged the Caps Lock key to type the preceding upper case package names, disengage the Caps Lock key now.

5. Press any key to reboot the system and press `Enter` when the boot prompt appears:

```
XENIX System V
Boot
```

Loading Informix

You must now install the INFORMIX data base package.

1. Simultaneously hold down the **Control** key and D key **(Ctrl-D)**.
2. Enter the correct time in the proper format, followed by `Enter`, or just press `Enter` if the time is already correct (The time is based on a 24 hour clock).
3. A message saying!

```
*** cron started ***
```

appears, followed by

```
xenix386! login:.
```

Enter

`root`

When the password prompt appears, enter your super-user password.

4. You see:

```
Welcome to SCO Xenix System V
            from
The Santa Cruz Operation, Inc.
#
```

is the super-user prompt. When you see this, enter

`mkuser`

5. The system prompts you with the following message:

```
Do you require detailed instructions ? (y/n/q) :
```

`Respond` **`n`** `to this message.`

6. Enter new user login name, or enter **q** to quit:
7. Type

`informix`

followed by `Enter`. The next prompt that appears is

```
Do you wish to use the next available user id ? (y/n/q):
```

8. Enter **y** followed by `Enter`. The next prompt that appears is

```
Do you wish to use the default group ? (y/n/q):
```

9. Respond **n** followed by `Enter`. The following prompt appears:

```
Existing groups are Group "group" (50): Do you want to use
one of these groups ?
```

10. Respond **n** followed by `Enter`. You are asked:

    ```
    Please enter the name for the new group or enter q to quit.
    ```

11. Type

    `informix.`

    The new group name is `informix`. The next prompt that appears asks:

    ```
    Please enter number for new group, press ENTER for default
    number, or enter q to quit :
    ```

12. Press `Enter`**.** This selects the next default group #.

    The following menu appears :

    ```
    1.  sh Standard (Bourne) Shell
    2.  rsh Restricted Shell
    ```

13. Enter **1** to select the Standard (Bourne) Shell. Next the following prompt appears :

    ```
    Enter Password :
    ```

14. Enter at least 5 characters for the Informix password then press the `Enter` key. You are asked:

    ```
    Re-enter for check:
    ```

15. Enter the same characters you did in the previous step. Press the `Enter` key again for comments. Now the selected information is displayed:

    ```
    User name is "informix", user id is "201".
    Group name is "informix", group number is "51".
    Shell is "sh".
    Comment field is:
    ```

    The following prompt appears:

    ```
    Do you want to change anything ? (y/n/q):
    ```

16. Answer **n** and press `Enter`. The following prompt appears:

    ```
    Do you want to add another user ? (y/n/q):
    ```

17. Answer **n** and press `Enter`.

18. At the # prompt, type in the following lines and press `Enter` after each line:

    ```
    INFORMIXDIR=/usr/informix
    PATH=$PATH:$INFORMIXDIR/bin
    export INFORMIXDIR PATH
    cd $INFORMIXDIR
    ```

19. If you are installing Informix Version 2.10.03K, place the first informix runtime diskette of the set in the disk drive and type the following:

    ```
    cpio -icvdBum</dev/rfd0135ds18
    ```

(for 3.5-inch floppies in drive 0)

20. Press `Enter`.
21. After the files are loaded, type the following:

    ./installesqrf

    (for Version 2.10.03K Informix)
22. Press `Enter`.

    The following appears:

    ```
    Press Enter to continue, or the interrupt key (usually Con-
    trol-C or Delete) to abort.
    ```
23. Press `Enter`.

    The following message is displayed:

    ```
    Informix serialization

    Enter your serial number and press Enter:
    ```
24. Enter your Informix serial number exactly as shown on your serialization card and press `Enter`. Then you see the message:

    ```
    Enter your activation key and press Enter:
    ```
25. Enter your Informix System activation key exactly as it is shown on your Serialization card and press `Enter`.

    Next, you see `Installing <filename> messages.` When this process is finished, the message `Installation Complete` appears signifying that Informix is loaded.
26. Carefully remove the diskette.

Proceed to the next topic, *Loading GTS Software*.

Loading GTS Software

Once Informix is installed, you load GTS software. You only need to follow this procedure when loading GTS for the first time. For routine updates to software, you may use the "Load a Software Release" routine in the Maintenance Utilities menu.

GTS software is provided on a set of fourteen diskettes. The first disk is a setup disk which contains the basic loading software which handles the rest of the loading operation; this minimizes the number of XENIX commands required on your part. After the setup disk are a kernel disk, two ESCC disks, and a set of disks labelled 1 — 10. When you enter XENIX commands, be sure to include the spaces shown in these directions and follow upper/lower case spelling exactly. Everything that you must type in at the keyboard is in boldface type.

Note *Before you begin these procedures, check the Caps Lock indicator on your keyboard. If illuminated, press the Caps Lock key until the indicator turns off. Do not attempt to log in to XENIX with the Caps Lock key set.*

Follow these instructions to load GTS software:

At the # prompt:

1. Type **shutdown 0** and press `Enter`. The system shuts down. When the shutdown is finished, the reboot prompt appears:

   ```
   Press any key to reboot
   ```

2. Press `Enter`. The screen displays:

   ```
   XENIX System V

   Boot

   :
   ```

3. Press `Enter`. The screen displays:

   ```
   hd(40) xenix
   ```

4. Press the **Ctrl** and **D** keys simultaneously. Enter the date by year, month, and day (yy/mm/dd). The date and time prompt appears. Enter the time in the 24 hour (military) format (hh/mm). Press `Enter`. The login prompt appears:

   ```
   xenix386! login
   ```

5. Type **root** and press `Enter`. The password prompt appears:

   ```
   Password:
   ```

6. Enter the super-user password. The super-user prompt appears:

   ```
   #
   ```

   Insert Basic Setup floppy disk of the TMS software set into the disk drive slot. Type:

   ```
   fsck  -n  /dev/fd0135ds18
   ```

   (if using 3.5-inch drive 0)

   and press `Enter`.

7. When the superuser prompt # appears again, type

   ```
   /etc/mount  -r  /dev/fd0135ds18  /mnt
   ```

   (if using 3.5-inch drive 0)

   and press `Enter`.

   The drive that you mount to perform the mninstall procedure is set as the default drive and all further floppy disk drive access through the TMS software uses the default drive.

8. When the superuser prompt appears again, type

   ```
   cp /mnt/mninstall .
   ```

   and press `Enter`.

9. Type:

   ```
   ./mninstall
   ```

   and press `Enter`.

10. Follow the directions appearing on the screen concerning the loading and removing of floppy disks.

11. When instructed to do so, remove the last diskette from the disk drive. Then press `Enter` to reboot the system.

Note *You may have to perform Steps 13 through 15 when a TMS software upgrade is made (without reinstalling XENIX O.S.) or when a shutdown with the Autologin feature disabled is performed. Otherwise, the system goes through the complete Autologin function (automatically boots itself without operator interaction). After several minutes, the first screen appearing is the GDC logo screen. Follow Steps 1 and 2 (on the next page) to continue.*

---

12. Press `Enter` again and the following appears:

    ```
    XENIX System V

    Boot

    :
    ```

    Press `Enter`. The following appears:

    ```
    hd(40) xenix:
    ```

    Press `Enter`. Another prompt appears.

13. Press the **Ctrl** key and the **D** key simultaneously to proceed with normal startup.

14. Enter the correct time if necessary. Press `Enter`. The message

    ```
    cleaning print queue done
    ```

    appears.

    If the optional Digiboard multiport card is not installed in your PC, you see the following message:

    ```
    No Board found at port 0000nnn.  Check switch settings.
    ```

15. At the Xenix386! login prompt, type

    `gts`

    The Controller should now initialize. Press **F4** to reach the Network Access menu.

16. Move the cursor to Access Disk-Based Manual and press `Enter`.

17. If you are not familiar with using the disk-based manual, *refer to the Preface in GDC 036R603-Vnnn.*

Installing INFORMIX in a Controller Containing a Previous Version

If TMS software is already installed, perform the following steps:

1. Select Controller Maintenance from the TMS main menu. Next, select Shutdown (Disable AutoLogin). Answer **y** to the question about shutting down to reinstall TMS. If you want to restore the Auto Login function, you have to do the mninstall procedure again.

2. Reboot the controller.

3. Login as root.

If TMS software is not installed, you should login as root. Use the following procedure to install informix on the hard disk. Type the commands shown in boldface and press `Enter.`

1. Enter the following at the # prompt:

   `rm -r /usr/informix`

2. At the next # prompt enter:

   `rmuser`

Note *XENIX may prompt you to manually delete some mail files, etc.*

---

3. The following prompt appears:

   `Press Enter when you are ready.`

   Press `Enter`

4. The following prompt appears:

   `Enter login name..`

   Type **informix** in response to this prompt.

5. The computer responds with the message

   `Removing user...CONFIRM..`

   Enter **y**. The next message appears:

   `Do you want to remove another...`

   Enter **n**.

6. At the # prompt, simultaneously press the **Ctrl** and **D** keys to logout.

7. Follow the instructions *Loading INFORMIX Software* as decribed earlier in this chapter.

Maintenance Console

At a remote TMS-3000 node or any TMSC node that does not house the Controller you may need to use a separate Maintenance Console to initialize the node. The Maintenance Console is used to set up a single aggregate that communicates with the master TMS-3000 node or with another node that is already communicating with the master node. Once you have established communication, configuration information can be downloaded to the node.

Note *Some of the TMS common cards (ESCC, ACM, CDA, TPP and OPP) have a front monitor port for connecting the Maintenance Console. The cable required for this connection is GDC 024H140.*

Refer to GDC 036R610-000, TMS Maintenance Console for complete instructions on the use of the Maintenance Console.

Summary

In this chapter we covered the procedures for installing the TMS Controller hardware and software.

Chapter 6, Maintenance

Scope

Topics in this chapter include:

Overview

This chapter provides routine maintenance and troubleshooting procedures for the TMS.

Troubleshooting information describes sequences of tests and other troubleshooting procedures which isolate TMS failures to a single replaceable module. For detailed instructions on performing a particular test, *refer to the Status and Diagnostics chapters* in *GDC 036R603-Vnnn*. Refer to the front panel drawings in *Chapter 4* of this manual to help you develop a basis of knowledge for informed troubleshooting.

Routine Maintenance

Performance of the following routine maintenance tasks considerably reduces "down time" due to equipment failure:

- Check alarm display on the Controller at least once a day to identify alarm conditions as soon as possible. Leave the Controller in the alarm screen display mode when otherwise inactive, so that newly reported alarms are observed immediately.

- Observe front panel indicators for signs of equipment failures. When checking indicator conditions, remember that green LEDs indicate normal operation when lit; red LEDs indicate an alarm condition when lit.

- Inspect cable connections for looseness, bent or missing pins, or damage to cable.

Corrective Maintenance

Corrective maintenance consists of troubleshooting a suspected fault to a system component (module, cable, etc.), removal of the malfunctioning item, and repair or replacement to restore normal operation. The next paragraphs describe the removing and installing TMS modules and discuss various troubleshooting features for spotting failures within the TMS system.

Module Replacement

In many instances, removing and replacing TMS modules corrects a problem. When replacing modules, follow the instructions below to avoid unnecessary disruption of the system and possible module damage.

Note *GDC recommends periodically testing the "out of service" modules in a TMS that utilizes redundant common modules. In a TMS, not all failures of the out-of-service module are detectable. Certain conditions may prevail causing disruption of the network when that module is placed into service.*

Effects of Module Removal and Replacement

Removal of most common modules (or in-service common modules in a redundant system) stops data traffic through the system or through some segment of the system. Removal of any module may cause temporary disruption of the node. The following describes the effect of the removal of each of the common modules; be sure that you understand these consequences before removing a module from the shelf.

Enterprise System Control Card

BeFore removing the Enterprise System Control Card, place the Enable/Disable switch in the Disable position. In many instances, removing and replacing an ESCC corrects a problem, as described below.

ESCC Removal **—** To remove an ESCC from its assigned receptacle in the TMS shelf, proceed as follows:

1. If the ESCC is the in-service ESCC of a redundant pair, place it in the standby mode by using the diagnostics function of the Controller.
2. Place the ESCC front panel Enable/Disable switch in the Disable position.
3. Grasp the ejector knobs on the top and bottom of the ESCC front panel. Tilt the top knob up and the bottom knob down to unhook the ESCC, then guide it straight out from the receptacle.

Note *Removing an ESCC in a non-redundant system, or the redundant pair of ESCCs in a redundant system, stops all data traffic on the node and isolates the node from the Controller.*

Removing the in-service ESCC in a redundant system causes the node to reinitialize. As a result, all data and communications traffic is interrupted for approximately 2 to 5 minutes. Therefore, before removing the in-service ESCC, use the Controller to switch it to the standby mode.

When replacing a defective ESCC with a spare, remember that software must be downloaded from the Controller at the master site.

ESCC Replacement/Installation **—** To reinsert an ESCC in the TMS shelf, proceed as follows:

1. Select the ESCC options.

2. Place the ESCC front panel Enable/Disable switch in the Disable position.

3. Position the ESCC in the receptacle guides (top and bottom) of the slot shown in *Figure 4-2* and carefully slide the ESCC into the receptacle until it stops. Tilt the top ejector knob up and the bottom ejector knob down and gently push the ESCC into the rear connector. The knobs automatically assume their normal positions.

4. Place the ESCC front panel Enable/Disable switch in the Enable position.

Redundancy Control Card

Removal of the Redundancy Control Card in a redundant system causes the primary module in each pair of redundant modules (the right-hand module of the pair) to become in-service except the ESCC in which the secondary card is in-service. In a non-redundant configuration, all common modules and expansion cards must be in the right-hand slot of each pair of slots; any common module or expansion cards in the left-hand slot are removed from operation except the ESCC which is in the left-hand slot.

Aggregate Control Card

Removal of the Aggregate Control Module in a non-redundant system, or the redundant pair of modules in a redundant system, stops data traffic on the associated aggregate trunk for that module and on any channel that is routed through that aggregate trunk.

CDA (Combined Digital Aggregate) Module

Removal of the CDA Module in a non-redundant system, or the redundant pair of modules in a redundant system, stops data traffic through the associated DS1 ports for that module and on any channels routed through the DS1 ports to a TMS node or associated D4 device. To remove the CDA Module, first press the Dsbl (disable) switch on the front panel once. All front panel LEDs should go off. The module is now in a low power mode and may be removed from the shelf in the usual manner. If the module is not removed, pressing the Dsbl switch once more reactivates the module and the INIT LED lights.

ACM

Removal of the ACM in a non-redundant system, or the redundant pair of modules in a redundant system, stops data traffic through the associated ports for that module and on any channels routed through the ports to a TMS node, DPBX or APBX.

To remove the ACM, first press the Dsbl (disable) switch on the front panel once. All front panel LEDs should go off. The module is now deactivated and may be removed from the shelf in the usual manner. If the module is not removed, toggling the Dsbl switch once more reactivates the module and the INIT LED lights.

Channel Interface Card

Removal of the Channel Interface Module in a non-redundant system, or the redundant pair of modules in a redundant system, stops data traffic on any channel that communicates through that module or pair of modules.

Removal of any other channel module disrupts data flow for that channel and causes minimal disruption of system data flow.

Module Removal

To remove a module from its assigned receptacle in the TMS, grasp the ejector knobs on the top and bottom of the module front panel. Tilt the top knob up and the bottom knob down to unhook the module, then guide it straight out from the receptacle.

Module Installation

To reinsert a module in the TMS shelf, proceed as follows:

1. Verify correct module location by referring to your Network Documentation Package.
2. Select all options required on the module according to your Network Documentation Package (unless some problem with option configuration is found, reproduce the option selections made on the module being replaced). Make sure that any required program plugs or resistor networks are mounted on the module.
3. Position the module in the receptacle guides (top and bottom) and carefully slide the module into the receptacle until it stops. Tilt the top ejector knob up and the bottom ejector knob down and gently push the module into the rear connector. The knobs automatically assume their normal position.
4. When reinstalling the ESCC, make sure the Enable/Disable switch is in the Disable position before placing it into the Main Backplane. After the module is correctly seated, move the switch to the Enable position.

Maintenance Console

The Maintenance Console can set some aggregate parameters and perform basic maintenance functions. *Refer to GDC 036R610-000* for more information on these functions.

Troubleshooting Procedures

The diagnostic features of the TMS generally allow isolation of a failure to a single component within the system. The TMS has the following diagnostic features:

- Front Panel Alarm Indicators
- Controller Reported Alarms and Status Displays
- Data Path/Loopback Tests
- Maintenance Console Diagnostics
- Front Panel Test Points

Preliminary Checks

TMS problems may often be diagnosed by checking the condition of cables, power cords, and other mechanical connections. Incorrect TMS configuration entries may also be the cause of some problems. Perform the following preliminary checks before starting detailed troubleshooting procedures.

1. If no indicators on TMS are lit, check the ac power cord (or battery connections for system using DPS-8A dc power supply). Check the power supply for a blown fuse.
2. Inspect tightness and integrity of all connections, such as channel device cables and aggregate line connections.
3. If the TMS communicates at the aggregate level, but channels seem unable to pass data, check the configuration entries for those channels. This problem is most likely to occur when a new configuration is being activated.
4. If channels are correctly configured and appear to function normally, but do not seem to be communicating with connected channel devices, check the fused link located beneath the channel connector.

Alarms

Alarms are the first indication of problems in the TMS system. Alarms are divided into two categories: major alarms, representing failures which could disrupt system operation, and minor alarms, representing failures which could affect a single channel. Generally, common module failures are reported as major alarms, and channel module failures are reported as minor alarms.

Alarms are reported through the Controller, the Maintenance Console CRT, or front panel LEDs. You can also connect an additional alarm to the external alarm connector on the Main Shelf backplane. For a comprehensive evaluation of the condition of a system, you should note both the CRT reported alarm messages and front panel indicators.

Test Points

The test points located at the bottom of the ESCC, ACM, CDA, ACC, Voice Channel, and Data Channel Modules provide immediate indications of TMS functions. By connecting oscilloscope leads between test points and a reference point, a technician may observe data and clock signals and identify conditions that characterize proper or improper TMS operation. *Chapter 4 of this manual contains descriptions of each module front panel, including the test points. Pin assignments for the card connectors are defined in Chapter 8*. The following paragraphs suggest checks and comparisons that may be made with the front panel test points on each module.

Enterprise System Control Card

The ESCC test points provide immediate indications of TMS timing functions. By connecting oscilloscope leads between test points and a reference point, a technician may observe data and clock signals and identify conditions that characterize proper or improper TMS operation. *Chapter 4* of this manual contains descriptions of ESCC front panel, including the test points. The following paragraphs suggest checks and comparisons that may be made with the front panel test points on each module.

Each of the following frequencies is produced by a phase-lock loop: 18.432 MHz, 16.896 MHz and 1.544 MHz. After achieving phase lock with the master timing source, the 18.432-MHz primary frequency is used as a reference to create the other two primary frequencies of the clock bus of this node. The 18.432 MHz primary frequency is further divided to create the slower channel and aggregate frequencies.

The ESCC test point labeled “Test” is the 8-kHz prescaled frequency after it has been fed back to the phase detector from a phase-locked voltage controlled oscillator. The test point labeled “Ref” is the incoming frequency produced by a master timing source. The test clock must be synchronized to the Ref clock.

Note *Use this procedure for the in-service ESCC only. An out-of-service ESCC shows erroneous results if the node is configured for aggregate or external timing.*

---

1. Place oscilloscope leads on the Test point and the Ref point. If they are frequency locked, the incoming clock from the master timing source is successfully being phase locked at this node.

2. Place oscilloscope leads on the Test point and the Aggregate Control XMT CLK test point. If they are frequency locked, the clock rate for that Aggregate Control Card's aggregate trunk has successfully gone through the ESCC divider circuits and the clock bus to the Aggregate Control Card.

3. Place oscilloscope leads on the Test point and a Channel Module XMT CLK test point. If frequency locked, the clock has made it through the ESCC divider circuits, the clock bus, and the Channel Interface divider circuits.

Note *A few incoming frequencies may not be an even multiple of the test signal and therefore, it may be difficult to determine frequency lock with an oscilloscope.*

Aggregate Control Card

Check for the following conditions:

- RCV CLK and XMT CLK should be frequency locked with some jitter.

- Placing oscilloscope leads on RCV data and XMT data shows whether data is being received and transmitted.

- Placing oscilloscope leads on RCV sync and XMT sync shows whether the TDM is in sync. It also shows the size of frame being run.

ACM or CDA Modules

Check for the following conditions:

1. Place the leads of a dual trace oscilloscope on the XMT CLK A and RCV CLK A test points. Both patterns displayed should be frequency locked with some jitter.
2. Place the leads of a dual trace oscilloscope on the XMT CLK B and RCV CLK B test points. Both patterns displayed should be frequency locked with some jitter.

Data II, III, IV Channel or UDC Modules

Check for the following conditions:

- If the channel is active, data should be present on the DATA In and DATA Out test points.
- Receive data should be synchronized (no phase slippage) to the internal (INT) channel clock. If the channel is in the synchronous mode, the clock frequency is the same as the channel data rate; if the channel is in any other mode, the clock frequency is 16 times the channel data rate (except for Data IV Channel or UDC Modules).
- If channel is in synchronous mode and using external timing, internal (INT) and external (EXT) clock signals should be synchronized (no phase slippage).

Voice II or UVC Channel Modules

Check for the following conditions:

- If Voice Channel is active (busy) the voice signals in and out of the channel should be present at the IN and OUT test points.

Service and Support

Refer to the Preface of this manual for contacts, phone numbers and regional offices.

Summary

This chapter covered routine and corrective maintenance for the TMS.

Chapter 7, Diagrams

Overview

In the printed version of this document, this chapter contains TMS Compact harness card and wiring diagrams to support text descriptions of principles of operation, installation, and maintenance. These diagrams are principally useful in showing the physical connections between TMS Compact modules.

For readers using the electronic version of this document, contact your General DataComm Sales Representative for this wiring information.

Chapter 8, Connector Pin Assignments

Scope

Topics in this chapter include:

Overview

This chapter lists pin assignments for 25-pin aggregate and channel connectors. It also lists the pin assignments for the 5-pin external timing connector, the external modem connector, the external alarm relay connector, echo canceller piggyback card, CDA module, TID-III Data Channel Module, and ACM.

Aggregate Interface

Table 8-1 through Table 8-8 list the pin assignments of the 25-pin aggregate connectors. The functions listed are determined by the type of aggregate piggyback card used on the associated Aggregate Control Card.

Table 8-1 ITU-T G.703 256 KBPS Interface To Aggregate Line Transceiver 25-Pin Connector Pin Assignments

Pin No.	Signal Name	Description
1	Gnd	Chassis Ground
2	XMT DATA A	The “A’’ side of the transmit data pair.
3	RCV DATA A	The “A’’ side of the receive data pair.
14	XMT DATA B	The “B’’ side of the transmit data pair.
16	RCV DATA B	The “B’’ side of the receive data pair.

Table 8-2 ITU-T G.703 64 KBPS Codirectional Interface To Aggregate Line Transceiver 25-Pin Connector Pin Assignments

Pin No.	Signal Name	Description
1	Gnd	Chassis Ground
2	XMT DATA A	The “A’’ side of the transmit data pair.
3	RCV DATA A	The “A’’ side of the receive data pair.
14	XMT DATA B	The “B’’ side of the transmit data pair.
16	RCV DATA B	The “B’’ side of the receive data pair.

Table 8-3 T1/D4 1.544 MBPS Interface To Aggregate Line Transceiver 25-Pin Connector Pin Assignments

Pin No.	Signal Name	Description
1	Gnd	Chassis Ground
2	XMT DATA A	The “A’’ side of the transmit data pair.
3	RCV DATA A	The “A’’ side of the receive data pair.
14	XMT DATA B	The “B’’ side of the transmit data pair.
16	RCV DATA B	The “B’’ side of the receive data pair.

Table 8-4 ITU-T G.703 2.048 MBPS Interface To Aggregate Line Transceiver 25-Pin Connector Pin Assignments

Pin No.	Signal Name	Description
1	Gnd	Chassis Ground
2	XMT DATA A	The “A’’ side of the transmit data pair.
3	RCV DATA A	The “A’’ side of the receive data pair.
14	XMT DATA B	The “B’’ side of the transmit data pair.
16	RCV DATA B	The “B’’ side of the receive data pair.

Table 8-5 ITU-T G.703 64 KBPS Contradirectional Interface To Aggregate Line Transceiver 25-Pin Connector Pin Assignments

Pin No.	Signal Name	Description
1	Gnd	Chassis Ground
2	XMT DATA A	The “A’’ side of the transmit data pair.
3	RCV DATA A	The “A’’ side of the receive data pair.
13	RCV CLK B	Receive clock for B
14	XMT DATA B	The “B’’ side of the transmit data pair.
15	XMT CLK A	Transmit clock for A
16	RCV DATA B	The “B’’ side of the receive data pair.
17	RCV CLK A	Receive clock for A
19	XMT CLK B	Transmit clock for B

Table 8-6 ITU-T V.35 Interface To Aggregate Line Transceiver 25-Pin Connector Pin Assignments

Pin No.	Signal Name	Description
1	Gnd	Chassis Ground
2	XMT DATA A	The “A’’ side of the transmit data pair.
3	RCV DATA A	The “A’’ side of the receive data pair.
4	+V	+5V
12	EXT TIM B	External transmit clock for B
13	RCV CLK B	The receive clock for B
14	XMT DATA B	The “B’’ side of the transmit data pair.
15	XMT CLK A	Transmit clock for A
16	RCV DATA B	The “B’’ side of the receive data pair.
17	RCV CLK A	The receive clock for A
19	XMT CLK B	The transmit clock for B
20	+V	+5V
24	EXT TIM A	The external transmit clock for A

Table 8-7 RS-422/423, MIL-188-114 Interface To Aggregate LineTransceiver 25-Pin Connector Pin Assignments

Pin No.	Signal Name	Description
1	Gnd	Chassis Ground
2	XMT DATA A	The “A’’ side of the transmit data pair.
3	RCV DATA A	The “A’’ side of the receive data pair.
4	+V	+5V
12	EXT TIM B	External transmit clock for B
13	RCV CLK B	The receive clock for B
14	XMT DATA B	The “B’’ side of the transmit data pair.
15	XMT CLK A	Transmit clock for A
16	RCV DATA B	The “B’’ side of the receive data pair.
17	RCV CLK A	The receive clock for A
19	XMT CLK B	The transmit clock for B
20	+V	+5V
24	EXT TIM A	The external transmit clock for A

Table 8-8 EIA/TIA-232-E Interface To Aggregate LineTransceiver 25-Pin Connector Pin Assignments

Pin No.	Signal Name	Description
1	Gnd	Chassis Ground
2	XMT DATA	Transmit data
3	RCV DATA	Receive data
4	+V	+12V
7	SIG Gnd	Signal Ground
15	XMT CLK	Transmit clock
17	RCV CLK	Receive clock
20	+V	+12V
24	EXT TIM	External terminal timing
25	–V	–12V

Data and Voice II Channel

Table 8-9 and Table 8-10 list the pin assignments for the Data Channel and Voice II Channel connectors.

Table 8-9 Data Channel Connector Pin Assignments

Pin No.	Signal Unbalanced (EIA/TIA-232-E/ RS-423)	Signal Balanced (RS-422/ITU-T V.35)	Signal Balanced (ITU-T G.703)	RS-422 Adapter	Signal Unbalanced V.54 Using MM08	X.21 (X.27)
1	Chassis Ground	Chassis Ground	Chassis Ground	Chassis Ground	Chassis Ground	Chassis Ground
2	Transmit Data	Transmit Data "A"	Transmit Data "A"	Xmt Data A	Transmit Data	SD-A
3	Receive Data	Receive Data "A"	Receive Data "A"	Receive Data A	Receive Data	RD-A
4	Request To Send*	Request to Send*	Request to Send*	RTS A, RTS B	Request to Send*	RTS-A
5	Clear To Send*	Clear To Send*	Clear To Send*	CTS A, CTS B		RTS-B
6	Ready Out* (DSR)	Ready Out* (DSR)	Ready Out* (DSR)	Rdy A, Rdy B	Test Mode*	DCD-B
7	Signal Ground	Signal Ground	Signal Ground	Signal Ground	Signal Ground	Signal Ground
8	Carrier Detect*	Carrier Detect*	Carrier Detect*	DCD A, DCD B	Carrier Detect*	DCD-A
10	Non-Standard Control Signal*	Transmit/Receive Clock "B"	Nonstandard control signal	Xmt Data B	Remote Loopback	ST-B
11	Receive Ground	External Transmit Clock "B"		Xmt Clk B		TT-B
15/ 17**	Transmit/Receive Clock	Transmit/Receive Clock "A"		XmT/Rx Clk A	Transmit/Receive Clock	ST-A
20	Ready In* (DTR)	Ready In* (DTR)	Ready In* (DTR)	Rdy A, Rdy B	Ready Out (DTR)*	
22	Ring Indicator*	Transmit Data "B"	Transmit Data "B"	Xmt Data B	Local Loopback*	SD-B
24	External Transmit Clock	External Transmit Clock "A"		Xmt Clock A	External Transmit Clock	TT-A
25	Busy Out*	Receive Data “B’’	Receive Data “B’’	Receive Data B		RD-B

* Control signals are unbalanced, at EIA/TIA-232-E voltage levels.

** Pins 15 and 17 are tied together on backplane.

Table 8-10 Voice II/CVSD And PCM Channel Connector Pin Assignments*

Pin Number	Description
2	–BATT
3	M Lead
4	Receive Tip (RT)
5	Receive Ring (RR)
7	Signal Ground
8	Station Ground
10	Transmit Ring (TR)
11	E’ Lead
15	Station Battery
24	E Lead
25	Transmit Tip (TT)

The E’ lead is the same signal as the E lead, and provides no additional functions.

The CVSD card had a type C relay driving the E Lead and so both NC and NO outputs were made available for customer use. The UVC connected the E and E’ together.

Station Ground (pin 8) is the SG lead which is paired with the E Lead.

Signal Ground is an internal mux ground, and so is not normally used for signalling due to the added noise which may then be injected.

External Timing

Table 8-11 lists the pin assignments for the external timing connector (J4) on the TMSC backplane.

Table 8-11 External Timing Connector (J4) Pin Assignments

Pin Number	Description
1	Protected Ground
2	External Timing A (In)
3	External Timing B(In)
8	512 KHz Reference B (Out)
9	512 KHz Reference A (Out)

Internal/External Modem

Table 8-12 lists the pin assignments for the phone jack J7 located on the rear of the TMSC main shelf. The phone jack connects to the internal GDC 212A modem on the Redundancy Control Card. *Note that the internal modem is available only on early versions of the RCC. Table 8-13* lists the pin assignments for the external modem Port J8 located on the rear of the TMSC main shelf.

Table 8-12 Phone Jack Internal Modem Connector Pin Assignments

Pin Number	Description
3	Tip
4	Ring
Note that the internal modem is available only on earlier versions of the RCC.	

Table 8-13 External Modem Port J8 25-Pin Connector Pin Assignments

Pin Number	Description	
1	Protected Ground	
2	Send Data	(TD)
3	Receive Data	(RD)
4	Request to Send	(RTS)
5	Clear to Send	(CTS)
6	Data Set Ready	(DSR)
7	Ground	
8	Data Carrier Detect	(DCD)
12	Speed Mode Indicate	(SPD IND)
20	Data Terminal Ready	(DTR)
22	Ring Indicator	(RI)

External Alarm Relay

Table 8-14 lists the pin assignments for the external alarm relay connector (J3) located on the rear of the TMSC main shelf.

Table 8-14 Alarm Relay Connections, Rear Panel Connector J3

Pin Number	Function	Relay State	
1	Minor Alarm 2	Common	(CO)
2	Major Alarm 2	Common	(CO)
3	Spare		
4	Spare		
5	Major Alarm 2	Deenergized	(NO)
6	Major Alarm 1	Deenergized	(NO)
7	Minor Alarm 2	Deenergized	(NO)
8	Minor Alarm 1	Deenergized	(NO)
9	Major Alarm 1	Common	(CO)
10	Spare		
11	Minor Alarm 1	Common	(CO)
12	Major Alarm 2	Energized	(NC)
13	Major Alarm 1	Energized	(NC)
14	Minor Alarm 2	Energized	(NC)
15	Minor Alarm 1	Energized	(NC)

Echo Canceller Card

Table 8-15 lists the pin assignments for the Echo Canceller piggyback card. This card plugs into the Universal Voice Card.

Table 8-15 Echo Canceller Card Pin Assignments

XAP1 Pin Number	Signal Name	Description
1	+5V	+5 V dc Supply
2	TEST/	Disables the Echo Canceller during diagnostics
3	PCMDAT	Near-end speech signal
4	RESET/	Power-on reset pulse
5	PCMCK	Clock signals for RX64KDAT, PCMDAT, ECHOUT
6	FRASYN	Byte timing for RX64KDATA, PCMDAT, ECHOUT
7	MULAW/	Indicates Universal Voice Card “A’’ or “MU-LAW’’ Codec
8	RX64KDATA	Far-end speech signal
9	EHOUT	Echo Canceller output signal
10	DISABLE	External disable line
11	–12 V	–12 V dc supply
12	SPARE	Not used
13	GND	Ground

CDA Module DB25 Output 25-Pin

Table 8-16 lists the pin assignments for the Combined Digital Aggregate Module.

Table 8-16 CDA Module DB25 Output 25-Pin Connector Pin Assignments

Pin Number	Signal Name	Description
1	Gnd	Chassis Ground
2	XMT DATA A	The “A" side of the transmit data pair
3	RCV DATA A	The “A" side of the receive data pair.
14	XMT DATA B	The “B" side of the transmit data pair.
16	RCV DATA B	The “B" side of the receive data pair.
These pins are used when the second CDA module is connected as a non-redundant pair in conjunction with the special Y cable.		
18	RCV DATA B	The “B" side of the receive data pair.
4	XMT DATA A	The “A" side of the transmit data pair.
8	RCV DATA A	The “A" side of the receive data pair.
25	XMT DATA B	The “B" side of the transmit data pair.

TID-III Data Channel Module

Table 8-17 lists the pin assignments for the TID-III Data Channel Module.

Table 8-17 TID-III Data Channel Module EIA RS-422 Interface Connector Pin Assignments

Channel Card EIA Connector	Module Edge Connector P1 Pin Number	Signal Description
1	1	Chassis Ground
7	32	Ground
17	27	Receive Clock A*
10	52	Receive Clock B*
3	28	Receive Data A*
25	51	Receive Data B*
24	56	Transmit Clock A**
11	54	Transmit Clock B**
2	55	Transmit Data A**
22	50	Transmit Data B**
5	25	External Clock A
4	24	External Clock B
20	26	Test Signal
6	23	Test Signal

* From TID Channel to User
** From User to TID Channel

G.704 Aggregate Interface Piggyback Card

Table 8-18 and Table 8-19 list the pin assignments for the G.704 Aggregate Interface piggyback card.

Table 8-18 G.704 Aggregate Interface Piggyback Card Connector Pin Assignments (XP1)

Pin No.*	Description	Function
1	CHASSIS GND	Chassis ground — Connects to system chassis ground through Aggregate Control Card.
2	XMT DATA	Transmit data from Aggregate Control Card. Data changes on falling edge of the Transmit Clock.
3	XMT CLK	Transmit Clock to Aggregate Control Card — N x 64 kHz.
4	RCV DATA	Receive data to Aggregate Control Card. Data is sampled on rising edge of RCV CLK.
5	RLB	Receive Remote Loopback. Causes a remote loopback condition on the G.704 Aggregate Interface Piggyback card.
6	RCV CLK	Receive Clock to Aggregate Control Card — N x 64 kHz.
8	ROOS (L)	Indicates that the remote end is out of G.704 frame sync. Multiplexers is out of sync also. Signal low for ROOS.
9	SIG GND	Signal Ground
13	EXT TMG	External Transmit Input from TMS clock circuitry. 2.048 MHz code clock for transmit timing.
18	+5 V	Positive 5-volt dc supply.
19	SIG GND	Signal Ground.
20	LOOS (L)	Indicates that the local end is out of G.704 frame sync. Multiplexers is of sync also. Signal low for LOOS.
24	CDET	Carrier Detect output. Goes low when receive data is lost. High indicates carrier is present.
31	RCLK	Receive 2.048 MHz clock for node clocking.
35	RCVDATA B	Balanced Receive Data B from one side of T1 line input. Grounded by the UNB switch.
36	RCVDATA A	Balanced Receive Data A from one side of T1 line input.
38	XMTDATA A	Balanced Transmit Data A from one side of T1 line output.
39	XMTDATA B	Balanced Transmit Data B from one side of T1 line output.
40	PROT GND	Protective ground output from G.704 Aggregate Interface Piggyback to equipment cabinet.
* Pin numbers 7, 10-12, 14,-17 21-23, 25-30, 32-34, and 37 are not used. Note that Connector XP2 on the G.704 Aggregate Interface Piggyback is used on a later version of the Aggregate Control Card.		

Table 8-19 G.704 Aggregate Interface Piggyback Card Connector Pin Assignments (XP2)

Pin	Description	Signal Description
1	+5 V	Positive 5 volt input
3	SIG GND	Signal Ground
4	BD0	Microprocessor Data Bus 0
5	BD1	Microprocessor Data Bus 1
6	BD2	Microprocessor Data Bus 2
7	BD3	Microprocessor Data Bus 3
8	BD4	Microprocessor Data Bus 4
9	BD5	Microprocessor Data Bus 5
10	BD6	Microprocessor Data Bus 6
11	BD7	Microprocessor Data Bus 7
12	WRSTB	Write Strobe (when low condition is true)
13	RDSTB	Read Strobe (when low condition is true)
14	CSN	Board Select (when low condition is true)
15	BA0	Microprocessor Address Bus 0
16	BA1	Microprocessor Address Bus 1
17	BA2	Microprocessor Address Bus 2
18	BA3	Microprocessor Address Bus 3
Note that plesiochronous buffers introduce unwanted end-to-end delay on the aggregate link. Keep their size to a minimum when configuring the system.		

ACM Module DB25 Output 25-Pin

Table 8-20 lists the pin assignments for the ADPCM Compression Module.

Table 8-20 ACM DB25 Output 25-Pin Connector Pin Assignments

Pin Number	Signal Name	Description
1	Gnd	Chassis Ground
2	XMT DATA A	The “A’’ side of the transmit data pair
3	RCV DATA A	The “A’’ side of the receive data pair.
14	XMT DATA B	The “B’’ side of the transmit data pair.
16	RCV DATA B	The “B’’ side of the receive data pair.

Summary

This chapter provided the connector pin assignments for the various TMS cards and shelf connectors.

Chapter 9, Agency Rules and Regulations

> ***Note*** *This appendix supersedes any information contained in GDC 036R303-000.*
>
> *Before installing the equipment refer to the applicable national regulations within this document.*

Part 1: UK Regulations

This appendix must be read before connecting the equipment in the United Kingdom and, where appropriate, overrides any information provided in the text of the international manual. Any inquiries should be addressed to

GENERAL DATACOMM LIMITED
Molly Millars Close
Molly Millars Lane
Wokingham
Berkshire
RG11 2QF

Equipment to which these regulations apply:

TMS Compact

Applicable Regulations

Safety Aspects

Safety protection for this equipment relies on the provision of a protective earth. This should be hardwired to the earth stud provided on the rear of the power supply shelf.

> ***Caution*** *This equipment must be earthed.*

Alternatively, the unit must be isolated from the PTO line interface before the mains plug, containing the protective earth, is removed. In such cases, the PTO line interface should not be hardwired.

Caution *Connect only equipment complying with BS6301 to the ports.*

This equipment does NOT provide an isolation barrier between the PTO digital service and equipment connected to the ports. All equipment connected to the multiplexer ports should carry BS6301 approval, or be connected via an approved safety barrier.

It is possible to connect equipment having both BS6301 compliant and non-compliant ports to the multiplexer, thus creating a non-isolated path between hazardous voltages in the connected equipment and the PTO digital network. When connecting equipment of this type to the multiplexer, advice should be sought from a competent engineer.

Part 2: Telecommunication Attachment Details

This apparatus is approved for connection to Kilostream and Megastream services.

The approval of this equipment for connection to circuits provided by a Public Telecomms Operator is invalidated if the apparatus is subjected to any modification in any material way not authorised by British Telecomm or Telecomm Eireann. Misuse of the equipment by external software control or unconventional interconnection of auxiliary equipment, in such a way as to contravene relevant designated standards and regulatory specifications, shall invalidate the attachment approval.

Part 3: Attachment Information — UK

When completing the enclosed form for telecommunications attachment, the following details must be inserted for this equipment:

MODEL NUMBER	TMS
ATTACHMENT APPROVAL No.	NS/1132/123/H/452743
AUTHORISED FOR CONNECTION	Megastream 2 private circuits
	Kilostream X21bis (V.28) private circuits
	Kilostream X21bis (V.35) private circuits
	Kilostream X21 (V.11) private circuits
	The PSTN utilising PCM and ADPCM encoding

Part 4: Attachment Information — Republic Of Ireland

MODEL NUMBER	TMS Compact
ATTACHMENT APPROVAL NO.	
AUTHORISED FOR CONNECTION	

TELECOMMUNICATION ATTACHMENT DETAILS

GENERAL DATACOMM LIMITED
Molly Millars Close, Molly Millars Lane, WOKINGHAM, Berkshire RG11 2QF.
Telephone Wokingham (0734) 774868 Facsimile (0734) 774871

SUBSCRIBER'S PROCEDURE

IF THERE IS NO APPROPRIATE TELECOMMUNICATION CONNECTION POINT WITHIN 3 METERS OF THE SITING OF THIS EQUIPMENT, DISPATCH THIS FORM TO YOUR LOCAL TELEPHONE AREA OFFICE AS A REQUEST FOR SERVICE CONNECTION.

FOR GENERAL DATACOMM PRODUCT SUPPORT Telephone (0734) 774868

SUBSCRIBER'S DETAILS

COMPANY...

ADDRESS ....

....

....POSTCODE...

TELEPHONE...................................TELEX...

CONTACT NAME ....

---

* MODEL NO..

* ATTACHMENT APPROVAL NO. ——/1132/—/——/——————-

* AUTHORISED FOR CONNECTION TO THE FOLLOWING SERVICE(S)

2-WIRE PSTN LINE

4-WIRE LEASED LINE

KILOSTREAM

MEGASTREAM

PLEASE COME AND FIT.......................EXTENSION SOCKETS AS SOON AS POSSIBLE.

A Rates

Overview

Tables A-1 through A-12 list data rates for TMS to TMS nodes for each type of TMS class circuit in the TMS-3000. These rates are shown as found in the `Circuit Rate Selection` screen.

Note that the following circuit types have only one or two rates available:

ACM-D — 64 K PCM and 320 K

G.703 — 64 K, 128 K, *or* 256 K. Supports *one* of these three rates depending on the G.703 card version.

CADM — 16 K

TOR — 8 and 9.6 K

Table A-1 Synchronous Channel Rates

50	75	100	150	200	300	400	600	800
900	1.000 K	1.200 K	1.600 K	1.800 K	2.000 K	2.400 K	3.200 K	3.600 K
4.000 K	4.800 K	6.400 K	7.200 K	8.000 K	9.600 K	12.00 K	14.00 K	14.40 K
16.00 K	19.20 K	24.00 K	25.00 K	28.00 K	28.80 K	32. 00 K	36.00 K	38.40 K
39.00 K	40.80 K*	48.00 K	50.00 K	56.00 K	57.60 K	64.00 K	72.00 K	76.80 K
96.00 K	100.0 K	112.0 K	115.2 K	128.0 K	144.0 K	153.6 K	168.0 K**	192.0 K
224.0 K	230.4 K	256.0 K	280.0 K*	288.0 K	307.2 K	320.0 K*	336.0 K**	338.0 K*
384.0 K	392.0 K*	394.0 K*	448.0 K**	460.8 K	504.0 K*	512.0 KÜ	560.0 K*	576.0 K
616.0 K*	640.0 K*	672.0 K**	704.0 K*	728.0 K*	768.0 K	784.0 K*	832.0 K*	840.0 K*
896.0	921.6 K	952.0 K*	960.0 K*	1.008 M*	1.024 M	1.064 M*	1.088 M*	1.120 M*
1.152 M	1.176 M*	1.216 M*	1.232 M*	1.280 M*	1.288 M*	1.344 M**	1.408 M*	1.472 M*
1.528 M*	1.536 M***	1.544 MÜ	1.600 M*	1.664 M*	1.728 M*	1.792 M*	1.856 M*	1.920M
1.984 M*								

* Requires external clock
** Requires that ESCC option switches be set for 1.344 (S3-5 ON)
*** Requires that ESCC option switches be set for 1.536 (S3-4 ON)
Ü Maximum rate for Digital Bridge synchronous circuits

Table A-2 Isochronous Channel Rates

75	100	150	200	300	400	600	800	900
1.000 K	1.200 K	1.600 K	1.800 K	2.000 K	2.400 K	3.600 K	4.000 K	4.800 K
7.200 K	8.000 K	9.600 K	12.00 K	14.00 K	14.40 K	16.00 K	19.20 K	24.00 K
28.80 K	32.00 K	36.00 K	48.00 K	57.60 K	64.00 K			

Table A-3 Asynchronous Channel Rates

75	100	150	200	300	400	600	800	900
1.000 K	1.200 K	1.600 K	1.800 K	2.000 K	2.400 K	3.200 K	3.600 K	4.000 K
4.800 K	6.400 K	7.200 K	8.000 K	9.600 K	12.00 K	14.00 K	14.40 K	16.00 K
19.20 K								

Table A-4 Transition-Encoded Rates

75	100	150	200	300	400	600	800	900
1.000 K	1.200 K	1.600 K	1.800 K	2.000 K	2.400 K	3.600 K	4.000 K	4.800 K
7.200 K	8.000 K	9.600 K	12.00 K	14.00 K	14.40 K	16.00 K	19.20 K	24.00 K
28.80 K	32.00 K	36.00 k	48.00 K	57.60 K	64.00 K			

Table A-5 CVSD Channel Rates

14.40 K	16.00 K	19.20 K	24.00 K	25.00 K	28.00 K	28.80 K	32.00 K	36.00 K
38.40 K	48.00 K	56.00 K	57.60 K	64.00 K				

Table A-6 U-ADPCM Rates

16.00 K	24.00 K	32. 00 K	CC32K	A32 K	NA32 K	64K PCM

Table A-7 ASP Channel Rates

10.00 K	11.00 K	12. 00 K	14.00 K	16.00 K

Table A-8 TID-III Data Channel Rates

1.200 K	2.400 K	3.200 K	4.800 K	6.400 K	9.600 K	12.00 K	19.20 K	38.40 K
72.00 K	76.80 K	100.0 K	112.0 K	153.6 K	224.0 K	288.0 K	576.0 K	1.152 M

Table A-9 VLBRV Channel Rates

2.400 K	4.800 K	9.600 K

Table A-10 CELP Channel Rates

4.800 K	6.400 K	9.600 K

Table A-11 ACM-UVC and ACM-V Rates

16.00 K	24.00 K	32. 00 K	CC32K	A32 K	NA32 K	64K PCM

Table A-12 TPP Rates

50	75	100	150	200	300	400	600	800
900	1.000 K	1.200 K	1.600 K	1.800 K	2.000 K	2.400 K	3.200 K	3.600 K
4.000 K	4.800 K	6.400 K	7.200 K	8.000 K	9.600 K	12.00 K	14.00 K	14.40 K
16.00 K	19.20 K	24.00 K	25.00 K	28.00 K	28.80 K	3.200 K	36.00 K	38.40 K
39.00 K	40.80 K	48.00 K	50.00 K	56.00 K	57.60 K	64.00 K	72.00 K	76.80 K
96.00 K	100.0 K	112.0 K	115.2 K	128.0 K	144.0 K	153.6 K	168.0 K	192.0 K
224.0 K	230.4 K	256.0 K	280.0 K	288.0 K	307.2 K	320.0 K	336.0 K	338.0 K
384.0 K	392.0 K	394.0 K	448.0 K	460.8 K	504.0 K	512.0 K	560.0 K	576.0 K
616.0 K	640.0 K	672.0 K	704.0 K	728.0 K	768.0 K	784.0 K	832.0 K	840.0 K
896.0 K	921.6 K	952.0 K	960.0 K	1.008 M	1.024 M	1.064 M	1.088 M	1.120 M
1.152 M	1.176 M	1.216 M	1.232 M	1.280 M	1.288 M	1.344 M	1.408 M	1.472 M
1.528 M	1.536 M	1.544 M	1.600 M	1.664 M	1.728 M	1.792 M	1.856 M	1.920 M
1.984 M								

Tables A-13 through A-19 list data rates for TMS to OCM, OCM to OCM, and OCM Dual Private Voice circuits.

Table A-13 Synchronous, Isochronous, and Transition-Encoded Channel Rates (TMS-OCM single data card and OCM-OCM single data card)

300	600	1.200 K	1.600K	1.800 K	2.000 K	2.400 K	3.200 K	3.600 K
4.000 K	4.800 K	6.400 K	7.200 K	8.000 K	9.600 K	12.00 K	14.00 K	14.40 K
16.00 K	19.20 K	24.00 K	28.00 K	28.80 K	32.00 K	36.00 K	38.40 K	48.00 K
56.00 K	57.60 K	64.00 K	72.00 K	76.80 K	96.00 K	112.0 K	115.2 K	128.0 K
144.0 K	153.6 K	192.0 K	224.0 K	230.4 K	256.0 K	288.0 K	320.0 K	384.0 K
448.0 K	460.8 K	512.0 K	576.0 K	640.0 K	704.0 K	768.0 K	832.0 K	896.0 K
960.0 K	1.024 M	1.088 M	1.152 M	1.216 M	1.280 M	1.344 M	1.408 M	1.472 M
1.536 M	1.544 M	1.600 M	1.664 M	1.728 M	1.792 M	1.856 M	1.920 M	1.984 M
2.048 M								

Table A-14 Synchronous, Isochronous, and Transition-Encoded Channel Rates (TMS-OCM dual data card)

300	600	1.200 K	1.600 K	1.800 K	2.000 K	2.400 K	3.200 K	3.600 K
4.000 K	4.800 K	6.400 K	7.200 K	8.000 K	9.600 K	12.00 K	14.00 K	14.40 K
16.00 K	19.20 K	24.00 K	28.00 K	28.80 K	32.00 K	36.00 K	38.40 K	

Table A-15 Synchronous, Isochronous, and Transition-Encoded Channel Rates (OCM-OCM single data card)

300	600	1.200 K	1.600K	1.800 K	2.000 K	2.400 K	3.200 K	3.600 K
4.000 K	4.800 K	6.400 K	7.200 K	8.000 K	9.600 K	12.00 K	14.00 K	14.40 K
16.00 K	19.20 K	24.00 K	28.00 K	28.80 K	32.00 K	36.00 K	38.40 K	48.00 K
56.00 K	57.60 K	64.00 K	72.00 K	76.80 K	96.00 K	112.0 K	115.2 K	128.0 K
144.0 K	153.6 K	192.0 K	224.0 K	230.4 K	256.0 K	288.0 K	320.0 K	384.0 K
448.0 K	460.8 K	512.0 K	576.0 K	640.0 K	704.0 K	768.0 K	832.0 K	896.0 K
960.0 K	1.024 M	1.088 M	1.152 M	1.216 M	1.280 M	1.344 M	1.408 M	1.472 M
1.536 M	1.544 M	1.600 M	1.664 M	1.728 M	1.792 M	1.856 M	1.920 M	1.984 M
2.048 M								

Table A-16 Synchronous, Isochronous, and Transition-Encoded Channel Rates (OCM-OCM dual data card)

300	600	1.200 K	1.600 K	1.800 K	2.000 K	2.400 K	3.200 K	3.600 K
4.000 K	4.800 K	6.400 K	7.200 K	8.000 K	9.600 K	12.00 K	14.00 K	14.40 K
16.00 K	19.20 K	24.00 K	28.00 K	28.80 K	32.00 K	36.00 K	38.40 K	

Table A-17 Asynchronous Channel Rates (TMS-OCM single data card and TMS-OCM dual data card)

300	600	1.200 K	1.600 K	1.800 K	2.000 K	2.400 K	3.200 K	3.600 K
4.000 K	4.800 K	6.400 K	7.200 K	8.000 K	9.600 K	12.00 K	14.00 K	14.40 K
16.00 K	19.20 K							

Table A-18 Asynchronous Channel Rates (OCM-OCM single data card and OCM-OCM dual data card)

300	600	1.200 K	1.600 K	1.800 K	2.000 K	2.400 K	3.200 K	3.600 K
4.000 K	4.800 K	6.400 K	7.200 K	8.000 K	9.600 K	12.00 K	14.00 K	14.40 K
16.00 K	19.20 K	24.00 K	28.00 K	28.80 K	32.00 K	36.00 K	38.40 K*	

* Single data channel card only.

Table A-19 IMBE (OCM Dual Private Voice) Rates

2.400 K	4.800 K	6.400 K	8.000 K	9.600 K

B Technical Characteristics

Item	Specifications
Multiplexing Technique	Bit-interleaved, time division
Multiplexing Efficiency	Up to 99%, essentially unaffected by speed or mix of channels
Channel Capacity	Up to 512 channels of voice or data per node
Aggregate Interfaces	EIA/TIA-232-E/ITU-T V.28
	ITU-T V.35
	EIA RS-422 (ITU-T V.11), EIA RS-423 (ITU-T V.10), MIL-STD-188-114
	T1/D4 1.544 Mbps
	T1 1.544 Mbps (non AT&T)
	ITU-T G.703 64 Kbps Codirectional
	ITU-T G.703 64 Kbps Contradirectional
	ITU-T G.703 256 Kbps
	ITU-T G.703 2.048 Mbps
	ITU-T G.704 2.048 Mbps
	Fiber Optic 1.544 Mbps or 2.048 Mbps
Aggregate Capacity	Up to 8 redundant or 16 non-redundant aggregate trunks per node
Aggregate Rates	From 2400 bps to 2.048 Mbps
Environmental:	
Operating Temperature*	32°F to 124°F (0°C to 50°C) (for equipment mounted in EP-2T,EP-2M, and EP-4
Nonoperating	–4°F to 186°F (–40°C to +85°C)
Humidity	95% relative humidity with no condensation
Altitude	
Operating	10,000 ft (3048 m)
Nonoperating	40,000 ft (12,192 m)
Enterprise System Control Card	
Internal Clock Accuracy	25 ppm
Timing Specifications	Meets ATT Pub. 62411 specification — Stratum 4 Enhanced
Input/Output Ports	TMS Controller Port — sync at 19.2 Kbps, async up to 9600 bps
	Maintenance Port (front and rear) async up to 9600 bps
	External modem — async up to 4800 bps
* Derate operating temperature by 1°C/1000 ft above sea level.	

Technical Characteristics (Cont.)

Item	Specifications
CDA Module	
Framing method	Bit oriented proprietary or Byte oriented (DS0)
Frame structure	D4 or ESF (CDA-T1), CEPT G.732 or G.704 (CDA-E1)
CDA module compatibility	DACS (Digital Access Cross-connect), D4 Devices and TMS-3000 w/CDA
Cross connection	Meets DSX-12 interconnect specification
CDA channel capacity	128 TMS-3000 channels (Non-redundant CDA pair)
	256 TMS-3000 channels (Redundant CDA pair)
CDA line rate	T1 — 1.544 Mbps
	E1 — CEPT G.704 and G.732 — 2.048 Mbps
PLL Jitter Tolerance (Receiver)	Meets ATT Pub. 62411 specification — Stratum 4 Enhanced
Input/Output Ports	Two DS1 ports support up to 48 DS0 channels per CDA-T1 module.
	Two DS1 ports support up to 32 DS0 channels per CDA-E1 module (CEPT G.704, G.732)
Pulse Density Requirements	B8ZS or Bit 7 stuffing (suppression)
Data II/III/IV/UDC Channel	
Data Rates	
Synchronous	From 75 bps to 1.152 Mbps
Asynchronous	From 0 to 19.2 Kbps
Isochronous, Anisochronous	From 0 to 64 Kbps
	See Appendix A for listing of all standard channel rates
Interfaces	EIA/TIA-232-E/ITU-T V.28/ITU-T V.28
	ITU-T V.35
	EIA RS-422 (ITU-T V.11), MIL-STD-188-114 Balanced (Data and Timing)
	EIA RS-423 (ITU-T V.10), MIL-STD-188-114 Unbalanced (Data and Timing)
Interface Signal Characteristics:	DTE (Data Terminal Equipment) or DCE (Data Communications Equipment) may be chosen.
TID-III Data Channel	
Interface	Conforms to EIA RS-422 balanced differential interface for data and clock. Special application specific interfaces supported through interface piggyback.
Data Rates (Modes 1-4)	Channel rates, 1, 2, 2.4, 4, 4.8, 8, 9.6, 16, 32, 56, 64, 72, 96, 128, 192, 256, 512, 1024 Kbps*
	Corresponding TDM Rates: 1.2, 2.4, 3.2, 4.8, 6.4, 9.6, 12, 19.2, 38.4, 72, 76.8, 100, 112, 153.6, 224, 228, 576, 1152 Kbps.
Data Rates (Mode 5)	Any rate below pre-set maximum standard channel rates above**
Input Distortion (includes Clock/Data Skew and Clock Asymmetry)	Up to 25% maximum
Output Distortion (includes Clock/Data Skew	Less than 2.5%

* Other rates available. Consult GDC regarding availability of any specific desired rate not listed.

** For rates 2 Kbps and above, the lower limit is 850 Hz. For the 1 Kbps rate, the lower limit is 150 Hz.

Technical Characteristics (Cont.)

Item	Specifications
TID-III Data Channel (Cont.)	
Input Rate Offset	Dependent on input rate and mode selected. From ±0.001% to ±2%
Output Rate Accuracy	Dependent on input rate and mode selected. From ±0.001% to ±2%
Output Clock Jitter	Rate Dependent: From ±20 ns (±2%) bit-to-bit jitter at 1024 Kbps to ±0.03%
(Modes 1-3 and 5)	1 Kbps
Output Clock Jitter	±25 ms bit-to-bit jitter at 1024 to 512 Kbps. Less than ±0.75% at all other data rates
End-to-End Channel Delay	With 384-bit output FIFO Buffer Delay Setting: 527 ±135 bits
	With 96-bit output FIFO Buffer Delay Setting: 239 ±50 bits*
Acquisition Time	Maximum of 512 bits with no errors detected and 768 bits with detected errors
Transparency	Transparent to any data pattern
Channel Capacity	Requires 2 contiguous channel card slots of a TDM Multiplexer shelf
Power Requirement	+5 V at 3 A
Temperature	
Operating	0°C to 50°C (derate by 1°C/1000 ft above sea level)
Storage	–40°C to +85°C
Humidity	Up to 95% without condensation
Altitude	
Operating	10,000 ft
Storage	40,000 ft
Voice II/CVSD Channel	
Digital Interface	Synchronous
Impedance	600 ohms resistive ±10%
Return Loss	15 dB minimum, 300 to 3400 Hz
Longitudinal Balance	60 dB minimum, 300 to 3300 Hz
Usable Bandwidth	300 to 3300 Hz (3 dB points)
Input Levels	–16 or 0 dBm at transmitter input, switch selectable.
	–6.0 to +1.5 dB of compensation available in 0.5 dB steps.
Output Levels	0 or +7 dBm at receiver output, switch selectable.
	–6.0 to +1.5 dB of compensation available in 0.5 dB steps.
Performance Levels at 32 Kbps	
Idle Channel Noise	23 dBrnc0 maximum
Cross Talk Loss	60 dB minimum (0 dB Channel Gain)
	48 dB minimum (23 dB Channel Gain)
Harmonic Distortion at 1004 Hz	–25 dBm0 maximum
Intermodulation Distortion	2nd order –40 dBm0 max.
	3rd order –36 dBm0 max.

* For input rate tracking mode 1, the output FIFO settles to almost full (27-bit delay for 96-bit tap) and buffer excursion is limited to ±10 bits.

Technical Characteristics (Cont.)

Item	Specifications
Voice II/CVSD Channel (Cont.)	
Dynamic Range	+3 to –50 dBm0
Level Stability	±0.25 dB
Channel Gain at 1004 Hz	0 ±0.5 dB or 23 ±0.5 dB (Nominal gain ± Trim)
Signal to Quantizing	
Noise (1004 Hz Test Tone)	
At –39 dBm0 Signal Level	19 dB S/N
At –27 dBm0 Signal Level	25 dB S/N
At –18 to +3 dBm0 Signal Level	26 dB S/N
Frequency Response,	–1.5 dB to +1 dB (Relative to 1004 Hz)
400 to 3200 Hz	
Envelope Delay	
300 to 500 Hz	700 µs
500 to 2400 Hz	300 µs
800 to 2400 Hz	100 µs
2400 to 2900 Hz	300 µs
2900 to 3400 Hz	700 µs
E and M signaling states	
E-lead relay	Open = idle, Closed = busy
M-lead detector	Compatible with Types 1-5 signaling interface
M-lead input impedance	10 kilohms minimum, diode-protected
M-lead sensitivity	1 mA maximum
E-Lead Relay Contact Ratings	
Maximum Current	0.25 A
Maximum Voltage	100 volts*
Minimum Resistance	100 milliohms
Voice II/ASP Channel Module	
4-Wire Interface:	
Impedance	600 ohms resistive ±10%
Return Loss	20 dB minimum, 300 to 3400 Hz
Longitudinal Balance	56 dB minimum, 300 to 3400 Hz
Usable Bandwidth	300 to 3400 Hz (ASP Mode)
	300 to 3400 Hz (PCM Mode)
Nominal Input Levels:	–16 dBm or 0 dBm (switch selectable)
	–6.0 to +1.5 dB of compensation available in 0.5 dB steps (switch selectable)
Nominal Output Levels:	0 dBm or +7 dBm (switch selectable)
	–6.0 to +1.5 dB of compensation available in 0.5 dB steps (selected through supervisory port interface)
*This is an operating parameter, not a transient parameter.	

Voice II/ASP Channel Module (Cont.)	
Voice Channel Performance	
(PCM mode):	
Signal-to-total distortion ratio as function of input level (noise)	
–3 dBm0	26.3 dB
–6 to –27 dBm0	33.9 dB
–34 dBm0	32.2 dB
–40 dBm0	27.6 dB
–55 dBm0	12.6 dB
Signal-to-total distortion ratio as function of input level (sine wave)	
0 to –30 dBm0	33 dB
–40 dBm0	27 dB
–45 dBm0	22 dB
Idle Channel Noise	–67 dBm0p (ITU-T Weighted)
	23 dBrnc0 (C-Message Weighted)
Cross Talk Loss	–65 dB minimum (1.5 dB channel gain)
Intermodulation	35 dB maximum
Level Stability	10 minutes ±0.2 dB
	1 year ±0.5 dB
Frequency Response	
300 to 3000 Hz	0 dB ±0.5 dB
3000 to 3400 Hz	0 dB –1.8 dB +0.5 dB
Channel Gain at 800 Hz	±0.3 dB from nominal
Cross Talk Loss	–65 dB minimum (1.5 dB channel gain)
Envelope Delay	The absolute envelope delay at the frequency of minimum envelope delay is less than 600 microseconds. The minimum value is taken as reference for the envelope delay distortion.
Envelope Delay Distortion	
500 to 600 Hz	1.5 ms
600 to 100 Hz	0.75 ms
1000 to 2600 Hz	0.25 ms
2600 to 2800 Hz	1.5 ms
Voice Channel Performance	
(ASP Mode):	
Signal-to-Total Distortion	>20 dB at –40 dBm0 Input
Ratio (Sine wave input 700 to	>25 dB from –30 dBm0 to 0 dBm0 Input
1100 Hz)	
Idle Channel Noise	–67 dBm0P (ITU-T Weighted), 23 dBrnC0 (C-Message Weighted)
Cross Talk Loss	–65 dB minimum (0 dB channel gain)

Technical Characteristics (Cont.)

Item	Specifications
Voice II/ASP Channel Module (Cont.)	
Variation of Gain with Input Level (802 Hz ref.)	±0.5 dB from –40 dBm0 to +2.5 dBm0 relative to level at –10 dBm0
Level Stability	10 minutes: ±0.2 dB
	1 year: ±0.5 dB
Frequency Response	
300 Hz to 2400 Hz	0 dB ±0.5 dB
2400 Hz to 3400 Hz	0 dB –1.8 dB, +0.5 dB
Channel Gain at 800 Hz	±0.3 dB from nominal
Output Power Spectral Density	
5 kHz to 9 kHz	–40 dBm
10 kHz	–42.5 dBm
50 kHz to 500 kHz	–70 dBm
Power Requirements:	+5 V dc ±5% 230 mA max.
	+12 V dc ±10% 10 mA max.
	–12 V dc ±10% 30 mA max.
Universal Voice Card	
Interface Characteristics:	
Impedance	600 ohms resistive ±10%
Return Loss	20 dB minimum (300 to 3400 Hz)
Longitudinal Balance	56 dB minimum (300 to 3400 Hz)
Usable Bandwidth	300 to 3400 Hz
Signal to Total distortion Ratio:	
PCM Voice Channel and all PCM-T mode options (noise signal in accordance with ITU-T 0.131)	
Input level	
–3 dB	>26.3 dB
–6 dB	>33.9 dB
–34 dB	>32.2 dB
–40 dB	>27.6 dB
–55 dB	12.6 dB
ADPCM Voice Channel	
Input level	
–3 dB	27 dB
–6 dB	34 dB
–34 dB	32 dB
–40 dB	28 dB
–55 dB	13 dB
PCM Voice Channel	±3 dB at –50 to –55 dBm0 relative to channel level at –10 dBm Unspecified at less than –55 dBm0.
ADPCM Voice Channel	±3 dB at –50 to –55 dBm0 relative to channel level at –10 dBm

Technical Characteristics (Cont.)

Item	Specifications
Universal Voice Card (Cont.)	
Level Stability	10 minutes: ±0.2 dB
Frequency Response:	
300 Hz to 3000 Hz	0 dB ±0.5 dB
3000 Hz to 3400 Hz	0 dB +1.8 dB, –0.5 dB
Channel Gain at 800 Hz	±0.3 dB from nominal
Power Requirements:	
PCM	+5 V dc, 83 mA max.
	+12 V dc, 8 mA max.
	–12 V dc, 20 mA max.
ADPCM	+5 V dc, 107 mA max.
	+12 V dc, 8 mA max.
	–12 V dc, 20 mA max.
Echo Canceller Card	
Power Requirements:	
Using TMS32030 Digital Signal Processor	+5 V dc ±5%, 330 mA, typical –12 V dc ±10%, 1.2 mA, typical
Using TMS320C25 Digital	+5 V dc ±5%, 100 mA, typical
Signal Processor	–12 V dc ±10%, 1.2 mA, typical
Power Consumption:	
Using TMS 32020 Digital Signal Processor	1.6 Watts
Using TMS 320C25 Digital Signal Processor	0.5 Watts
TMSC Power Requirements	
Domestic Unit	Input Voltage Range: 85-129 V ac
(USA, Canada, Japan)	Fuses: 8 Amp 3AG
Non-Domestic Unit	Input Voltage Range: 175-242 V ac
(Europe)	Fuses: 5 Amp 5x20 mm
Non-Domestic Unit	Input Voltage Range: 204-264 V ac
(United Kingdom)	Fuses: 5 Amp 5x20 mm
Frequency	50/60 Hz
Output Voltage and Current	+5.1 V +3.0%, –2.5% at 8 to 105 amps
3 MOPS non-redundant	+12 V ±10% at 0.25 to 12 amps
4 MOPS redundant	–12 V ±10% at 0.25 to 12 amps
Remote Alarm Relay Contact Rating	Maximum Current: 0.25 amp
Power Consumption:	
CDA-T1 Module	Maximum: 28.75 Watts [5.75 amps (+5 V dc) (±12 V dc)]
CDA-E1 Module (with G.732 I/O Plug-In Card)	Maximum: 27.0 watts [5.4 amps (+5 V dc) (0.2 amps ±12 V ac)]

Technical Characteristics (Cont.)

Item	Specifications
TMSC Power Requirements (Cont.)	
Channel Interface Card	Maximum: 9.2 Watts [1.83 amps (+5 V dc) (±12 V dc)]
Enterprise System Control Card	Maximum: 20 Watts [4 amps (+5 V dc) 0.06 amps (–12 V dc)]
System Control Card	Maximum: 15.5 Watts [2.85 amps (+5 V dc) 0.12 amps (–12 V dc)]
Redundancy Control Card	Maximum: 4.1 Watts [0.55 amps (+5 V dc), 0.10 amp (+12 V dc), 0.01 amp (–12 V dc)]
ACM Module	Maximum: 20.0 watts [4.0 amps (+5 V dc) (0.5 amps ±12 V ac)]
Aggregate Control Card	Maximum: 18.5 Watts [3.6 amps (+5 V dc), 0.10 amp (+12 V dc)]
Harness Card	Maximum: 2.8 Watts [557 milliamps (+5 V dc) (+12 V dc)]
EIA/TIA-232-E Aggregate Interface Plug-In	0.5 Watts
V.35 Aggregate Interface Plug-In	1.2 Watts
RS-422/423 Aggregate Interface Plug-In	0.7 Watts
WECO 303 Aggregate Interface Plug-In	1.5 Watts
G.703 64 Kbps Codirectional Aggregate Interface Plug-In	1.0 Watts
G.703 64 Kbps Contradirectional Aggregate Interface Plug-In	0.4 Watts
G.703 2.048 Mbps Aggregate Interface Plug-In (75-ohm)	2.0 Watts
G.703 2.048 Mbps Aggregate Interface Plug-In (120-ohm)	1.9 Watts
G.704 2.048 Mbps Aggregate Interface Plug-In (75/120 ohm)	1.5 Watts
Expansion	0.2 Watts
Data II/III/IV Channel:	
EIA/TIA-232-E Interface	1.9 Watts
RS-422 Interface	1.8 Watts
RS-423 Interface	1.7 Watts
V.35 Interface	1.7 Watts
Voice II/PCM Channel	1.4 Watts
	0.42 Watts
ADPCM Plug-In	2.1 Watts
Voice II/CVSD Channel	1.9 Watts
Voice II/ASP Channel	1.6 Watts

Technical Characteristics (Cont.)

Item	Specifications
TMSC Power Requirements (Cont.)	
Universal Voice Card PCM Voice	0.69 Watts
Universal Voice Card ADPCM Voice	0.81 Watts
Maximum Power Consumption for TMSC node with 10 local data channels, 2 redundant Channel Interface Cards, 2 redundant Aggregate Control Cards, 2 redundant SCCs, and 1 Redundancy Control Card	135 Watts
ADPCM Compression Module (ACM)	
Framing method	Bit oriented proprietary to Byte oriented (DS0)
Frame structure	D4, T1/D4E, CEPT G.732
ACM Port Capability	DPBX, DACS Network or D4 devices
ACM module compatibility	Full TMS-3000 compatibility
ACM channel capacity	Up to 24 voice circuits compressed via GDC ADPCM compression techniques across a single DS1 line.
	Up to 30 voice circuits (E1 only) compressed via GDC ADPCM compression techniques across a single DS1 line.
ACM line rate	T1 DS1 — 1.544 Mbps
	ACM/E1 (G.704 and G.732) — 2.048 Mbps
PLL Jitter Tolerance	Meets ATT Pub. 62411 specification
ADPCM voice rates	64, 32, 24 and 16 Kbps
Input/Output Ports	One DS1 port supports up to 34 DS0 channels per ACM/T1
	One DS1 port supports up to 30 DS0 channels (CEPT G.732) per ACM/E1
Signaling Types	
Network	Robbed Bit,
	G.704 CAS Channel 16
	Message Oriented Common Channel Signaling (CCS)
	In Band Signaling (SF, Tone type)
Channel	No ABCD Signaling (Inband or CCS)
	2-State Signaling (A or E/M (ACM or UVC))
	4-State Signaling (A,B to ACM)
	16-State Signaling (A,B,C,D to ACM only)
Signaling Conditioning Types	A0+B0 (On-Hook)
	A0+B1 (On-Hook, No ringing for FXS Loop Start and FX0 Ground Start)
	A0/1+B0/1 (On-Hook, then Off-Hook)
	A1/0/1+B1/0/1 (Off Hook, then Hook Flash)
	A1+B1 (Off-Hook or Disconnect/Blocked (ITU-T)
	A1/0+B1 (Off-Hook, then On-Hook, No ringing for FXS Ground Start)

C VDE Required Installation Instructions and Rating Information

Installation Overview

This appendix contains information on the installation of the TMS Compact (TMSC). Unpacking, shelf mounting, cable and wire connections, are all discussed in this appendix.

Topics in this chapter include:

Unpacking and Inspection

The following steps detail the unpacking and inspection requirements for the TMSC.

1. When you remove this manual from the shipping carton, the TMSC is mostly unpacked. Remove any stray packing material from the unit.
2. Position the TMSC unit for easy access to the front and back of the unit.
3. Remove spare modules from their cartons. Spare modules, if any, are packed in plastic bags and contained in separate cartons.

Note *Do not discard carton or packing material; save for transporting or reshipping if necessary.*

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4. Inspect the components for visible signs of damage. If any damage is evident, notify the shipper immediately.
5. Inventory unit components for agreement with packing list (module types, quantities, etc.).
6. Verify that the unit's components and factory selected options on the various modules are properly configured for your TMSC applications. Use the systems drawing package supplied with your system to determine the proper option selections and card arrangements for your system. In particular, ensure that:

   (1)Each module is in its proper slot in the TMSC shelf. The correct locations are given in your Network Documentation Package. Module locations for a completely filled redundant node are illustrated in Figure C-1. (In a nonredundant system, each slot marked "SEC." on the diagram has a blank filler panel). Check that Data Channel and Voice Channel cards are in the correct channel slots.

   (2)The correct aggregate interface piggybacks or interface cards are installed on the Aggregate Control Cards. Table 1-4 in Chapter 1 lists the different interface piggyback cards.

Installation

TMSCs are usually shipped already mounted in GDC EP-2M or EP-4 cabinets. If your TMSC is already mounted, proceed directly to step d below. Otherwise, follow these directions:

1. If the TMSC shelf assembly is not being mounted in a rack, install it in a reasonably well ventilated location. Do not locate directly above other equipment (such as power supplies) which generate large quantities of heat. The ambient temperature should not exceed 122°F (50°C).
2. If the TMSC is being rackmounted, install it in a standard 19-inch rack. Two GDC cabinets are available for that purpose:

   EP2T — 30 in. (76 cm) by 23 in. (59 cm) by 24 in. (61 cm) with 2 fans

   EP4 — 76 in. (193 cm) by 23 in. (59 cm) by 26 in. (66 cm) with blower

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Note *The EP4 cabinet comes wired with a 20-ampere rated line cord and a twist-lock NEMA L5-20P type plug. This mates with a NEMA 20R type receptacle which must be available adjacent to the installation.*

Provide the following vertical rack space for each TMSC shelf component:

GPS-8A/B or DPS-8A — 7 in. (18 cm) (high-current applications only)

TMSC shelf — 14 in. (36 cm)

16-channel expansion shelf — 7 in. (18 cm)

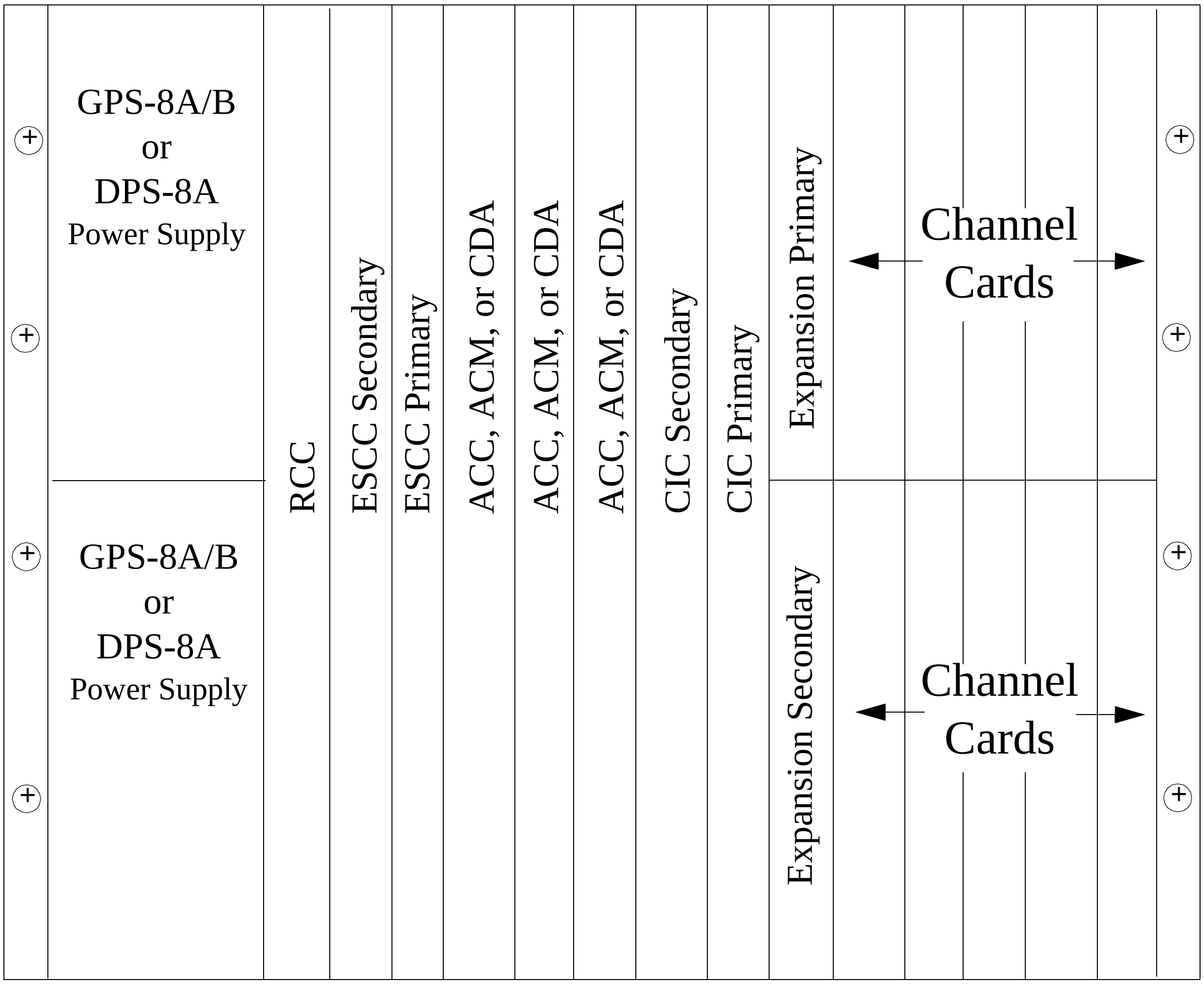

Figure C-1 TMSC Main Shelf Module locations

Caution *Air must be forced through the rack. A blower capable of moving 300 cubic feet per minute (CFM) must be installed at the bottom of the shelves. Three exhaust fans capable of moving 100 CFM must be installed at the top of the cabinet. Suitable fans and blowers are required. External ambient temperature ideally is between 25° to 30°C. Operation between 0° and 50°C maximum is an operating specification only when equipment is mounted in GDC EP-2T, EP-2M, and EP-4 cabinets.*

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3. An additional power supply shelf (with power supply) may be used with the TMSC for high-current applications. When additional power supplies are used, connect the dc power harness on the rear of the main shelf assembly to the GPS-8A/B or DPS-8A. The system's drawing package includes a wire list for the harness, which indicates the terminal connections for each wire. Connections to the power supply are made by inserting the wire into the appropriate power supply terminal, and tightening the screw that fits into the terminal.

   Refer to Chapter 7 for drawings of the main harness card (Figure 7-1) and main shelf channel harness card (Figure 7-3). The GPS-8A and DPS-8A Power Harness Cards for the TMSC are shown in Chapter 7, Figures 7-8 and 7-9, respectively.

   The location of the power supply connectors on the TMSC Expansion Harness Card are shown in Figure E-2. Table E-1 lists the wire color coding for the power supply harness.

   Check that power supply Power On/Power Off switch is set to Off. If you are using a GPS-8A/B, connect the power cord to grounded ac outlet; if using a DPS-8A, connect to -48 V battery supply according to instructions in DPS-8A Instruction Manual.

Caution *Do not apply primary power until all connections have been made and all options implemented.*

For more information on the installation and initialization of the TMS Controller, see Chapter 5 of this manual.

AC Power On/Off Procedure for a TMSC

GDC communications products contain voltage sensing circuits that ensure that proper reset signals are generated during power up/down switching. These circuits are designed to protect the electronics from lock-ups and memory loss for a wide range of known ac transients and power on/off conditions.

Switching power on/off via a branch circuit breaker can generate unpredictable transient conditions due to inductive and/or capacitive loads connected to the branch that impact the voltage on/off sensing circuits. The following procedure is recommended to ensure reliable operation. To turn TMSC Power On:

1. Turn the branch circuit breaker on first. This allows transients due to heavy inductive and capacitive line loads to settle.
2. If the communication product is mounted in a cabinet equipped with a local circuit breaker, such as a GDC EP-4 cabinet, turn the local breaker on next.
3. Turn off the dc power supplies mounted in the node.

To turn TMSC Power Off, reverse the power-on procedure by first turning off the dc power supplies.

Fused Links

Fused links are used in the interface circuits to protect the TMSC from sustaining damage in system applications.

The TMSC should be powered by the same power source as the equipment with which it interfaces, to prevent large circulating currents due to differences in ground potential. If it is not possible to determine whether the equipment is powered by the same power source, it should be confirmed that a potential difference of less than 0.25 V rms (as measured by a high impedance digital multimeter or equivalent) exists between the grounding circuits of the respective power outlets.

Caution *This TMSC unit incorporates internal fused links which may open if the ground potential exceeds 0.25 V rms between this unit and equipment interfaced with this unit. Do not apply power to the TMSC until all connections to peripheral equipment have been completed.*

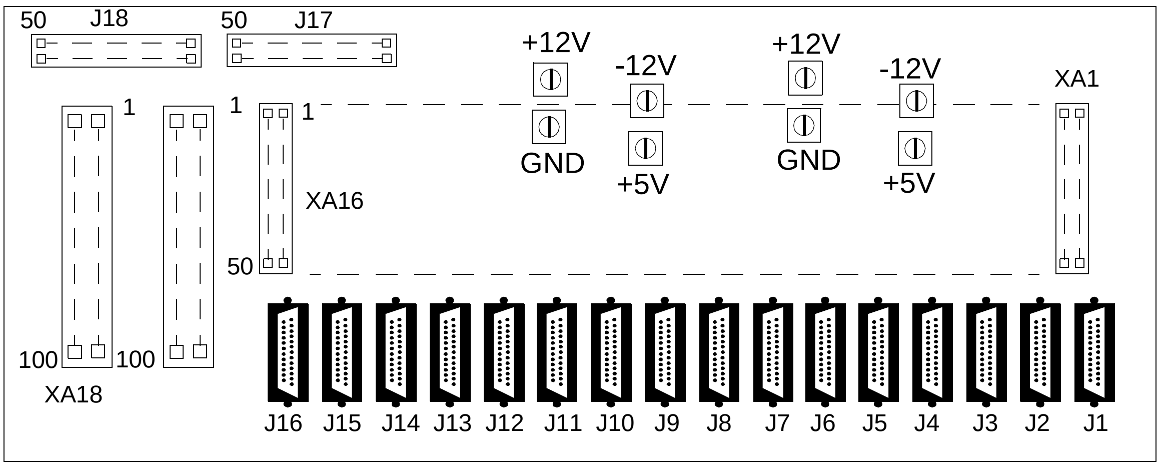

Figure C-2 Power Supply Connectors on TMSC Expansion Harness Card

Fused links on the TMSC are located on the rear of the harness card. Each interface circuit (both channel and aggregate) contains a fused link between the chassis ground (earth) connector pin (pin 1 of the 25-pin connector) and the chassis ground circuit of the TMSC. Each link is located directly below each 25-pin connector; the link appears as an extremely thin solder line, with one

end connected to the chassis ground plane on the harness card. Fused links that have opened because of excessive ground currents between equipment can be restored as follows:

1. Normalize the potential difference between associated grounding circuits to less than 0.25 V rms (as measured with a high impedance digital multimeter or equivalent).
2. Disconnect all power connections.
3. Restore fused link with a single strand of No. 32 to 40 AWG gauge copper wire (No. 32 is the standard strand of seven-strand No. 24 gauge wire). Solder the single strand to the appropriate terminals on the rear of the harness card.
4. Reconnect power connections and resume normal operations.

> **⚠ *Caution*** *When several cabinets are installed together, use a copper braided ground strap between the cabinets to ensure sufficient grounding.*

Compliance with Subpart J, Part 15 of FCC Rules

For full compliance with subpart J of Part 15 of FCC rules (governing radiated RF energy from computing devices), shielded cables with metal hooded connectors must be used for all TMSC aggregate and channel connections. Each cable hood must make firm contact with TMSC frame ground.

At the end of the cable hood are two screws that must be screwed in firmly to make ground contact. The hooded cable grounding arrangement is illustrated in Figure E-3.

GDC recommends that customers follow this procedure when using customer supplied cables. Use of unshielded cables or failure to properly install shielded cables may cause interference with nearby radio communication devices.

If you use a MEGAMUX PLUS expansion shelf for your data and voice channel modules, follow the cable grounding procedure explained in the MEGAMUX PLUS Instruction manual, GDC Publication No. 036R360.

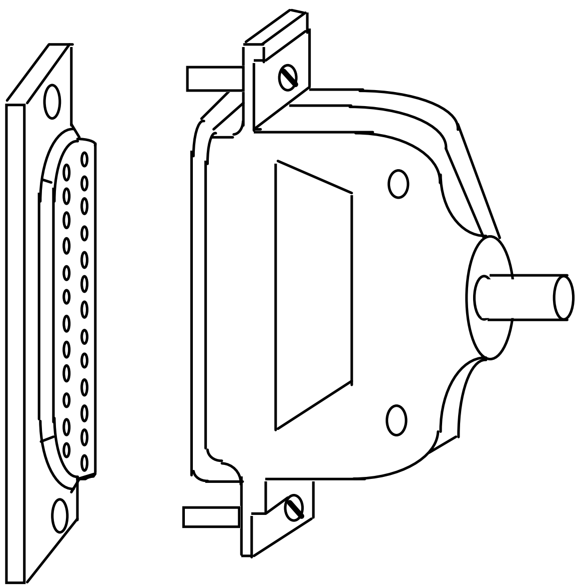

Figure C-3 Typical Hooded Cable Grounding Arrangement

Table C-1 Power Supply Harness Color Codes

Power Supply Harness Wire	Terminal Connection
Orange	+12 V dc
Purple	-12 V dc
White/Red	+5 V dc
White/Black	GND

Power Supply To TMSC Alarm Connections

Any TMSC node can report power supply failures (as an alarm condition) to the TMS Controller. Two separate power supply failures (Primary and Secondary) are reported. Primary power supply alarm connections are hardwired on the TMSC harness card. To enable node reporting of secondary power supply failures, the following connections must be made (the metal backplane shield on the main shelf must be removed to make these connections):

Secondary power supply Alarm Bus connector to TMSC main shelf connector XA201A, pin A2.

In most cases, TMSC shelves are shipped from the factory with these connections pre-wired.

Alarm Relay Connections

The Redundancy Control Card in the TMSC system contains relays that allow connections to external equipment. These connections provide visual or sound indications of major or minor alarms. Connections are made to EIA connector J3 on the TMSC harness card. Table E-2 lists the J3 pins used to connect the normally open or normally closed sides of the relay to the external equipment.

Any references made here to normally closed contacts suggest the relay is energized. Normally open contacts refers to the relay being deenergized. Do not exceed the maximum ratings of the relay contacts: 3 W, 0.25 A, 28 V.

Table C-2 Alarm Relay Connections, Rear Panel Connector J3

Pin Number	Function	Relay State
1	Minor Alarm 2	Common (CO)
2	Major Alarm 2	Common (CO)
3	Spare	
4	Spare	
5	Major Alarm 2	Deenergized (NO)
6	Major Alarm 1	Deenergized (NO)
7	Minor Alarm 2	Deenergized (NO)
8	Minor Alarm 1	Deenergized (NO)
9	Major Alarm 1	Common (CO)
10	Spare	
11	Minor Alarm 1	Common (CO)
12	Major Alarm 2	Energized (NC)
13	Major Alarm 1	Energized (NC)
14	Minor Alarm 2	Energized (NC)
15	Minor Alarm 1	Energized (NC)

NOTE: Any references made here to normally closed contacts (NC) suggest the relay is energized. Normally open contacts (NO) refer to the relay being deenergized.

Ratings

TMSC ratings are listed in Table E-3.

Table C-3 TMSC Ratings

Item	Rating
Environmental:	
Operating Temperature*	32°F to 124°F (0°C to 50°C) (for equipment mounted in EP-2T,EP-2M, and EP-4 cabinets).
Nonoperating	–40°F to 186°F (–40°C to +85°C)
Humidity	95% relative humidity with no condensation
Altitude	
Operating	10,000 ft (3048 m)
Nonoperating	40,000 ft (12,192 m)
TMSC Power Requirements	
Domestic Unit	Input Voltage Range: 85-129 V ac
(USA, Canada, Japan)	Fuses: 8 Amp 3AG
Non-Domestic Unit	Input Voltage Range: 175-242 V ac
(Europe)	Fuses: 5 Amp 5x20 mm
Non-Domestic Unit	Input Voltage Range: 204-264 V ac
(United Kingdom)	Fuses: 5 Amp 5x20 mm
Frequency	50/60 Hz
Output Voltage and Current	+5.1 V +3.0%, –2.5% at 5 to 35 amps
3 MOPS non-redundant	+12 V ±10% at 0.25 to 4 amps
4 MOPS redundant	–12 V ±10% at 0.25 to 4 amps
Remote Alarm Relay Contact Rating	Maximum Current: 0.25 amp
Power Consumption:	
CDA-T1 Module	Maximum: 28.75 Watts [5.75 amps (+5 V dc) (±12 V dc)]
CDA-E1 Module (with G.732 I/O Plug-In Card)	Maximum: 27.0 watts [5.4 amps (+5 V dc) (0.2 amps ±12 V ac)]
Channel Interface Card	Maximum: 9.2 Watts [1.83 amps (+5 V dc) (±12 V dc)]
System Control Card	Maximum: 15.5 Watts [2.85 amps (+5 V dc) 0.12 amp (–12 V dc)]
Redundancy Control Card	Maximum: 4.1 Watts [0.55 amps (+5 V dc), 0.10 amp (+12 V dc), 0.01 amp (–12 V dc)]
ACM	Maximum: 20.0 watts [4.0 amps (+5 V dc) (0.5 amps ±12 V ac)]
Aggregate Control Card	Maximum: 18.5 Watts [3.6 amps (+5 V dc), 0.10 amp (+12 V dc)]
Harness Card	Maximum: 2.8 Watts [557 milliamps (+5 V dc) (+12 V dc)]
EIA/TIA-232-E Aggregate Inter face Plug-In	0.5 Watts
V.35 Aggregate Interface Plug-In	1.2 Watts
RS-422/423 Aggregate Interface Plug-In	0.7 Watts
WECO 303 Aggregate Interface Plug-In	1.5 Watts
G.703 64 kbps Codirectional Aggregate Interface Plug-In	1.0 Watts
G.703 64 kbps Contradirectional Aggregate Interface Plug-In	0.4 Watts
G.703 2.048 Mbps Aggregate Interface Plug-In (75-ohm)	2.0 Watts
G.703 2.048 Mbps Aggregate Interface Plug-In (120-ohm)	1.9 Watts
G.704 2.048 Mbps Aggregate Interface Plug-In (75/120 ohm)	1.5 Watts

* Derate operating temperature by 1°C/1000 ft above sea level.

Table C-3 TMSC Ratings (Cont.)

Item	Rating
MEGAMUX TMS Power Requirements (Cont.)	
Expansion	0.2 Watts
Data II/III/IV/UDC Channel:	
EIA/TIA-232-E Interface	1.9 Watts
RS-422 Interface	1.8 Watts
RS-423 Interface	1.7 Watts
V.35 Interface	1.7 Watts
Voice II/PCM Channel	1.4 Watts
	0.42 Watts
ADPCM Plug-In	2.1 Watts
Voice II/CVSD Channel	1.9 Watts
Voice II/ASP Channel	1.6 Watts
Universal Voice Card PCM Voice	0.69 Watts
Universal Voice Card ADPCM Voice	0.81 Watts
Maximum Power Consumption for TMSC node with10 local data channels, 2 redundant Channel Interface Cards, 2 redundant Aggregate Control Cards, 2 redundant System Control Cards, and 1 Redundancy Control Card	135 Watts

D Glossary

Glossary

ACM

The ACM (ADPCM Compression Module) provides the means for a single DS1 (CEPT) line, containing 24 (30) PCM voice circuits, to be brought into the TMS node and compressed via GDC proprietary ADPCM compression techniques. The compressed signal is then transported across a trunk.

ADPCM

Adaptive Differential Pulse Code Modulation (See ACM)

Aggregate

A connection between two TMS nodes where the entire trunk carries a single bundle carrying the data originating from the TMS channels. This term has conventionally been used to define the TMS's Aggregate Control Card trunk. Also, see Subaggregate.

Aggregate Control Card (ACC)

This module interfaces the 16.896 MHz Fast Bus with a full duplex aggregate trunk connected to a remote node. It buffers data from the Fast Bus and reforms it according to the transmit frame by adding overhead and frame sync bits. Piggyback Cards on board the Aggregate Control Card then prepare the data to comply with transmission standards (EIA or ITU-T). The receive section locates the frame sync bits in the receive aggregate data stream, and, using these bits as a reference, disassembles the remainder of the data stream into channel data, channel controls, and overhead bits.

Aggregate Trunk

A full duplex communication line which transports data between two nodes.

Alarms

These are raised when a malfunction is detected in the system. Major alarms need immediate attention. Minor alarms are not immediately detrimental to the working of the system. Major alarms indicate that hardware on a Common Module is malfunctioning. Minor alarms indicate that the malfunction is in one of the Data or Voice Channel Cards.

Anisochronous

The essential characteristic of a time-scale or a signal such that the time intervals between significant instants do not necessarily have the same duration or durations that are integral multiples of the shortest duration.

Backplane

This is the back panel of Main and Expansion Shelves. It holds the external connectors used by all the modules and covers the Main Harness Card.

Base Card

A board that can have one or more cards called "piggybacks" plugged into it. It can be tested, removed, and replaced as a unit independent from the piggyback card(s).

B8ZS (Binary Eight Zero Suppression)

Timing is critical in a digital T1 network. If too many consecutive zeros are in the aggregate data stream, the system may lose synchronization. B8ZS is a method used to meet the "ones density" constraints by taking strings of zeros, converting them to ones and zeros, and placing them back into the aggregate bit stream.

bps

Bits per second transmitted or received. Also referred to as Hz

Bridge

A device for connecting similar LANs using the data link layer MAC source and destination addresses contained in the data frames of all LAN traffic.

Buffer

A storage device used to streamline data transfer when there is a slight difference in data rates caused by, for example, doppler shift or separate clock sources.

Card

An assembly of components that can be tested, removed, and replaced as a unit. A card usually refers to a single unit without piggybacks connected to it, although in this manual "card" is usually used interchangeably with "module."

CDA Module

The CDA-T1 (Combined Digital Aggregate) Module allows the TMS using DS1 framing to operate on a DACS Network (byte-oriented). Also available in a ITU-T 2.048 Mbps version (CDA-E1)

CELP

The CELP Channel Module provides Codebook Excited Linear Prediction (CELP) voice encoding algorithms that maximize voice channel bandwidth utilization. The voice is compressed at rates of 4.8 Kbps, 6.4 Kbps, or 9.6 Kbps.

Channel

Endpoint of a circuit path. The channel is the card at each end of the path.

Channel Module

This Voice or Data Channel Module plugs into an Expansion Shelf, TMS Compact, MEGAMUX Plus or OCM. It interfaces external equipment (via cables) to a Channel Interface Card.

Channel Interface Card

This card interfaces with Channel Modules and the 16.896 MHz Fast Bus. It contains all the circuitry necessary to control, frame, multiplex, and demultiplex up to 64 channels onto the Fast Bus. Channel Card connections to the Channel Interface Card are made via a pair of ribbon cables that run from the backplane of the Expansion shelf, holding the channel cards, to the Main Shelf Backplane where the Channel Interface Card is located.

Circuit

An end-to-end data or voice path which can pass through several entities in a communication system. A circuit is described or referred to by the node/channel names which identify the endpoints of the circuit.

Common Module or Common Card

A generic term for any module that, when removed, will cause a major alarm. This includes all modules housed in the main TMS shelf plus the Expansion Modules located on each TMS Expansion Shelf.

CSU

Channel Service Unit.

DACS Network

DACS (Digital Access Cross-connect System) is a byte oriented (DS0) digital T1 network service.

DCE

Data Communications Equipment.

Dial Backup

A feature that provides a direct node to controller link if normal supervisory communication between the TMS node and the Controller is disrupted. Dial Backup establishes the link using the internal GDC 212A modem on the Redundancy Control Card, or an external modem.

Digital Bridging

A function that provides for a single channel to broadcast to multiple channels and for those channels to respond to the single channel. In TMS, the Digital Bridging Card (DBC) is used for this function.

Diversity

The term for two aggregate trunk lines between the same nodes if one trunk is operational and the other is in stand-by in case the first goes down. Both lines are monitored for serviceability by firmware on the Aggregate Control Card. Switching of the line is controlled independently at both ends by the Aggregate Control Card.

DLC

Data Link Connection.

DS0 (Digital Signal Level 0)

A single 64 kbps channel. The data stream is divided into 8-bit bytes. DS0 is a byte-oriented environment.

DS1 (Digital Signal Level 1)

A combination of 24 DS0 channels and 8000 framing bits into a 1.544 Mbps data stream.

DSX-1 Interface

An electrical interface that converts a formatted data signal into the proper signal levels for the digital T1 network. Also called a cross-connect.

DTE

Data Terminal Equipment.

ESCC

Enterprise System Control Card. A card that is installed in the TMS shelf to monitor and control the activities other cards in the shelf. The ESCC is responsible for several functions: Permanent storage of software programs for all of the common cards in the TMS network, communications with other ESCCs and SCCs in neighboring nodes, communications within the node, communications with the Controller if locally connected, and control of all customer traffic within the node. Supports non-disruptive software downloads, expanded non-volatile memory, better Fastbus select resolution, MicroCell Transport, and additional features.

ESF (Extended Superframe)

A modified D4 framing format. The basic D4 framing structure contains 1 frame bit followed by 24 eight-bit time slots or a 193 bit frame. An ESF contains 24 193-bit frames. ESF allows a greater amount of access to digital network services (See "Superframe").

Ethernet

A LAN for connecting devices within the same building, operating over twisted-pair wire or coaxial cable at speeds up to 10 Mbps. It operates at the Physical and Data Link layers of the OSI model, specifying CSMA/CD.

Expansion Shelf

Shelf that holds up to 16 Channel Modules and 2 Expansion Modules (one primary, one redundant). Since one Channel Interface Card can interface up to 64 channels, at maximum a Channel Interface Card is connected to 4 Expansion Shelves.

Fan

A type of full-duplex circuit topography typified by multiple terminations on one end and a single termination on the other end.

Fast Bus

The Fast Bus carries controls and data between the Channel Interface and the other common modules in the node. One bit of data is conveyed by every clock bit on this bus. Physically, it spans across the Main Harness Card.

FX

See Foreign Exchange

Intelligent Automatic Rerouting (IAR)

A Controller function that automatically determines proper routing of circuits around any failed node or facility.

IP

Internetworking Protocol.

ISDN

Integrated Services Digital Network

Isochronous

A method for transmitting asynchronous data by synchronous means. A transmission format where the asynchronous characters (i.e., those delineated with Start and Stop bits) are sent with a clocking connection between the transmitter and receiver.

ITU-T

International Telecommunications Union - Telecommunications Standardization Sector. A committee that sets international communications standards.

LAN

Local Area Network.

LAN*TMS

Local Area Network Transport Management System. A network-managed system for integrating multiple local area networks (LANs) into a single communications network.

Link

A transmission path between two stations, channels or parts of a communication s system.

Main Harness Card or Main Harness Backplane

This assembly is covered by the back panel of the Main Shelf. It contains the external connectors used by all the modules in the Main Shelf. Three buses on the Main Harness Card enable the modules to communicate with each other. These three buses are the Fast Bus, the MP Bus (or Communication Bus), and the Clock Bus.

Maintenance Console

A software package that allows you to interact with the TMS on a local level. This software is designed to work with any terminal that runs at 1200 to 9600 baud ASCII on an EIA/TIA-232-E interface. The terminal is connected to the TMS main shelf backplane.

MINIMUX

A self-contained TDM capable of multiplexing and de-multiplexing as many as six channels of synchronous, asynchronous, isochronous, or anisochronous data, or voice grade telephone signals.

Module

An assembly which has definable performance characteristics so that it can be tested, removed, and replaced as a unit. In a TMS system, each card on the Main Shelf and Expansion Shelves is a module. A module can have other cards called "piggybacks" or "plug-ins" installed on it. In most cases, in this manual, the terms "module" and "card" are used interchangeably. For example, Channel Interface Card and Channel Interface Module refer to the same component.

Network

Term used to refer to a group of three or more nodes connected together with aggregate trunks. Not all the nodes in a network will necessarily be TMS nodes.

Node

Any addressable location within a network capable of carrying a TMS circuit. In a network, a TMS Compact in Philadelphia or an OCM-2000 in Boston are nodes (also see Tail Node).

OCM-2000

Office Communications Manager. A feeder multiplexer that is used as a node in a TMS network. It is a system of modules installed in a OCM-2000 Enclosure or OCM-2000 Shelf, separate from the TMS shelf, that multiplexes data from a variety of analog and digital devices, then transfers that data to the TMS for further routing. May also be referred to as TMS-2000 or OCM*TMS.

OPP

OCM Packet Processor. A module installed in an OCM-2000 Enclosure or Shelf that interfaces externally with public frame relay networks or frame relay devices such as LAN bridges, routers and frame relay PADs. OPP is the OCM counterpart to the TPP.

Packet

A sequence of data, with associated control elements, that is switched and transmitted as a whole; refers mainly to the field structure and format defined within the CCITT X.25 recommendation; multiple packets may be required to carry one complete document or a lengthy block of information.

Piggyback Card

A card that plugs into a base card. The piggyback is a separate assembly that can be tested, removed, and replaced as a unit.

Plesiochronous

The essential characteristic of time-scales or signals such that their corresponding significant instants occur at nominally the same rate, any variation in rate being constrained within specified times. Note that two signals having the same nominal digit rate, but not stemming from the same clock or homochronous clocks, are usually plesiochronous; there is no time limit to the time relationship between corresponding significant instants.

PLL

Permanent Logical Link.

Port

Any switchable entity. A port may be a logical entity that is not necessarily realized through a physical connector. For example, a single Frame Relay interface can support many Frame Relay ports. Traditionally, this has referred to a physical and electrical interface point on a TMS network interface card.

Printed Circuit Board (pcb)

See "card".

Red Alarm

A network alarm that is produced by the receiver to indicate that it has lost its input signal, frame alignment, loss of sync, or error rate exceeding a predetermined level. A red alarm is considered a network alarm and applies to the following TMS modules only: ACM and CDA.

Redundant Controllers

In the TMS, a network can contain more than one Controller. Software allows the use of multiple PC controllers. One master controller serves as the point of control for the entire network. All other controllers (subordinate) function as backups and as additional access points into the network. The master controllers responsibility is to synchronize its data base (only for the current network configuration data portion) with all subordinate controllers. Software allows up to five subordinate and one master controller.

Route

A logical path through a network from the transmitting equipment to the receiving equipment. The path can go through several nodes.

Subaggregate

A collection of data channels and supervisory communications and frame synchronization information routed to a single destination. One or more subaggregates may be carried on a single physical aggregate and routed to different destinations via a DACS network. Subaggregates can be of different types:

TMS - This type carries TMS proprietary data which includes overhead of synchronization and supervisory communication as well as channel data.

Network - This type carries network (DS0) compatible data. This data originates from a non-TMS device and terminates on a non-TMS device.

X.50 - This type is considered as a network type subaggregate by CDAs and IACs, but as a TMS subaggregate to the OCM.

Superframe

A D4 frame consists of 1 frame bit followed by 24 eight-bit time slots. A D4 superframe contains 12 consecutive 193-bit frames.

Supervisory Data

Information which travels from the Enterprise System Control Card via the MP Bus. It does not have any immediate bearing on the data being multiplexed. Instead, it keeps supervisory software in various parts of the system up to date.

Supervisory Pass Through

A feature that establishes a supervisory data path to several TMS Compact nodes at a local site. This allows an increase in transmission capability from a site by generating more aggregate trunks.

TCP

Transmission Control Protocol.

TMS Controller

A computer that is connected to the Enterprise System Control Card in a TMS node via an external connection on the Main Harness Card. The recommended controller is a Pentium 90. It performs configuration and framing calculations for the entire network, as well as other status, diagnostics, and alarm functions. A Maintenance Console is not classified as a Controller because it has limited control over only one node.

TPP

TMS Packet Processor. A module installed in a TMS main shelf that interfaces externally with public frame relay networks or frame relay devices such as LAN bridges, routers and frame relay PADs. It also has internal access to the Fastbus, allowing it to transfer frame relay, HDLC and SDLC data to other TPP modules in the shelf or to modules such as CIC, CDA, ACC and IAC. *Not used in a TMSC node.*

Trunk

Defines a connection between a TMS port and a Network port (or another TMS port). Also see "Aggregate Trunk."

Universal Voice Card

Provides full duplex voice communication capabilities in a TMS. Pulse Code Modulation (PCM), Adaptive Differential Pulse Code Modulation (ADPCM) and Advanced Speech Processing (ASP) card configurations are available.

VLBRV

Very Low Bit Rate Voice Module. An analog voice channel card for TMS, TMS Compact, Universal MM+ V4, MINIMUX, and OCM-2000 TDMs. Maximizes voice channel bandwidth utilization while offering low bit rate values of 9.6, 4.8, and 2.4 kbps.

XNET

XNET allows connection between two independently operating TMS networks. Supervisory communication does not pass between networks, maintaining independent control of each network. A network operator will be allowed to configure an XNET node and aggregate. The operator can then configure circuits to traverse the XNET aggregate. The operator running the other network must also configure a matching XNET node, aggregate and circuits. XNET allows limited diagnostic tests (loopbacks) to be performed.

E EC Declaration

EC Declaration of Conformity for Electromagnetic Compatibility and Safety

We, General DataComm Inc., declare under our sole legal responsibility that the following products conform to the following relevant harmonized standards, the reference numbers of which have been published in the Official Journal of the European Communities:

Electromagnetic Compatibility — (EMC Directive 89/336/EEC):

- The affixing of the CE mark is based on compliance with directive 89/336/EEC as amended by directive 93/68/EEC.
- EN 55022 (Based on CISPR 22), Specification for limits and methods of measurement of radio interference characteristics of information technology equipment.
- EN 55024 Limits and methods of measurement of the immunity to Electro-Magnetic interference for information technology equipment.
- EN 50081-1(Based on IEC 801), Electromagnetic compatibility generic emissions standard Part 1: Residential, Commercial and light industry.
- EN 50082-1 Electromagnetic compatibility generic immunity standard Part 1: Residential Commercial and light industry.

Low Voltage Directive — (LVD 73/23/EEC):

- The affixing of the CE mark is based on compliance with directive 73/23/EEC as amended by directive 93/68/EEC.
- EN 60950 Safety of Information Technology Equipment including Electrical Business Equipment.
- EN 41003 Particular Safety Requirements for Equipment to be connected to Telecommunications Networks.

Equipment List

TMS Channel Cards	
036M078-001	UDC/232/V.24/V.2036M078-002
036M078-002	UDC/422/V.11
036M078-003	UDC/423/V.10
036M078-004	UDC/V.35
GS936M014-001	TDC-2 (256K0
GS936M014-002	TDC-5 (512K0
036P265-003	UVC/ADPCM
036M285-002	CELP Voice Channel w/Fax
036M285-003	CELP Voice Channel
036M285-004	CELP 9.6K Voice Channel w/Fax
036M285-005	CELP 9.6K Voice Channel
036P270-001	Echo Canceller
036M335-001	ACM II/E1
TMS 3000 Options	
036M337-001	ESCC (Enterprise System Control Card)
036P302-001	RCC (Redundancy Control Card)
036P307-002	ECC-II (Expansion Common Card)
S-036P042-001	Sync Status Module
S-036B001-002	CP-12 Adapter (Expansion Shelf)
S-036P001-001	CP (422/423/449 Ext. Adapter)
039P002-001	DLD=M (Ext. Line Driver
OCM*TMS 2000 Feeder	
036M486-002	2121 Standalone Enclosure w/CCM N/R
036M481-001	2220 Shelf w/CCM, N/R
036M481-002	2320 Shelf w/CCM, Redundant
036M482-001	2230 Shelf w/CCM, NR -48VDC
OCM 1000 Point-to-Point	
036M488-002	1120 Standalone Enclosure, w/CCM, N/R
036M484-001	1220 Shelf w/CCM, N/R
036M484-002	1320 Shelf w/CCM, Redundant
OCM*TMS 1000/2000 LIM Cards	
036M410-002	E-1
036P436-002	V.35 LIM
036P436-001	V.11 LIM
036P437-001	Subrate LIM (RS232/V.28)
Expansion Shelf (OCM*TMS 1000/2000)	
010M064-001	MS-1 AC Expansion Shelf 117V
010M065-001	MS-1 AC Expansion Shelf 220/240V
010M066-001	MS-1 DC Expansion Shelf

Data Channel Cards	
036P413-001	DDC (RS-232)
036P410-001	HS SDC (RS-232)
036P410-002	HS SDC (V.35)
036P410-003	HS SDC (RS-422)
036P410-004	HS SDC (RS-423)
LAN/Frame Relay Cards	
036M450-003	OPP/Ethernet
036M450-004	OPP/Ethernet w/o Packet Bus
036M451-001	OPP Token Ring *(-003 non-existent P/N)*
036M451-004	OPP Token Ring w/o Packet Bus
Voice Signaling (2W/4W E&M)	
036M420-006	PCM/ADPCM-No Echo
036M420-003	PCM/ADPCM-w/Echo
036M420-028	CELP No Fax
036M420-025	CELP w/Fax
Voice Signaling (2W FXS)	
036M420-004	2W FXS/ADPCM/No Echo
036M420-001	2W FXS/ADPCM w/Echo
036M420-026	
036M420-023	
Spares and Options	
036M040-004	CCM-4
036M040-005	CCM-5
TMS-3000 Compact Shelf	
036M357-001	TMS Compact w/ESCC, N/R
036M357-002	TMS Compact w/ESCC, Redundant
Module Interface	
036P041-001	EIF-E (RS232/V.24)
TMS-3000 Channel Cards	
036M078-005	Hyper UDC/422
036M078-006	Hyper UDC/V.35
TMS-3000 Options	
036P365-001	Universal I/O red.
036P351-001	Sync Status Module
OCM*TMS 2000 Feeder	
036M482-001	2230 Shelf w/CCM, N/R, -48
Data Channel Module	
036P416-001	OCM G.703 Data Channel

Voice Signaling (2W FXO)	
036M420-005	2W FXO/ADPCM - No Echo
036M420-002	2W FXO/ADPCM w/ Echo
036M420-027	2W FXO/CELP No Fax
036M420-023	2W/4W FXS/CELP w/Fax
036M420-024	2W FXO/CELP w/Fax
Minimux Plus Basic Assembly	
G036B003-015	Minimux Plus Enclosure 220/240V
S-036B016-001	Minimux Exp. Shelf 117V
G036B015-002	Minimux Plus Exp. Enclosure
036M333-029	Minimux Plus 117V w/UAF+, ETR+ Analog Clk Gen Assy
G036M003-015	Minimux Plus 220/240V w/UAF+, ETR+, Analog Clk Gen Assy
TMS-3000 Compact	
036M358-001	TMS Compact w/ESCC, N/R
036M358-002	TMS Compact w/ESCC, Redundant
Module Interface	
036P064-001	EIF-G (64K Co-Direct)
036P066-001	EIF-C (64K Contra-Direct)
036P043-001	EIF-P (RS 422/423/MIL-188)
Data Channel Cards	
036P243-001	TMS G.703 Data Channel
036P414-001	X.50 Quad Data Card

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