GDC 036R340-000
Issue 11, February 1999

Installation and Operation

Office Communications Manager

(OCM-2000, OCM-1000)

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.

Warranty

General DataComm warrants that its equipment is free from defects in materials and workmanship. The warranty period is one year from the date of shipment. GDC's sole obligation under its warranty is limited to the repair or replacement of the defective equipment provided it is returned to GDC, transportation prepaid, within a reasonable period. This warranty will not extend to equipment subjected to accident, misuse, or alterations or repair not made by GDC or authorized by GDC in writing. *The foregoing warranty is exclusive and in lieu of all other warranties, express or implied, including but not limited to, warranties of merchantability and fitness for purpose.*

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Antistatic Precautions

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.

Industry Canada 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.

Electromagnetic Compatibility: This Class A digital apparatus complies with Canadian ICES-003.

Avis D'industrie Canada

L'étiquette d'Industrie Canada identifie le matériel homologué. Cette étiquette certifie que le matériel est conforme aux normes de protection, d'exploitation et de sécurité des réseaux de télécommunications, comme le prescrivent les documents concernant les exigences techniques relatives au matériel terminal. Le Ministère n'assure toutefois pas que le matériel fonctionnera à la satisfaction de l'utilisateur.

Avant d'installer ce matériel, l'utilisateur doit s'assurer qu'il est permis de le raccorder aux installations de l'entreprise locale de télécommunication. Le matériel doit également être installé en suivant une méthode acceptée de raccordement. L'abonné ne doit pas oublier qu'il est possible que la comformité aux conditions énoncées ci-dessus n'empêche pas la dégradation du service dans certaines situations.

Les réparations de matériel homologué doivent être coordonnées par un représentant désigné par le fournisseur. L'entreprise de télécommunications peut demander à l'utilisateur de débrancher un appareil à la suite de réparations ou de modifications effectuées par l'utilisateur ou à cause de mauvais fonctionnement.

Pour sa propre protection, l'utilisateur doit s'assurer que tous les fils de mise à la terre de la source d'énergie électrique, des lignes téléphoniques et des canalisations d'eau métalliques, s'il y en a, sont raccordés ensemble. Cette précaution est particulièrement importante dans les régions rurales.

Avertissement: L'utilisateur ne doit pas tenter de faire ces raccordements lui-même; il doit avoir recours à un service d'inspection des installations électriques, ou à un électricien, selon le cas.

Avis: L'indice d'équivalence de la sonnerie (IES) assigné à chaque dispositif terminal indique le nombre maximal de terminaux qui peuvent être raccordés à une interface. La terminaison d'une interface téléphonique peut consister en une combinaison de quelques dispositifs, à la seule condition que la somme d'indices d'équivalence de la sonnerie de tous les dispositifs n'excède pas 5.

La Compatibilité d' Eléctro-magnetique: Cet appareil numerique de la classe A est conforme a la norme NMB-003 du Canada.

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.

FCC Registration number: **AG6USA-74711-XD-N**

Registration Status	Port ID	SOC	FIC	USOC
Original	T1	6.0N	04DU9-BN	n/a
			04DU9-DN	
			04DU9-1KN	
			04DU9-1ZN	
Original	FXS	9.0F	OL13B	RJ11C
Modification	T1 NLIM	6.0Y	04DU9-BN	RJ48C
			04DU9-DN	
			04DU9-1KN	
			04DU9-1ZN	
Modification	ADPCM FXO	0.8B/9.0F	O2LS2	RJ11C
Modification	ADPCM E&M	9.0F	TL11M, E	RJ2EX; RJ2FX
Add Model	VLBRV FXS	9.0F	OL13B	RJ11C
Add Model	VLBRV FXO	0.8B/9/0F	O2LS2	RJ11C
Add Model	VLBRV E&M	9.0F	TL11M, E	RJ2EX; RJ2FX
Add Model	CELP FXS	9.0F	OL13B	RJ11C
Add Model	CELP FXO	0.8B/9.0F	O2LS2	RJ11C
Add Model	CELP E&M	9.0F	TL11M, E	RJ2EX; RJ2FX
Modification	IMBE DPV FXO	1.7B/9.0F	O2LS2	RJ11C
Modification	IMBE DPV FXS	9.0F	OL13B	RJ11B
Modification	IMBE DPV E&M	9.0F	TL11M, E	J2FX
Modification	T1 CSU	6.0Y	04DU9-BN	RJ48C
			04DU9-DN	
			04DU9-1KN	
			04DU9-1ZN	

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Chapter 2: Enclosures/Shelves

Preface

Scope

Your OCM (Office Communications Manager) is a factory configured unit. This means that you specify your system requirements when you order your OCM. The unit is factory configured per order, tested, and is ready to operate after installation. The OCM modules, including the power supplies, and the shelf and standalone enclosure are described in this manual. Each module has its own chapter. This allows future modules to be inserted easily into this manual.

Organization of Chapters

This manual has eight chapters.

- Chapter 1 - System Description introduces important concepts, features and applications of the OCM.
- Chapter 2 - Enclosures/Shelves describe the enclosure, shelves and power supplies of the OCM.
- Chapter 3 - Common Control Module - Describes the Common Control (CCM module.
- Chapter 4 - Line Interface Modules - Describes the various Line Interface Modules (LIMs).
- Chapter 5 - Data Channel Modules - Describes the various Data Channel Modules (DCMs).
- Chapter 6 - Voice Channel Modules - Describes the various Voice Channel Modules including the Dual Private Voice Module.
- Chapter 7 - Alarm Card - Describes the system Alarm Card.
- Chapter 8 - OCM Packet Processor - This chapter reviews the OPP card. Refer to the *Installation and Operation manual for the OCM Packet Processor (OPP),GDC 036R342-000* for a detailed description of this module.

Document Conventions

Level 1 paragraph headers introduce major topics.

Level 2 paragraph headers introduce subsections of major topics.

Level 3 paragraph headers introduce subsections of secondary topics.

`This typewriter font shows output that is displayed on the screen.`

This bold font shows specific input that you type at the keyboard.

This bold italicized font shows variable input that you type at the keyboard.

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

Related Publications

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

User Guide for Megamux TMS (MSO V3.0.1)	GDC 036R602-301
OCM*TMS Maintenance Console User Guide V1.0	GDC 036R611-000
User Guide for OCM-1000	GDC 036R612-Vnnn
Operation manual for TMS-3000 Controller	GDC 036R603-Vnnn
Installation and Operation manual for the OCM Packet Processor (OPP)	GDC 036R342-000
TPP/OPP/ILAN XL Router Guide	GDC S-078R003-001
IMS User Guide	GDC S-078R001-xxx

GDC publication numbers (e.g., GDC 036R340-000) are used to track and order technical manuals. Publication numbers use the following format:

GDC NNNRnnn-000 or GDC NNNRnnn-Vnnn

NNNidentifies the product family (e.g. OCM 2000)

R	denotes a technical publication
nnn	a number assigned by Technical Publications
000	identifies a hardware product and does not change
Vnnn	the software version associated with a product may be updated periodically

The Issue Number on the title page only changes 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.

Service and Support

General DataComm is committed to providing the service and support needed to install, manage, and maintain your equipment. For information about service programs or for assistance with your support requirements, contact your local Sales Representative or call General DataComm Service at the 24-hour toll free number listed below.

- in the U.S. dial **1-800-243-1030**
- outside the U.S. dial **1-203-598-7526**

Be ready with the site name and phone number and a description of the problem and the next available support representative will promptly return your call.

Hands-on training courses are provided by Educational Services. Courses range from basic data communications, modems and multiplexers, to complex network and ATM systems and are taught in Connecticut or at a customer location. Call 1-800-242-1030 and follow the menu instructions to discuss educational services or to receive a course schedule.

Chapter 1: System Description

Overview

Advances in technology and decentralized data processing have allowed companies to improve business efficiency and performance by automating key functions and introducing new electronic applications at the branch level. As a result, branch offices need to access the backbone communications network in order to electronically exchange information. Today's networks need to integrate the communications requirements of every business location and to support high speed connectivity (often with 56/64 kbps or more bandwidth) between the branch office and the backbone network.

General DataComm's OCM (Office Communications Manager) is a powerful, cost-effective networking platform that extends the backbone network's capabilities to remote branch office locations. Supporting voice, fax, data, video, image and LAN (Local Area Network) applications, the OCM can easily be tailored to any organization's network requirements.

The OCM offers connectivity to a variety of digital carrier services, allowing you to select the one providing the best performance/cost ratio in each location. These service options include: 56/64K leased line services, fractional T1/E1 services (groomed Nx56/64K services), and T1/E1 services.

The OCM is ideal for branch office locations. Its modular architecture makes it easy to install and maintain. To guarantee reliable performance, the OCM offers optional, fully redundant power supplies, common logic and line interface modules (LIMs).

At backbone network locations, the OCM-2000 connects to GDC's Transport Management System (TMS) product family. The OCM-2000 is fully channel compatible with the TMS, and all OCM management functions, including configuration, monitoring, diagnostics, fault management, and network restoral, are performed from the central TMS controller (s). The TMS architecture allows the connection of up to 248 OCMs to each TMS device and up to 10,000 OCM-2000 devices in a network.

The OCM-1000 is a networking multiplexer. It supports fax, data, video, image and LAN (Local Area Network) applications. The OCM-1000 offers connectivity to a variety of carrier services, allowing you to select the best configuration for your network. These service options include 9.6 to 28.8 kbps analog services, 56/64 kbps leased line services, fractional T1/E1 services (groomed Nx56/64 kbps services), and T1/E1 services.

The OCM-1000 can be upgraded to an OCM-2000 by simply swapping a common logic module.

Common Features

- The OCM combines voice, data and LAN traffic
- Optional local Maintenance Console allows support (but not configuration) of Local Channel Loopback, Local Aggregate Loopback including and excluding Line Interface Module, as well as local Alarm reporting.
- Available in either a 16-slot 19" rackmountable shelf (that may be mounted in an EP-4 cabinet) or a 10-slot standalone enclosure. Shelf may be expanded to 32 slots by adding a second shelf.
- Line interface, data, voice and power supply modules plug in from the front of the shelf and enclosure. No connectors have to be removed, as all connections are made from the rear of the shelf and enclosure.
- Line interfaces are T1/DSX-1 and T1 CSU, E1, V.11, V.35. All LIMs can be configured to be redundant. Available aggregate rates range from 56k to 2.048 Mbps.
- Supports two aggregates through one or two Line Interface Modules (LIMs).

- Data channel interfaces are EIA/TIA-232-E, V.35, EIA-422, and EIA-423, ITU-T-G.703 X.21, and X.50. Supports, through network management, operation of V.54 controls to control Remote Loopback and Local Loopback of connected modems, and to acknowledge Test Mode Indication on a modem tail circuit.
- Voice channel interfaces are 2W FXO and FXS, and 2W or 4W E&M.
- Programmable RTS (Request-to-Send) to CTS (Clear-to-Send) delays at local OCM channels.
- Safety Compliance - OCM in a domestic shelf or enclosure is recognized to UL 1459 and certified to CSA C 22.2 # 225 (Telco Equipment Safety). OCM in an international version shelf or enclosure meets EN60950 (Safety of Information Technology Equipment) and EN41003 (Safety of Equipment for Connection to the Telecom Network).
- EMC (Electromagnetic Compatibility) Compliance - OCM in a domestic shelf or enclosure meets FCC Part 15 class A. An OCM in an international shelf or enclosure meets EN55022 class A.
- Telecom Approval - Refer to the Technical Characteristics table in each module chapter.

OCM-2000 Features

- OCM-2000 acts as a feeder multiplexer to the TMS-3000 using CDA or IAC.
- CDA/T1/E1 allows termination of up to 32 OCM-2000 tail nodes.
- The OCM-2000 communicates to the TMS Controller via a supervisory communication path. Configuration is downloaded from the TMS Controller. OCM supports TMS status, alarms and diagnostics.
- TMS circuits originating at OCM-2000 channels pass through CDA subaggregates to terminate in TMS channels or other OCM channels.

OCM-1000 Features

- OCM-1000 acts as a point-to-point, point-to-multipoint access multiplexer, independent of a TMS network.
- Supports subrate LIM at rates of 9.6 to 64 kbps.
- Controlled by PC-based controller, via OCM Management Software (OMS).

Description

The OCM system is a platform that combines internetworking and multiplexer functions. The OCM consists of a shelf (MS) or enclosure (ME), power supply(s), and a set of plug-in modules. A basic OCM would consist of the shelf or enclosure, power supply, a single Common Control Module (CCM), a single Line Interface Module (LIM), and multiple Data Channel Modules (DCM) or OCM Packet Processor Modules (OPP). To provide additional slots, an expansion shelf may be added to the rack-mounted configuration.

Modules

The modules used in the OCM are interchangeable (with certain limitations).

Each module is fully described in its own chapter.

OCM Enclosure

The enclosure (MultiPak) is constructed of molded plastic and formed sheet metal components measuring 9 inches (229 mm) high by 13.5 inches (343 mm) wide by 11.5 inches (292 mm) deep. The enclosure has a hinged plastic door assembly with a removable tinted window that allows you to view the product cards LEDs. Other features are:

- Low profile, compact design for desktop use.
- Packaging for 10 plug-in-modules.
- Separate rear connectors Zones for network and business equipment connections.
- Plug-in power supply modules are available in the following voltages:

  100/120 Vac (47-63 Hz)
  220/240 Vac (47-63 Hz)

OCM Shelf

The shelf is constructed of formed sheet metal components measuring 7 inches (178 mm) high by 17.5 inches (445 mm) wide by 11.5 inches (292 mm) deep. Other features are:

- Cabinet mountable.
- 23-inch racks can be accommodated by reversing position of the mounting brackets.
- Center-of-gravity mounting is accomplished with several locations of mounting brackets
- Each shelf accepts one or two power supplies.
- Sixteen module slots and two power supply slots per shelf.
- An expansion shelf provides an extra two power supply slots and sixteen module slots.
- A shelf address jumper sets the address for each shelf in a two-shelf system.
- The rear panel is factory configured with connector panels (consisting of dual 8-pin modular jacks in Zone 1 and DB-25 connectors in Zone 3 (See *Figure 1-1 on page 1-5*). The rear of the OCM shelf with typical cabling is shown in *Figure 1-2 on page 1-13*.
- Plug-in power supply modules are available in the following voltages:

  100/120 VAC (47-63 Hz)
  220/240 VAC (47-63 Hz)
  -48 and -60 Vdc (station battery) version (designed to meet Conducted Emissions requirements in Bellcore 1089)

- Shelf power supply front panel provides: Power On switch, and Power On (green) and Failure (red) indicator.
- Split Bus Shelf option.

The enclosures and shelves are described in *Chapter 2 - Enclosures/Shelves.*

Split Shelf (OCM-1500 and 2500)

The Split Shelf for the OCM allows two independent nodes to occupy the same physical shelf. The shelf is divided into I/O slots 1 through 8 for the left node, and slots 9 through 16 for the right node. The features are:

- Each node is independent.
- Each node can support the full complement of High Speed links.
- The power bus backplane can serve both shelf halves.
- Can accommodate Central Site applications.

Zones

The rear panel of both the MS Shelf and the ME Enclosure is divided into three horizontal rows, (or Zones). Zone 1 (located at the top) and Zone 3 (located at the bottom) accept a connector panel that is pre-configured at the factory. Zone 1 is used for network interfaces, voice, and in some applications, digital interfaces. Zone 3 is used for digital interfaces (EIA/TIA-232-E, V.35, etc.). Zone 2 is used for internal busses and power. See *Figure 1-1*.

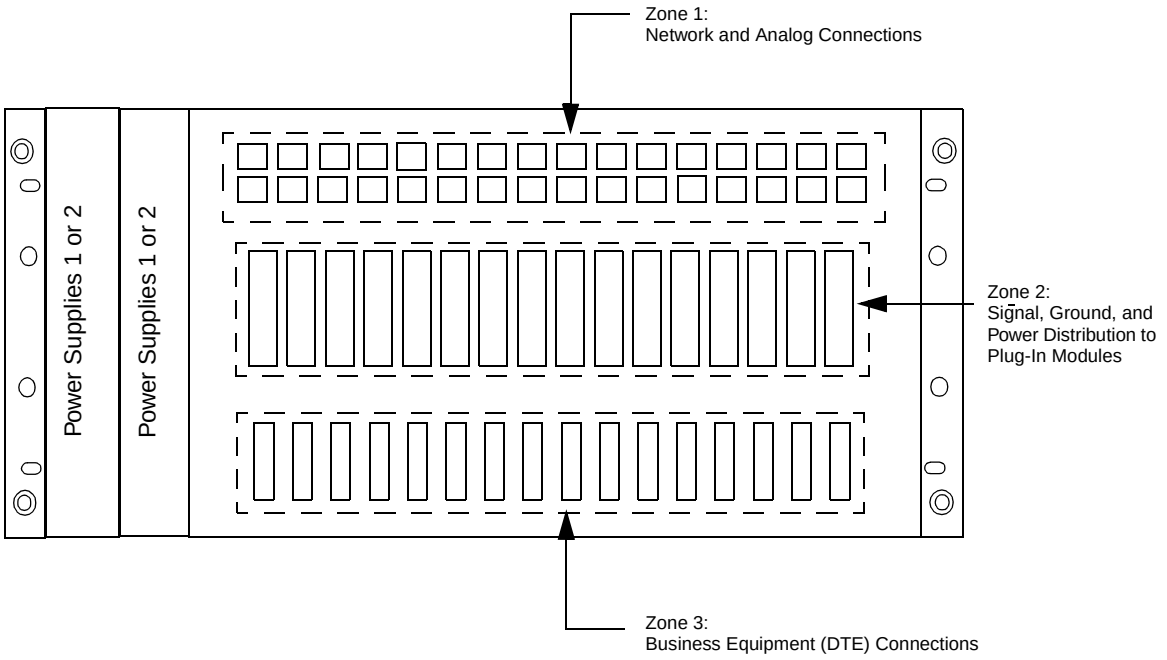


Figure 1-1: OCM Shelf Front View

Configuration/Status/Diagnostics/Alarms

The OCM-2000 accepts configuration, status, and diagnostic commands from the TMS Controller and reports status summaries and alarms back to the TMS Controller. Refer to the *Operation manual for TMS 3000 Controller, GDC 036R603-Vnnn; User Guide for OCM-1000, GDC 036R612-Vnnn; and User Guide for OCM*TMS Maintenance Console, GDC 036R611-000*.

In addition to the Power-Up Self-Test described below, the OCM modules may be performance tested in two ways, from the TMS Controller or from the optional on-site Maintenance Console (limited to Local Channel Loopback, Local Aggregate Loopback, and Local Alarm Reporting).

Maintenance Console diagnostics are available only with full-feature software in the CCM and with a valid configuration. These tests allow you to isolate problems in the system or OCM during the installation of your communications network, after installation of the OCM, or following repair.

Power-Up Self-Test

This test is performed for several seconds on the Common Control Module (CCM) and the Line Interface Module (LIM) when powered up. The CCM boot firmware performs a basic self-test to verify that a software download from the TMS Controller can be performed. During this test, the front panel Test LED lights. When the CCM passes this test, the Test LED goes off. When the test fails, the LED remains on.

Equipment List

The components that may be used in your OCM are presented in *Table 1-1*.

Table 1-1: Equipment List

Description	GDC Part No.
Common Modules	
Common Control Module (OCM-2000)	036M400-004, -006
Common Control Module (OCM-1000)	036M400-005, -007
Line Interface Modules	
Line Interface Module T1	036M410-001
Line Interface Module CSU T1	036M410-003
Line Interface Module V.11	036P436-001
Line Interface Module V.35	036P436-002
Line Interface Module E1	036M410-002
Line Interface Module X.21	036P436-003
SubRate Line Interface Module	036P437-001
BQM (2B1Q Module)	036P438-001
BQM without loop current	036P438-002
Data Modules	
Dual Data Module 232 Dual Data Module 232 with RTS Delay	036P413-001 036R413 -003
High-Speed Data Module 232	036P410-001
High-Speed Data Module V.35	036P410-002
High-Speed Data Module 422	036P410-003
High-Speed Data Module 423	036P410-004
High-Speed Data Module X.21	036P410-005
G.703 Data Module Data Rate Upgrade Kits: 128K 192K 256K	036P416-001 036K288-001 036K289-001 036K290-001
X.50 Data Module Zone 1 Connector Panels: 8-DB25 connectors 6- DB25 connectors and 2 shielded modular jacks	036P414-001 036K338-001 036K339-001
Voice Modules	
2W FXS ADPCM with echo cancellation	036M420-001
2W FXO ADPCM with echo cancellation	036M420-002
2W/4W E&M ADPCM with echo cancellation	036M420-003
2W FXS ADPCM	036M420-004
2W FXO ADPCM	036M420-005
2W/4W E&M ADPCM	036M420-006
2W FXO VLBRV with FAX	036M420-007

Table 1-1 Equipment List (Cont.)

Description	GDC Part No.
2W FXS VLBRV with FAX	036M420-008
2/4W E&M VLBRV with FAX	036M420-009
2W FXO VLBRV	036M420-010
2W FXS VLBRV	036M420-011
2W/4W E&M VLBRV	036M420-012
2W FXS CELP with FAX	036M420-013
2W FXO CELP with FAX	036M420-014
2W/4W E&M CELP with FAX	036M420-015
2W FXS CELP	036M420-016
2W FXO CELP	036M420-017
2W/4W E&M CELP	036M420-018
2W FXS CELP 9.6 with FAX	036M420-023
2W FXO CELP 9.6 with FAX	036M420-024
2W4W E&M CELP 9.6 with FAX	036M420-025
2W FXS CELP 9.6	036M420-026
2W FXO CELP 9.6	036M420-027
2W4W E&M CELP 9.6	036M420-028
Dual Private Voice Modules	
Dual private Voice 2W FXS	036P460-001
Dual private Voice 2W FXS/FAX	036P460-002
Dual private Voice 2/4W E&M	036P461-001
Dual Private Voice 2/4W E&M/FAX	036P461-002
Dual Private Voice 2W FXO	036P462-001
Dual Private Voice 2W FXO/FAX	036P462-002
Dual Private Voice 2W FXO/FAX Ground Start	036P463-001
OCM Enclosure Dual Zone 1 installation kit	036K064-001
OCM Shelf Dual Zone 1 installation kit	036K065-001
OCM Expansion Dual Zone 1 installation kit	036K066-001
DPV Zone 1 kit instruction sheet	036R340-K1
Packet Processor Cards	
OPP - Ethernet w/Packet Bus	036M450-001 or -005
OPP - Ethernet w/o Packet Bus	036M450-004
OPP - Token-Ring w/Packet Bus	036M451-001 or - 005
OPP - Dual Bus Interface	036M450-003
Alarm Card	
Alarm Card	048P067-001

Table 1-1 Equipment List (Cont.)

Enclosures (The Zone 1 panel used on the OCM Enclosure does not come as an assembled part but must be assembled from individual components in the factory)	
OCM-2000 Enclosure with CCM, N/R, North American (100/120V)	036M486-001
OCM -2000 Enclosure with CCM, N/R, International (220/240V)	036M486-002
OCM-1000 Enclosure with CCM, N/R, North American (100/120V)	036M488-001
OCM -1000 Enclosure with CCM, N/R, International (220/240V)	036M488-002
Enclosure w/o CCM and Power Supply	010B158-003
Power Supply Modules (Enclosure)	
GPS-13, North American (100/120V)	035P010-001
GPS-13E, International (220/240V)	035P010-002
Shelves	
OCM-2210 Shelf with CCM, N/R, North American (100/120V) Zone 1 16 RJ45 Zone 1 Dual RJ45	036M480-001 010C342-001 010C342-003
OCM -2310 Shelf with CCM, R, North American (100/120V) Zone 1 16 RJ45 Zone 1 Dual RJ45	036M480-002 010C342-001 010C342-003
OCM -2220 Shelf with CCM, N/R, International (220/240V) Zone 1 16 RJ45 Zone 1 Dual RJ45	036M481-001 010C342-001 010C342-003
OCM -2320 Shelf with CCM, R, International (220/240V) Zone 1 16 RJ45 Zone 1 Dual RJ45	036M481-002 010C342-001 010C342-003
OCM -2230 Shelf with CCM, N/R, DC (-48V) Zone 1 16 RJ45 Zone 1 Dual RJ45	036M482-001 010C342-001 010C342-003
OCM -2330 Shelf with CCM, R, DC (-48V) Zone 1 16 RJ45 Zone 1 Dual RJ45	036M482-002 010C342-001 010C342-003
OCM-1210 Shelf with CCM, N/R, North American (100/120V) Zone 1 16 RJ45 Zone 1 Dual RJ45	036M483-001 010C342-001 010C342-003
OCM -1310 Shelf with CCM, R, North American (100/120V) Zone 1 16 RJ45 Zone 1 Dual RJ45	036M483-002 010C342-001 010C342-003

Table 1-1 Equipment List (Cont.)

Description	GDC Part No.
Shelves	
OCM -1220 Shelf with CCM, N/R, International (220/240V)	036M484-001
Zone 1 16 RJ45	010C342-001
Zone 1 Dual RJ45	010C342-003
OCM -1320 Shelf with CCM, R, International (220/240V)	036M484-002
Zone 1 16 RJ45	010C342-001
Zone 1 Dual RJ45	010C342-003
OCM -1230 Shelf with CCM, N/R, DC (-48V)	036M485-001
Zone 1 16 RJ45	010C342-001
Zone 1 Dual RJ45	010C342-003
OCM -1000 Shelf with CCM, R, DC (-48V)	036M485-002
Zone 1 16 RJ45	010C342-001
Zone 1 Dual RJ45	010C342-003
OCM Split Shelf Backplane	010P160-001
OCM 1510 Split Shelf, 117 Vac	036M491-001
Zone 1 Dual RJ45	010C342-003
OCM 1520 Split Shelf, 220 Vac	036M492-001
Zone 1 Dual RJ45	010C342-003
OCM 1530 Split Shelf, DC-48 Vdc	036M493-001
Zone 1 Dual RJ45	010C342-003
OCM 2510 Split Shelf, 117 Vac	036M494-001
Zone 1 Dual RJ45	010C342-003
OCM 2520 Split Shelf, 220 Vac	036M495-001
Zone 1 Dual RJ45	010C342-003
OCM 2530 Split Shelf, DC-48 Vdc	036M496-001
Zone 1 Dual RJ45	010C342-003
OCM 1510/2510 Split Shelf, 117 Vac	036M497-001
Zone 1 Dual RJ45	010C342-003
OCM 1520/2520 Split Shelf, 220 Vac	036M498-001
Zone 1 Dual RJ45	010C342-003
OCM 1530/2530 Split Shelf, DC-48 Vdc	036M499-001
Zone 1 Dual RJ45	010C342-003
OCM X.50 W/CCM N/R, DC (-48V)	036M482-003
Zone 1 8-slot RS232 (DB25)	010B171-001
Zone 1 1-slot RS232 (DB25)	010B170-001
Zone 1 1-slot RJ45	010B169-001
Shelf Assemblies:	
AC Shelf - MS-1(with bus term. cards)	010B143-001
DC Shelf - MS-1/DC(with bus term. cards)	010B143-002
AC Expansion Shelf (100/120V)	010M064-001
AC Expansion Shelf (220/240V)	010M065-001
DC Expansion Shelf (100/120V	010M066-001

Table 1-1 Equipment List (Cont.)

Power Supply Modules (Shelf)	
GPS-11 (AC input North American - 100/120V) GPS-11E (AC input International - 220/240V) DPS-11 (DC volt. -48V)	035P034-001 035P034-002 041P050-001
Miscellaneous Equipment	
Bus Termination Card (shelf/enclosure)	010P134-001
Power Cord - Domestic 100/120 Vac (Ferrite Suppression)	028H104-006
Power Cord - International 220V(Eur. - 2-prong)	830-061-002
Power Cord - International 220V(UK)	830-060-102
Extender Card	010P141-001
Bar, Int'l Card Lock Kit (Prevents modules from being unseated unintentionally)	010K021-001
Bus Power Cable (expansion shelf - AC power supply)	024H607-002
Bus Power Cable (expansion shelf - DC power supply)	024H607-001
Bus Signal Cable (expansion shelf)	830-063-002
Blank Panel, Card Slot	010P142-001
Blank Panel, Power Supply	010D727-001
Alarm Interface Adapter	048P068-001
X.21 Interface Adapter (DB25 to DB 15) GDC	209-036-019
System Cables (For application information, refer to OCM Cable Applications later in this table.) GDC cables can be ordered in a variety of lengths. Custom lengths may also be ordered. When ordering cables, be sure to include the basic number and also the desired length.	
CCM	
DB-25 M to DB-25 M 232 maintenance port cable	028H502
DB-25 M to DB-9 F PC serial port cable OCM-1000	028H303
8-pos mod to DB-9 F PC serial port cable OCM-1000	027H249
8-pos mod to 8-pos mod daisy-chain for OCM-1000	022H024
Adapter connector, DB-25 M to dual 8-pos mod	209-036-005
DB-25 M to DB-25 F, MAU-1 adapter	028H206
CCM Redundancy cable	028H608
T1/E1 LIM	
T1/E1 8-pos. mod. to DB-25M	027H245
T1/E1 8-pos mod to DB25M (crossover)	027H239
V.11 LIM	
DB-25 M to DB-25 M straight thru	027H525
DB-25 M to DB-37 F RS449 adapter	027H501
DB-37 M to DB-37 M, RS449	027H603
DB-25 M to DB-15 M, V.11 LIM to X.21	027H423
V.11 Redundancy cable	029H608

Table 1-1 Equipment List (Cont.)

V.35 LIM	
DB-25 m to DB-25 M straight thru	027H525
DB-25 M to 34-pin male, V.35 LIM	027H579
DB-25 M to DB-25 M, V.35 LIM to DS-1 shelf	027H580
V.35 Redundancy cable	029H608
SubRate LIM	
SubRate LIM to Modem (DB-25 to DB-25 - straight through)	028H502
BQM	
8-pos. modular cable (14ft.)	830-028-814
Y-cable for redundant LIMs	029H408-x06, or use a commercial splitter/combiner (2-wire)
Dual Data Channel	
DDC "Y" cable 232, CH-A-PL/CH-B-PL	028H603
DDC "Y" cable 232, CH-A-PL/CH-B-SN	028H604
DDC "Y" cable 232, CH-A-SN/CH-B-PL	028H605
DDC "Y" cable 232, CH-A-SN/CH-B-SN	028H606
DDC "Y" cable 232 V.54 crossover	028H610
HS Data Channel	
DB-25 M to DB-25 M 232 straight thru.	028H502
DB-25 M to DB-25 M 232 crossover	028H401
DB-25 M to DB-25 M straight thru. RS422/RS423	027H525
DB-25 M to DB-25 crossover, RS422/RS423	027H569
DB-25 M to DB-37 F, RS449 adapter	027H501
DB-37 M to DB-37 M, RS449	027H603
DB-25 M to 34-pin male, V.35	027H579
V.35 34-pin to V.35 34-pin straight thru.	027H570
V.35 34-pin to V.35 34-pin crossover	027H571
V.35 DB-25 M to V.35 34-pin female adapter	027H572
DB-25M to DB-25M V.54 crossover	028H416
Dual Private Voice 2W FXO/FAX	036P462-002
G.703 Data Module	
DB25 to DB25 male straight-thru	027H525
X.50 Data Module	
X.50 Data Module Y-Cable to DB25 male	028H619
Voice Channel Modules	
8-pos mod to 8-pos mod, keyed	830-028
Six 8-pos mod to 50 pin Amphenol	024H608

Table 1-1 Equipment List (Cont.)

Description	GDC Part No.
Line Cords	
100/120 Volt Line Cord	830-024-003
European Line Power Cord	830-061-002
UK Line Power Cord	830-060-102
OCM Cable Applications	
022H024	OCM-1000 (8-position modular jack to 8-position modular jack)
027H249	OCM-1000 (DB-9 female to 8-position modular jack male)
027H525	DB-25 male to DB-25 male
027H580	V.35 to DS-1 Shelf (DB-25/DB-25)
027H603	DB-37 male to DB-37 male RS449
028H206	OCM-1000 MAU-1A Adapter Cable (DB-25 male to DB-25 female)
028H303	OCM-1000 Multidrop PC to MAU-1A Cable (DB-25 male to DB-9 female.)
028H401	EIA/TIA-232-E Crossover (DB-25/DB-25)
028H408	Redundancy cable, (2-8 pos. mod male to 1-8 pos. mod. female)
028H416	DB-25M to DB-25M V.54 crossover
028H502	EIA/TIA-232-E (DB-25/DB-25)
028H603	Dual EIA/TIA-232-E "Y" cable, PL+PL (DB-25 to "Y" DB-25)
028H604	Dual EIA/TIA-232-E "Y" cable, PL+SN (DB-25 to "Y" DB-25)
028H605	Dual EIA/TIA-232-E "Y" cable, SN+PL (DB-25 to "Y" DB-25)
028H606	Dual EIA/TIA-232-E "Y" cable, SN+SN (DB-25 to "Y" DB-25)
028H608	Redundancy cable, (2-DB25 male to 1 DB25 female)
028H610	DDC "Y" to 232 V.54 crossover
206-059-003	OCM-1000 CCM Adapter
209-036-005	OCM-1000 CCM Adapter
830-028-807	Integral DSU to Network
830-028-8xx	8-pin modular plug to 8-pin modular plug, 8 conductors, non-keyed
830-029-8xx	8-pin modular plug to spade lugs
027H239	OCM T1/E1 LIM to TMS 3000 CDA

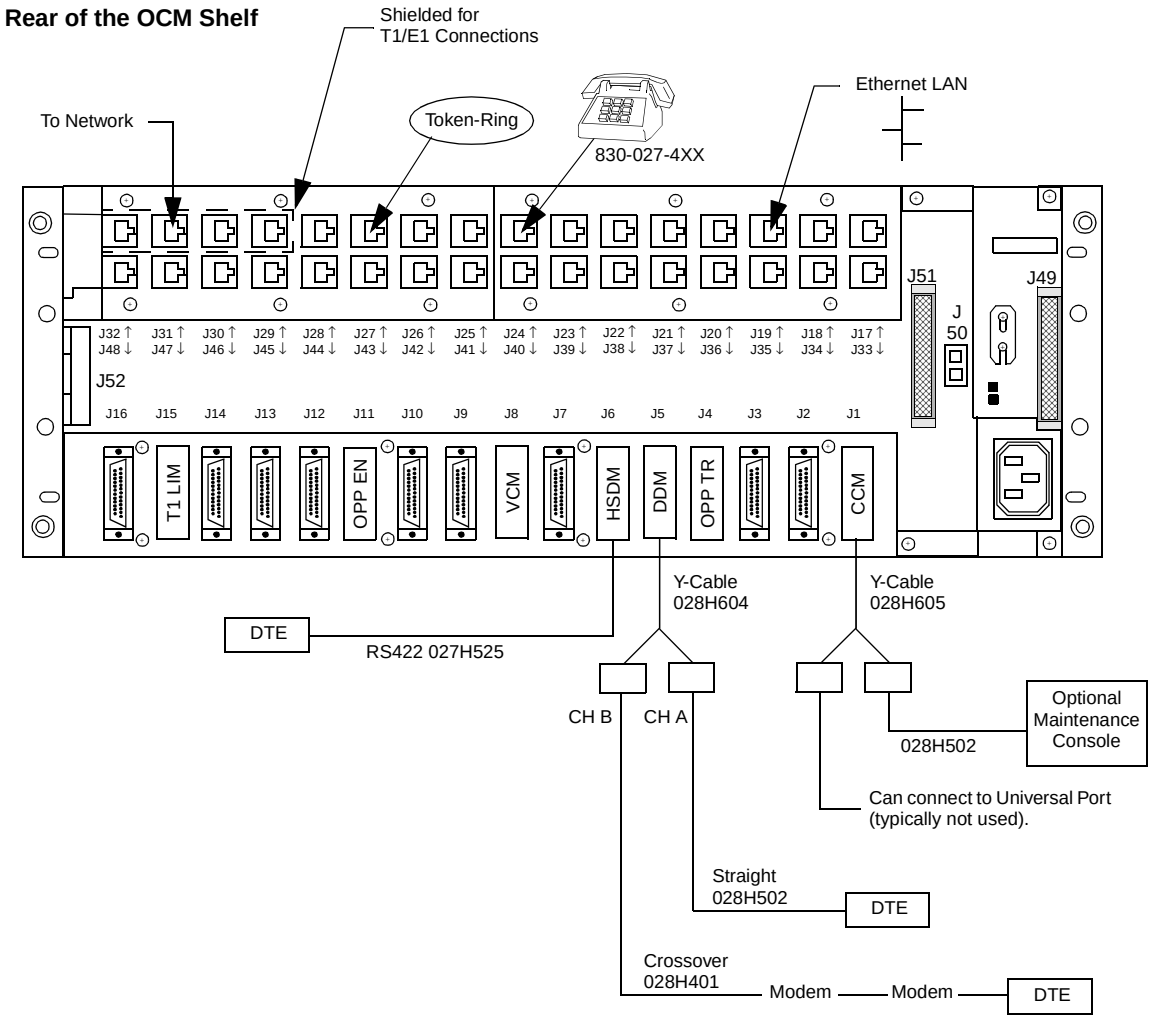


Figure 1-2: Typical OCM Cabling

Chapter 2: Enclosures/Shelves

Overview

Although most OCMs are pre-assembled, tested, and ready to use, this chapter takes you step-by-step through the process of installing your enclosure or shelves. If this is your first introduction to the OCM, review *Chapter 1* to give you a summary of the OCM key features and help you understand the process of installing and using it on your network.

Unpacking

Inspect the OCM for damage; if any is observed, notify the shipper immediately. Save the box and packing material; you can use it to reship the unit, if necessary.

Location

Locate the enclosure or shelf in a ventilated area where the ambient temperature does not exceed 122°F (50°C). Do not install the shelf directly above equipment that generates a large amount of heat (such as power supplies).

Load Number

When configuring the shelf or enclosure, ensure that the total load of all the modules does not exceed the capacity of the power supply (s). The Load Number is a tool which enables you to calculate the power consumption of the system when it is configured. The Load Number is normalized to the number of slots (10) in an enclosure or 16 in a shelf. For example, in a single shelf, the sum of the Load Numbers should not exceed 16, and in a multiple shelf, the sum should not exceed 32. The enclosure should not exceed 10 (10 slots available).

Each power supply is designed to power plug-in modules whose Load Numbers total up to no more than 16 (or 10) Each shelf or enclosure is designed to house plug-in modules whose Load Numbers total up to no more than 16 or 10. Exceeding these Load Number requirements, violates GDC warranties with regard to performance of that system.

The Load Number for each module used in the OCM, is listed in Technical Characteristics table for each module.

Cooling Requirements

The following rules should be adhered to when stacking shelves in Open Frame or EP-4 Cabinets. The rules are based on worst case power requirements (fully loaded 96 Watt power consumption). Although lightly loaded shelves require less cooling, we recommend that these rules be followed to eliminate the necessity to upgrade in the field. In any case, be sure to use blank filler panels in any unused slot of the shelf when stacking. Refer to *Table 2-1* and *Figure 2-1* through *Figure 2-3*.

Power Supplies

Redundant power supplies run cooler than non-redundant supplies because the load is divided between them. Thus, the cooling requirements are lower for a system with redundant supplies.

Fan Tray Assemblies

In all cabinets you can install Fan Tray Assemblies for forced air cooling. One fan tray can cool two shelves below it and two shelves above it, drawing cool air in at the bottom and exhausting warm air at the top. This means that you can install two shelves below the bottom fan tray, two

shelves above the top fan tray, and up to four shelves between two fan trays. You cannot install a Fan Tray assembly between an OCM main shelf and expansion shelf.

In an EP-4 cabinet, fewer fan trays are required because the cabinet includes blowers at the bottom and top. You can stack four shelves before you must install a fan tray.

Aux. Fan Assembly	Part No.
AC Domestic	010B160-001
AC Export	010B161-001
DC	010B162-001

Air Baffles

In an open frame rack or in an EP-2M cabinet, you can install Air Baffles, instead of fan trays, for convection cooling. The baffle draws cool air in at the bottom (for the shelf above it) and exhausts warm air at the top (from the shelf below it). With non-redundant supplies, you must install a baffle above every shelf. With redundant supplies, you must install a baffle above every two shelves. (A baffle is not required at the very bottom or the very top, only between shelves.) The GDC part number for the baffle assembly is 010D787-001. You cannot install a baffle between an OCM main shelf and expansion shelf.

In an open frame rack with each shelf drawing no more than 60 watts ac (or 70 watts dc). You can stack four shelves before you must install a baffle, regardless of the power supply configuration.

Air Flow

Each shelf requires an unrestricted air flow of at least 37 cfm. Do not install anything on the shelf that may block the flow of air through the closed column formed by stacked shelves. Proper installation of the shelves with fans or baffles creates an enclosed column and provides the proper air flow.

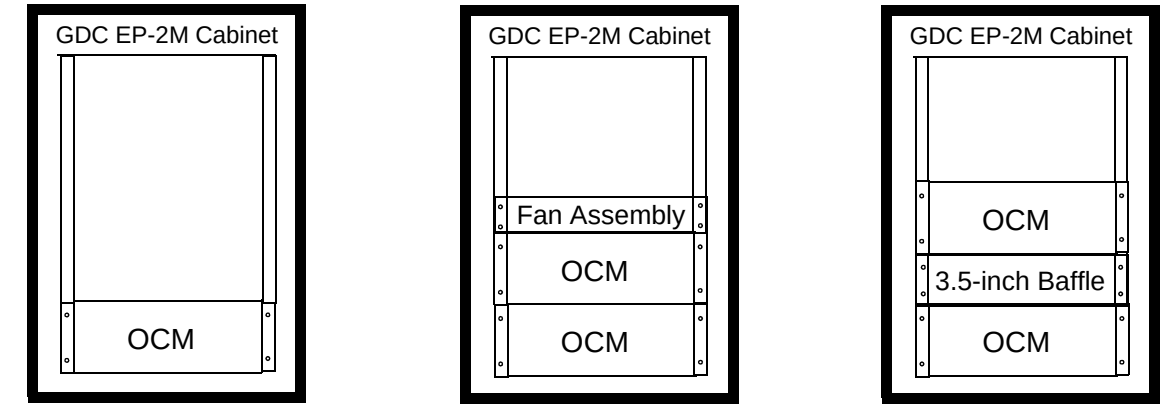
1. To provide proper air flow through a cabinet or rack, you must follow the guidelines described above. There must be no open space between components, and you must install blank front panels in all unused slots. Failure to do so may result in overheating and subsequent power supply shutdown.
2. There must be adequate provision for the circulation of cooling air and exhaust of warm air.

Table 2-1: Shelf Configurations

Enclosure	Power Supplies	Cooling Method Fan [1]	Cooling Method Baffle [2]	Shelf Illustrations
EP-2M				
1 shelf	non-redundant	optional	optional	2-1-A
	redundant	optional	optional	C-A
2 shelves	non-redundant	1 required	1 required	2-1-B (fan) 2-1-C (baffle)
EP-4				
1 shelf	non-redundant	optional	not applicable	2-2-A
	redundant	optional	not applicable	2-2-A
2 shelves	non-redundant	optional	not applicable	2-2-B
	redundant	optional	not applicable	2-2-B
4, 6, 8 shelves	non-redundant	1 required	not applicable	2-2-C, 2-2-D, 2-2-E
	redundant	1 required	not applicable	2-2-C, 2-2-D, 2-2-2E
Open frame				
1 shelf	non-redundant	optional	optional	2-3-A
	redundant	optional	optional	2-3-A
2 shelves	non-redundant	1 required	1 required	2-3-B (fan) 2-3-E (baffle)
	redundant	optional	optional	2-3-C
4 shelves	non-redundant	1 required	3 required	2-3-D (fan) 2-3-E (baffles)
	redundant	1 required	1 required	2-3-D (fan) 2-3-F (baffle)
6 shelves	non-redundant	2 required	5 required	2-3-E (baffles)
	redundant	2 required	2 required	2-3-F (baffles)
8 shelves	non-redundant	2 required	7 required	2-3-E (baffles)
	redundant	2 required	3 required	2-3-F (baffles)

1. Use of the fan assembly for forced air cooling is optional in single-shelf configurations and in configurations with two shelves with redundant supplies. Most other configurations require one or more fan assemblies.

2. You may use the baffle assembly (for convection cooling) instead of the fan assembly (for forced air cooling) only in an EP-2M cabinet or open frame rack with redundant power supplies. Do not use it in an EP-4 cabinet.



A. One Shelf (Redundant Power Supplies)

B. Two Shelves

C. Two Shelves

Figure 2-1: Rackmounting OCM Shelves In a GDC EP-2M Cabinet

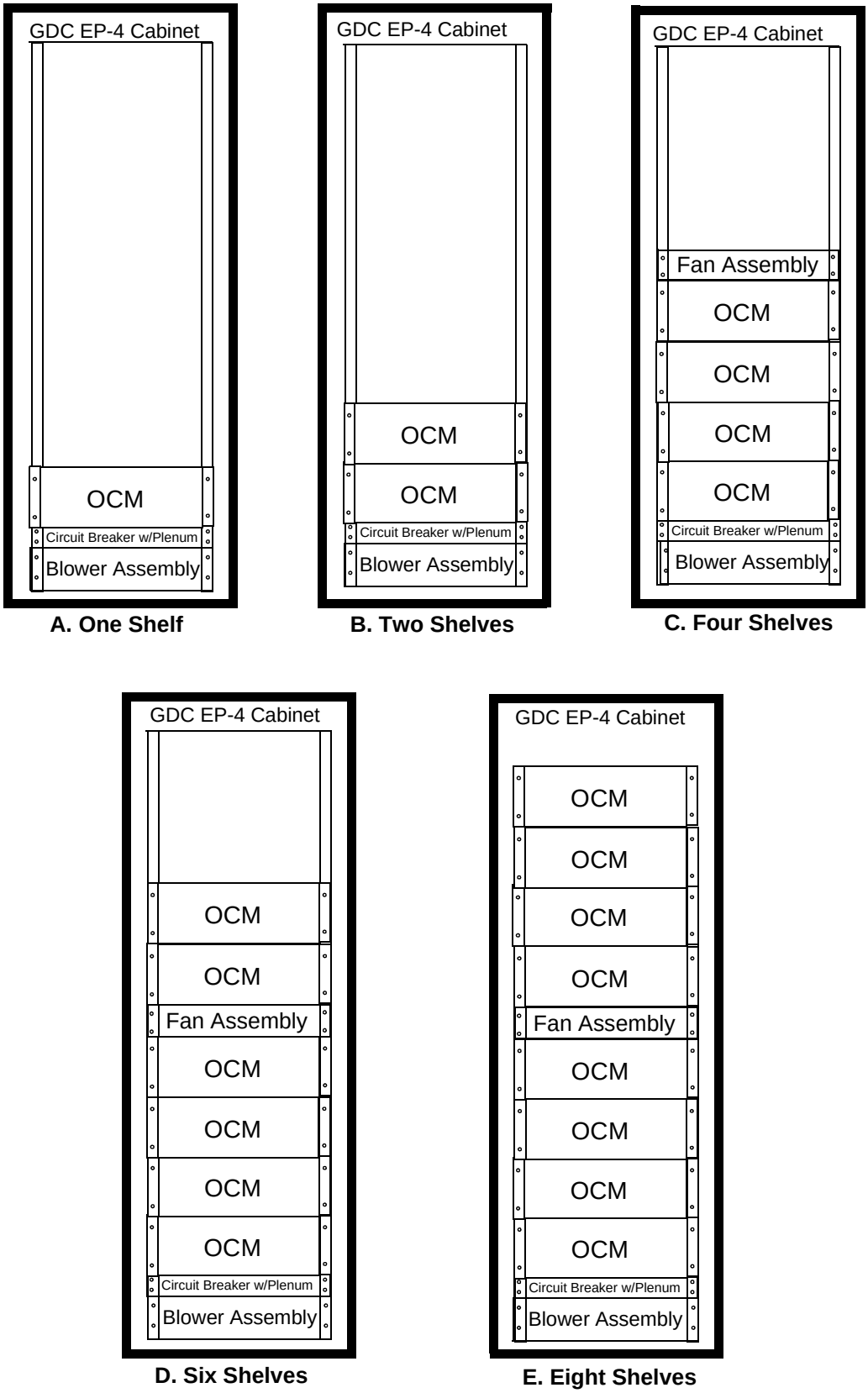


Figure 2-2: Rackmounting OCM Shelves In a GDC EP-4 Cabinet

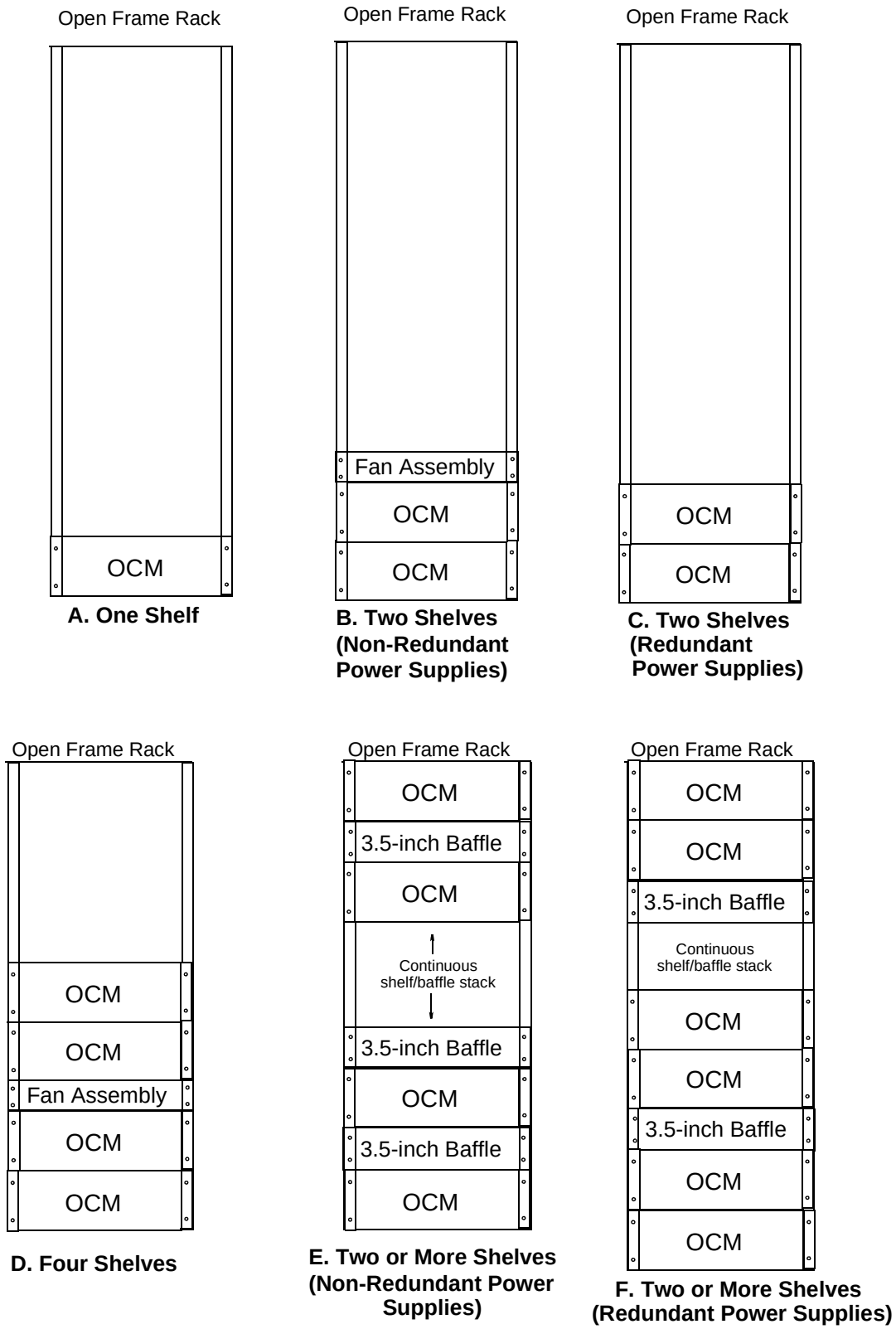


Figure 2-3: Rackmounting OCM Shelves In an Open Frame Rack

Grounding

Proper grounding is important for several reasons as discussed in the following:

Safety

The chassis of the AC powered shelf or enclosure must be connected to protective (earth) ground for safety reasons. This is normally done via the power cord ground wire, or optionally via a separate ground wire from a grounded post (chassis ground) on the rear panel.

Figure 2-4 shows an optional ground connection on an AC or DC shelf using an anti-rotational lug or a ring lug terminal.

Field connections are made to the shelf frame by crimping a 10 or 12 AWG wire to one of the lugs in the terminal lug kit GDC Part No. 010K030-001 using Burndy Electric Co. Hytool Type Y1OD. Call Burndy customer service 1-800-346-4175 for tool order information.

Attach the lug and wire to the left side plate of the shelf as shown in Figure 2-4 using the hardware supplied in the kit.

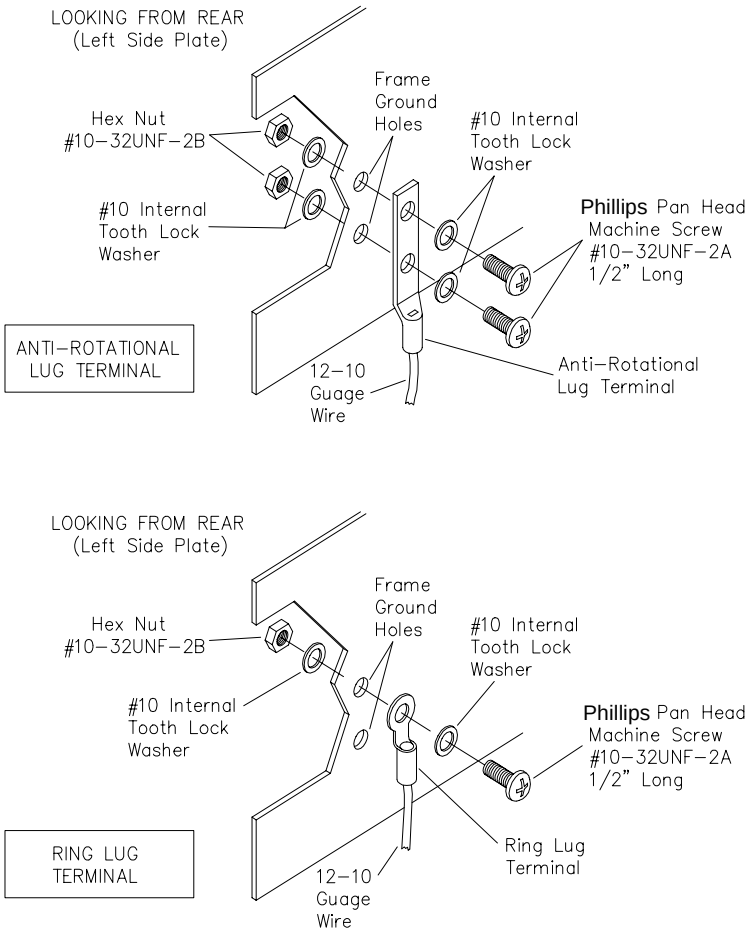


Figure 2-4: Shelf Frame Ground Connection

EMI (Electromagnetic Interference)

Zone 3 - Shielded cables minimize EMI and are required for Zone 3 I/O connections to meet the radiated EMI limits for FCC Part 15 Class A and EN55022 Class A.

These shielded cables are connected to the OCM chassis and thus to local earth ground. This occasionally causes a problem if the equipment to which the OCM is connected is at a different ground potential than the OCM, and that equipment also grounds the cable shields to its earth ground. These shielded cables are connected to chassis ground via the two mounting screws on the connector hood. See *"Tying Signal Ground to Chassis Ground"* below.

Zone 1 - When using unshielded cables the OCM Zone 1 EMI Ferrite Toroid Kit - GDC Kit No. 036K063-001 (See *Figure 2-5*) should be used. It consists of a ferrite toroid, Part No. 235-001-002 and the following instructions:

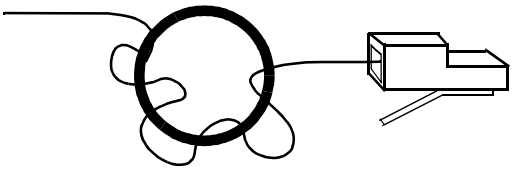


Figure 2-5: Toroid Kit

Use it to suppress unwanted Electromagnetic Interference (EMI) from the OCM Zone 1 unshielded cables. These cables are typically used with the VCM Voice Channel Modules. Each Zone 1 unshielded cable must be wound around a toroid as shown in order to meet the requirements of the International EMI Specification EN55022 Class A.

- Take the end of the cable and pass it four (4) times through the toroid as shown in *Figure 2-5*. Position the toroid so that it is no more than 2 inches (50 mm) from the modular plug.
- Connect the cable to the Zone 1 modular jack of the correct slot.

Telephone Signaling

E&M Types I, V and SSDC5A signaling uses an implicit ground connection between the switching equipment (PBX) and the transmission equipment (OCM), for the return current in the E and M signaling leads. On the OCM, this return path is via chassis ground. Make sure that a connection is made between the OCM chassis ground and the reference ground of the switching equipment when using E&M Type I, V or SSDC5A signaling. FXS and FXO ground start signaling also uses an implicit ground connection for current return. On the OCM, this current return path is via chassis ground. Connect the chassis ground screw post to a good earth ground when using FXS or FXO ground start signaling.

Tying Signal Ground to Chassis Ground

You are responsible for providing Earth connection to the cabinets or racks that the shelves are mounted in. This is in addition to any earth conductor that may exist. Continuity between the shelves and cabinets or racks must be verified.

It is common practice to tie chassis ground and signal ground together. Signal ground is the 0V reference for the digital circuits in the unit and is also the reference for unbalanced data interfaces such as EIA/TIA-232-E and RS423. The default (shipped) and preferred position for the Signal Ground-Chassis ground strap is shorted. This is usually best for AC power line noise immunity, but a problem can exist if signal grounds on two equipments (at different chassis ground potentials) are connected together via a data cable. A large current can flow in the signal ground lead (EIA/TIA-232-E pin 7). To prevent this, make sure the potential difference between grounds is less than 0.25 V RMS. Alternatively, open the connection between chassis ground and signal ground on the unit and connect a wire from chassis ground to the preferred earth point.

The enclosure and shelf are shipped from the factory with the signal and chassis ground strapped together at the two screw terminals located on the rear panels. This is the required position if using any FXS voice channel card or the DPV FXO ground start card.

Figure 2-6 on page 2-11 illustrates the enclosure and shelf ground connections.

To connect common signal ground to chassis ground:

1. Loosen both ground post screws.
2. Slide or rotate the strap to make contact with both ground terminals.
3. Tighten both screws.

To attach separate wire to earth at a remote location:

1. Loosen both ground post screws.
2. Slide the strap up, then rotate it one-half turn to prevent it from contacting the signal ground terminal.
3. Connect a wire from earth ground to the earth point.

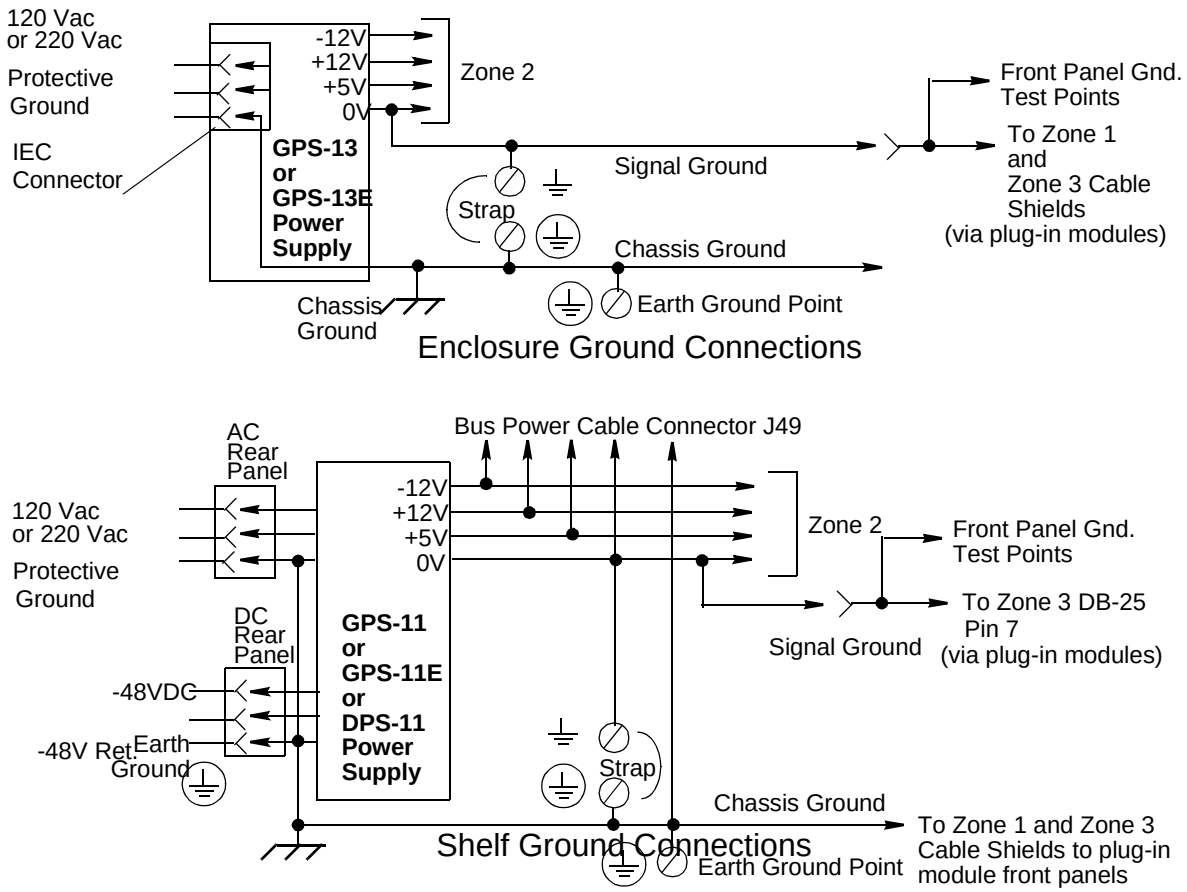


Figure 2-6: Ground Connections

Enclosure

When you order an OCM installed in an enclosure, it is factory configured for your system with the proper connector panels installed at the rear panel. The panels are not field-replaceable. See *Figure 2-7 on page 2-12*.

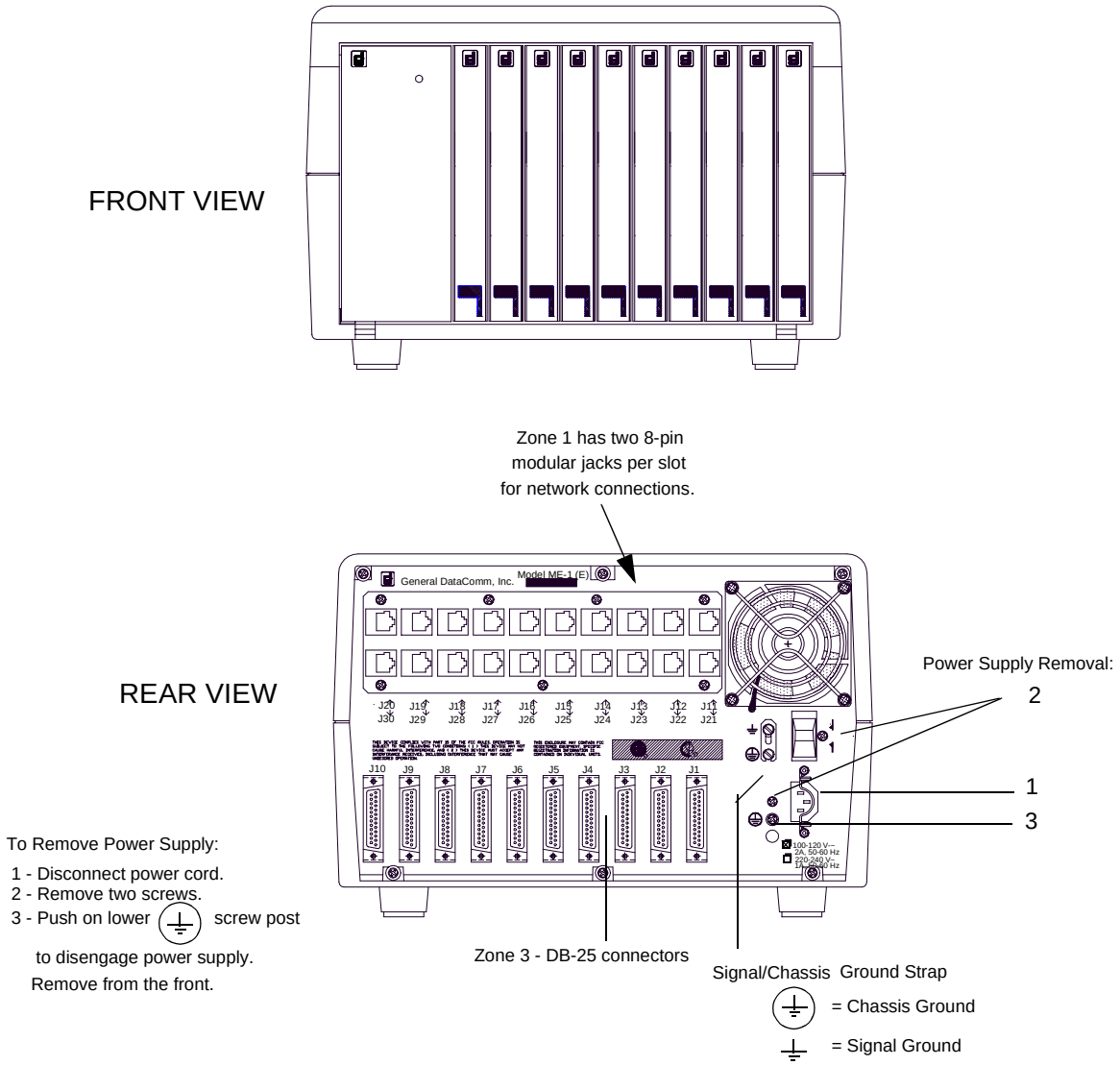


Figure 2-7: 10-Slot Enclosure

Power Supplies

The enclosure uses a GPS-13 (100/120 V) or GPS-13E (220/240 V) power supply for non-redundant use only. The front panel is illustrated in *Figure 2-8 on page 2-13*. The power supply is rated at 100 watts total (+5 VDC = 0 - 20A, ±12 VDC = 0 - 1.0A).

The power supply module has a front panel green LED POWER ON indicator. The power On-Off switch is located on the rear panel of the supply. If the power supply fails, there is no power to the OCM. This condition is displayed on the TMS Controller as a no signal condition. The enclosure's power supply module is installed from the front of the enclosure and secured by two screws at the rear of the enclosure. See *Figure 2-7* for removal procedure.

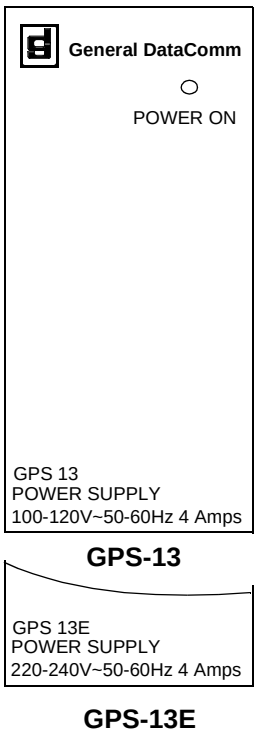


Figure 2-8: Enclosure Power Supply Front Panels

Note	*Power supplies are modular units. If power supply removal is necessary, we recommend that power is first removed from the enclosure.*

Power Cord

The enclosure is equipped with an IEC-type AC power cord. Connect the line cord plug to a polarized grounded outlet providing the required AC power.

Connector Panels

The Zone 1 connector panel located at the top of the enclosure is attached to the rear of the enclosure with 5 screws. The Zone 3 connector panel is located at the bottom of the enclosure and is permanently attached. See *Figure 2-7*.

Shelves

When the OCM is installed in the shelf, the basic plug-in module system is the same as the enclosure except more (up to 16) plug-in modules may be installed. Its dimensions are: 19.0"W x 7.0"H x 12.0"D.

Sixteen slots are used for plug-in modules and for a space reserved for up to two GPS-11 power supplies. A dual shelf configuration allows up to sixteen more module slots and two more supply modules. *Figure 2-9 on page 2-14* shows the rear of the shelf along with an optional dual shelf configuration.

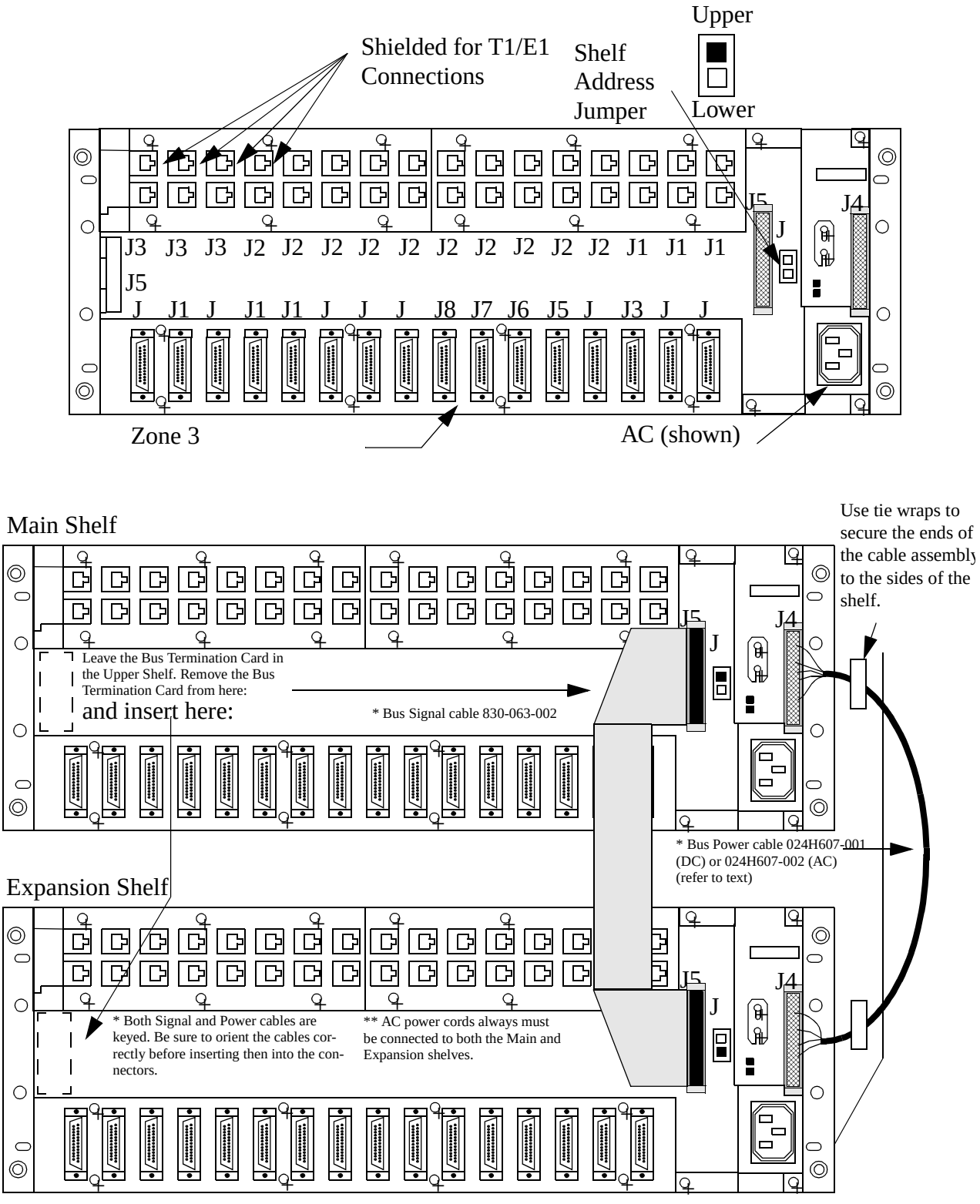


Figure 2-9: Rear Panel, Shelf

Mounting Brackets

The shelf mounting brackets allow the use of two different Telco frame widths. The brackets are simply right-angle brackets (longer on one side) designed to mount 19" shelves to 19" frames, or by reversing the brackets, to adapt the 19" shelf to 23" frames. The brackets also provide center-of-gravity shelf support and depth adjustment when matched with the appropriate threaded holes provided in the sides of the shelf.

Connector Panels

When you order a shelf-mounted OCM, it is factory configured for your system with the proper connector panels installed in the appropriate Zone(s). The shelves and connector panels are listed in *Table 1-1 on page 1-6*. Zone 1 connector panels are attached to the top of the shelf with six screws. The Zone 3 connector panel is attached at the bottom of the shelf with eight screws.

Bus Termination Cards

The shelf is shipped with two Bus Termination Cards (010P134-001) that provide proper impedance matching for the data bus on Zone 2. A single shelf has one card inserted into J51 located at the rear of the shelf. The other bus termination card is located inside the shelf in the XA20 connector. See *Figure 2-9*

Shelf Address Jumper (J50)

The shelf address jumper tells the modules whether they are in an upper shelf or a lower shelf of a dual shelf OCM. It is located on the rear of the shelf next to J51 (see *Figure 2-9*). After power is removed from the shelf, jumper J50 (recessed under a protective cover) may be accessed. Set to upper for a single shelf OCM. Set to lower if a second shelf is used. Its default position (single shelf) is upper.

Expansion Shelf (Dual Shelf Redundancy)

Note	*Before adding an expansion shelf, be sure you remove power from the main shelf.* *The expansion shelf has no shielded modular jacks in Zone 1. Therefore, you must install the E1/T1 LIMs in the upper or main shelf.*

Adding dual (or expansion) shelves allows up to four power supplies and extra cards in the upper and lower shelves. A power supply may power either shelf and is called redundancy. For example, if a dual shelf has three power supplies and any one power supply fails, the remaining two power supplies provide power for both shelves. Each shelf requires separate AC or DC input power.

If you decide to operate two shelves with a single upper power supply (none in the expansion shelf) and Power Bus Cable installed, do not exceed the load rating of one power supply by installing too many plug-in cards. With expansion shelf configurations, load sharing always occurs between power supplies. Refer to the description of Load Number described on page 1 of this chapter.

In a redundant system, the front panel FAIL indicator lights when the supply shuts down due to an overload condition including an absence of input voltage caused by turning off the power

switch on the supply. If a power supply failure is indicated, turn off the power switch, wait one minute, correct the overload condition, then turn back on. If the power supply still shows a failure, the power supply (or a faulty backplane or module) is defective. Power supply failure is also reported to the TMS Controller.

See the lower view of *Figure 2-9*. An MS-1 or MS-1E shelf used for expansion must be mounted directly below the main shelf, with no intervening gap, to allow for inter-shelf cabling.

The optional expansion shelf is not shipped with termination cards. For dual-shelf applications, see *Figure 2-9*, and refer to the following text.

If a two shelf configuration is used for expansion, the expansion shelf should be placed below the original shelf and should be linked using bus power cable 024H607-001 (for DC power supplies) or 024H607-002 (for AC power supplies) between rear panel connectors J49 (observe proper keying). The Bus Termination Card should be removed from J51 of the original shelf and inserted into slot XA20 located at the inside right-hand side of the expansion shelf. The bus signal cable 830-063-002 is then plugged into connector J51 (observe proper keying) of the original shelf (where the Bus Termination Card was removed) and connected to J51 of the expansion shelf. The Bus Termination Card on the inside of the original shelf in the XA20 position remains where it was. To prevent the possibility of the Power Bus Cable coming loose from J49, use tie wraps included in the Expansion Shelf package to secure both ends of the cable to holes in the side of the shelf.

Two shelf system with four power supplies

The power cable is not required in this configuration but is optional. For reliability, we advise not to use this cable. Each individual shelf is fully redundant without this cable.

Two shelf configurations that require the use of a power cable are:

- 2 shelves with 2 power supplies, where 1 power supply is capable of powering both shelves.
- 2 shelves with 3 power supplies where 2 power supplies are required to power both shelves.

Split Shelf

Follow the same installation instructions for the Split Shelf as those for the conventional OCM Shelf with the exceptions described in *Table 2-2*. *Figure 2-10* shows the card slot configuration.

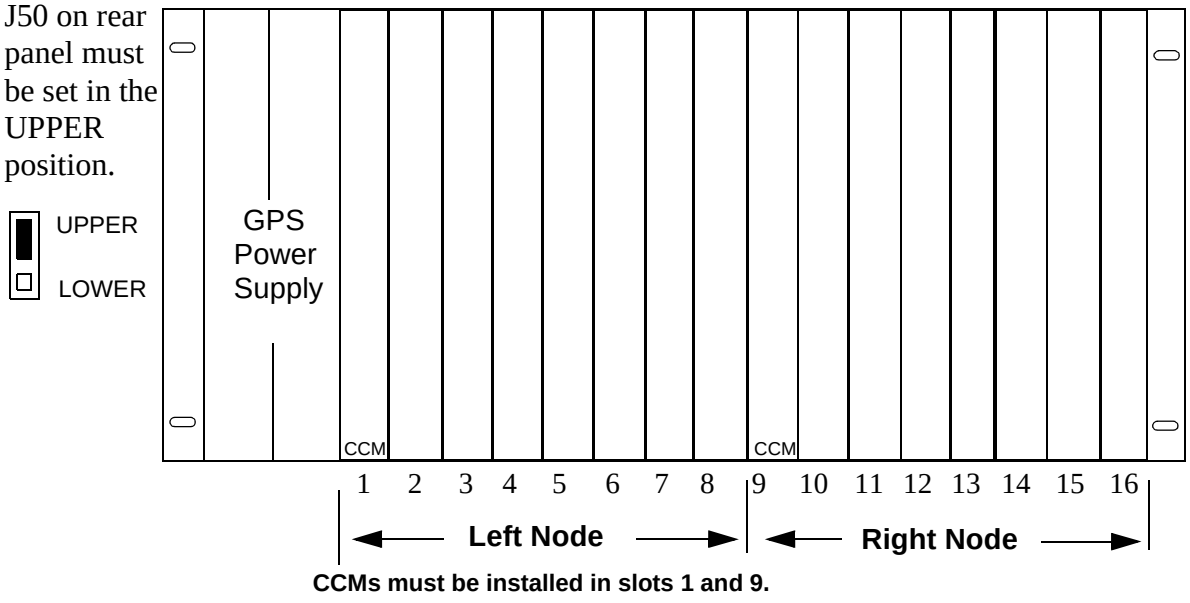


Figure 2-10: Split Shelf - Card Slot Configuration

Table 2-2: Physical Slots Configuration Numbers

	Physical Slot	Configuration Slot	Card Type
	1	Not Available	CCM
Left Node	2	2	Redundant CCM or any channel or LIM card
	3	3	Channel or LIM card
	4	4	
	5*	5	
	6*	6	
	7*	7	
	8*	8	
	9	Not Available	CCM
Right Node	10	2	Redundant CCM or any channel or LIM card
	11	3	Channel or LIM card
	12	4	
	13*	5	
	14*	6	
	15*	7	
	16*	8	

* When using an E1 or T1 LIM, you should place them in a shielded modular connector slot. (Slots 5-8 for the left node, and slots 13-16 for the right node.)

Power Supplies

The AC shelf (MS-1 or MS-1E) may use one or two power supplies GPS-11 (120 V) or GPS-11E (220 V) for non-redundant, or redundant use. The front panel is illustrated in *Figure 2-11*. The power supply is rated at 96 watts total (+5 VDC = 0 - 16A, ±12 VDC = 0-1.67A).

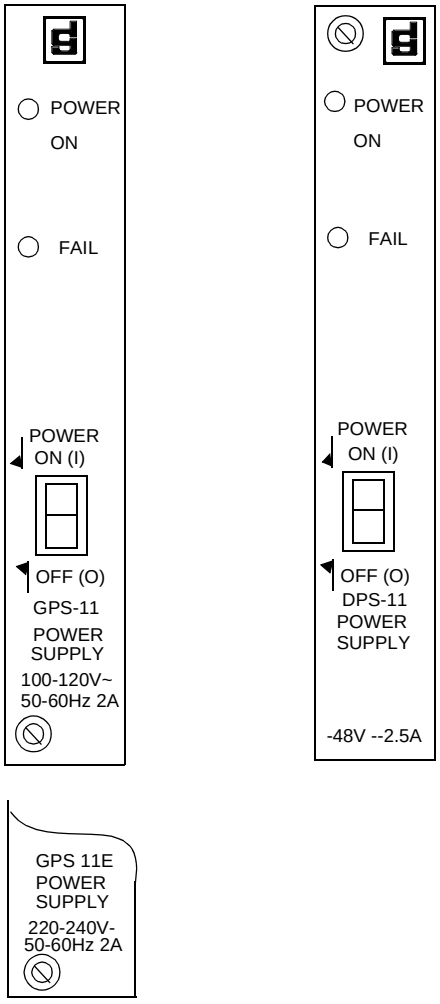


Figure 2-11: Shelf Power Supply Modules, Front Panels

Each power supply module has a front panel green LED POWER ON indicator and a red LED FAIL indicator. An On-Off switch is located on the front panel.

Besides operation from AC input voltages, a DC shelf (MS-1/DC) is available that uses one or two power supplies (DPS-11) that operate from one or (optionally) two -48 VDC station battery(s). The DC power supply is rated at 96 watts total (+5 VDC = 0 - 16A, ±12 VDC = 0-1.67A).

To insert a power supply:

1. Make sure power supply switch is in “OFF” position **before** inserting power supply into shelf.

2. Insert the module into its slot with the GDC logo on top, then slide it in until it makes contact.

3. Tighten the front panel screw to press the front panel firmly against the shelf frame and seat the module.

4. Turn on the power supply.

To remove a power supply:

1. Turn off the power supply.

2. Loosen the front panel screw to unseat the power supply, then pull on the screw.

Note *Power supplies for the MS-1 and MS-1E shelves are modular units. If power supply removal is necessary, we recommend that:*

1 - Power is first removed from the shelf or

2 - In a redundant shelf situation, at least one good power supply remains in the shelf in both the upper and lower shelf.

Power Supply Redundancy (Shelf Only)

You can power the OCM shelf system with one power supply or with multiple redundant, load-sharing power supplies in one shelf or in two adjacent, interconnected shelves (using associated bus power cable) with up to two supplies per shelf. Each shelf is required to house at least one power supply. Additional power supplies need to be installed when redundancy is required. A redundant power supply system has at least one more installed power supply than is required for proper operation. For example, if one power supply fails, the remaining power supplies can power the installed cards. The installed power supplies actively shares current, dividing the total load among all functional supplies.

Adding a second power supply in a shelf provides redundancy such that if one power supply fails, the remaining power supply has the capacity to maintain power to that shelf. The second power supply current shares with the first power supply with the benefit that both power supply modules run cooler and therefore have a lower failure rate.

Station Battery

The dc-powered shelves require customer provided station battery power. Use No. 16 to 12 AWG stranded, insulated copper wire for battery connections, sized to carry 3 amps at –48 V dc nominal per shelf. See *Figure 2-12*.

When a single -48 VDC station battery is used, connect a short jumper wire to terminals 1 and 2, and another to terminals 5 and 6. Connect the station battery positive side to terminal 3, and the negative side to terminal 4. Be sure to observe polarity when you connect the leads to the station battery.

When two batteries (redundant battery system) are used, disconnect jumpers (if any) on 1 and 2, and 5 and 6. Connect station battery A positive side to 3, and A negative side to 4. Battery B positive side connects to 1 and its negative side connects to 6. Be sure to observe polarity when connecting leads to station battery A and B.

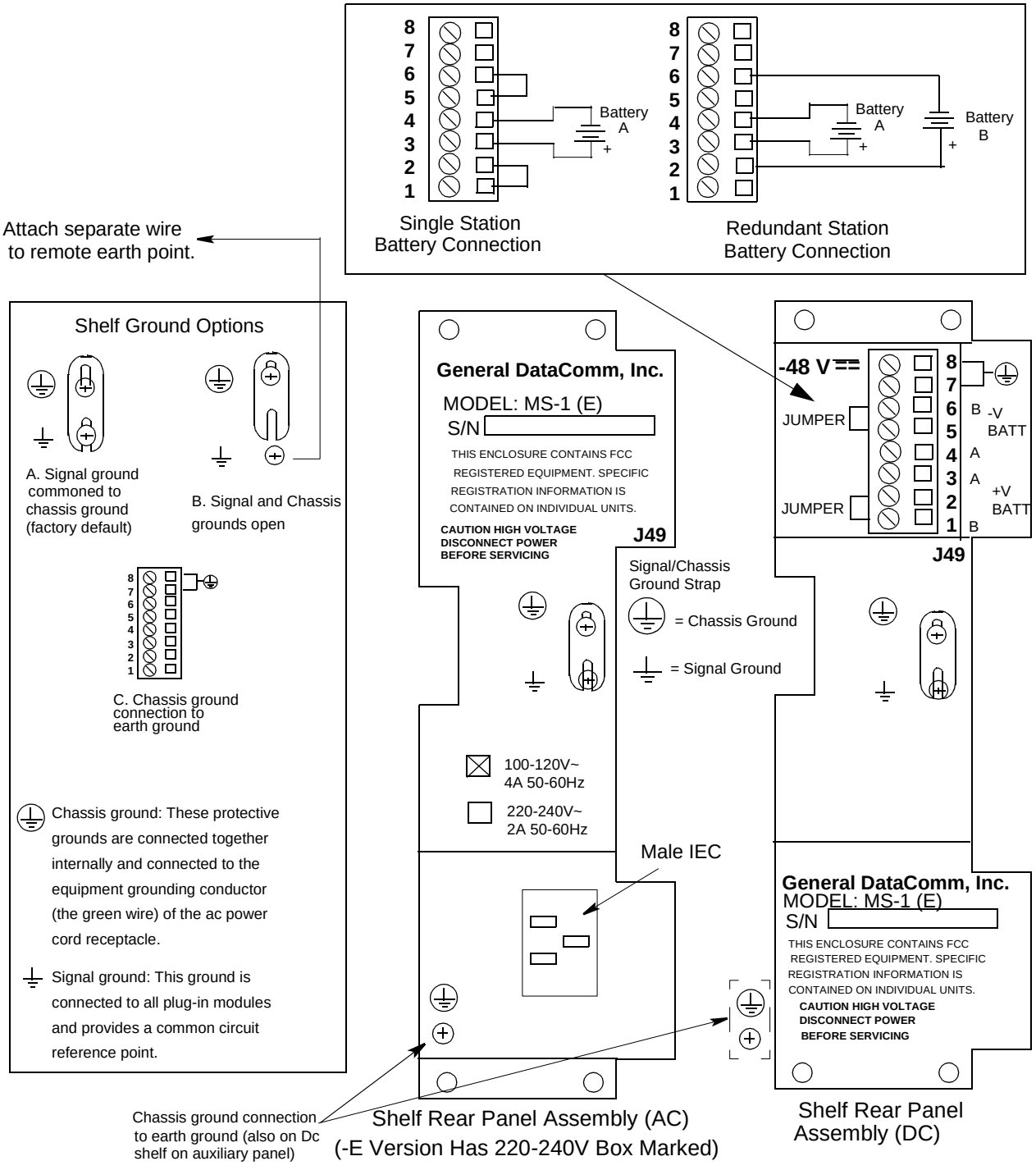


Figure 2-12: Rear of Shelf - Station Battery Use

Noise Immunity Kit - (Early DC Supplies, J- and below)

The revision level of the DC supply is found on a white label at the lower edge of the card. Supplies that don't need this kit are marked K- or above).

Some especially sensitive equipment operating environments may require the use of additional suppression of conducted emissions generated by the equipment, or may require enhanced immunity from susceptibility to "noise" present in that environment. Use of the ferrite toroid in this kit will provide the additional suppression or immunity enhancement required when installed as shown in *Figure 2-13*.

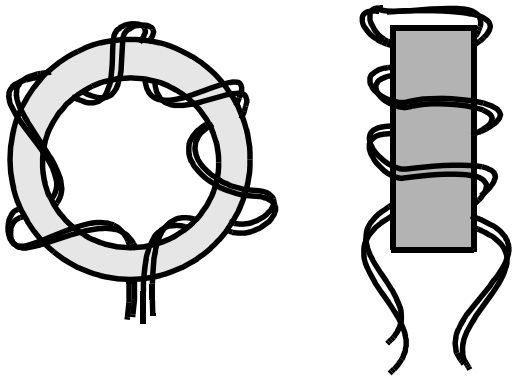


Figure 2-13: Noise Immunity Kit

Each pair of DC battery input wires (-48V, -48VRET) must be wound 6 times around a ferrite toroid, part number 235-001-002, before the wires are connected to the terminal block in the rear of the shelf. The 6 turns must be evenly distributed around the toroid. The toroid must be located a maximum of 3 inches from the terminal block.

For applications where separate A and B battery inputs are used, each pair of wires must be wound around a separate toroid.

Table 2-3: Technical Characteristics

Item	Characteristic
Multiplexing Technique	Bit-interleaved, time division
Multiplexing Efficiency	Up to 99%, essentially unaffected by speed or mix of channels
Channel Capacity	Up to 30 channels of voice or 60 channels of data in MS Shelf Up to 8 channels of voice or 16 channels of data in ME Enclosure
Aggregate Interfaces	T1 DSX-1 (T1 LIM) E1 (E1 LIM) T1 (CSU T1 LIM) V.11 (V.11 LIM) V.35 (V.35 LIM) SubRate (SubRate LIM)
Aggregate Rates	NX56 kbps, NX64 kbps, 1.544Mbps, 2.048Mbps
No. of Aggregates	2
Ambient Temperature Operating: Nonoperating:	 32°F to 122°F (0°C to 50°C) –40°F to 186°F (–40°C to 85°C)
Humidity	95% relative humidity with no condensation
Altitude Operating: Nonoperating:	 10,000 ft. (3048 m) 40,000 ft. (12,192 m)
GPS-13 power supply	
No. Per System Input Power Output Power	1 per enclosure - non-redundant 90-129 VAC, (100-120 nominal) 50/60 Hz +5V 20A +12V 1.05A –12V 1.05A Total Power = 100W Load Number = 10.0

Table 2-3: Technical Characteristics (Continued)

Item	Characteristic
GPS-13E power supply	
No. Per System	1 per enclosure - non-redundant
Input Power	175-264 VAC, (220-240 nom.) 50/60 Hz
Output Power	+5V 20A +12V 1.05A –12V 1.05A Total Power = 100W Load Number = 10.0
GPS-11 power supply	
No. Per System	1 or 2 per shelf, up to 4 for a dual shelf
Input Power	90-129 VAC,(100-120 nom.) 50/60 Hz
Output Power	+5V 16A +12V 1.67A -12V 1.67 Total Power = 96W Load Number = 16.0
GPS-11E power supply	
No. Per System	1 or 2 per shelf, up to 4 for a dual shelf
Input Power	175-264 VAC,(220-240 nom.) 50/60 Hz
Output Power	+5V 16A +12V 1.67A –12V 1.67A Total Power = 96W Load Number = 16.0
DPS-11 power supply	
No. Per System	1 or 2 per shelf, up to 4 for a dual shelf
Input Power	–42 to -56 VDC, (-48 VDC nominal) 4A DC max. input current
Output Power	+5V 16A +12V 1.67A –12V 1.67A Total Power = 96W Load Number = 16.0

Chapter 3: Common Control Module

Common Control Module (CCM)

All modules installed in an OCM node communicate with the Common Control Module. The CCM in turn communicates with the TMS network controller or OCM-1000 Controller and accepts and stores downloaded software. It also contains the circuitry that provides the multiplexer clocking. All of the downloaded OCM software and configuration information resides on this module. The CCM controls configuration on all other modules. Expanded memory versions of the Common Control Module (-007 and -006 below) are available and intended to support future releases of the OCM. These versions are referred to as CCM+.

Three versions of the CCM are available. OCM-1000 uses 036M400-005 or -007 (front panel reads PT-PT COMM CNTRL for -005 and PT-PT COMM CNTRL+ for -007) while the OCM-2000 uses 036M400-004 or -006 (front panel reads COMM CNTRL for -004 and COMM CNTRL+ for -006). The 036P404-001 (front panel reads CCM10) is equipped with expanded memory and is compatible with all previously mentioned versions. The modules provide:

- An LSI System Communications Manager (SCM) that controls all supervisory communications to other modules and Status/Alarms information.
- Self test on power-up.
- A Maintenance Console port for use with a local terminal.
- Control of diagnostics when commanded by the TMS Controller.

Two CCMs may also be configured as a redundant pair. One is in-service and the other is in standby. If a fault occurs in the in-service CCM, the OCM automatically switches over to the standby CCM, bringing it into service and causing the in-service CCM to go into standby.

The front panel disable (Disable) switch can be used to perform a redundant switchover manually. This is a momentary push-button switch. When you push it on the in-service CCM, the standby LED will light to confirm that the switch was pressed. You must press the switch for at least one second. Then the in-service CCM goes into standby and the standby CCM goes in-service.

Procedure for removing a CCM: (as part of a redundant pair)

1. To minimize disruption to the OCM, remove a CCM only when it is in sleep mode (refer to step 3).
2. If the CCM is in-service, press front panel disable (Disable) switch for at least one second. The standby LED lights, and the CCM goes into standby.
3. If the CCM is in standby, press the front panel switch for at least one second. All LEDs go out. The CCM is now in sleep mode.
4. Extract the CCM within five seconds.
5. If you don't remove the CCM within five seconds, the CCM automatically restores itself to the standby mode.

Options

Examine the module by checking the option switches and/or headers on the modules. *Figure 3-1 on page 3-5* and *Figure 3-2 on page 3-6* locate and describe the switches and headers on the CCM and CCM 10, respectively. For OCM-1000, you must set an address (See *Table 3-1 on page 3-4*).

The configuration is set at the factory to match your network operation. The option switches and/or headers are shown in their normal or default (factory shipped) positions.

Check these settings when you first install the unit. You need not repeat the procedure unless you change your network.

When you are satisfied that the option settings are correct, install the modules in the enclosure or shelf following the directions below:

With the exception of the power supply modules, all plug-in modules have an insertion and extraction tab on the bottom of the front panel. To insert a plug-in module:

1. Insert the module into its slot with the GDC logo on top, then slide it in until it makes contact.
2. Pull down the insertion/extraction tab and firmly push the module in until it seats in the rear connectors.

To remove a plug-in module, pull down the insertion/extraction tab to unseat the module, then pull on the tab.

Table 3-2 through *Table 3-5*, on page 3-8 and page 3-9, describe Technical Characteristics and Pinouts, respectively, of each module.

Module Restrictions

Since each module slot in either a shelf or an enclosure is identical, apart from the backplane slot address signals, any module may be installed in any slot, with the following restrictions:

1. Assignment of modules to slots must be that of the configuration on the TMS Controller or OCM-1000 Point-to-Point Controller. For example, the CCM should be placed in the first slot following the power supply module(s), if that is what the configuration shows.
2. Redundant or diverse pairs of modules, when used, must be in adjacent paired slots, in the same shelf, for example, 1-2. Rear panel Zone 1 (top) and Zone 3 (bottom) connector panels must meet the module requirements. The X1 jumper must be in the correct position.
3. For maximum system reliability, we recommend that a module be removed from the currently active TMS configuration before it is extracted from its slot.

Table 3-1: CCM Addressing (OCM-1000)

	Switch S1 (CCM pcb)				
Address	1	2	3	4	5
01 (default)	opened*	closed*	closed	closed	closed
02	closed	opened	closed	closed	closed
03	opened	opened	closed	closed	closed
04	closed	closed	opened	closed	closed
05	opened	closed	opened	closed	closed
06	closed	opened	opened	closed	closed
07	opened	opened	opened	closed	closed
08	closed	closed	closed	opened	closed
09	opened	closed	closed	opened	closed
10	closed	opened	closed	opened	closed
11	opened	opened	closed	opened	closed
12	closed	closed	opened	opened	closed
13	opened	closed	opened	opened	closed
14	closed	opened	opened	opened	closed
15	opened	opened	opened	opened	closed
16	closed	closed	closed	closed	opened
17	opened	closed	closed	closed	opened
18	closed	opened	closed	closed	opened
19	opened	opened	closed	closed	opened
20	closed	closed	opened	closed	opened
21	opened	closed	opened	closed	opened
22	closed	opened	opened	closed	opened
23	opened	opened	opened	closed	opened
24	closed	closed	closed	opened	opened
25	opened	closed	closed	opened	opened
26	closed	opened	closed	opened	opened
27	opened	opened	closed	opened	opened
28	closed	closed	opened	opened	opened
29	opened	closed	opened	opened	opened
30	closed	opened	opened	opened	opened
31	opened	opened	opened	opened	opened
* CCM10 Switch Addressing: opened = down; closed = up					

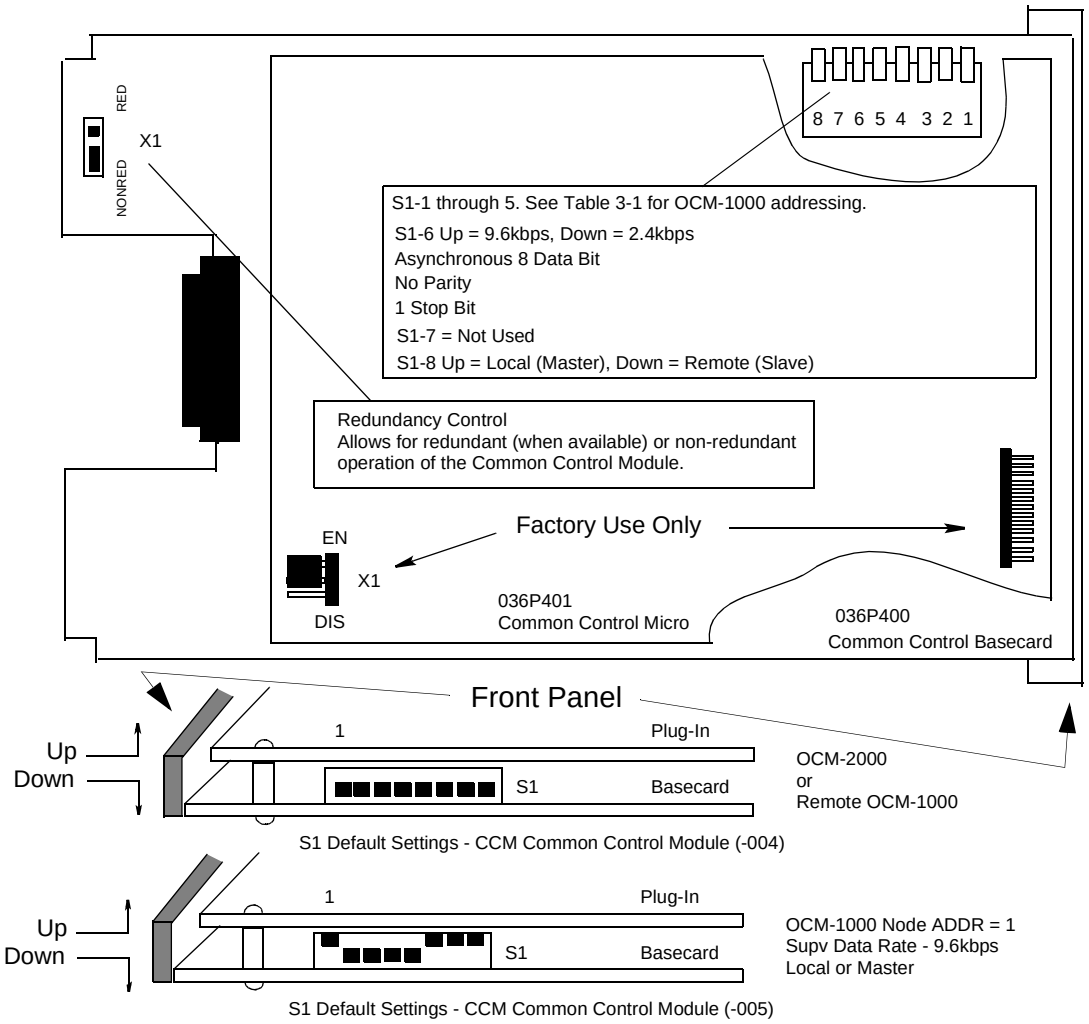


Figure 3-1: Common Control Module: Switches and Headers

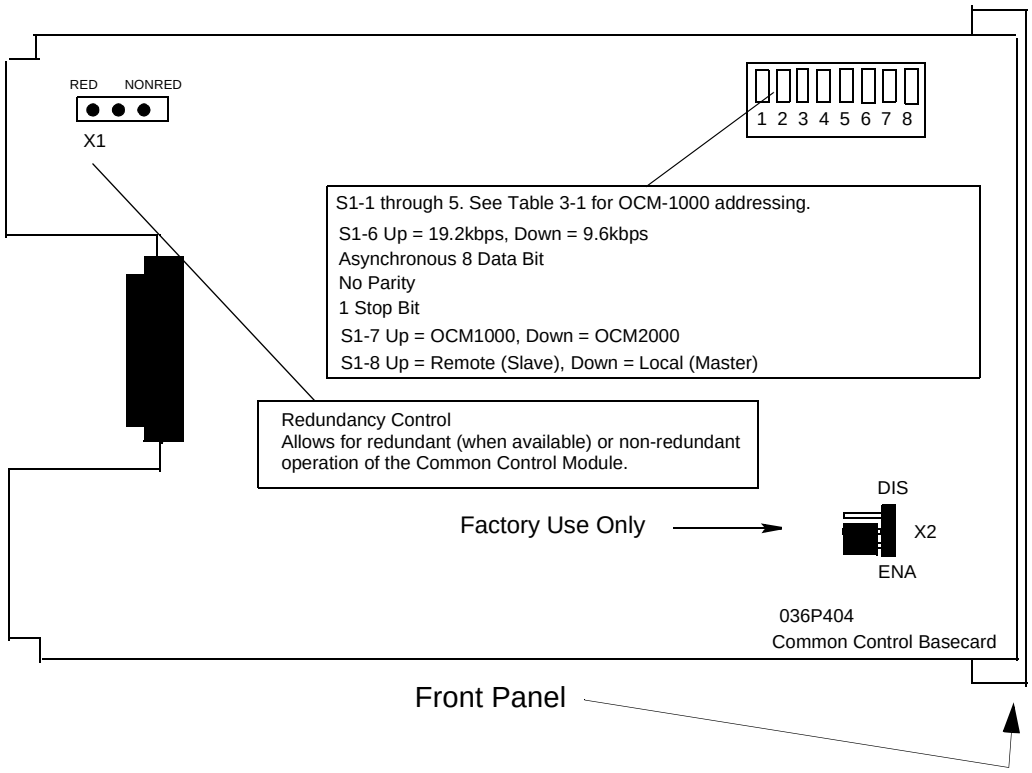


Figure 3-2: Common Control Module 10: Switches and Headers

Front Panel

Figure 3-3 shows the CCM front panel and explains the function of each switch and indicator. You may check the operation of each unit by monitoring the front panel indicators. The colors of the LED indicators on the modules front panels are consistent in function:

Red and yellow are used for alarms or "service-affecting" conditions. This includes test modes that are interfering with normal user data. Alarm conditions depend on the modules, but normally, red indicates a Major Alarm (a number of problems), and yellow indicates a Minor Alarm (channel alarms).

The green LED indicators are used for all other conditions, including data activity and E&M signaling leads.

In Service

Green LED indicates when the channel is entered in the currently active TDM configuration. This indicates that the module is operating.

Stand By

Green LED indicates the module is configured, and ready to go into service when needed.

Initialization

Yellow LED indicates that the module is running boot firmware. Also flashes during software download.

Alarm

Yellow LED indicates if any of the following conditions exist: Remote or local out-of-sync, power-on self-test failed, hardware configuration mismatch, or download failure.

Test

Yellow LED indicates that one of the following diagnostic tests are being performed: Power-on self-test or other diagnostic test.

Card Fail

Red LED indicates that module has detected an internal failure.

Disable

Press to disable module before extracting it, or to force a redundant switchover.

Test Points

8kREF - 9.216 Mhz system clock divided down to 8khz

TRef - Timing reference derived from LIM receive Clock.

The disable button of the CCM must be depressed before removing the module from the shelf. Failure to do so may result in loss of program code which requires a download.

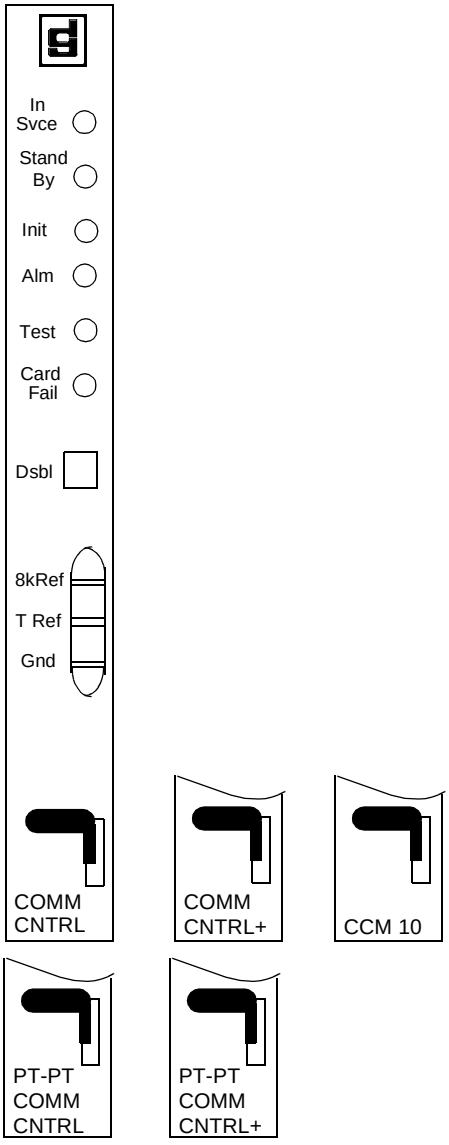


Figure 3-3: Common Control Module and CCM 10: Front Panel

Table 3-2: Technical Characteristics: Common Control Module

Item	Characteristic
Common Control Module	
Subaggregates supported	Up to 2 subaggregates
Subaggregate framing	TMS CDA compatible framing of channel data, voice, communications and synchronization information
Maintenance Port	
Interface	EIA/TIA-232-E
Rates	9.6 kbps
Type	DCE
Universal Port	
Interface	EIA/TIA-232-E
Rates	2.4, 4.8, 9.6 kbps
Type	DTE
Controls	RTS, CTS, DCD, DTR
Power Consumption	+5V 800 ma +12V 32 ma –12V 0 Total Power = 4.4W Load Number = 0.8
Capacitor-backed memory retention time: (used to store downloaded software [and configuration in the OCM-1000]) 48 hours	

Table 3-3: Technical Characteristics: Common Control Module 10

Item	Characteristic
CCM 10	
Subaggregates supported	Up to 2 subaggregates
Subaggregate framing	TMS CDA compatible framing of channel data, voice, communications and synchronization information
Maintenance Port	
Interface	EIA/TIA-232-E
Rates	9.6 kbps
Type	DCE
Universal Port	
Interface	EIA/TIA-232-E
Rates	9.6, 19.2 kbps
Type	DTE
Controls	RTS, CTS, DCD, DTR
Power Consumption	+5V 520 ma +12V 18 ma –12V 7 ma Total Power = 3.0W Load Number = 0.5
CR2032 battery provides battery-backed memory retention (used to store downloaded software [and configuration in the OCM-1000]). CR2032 battery life and retention time is typically 10 years. **NOTE: BATTERY MUST BE INSTALLED OR CCM10 WILL NOT OPERATE.**	

Table 3-4: Common Control Module (Zone 3 DB-25) Pinouts

Pin No.	Maintenance Port (DCE)
2	Transmitted Data (TXD) to CCM
3	Received Data (RXD) from CCM
5	CTS
6	
7	Signal Ground
8	DCD
9	
10	
11	
12	
13	
14	
16	
19	
21	
22	DSR
Pins 1, 4, 15, 17, 18, 20, 23-25 not used.	

Table 3-5: Common Control Module 10 (Zone 3 DB-25) Pinouts

Pin No.	Maintenance Port (DCE)
2	Transmitted Data (TXD) to CCM
3	Received Data (RXD) from CCM
6	DSR
7	Signal Ground
9	CPLUS12 (+12V)
10	CTXDATA
11	CTXSTB-
12	CRXDATA
13	CRXSTB-
14	UPTXD
16	UPRXD
18	CADDR0
20	DTR
21	CADDR1
22	CADDR2
23	IMMEN- (signal enabled by protocol analyzer only)
Pins 1, 4, 5, 8, 15, 17, 19, 23-25 not used.	

Chapter 4: Line Interface Modules

Overview

This chapter describes the various Line Interface Modules, hereafter referred to as LIMs.

Line Interface Modules

The OCM features a variety of LIMs. It is the network-side interface for the OCM. It provides link synchronization and aggregate framing. In conjunction with the CCM, it supports up to 2 subaggregates for each OCM. The 2 subaggregates maximum can be supported in several different ways (for example, 2 LIMs supporting 1 subaggregate each or 1 LIM supporting 2 subaggregates. The LIM can support the T1/D4/ESF connections for North American applications or the G.704 connections used in ITU-T countries.

The T1 interface is fully compatible with AT&T Pub. 62411. It will support a full 1.544 Mbps link speed, as well as fractional T1 rates in N X 64 kbps increments. The E1 interface supports the 2.048 Mbps link rate and conforms to the ITU-T G.704 standard for N X 64 kbps links. Electrically, the E1 interface is per ITU-T G.703; and the frame structure adheres to ITU-T G.704.

Module Restrictions

Redundancy - Two LIM modules provide redundancy. The pair must be installed in an odd-numbered, even-numbered pair of adjacent slots. Both LIMs must be connected to the line via a suitable cable. One module is in-service and connected to the line, the other module is in a standby condition disconnected from the line. If the in-service module fails, it disconnects from the line and the standby module connects to the line to restore operation as an in-service module. The redundancy switch must be set in the proper position:

S1 - REDN on the T1/E1, T1 CSU, Network T1/E1, and Network T1 CSU

S1- RD/NRD on the V.11, V.35, X.21 and SubRate

RED on the 2B1Q

The front panel disable (Dsbl) switch can be used to perform a redundant switchover manually. This is a momentary push-button switch. When you push it on the in-service LIM, the standby LED will light to confirm that the switch was pressed. You must press the switch for at least one second. Then the in-service LIM goes into standby and the standby LIM goes in-service.

Before you remove an in-service LIM, you should put it in standby first and then remove it. This minimizes disruption to the OCM.

If the LIM is non-redundant, you should still put it in standby before removing it.

The disable switch on a standby LIM has no function.

Procedure for removing a LIM

1. To minimize disruption to the OCM, remove a LIM only when it is in standby.
2. If the LIM is in-service, press front panel disable switch for at least one second. The standby LED lights, and the LIM goes into standby.
3. Extract the standby LIM.

T1 and CSU T1 Line Interface Module

The T1 LIM provides a DSX-1 interface at 1.544 Mbits/s. The CSU T1 LIM contains an integral CSU and can be connected directly to the network. Both LIMs also:

- Support Fractional T1 services
- Support D4 and ESF formats
- Support Alternate Mark Inversion (AMI) and Bipolar with 8 Zero Substitution (B8ZS) line codes
- Recover the clock from the T1 line for use in OCM clocking when configured for slave timing
- Provide visual indicators on the front panel for local (red alarm), remote (yellow alarm), in service or not in service, and self-test passed or failed. Local and remote alarm LEDs ON indicates AIS alarm

Options

Examine the module by checking the option switches and/or headers on the modules. *Figure 4-1 on page 4-4* and *Figure 4-2 on page 4-5* locate and describe the switches and headers on the T1 and CSU T1 LIMs.

The configuration is set at the factory to match your network operation. The option switches and/or headers are shown in their normal or default (factory shipped) positions.

Check these settings when you first install the unit. You need not repeat the procedure unless you change your network.

When you are satisfied that the option settings are correct, install the modules in the enclosure or shelf following the directions below:

With the exception of the power supply modules, all plug-in modules have an insertion and extraction tab on the bottom of the front panel. To insert a plug-in module:

1. Insert the module into its slot with the GDC logo on top, then slide it in until it makes contact.
2. Pull down the insertion/extraction tab and firmly push the module in until it seats in the rear connectors.

To remove a plug-in module, pull down the insertion/extraction tab to unseat the module, then pull on the tab.

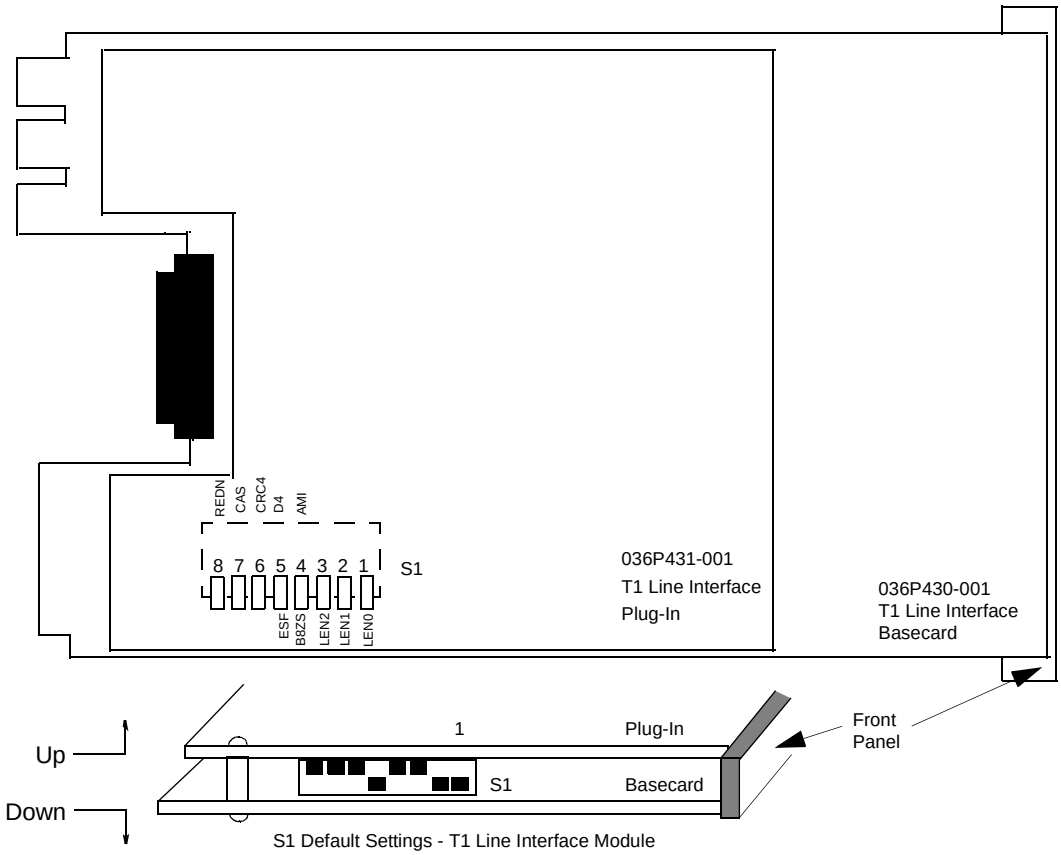


Figure 4-1: T1 Line Interface Module

Table 4-1: T1 LIM Plug-In Option Settings

Options	Position	Applications
S1-1-3 Length (feet) (Transmit Equalization) (LEN0-LEN2)	0-133 - 3 Up, 2 Down, 1 Down (default) 133-266 - 3 Down, 2 Up, 1 Up 266-399 - 3 Down, 2 Up, 1 Down 399-533 - 3 Down, 2 Down, 1 Up 533-655 - 3 Down, 2 Down, 1 Down Other combinations are reserved or undefined.	Clock and data extraction are improved by cable length transmit equalization. This feature allows line lengths up to 655 feet. With transmit equalization, the pulse shape and amplitude at properly terminated equipment conforms to AT&T standards.
S1-4 Line Coding (B8ZS/AMI)	B8ZS - Up (default) AMI - Down	Selects either B8ZS (Bit 8 Zero Suppression) line coding or AMI (Alternate Mark Inversion) line coding.
S1-5 Framing (ESF/D4)	ESF - Up D4 - Down (default)	Selects the type of framing. D4 consists of 12 193-bit frames called superframes. ESF (Extended Super Frame) retains the structure of D4 but consists of 24 193-bit frames.
S1-6 (ATT/ANSI)	ATT - Up Selects ATT ESF (default) ANSI - Down Selects ANSI ESF	This switch selects either ESF according to AT&T Pub 54016 or ESF according to ANSI Specification T1.403.
S1-7 not used		
S1-8 Redundancy (REDN)	Non- Redundant - Up (default) Redundant - Down	Configures T1 LIM for redundant operation.

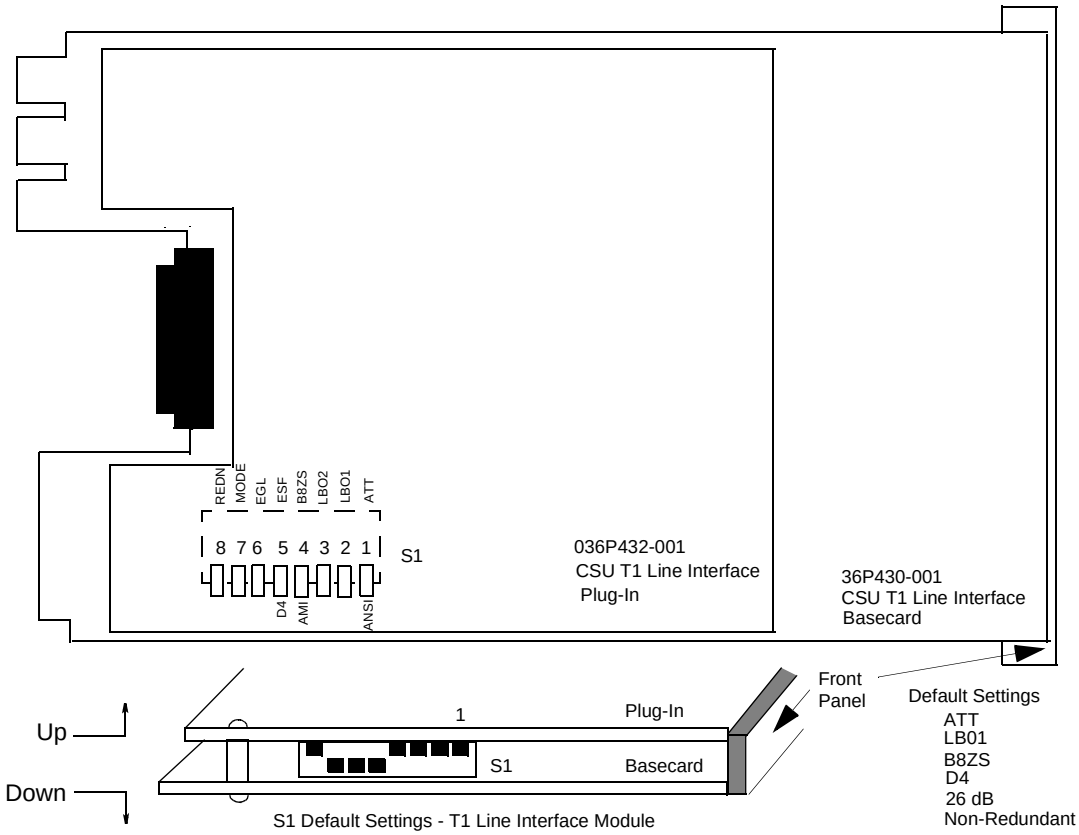


Figure 4-2: CSU T1 Line Interface Module

Table 4-2: CSU T1 LIM Option Settings

Options	Position	Applications
X1 and X2 (SPAN)	IN - Place jumper on X1 OUT - Place jumper on X2 (default)	Allows Simplex Span Current to be looped toward the network. Span In - Span current looped toward the network. Span out - Span current not looped toward the network.
S1-1 ATT or ANSI Selection (ATT/ANSI)	ATT - Up Selects ATT ESF (default) ANSI - Down Selects ANSI ESF	This switch selects either ESF according to AT&T Pub 54016 or ESF according to ANSI Specification T1.403.
S1-2/3 Transmit Line Buildout (LBO1/LBO2)	0dB - 2 Up, 3 Up 7.5dB - 2 Down, 3 Up 15.0dB - 2 Up, 3 Down 22.5dB - 2 Down, 3 Down	The transmit line buildout attenuates the transmit signal.
S1-4, and S1-7 Line Coding (AMI/B8ZS and MODE))	AMI - 7 Up, 4 Down B8ZS - 7 Down, 4 Up (default)	Enables either B8ZS (Bit 8 Zero Suppression) line coding or AMI (Alternate Mark Inversion) line coding. This option must be used in conjunction with S1-7 - MODE.
S1-5 Framing (ESF/D4)	ESF - Up D4 - Down (default)	Selects type of framing. D4 consists of 12 193-bit frames called superframes. ESF (Extended Super Frame) retains structure of D4 but consists of 24 193-bit frames.
S1-6 Equalizer Gain (EGL)	26dB- Down (default) 36dB - Up	Selects the receive equalizer gain range. It is factory set at 26dB and should remain in this position.
S1-8 Redundant Operation (REDN)	REDN - 8 Down (redundant) 8 Up (non-redundant) (default)	Configures CSU T1 LIM for redundant or non-redundant operation.

Front Panels

Figure 4-3 shows the T1 and CSU T1 LIM front panels and explains the function of the front panel switch and indicators. You may check the operation of each unit by monitoring the indicators. The colors of the LED indicators on the front panels are consistent in function:

Red and yellow are used for alarms or “service-affecting” conditions. This includes test modes that are interfering with normal user data. Alarm conditions depend on the modules, but normally, red indicates a Major Alarm (a number of problems), and yellow indicates a Minor Alarm (channel alarms).

The green LED indicators are used for all other conditions. This includes data activity, and E&M signaling leads.

In Service

Green LED indicates when the channel is entered in the currently active TDM configuration. This indicates that the module is operating.

Stand By

Green LED indicates the module is configured, and ready to go into service when needed.

Initialization

Yellow LED indicates that the module is running boot firmware. Also flashes during software download.

Local Alarm

Red LED indicates an aggregate red alarm.

Remote Alarm

Yellow LED indicates an aggregate yellow alarm. Both local and remote LEDs on indicates AIS condition.

Test

Yellow LED indicates module is performing power-up self-test or other diagnostic test.

Card Fail

Red LED indicates that module has detected an internal failure.

Disable

Press to disable module before extracting it, or to force a redundant switchover.

Test Points

Rx Clk - Receive clock from line.

Tx Clk - Transmit Clock to line.

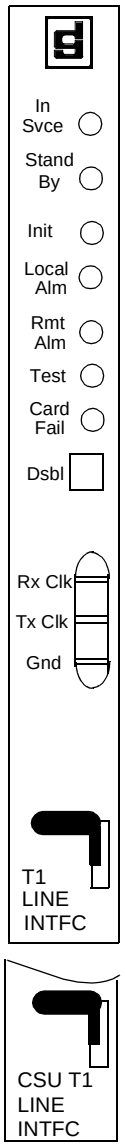


Figure 4-3: T1 and CSU T1 Line Interface Module

Table 4-3: Technical Characteristics

Item	Characteristic
T1 or CSU T1 Line Interface Module	
Interface Type	DSX-1 (T1 Lim), DS-1 (CSU-T1 Lim)
Interface Connector	Zone 1 8 position modular jack, RJ48C
Compliance	FCC Part 68
Line Rate	1.544 Mbps, supports full or fractional T1
Framing Method	D4 or ESF
Line Coding	B8ZS or AMI
Line Buildout Settings (CSU T1)	0, 7.5, 15.0, and 22.5 dB at 772 khz
Line Length Settings (T1)	0-133, 133-266, 266-399, 399-533, 533-655 feet of ABAM type cable
ESF Compatibility (CSU T1)	ATT or ANSI
Receiver Operating Range (CSU T1)	0-26 dB of cable loss at 772 khz
Electrical Interface	Meets AT&T Pub 62411
Power Consumption (T1)	+5V 580mA +12V 65 mA -12V 0 Total power = 3.7W Load Number = 0.6

Table 4-4: T1, CSU T1, and E1 Line Interface Modules (Zone 1 8 position Modular Jack RJ48C) Pinouts

Pin No.	Function
1	Received Data (Ring) to LIM
2	Received Data (Tip) from LIM
4	Send Data (Ring) from LIM
5	Send Data (Tip) from LIM
3, 6, 7, 8	Not Used
When using the modular jacks, Pin 1 is on the bottom and Pin 8 is on the top when facing the rear panel.	

E1 Line Interface Module

The E1 Line Interface Module is a plug-in module that provides OCM with a high-speed aggregate interface for connection to 2.048 Mbps digital services. It provides the following features:

- G.703/G.704/G.706 compatibility
- 2.048 Mbps data rate
- 120 ohm balanced or 75 ohm unbalanced interface, jumper selectable
- Full or fractional E1 services
- Clock recovery from the E1 line for use in OCM clocking when configured for slave timing
- Time slot 16 for data use
- Visual indicator on front panel for local alarm (loss of signal, loss of frame alignment), remote alarm (receipt of alarm indication bit from remote end), AIS alarm, in service or standby and self-test passed or failed
- CRC-4 detection and generation.
- Local and remote loopback capability
- Redundant or non-redundant operation

The E1 LIM is fully compatible with ITU-T recommendation G.703 (Physical/Electrical Characteristics of Hierarchical Digital Interfaces) at 2.048 Mbps. It is compatible with the frame structure at 2.048 Mbps specified in ITU-T recommendation G.704 (Synchronous Frame Structure Used at Primary and Secondary Hierarchical Levels).

The E1 LIM supports the use of CRC-4 (Cyclic Redundancy Check - 4) error monitoring capability. This feature can be enabled or disabled by means of a switch located on the E1 LIM plug-in card. If it is enabled, and the E1 service does not support CRC-4, no alarms are generated. The spare bits in time slot 0 are not used and are set to 1.

Frame alignment and CRC-4 procedures are compatible with ITU-T recommendations G.706 (Frame Alignment and Cyclic Redundancy Check (CRC) Procedures Relating to Basic Frame Structures Defined in Recommendation G.704).

Time slot 16 may be used to carry payload data (TMS subaggregates) or it may be skipped if the E1 line uses time slot 16 for signaling such as Channel Associated signaling (CAS). This is selected via a switch located on the E1 LIM plug-in card. If the switch is set to CAS (ON), then 30 time slots are available to carry TMS payload data. If the switch is OFF, then 31 time slots are available to carry TMS payload data.

When CAS is selected, time slot 16 of frame 0 contains the multiframe alignment word, with the three x bits set to 1 (not used). The y bit is set to 0 (no alarms). In all other frames, the abcd signaling bits are sent. These are set to 0. Signaling information received in time slot 16 is ignored.

Options

Examine the module by checking the option switches and/or headers on the modules. *Figure 4-4 on page 4-9* locates and describes the switches and headers on the E1 LIM.

The configuration is set at the factory to match your network operation. The option switches and/or headers are shown in their normal or default (factory shipped) positions.

Check these settings when you first install the unit. You need not repeat the procedure unless you change your network.

When you are satisfied that the option settings are correct, install the modules in the enclosure or shelf following the directions below:

With the exception of the power supply modules, all plug-in modules have an insertion and extraction tab on the bottom of the front panel. To insert a plug-in module:

1. Insert the module into its slot with the GDC logo on top, then slide it in until it makes contact.

2. Pull down the insertion/extraction tab and firmly push the module in until it seats in the rear connectors.

To remove a plug-in module, pull down the insertion/extraction tab to unseat the module, then pull on the tab.

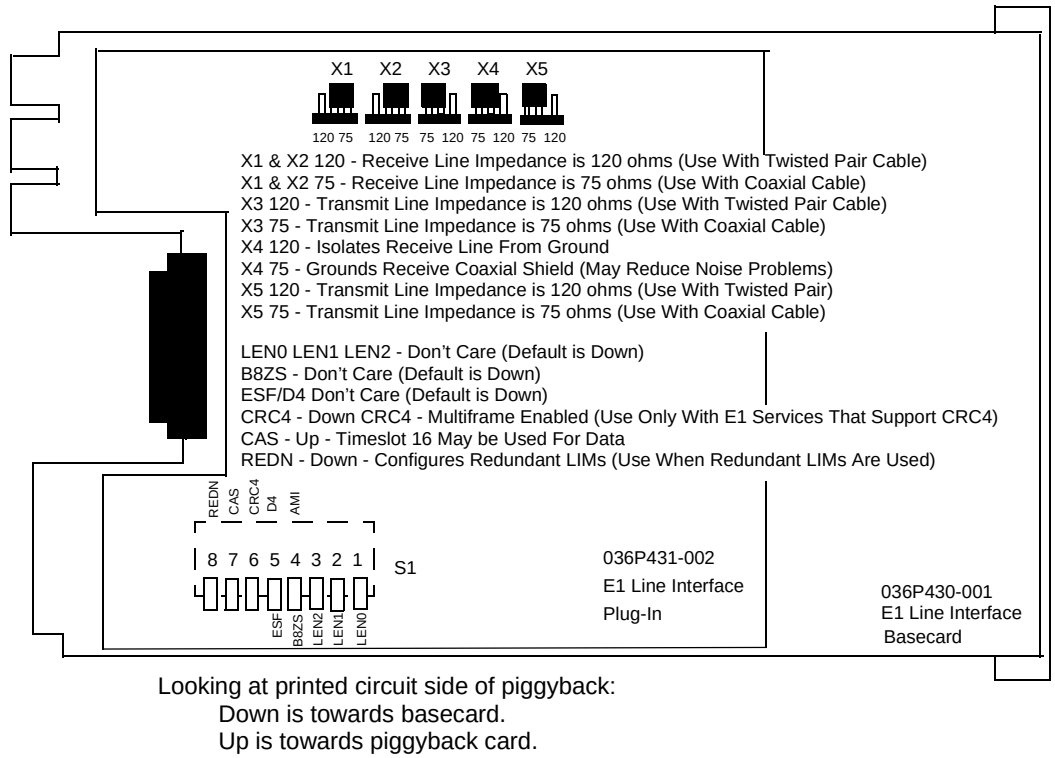


Figure 4-4: E1 Line Interface Module

Front Panel

Figure 4-5 shows the E1 LIM front panel and explains the function of the front panel switch and indicators. You may check the operation of each unit by monitoring the indicators. The colors of the LED indicators on the front panel are consistent in function:

Red and yellow are used for alarms or "service-affecting" conditions. This includes test modes that are interfering with normal user data. Alarm conditions depend on the modules, but normally, red indicates a Major Alarm (a number of problems), and yellow indicates a Minor Alarm (channel alarms).

The green LED indicators are used for all other conditions. This includes data activity, and E&M signaling leads.

In Service

Green LED indicates when the channel is entered in the currently active TDM configuration. This indicates that the module is operating.

Stand By

Green LED indicates the module is configured, and ready to go into service when needed.

Initialization

Yellow LED indicates that the module is running boot firmware. Also flashes during software download.

Local Alarm

Red LED indicates: loss of incoming signal, loss of frame alignment.

Remote Alarm

Yellow LED indicates that an alarm indication is received from the remote end (bit 3 of time slot 0). Both local and remote LEDs on indicates AIS condition.

Test

Yellow LED indicates module is performing power-up self-test or other diagnostic test.

Card Fail

Red LED indicates that module has detected an internal failure.

Disable

Press to disable module before extracting it, or to force a redundant switchover.

Test Points

Rx Clk - Receive clock from line.

Tx Clk - Transmit Clock to line.

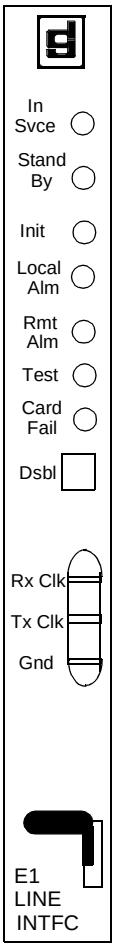


Figure 4-5: E1 Line Interface Module

Table 4-5: Technical Characteristics

Item	Characteristic
E1 Line Interface Module	
Interface Type	G.703
Line Rate	2.048 Mbps, supports full or fractional E1 (G.704)
Alarm Conditions	Loss of signal Loss of frame alignment
Alarm Indication	Lights front panel Local LED for any of above alarm conditions Lights front panel Remote LED if alarm indication bit is received from remote end Lights both Local and Remote LEDs if Alarm Indication Signal (AIS) is detected (AIS consists of an unframed all one's signal). All alarms reported to TMS Controller
Alarm Generation	Sends alarm indication bit (bit 3 of time slot 0) to remote end for any of the above alarm conditions.
Power Consumption	+5V 550 mA +12V 65 mA –12V 0 Total Power = 3.5W Load Number = 0.6

Table 4-6: T1, CSU T1, and E1 Line Interface Modules (Zone 1 8 position Modular Jack RJ48C) Pinouts

Pin No.	Function
1	Received Data (Ring) to LIM
2	Received Data (Tip) from LIM
4	Send Data (Ring) from LIM
5	Send Data (Tip) from LIM
3, 6, 7, 8	Not Used
When using the modular jacks, Pin 1 is on the bottom and Pin 8 is on the top when facing the rear panel.	

Network Line Interface Module

The Network LIM is based on the T1, CSU T1, and E1 LIMs (using the same line interface plug-ins), the addition of signaling support being the only design difference. Signaling support allows the Network LIM to pass signaling information between the line and the OCM bus for transportation to other network compatible cards.

Drop and Insert (D&I) is an OCM feature which is available with the Network LIM. D&I provides the means for a network circuit to bypass from LIM to LIM or drop/insert from LIM to channel. Drop and Insert is an incremental feature of the OCM and does not reduce any other features of the OCM.

Use of D&I allows the LIM T/S information to be passed from one Network LIM to another Network LIM. Timeslot information is in two parts, data and associated signaling.

Signaling

Channel Signaling uses bits associated with the voice circuits to convey call setup and tear-down information between customer equipment. On-hook, off-hook and ring are examples of signaling functions. In order to maintain compatibility in both Domestic and International public networks two basic types of channel associated signaling are supported: Robbed-bit (RBS) and Channel Associated Signaling (CAS). RBS embeds the signaling bits within the circuit in every sixth frame. It is used for voice transmissions only. Signaling is disabled for data circuits. CAS uses DS0 16 to convey the signaling bits.

The Network LIM or other network card uses the signaling bus in addition to the data bus to pass data and signaling within the OCM. The LIM extracts the associated signaling (ABCD) bits for each DS0 from the incoming RBS or CAS link and puts them on the signaling bus at the same time it writes the data bits for that DS0. The LIM also reads the signaling bits from the signaling bus and integrates them back into the data stream as either RBS or CAS, depending on the type of equipment configured.

The Network LIM does not perform any conversion of signals.

Signaling transportation (not conversion) from CAS (E1) to T1 (T1) Robbed-bit is supported for VTP (Voice Transcoder Platform) applications only. It is not useful for D&I since the LIM card hardware does not perform u-law to A-law conversion.

For D&I applications, associated signaling information (ABCD bits) is passed transparently, with the exception of failure conditioning or diagnostics where signaling bits are forced or conditioned.

For VTP applications the VTP shall provide the necessary signaling bits in the correct format for the LIM. All signaling protocols and algorithms are performed on the VTP or DPV (Dual Private Voice) card as necessary. The Network LIM itself is transparent to signaling as in the D&I application.

The Network LIMs condition channel data/signaling under certain alarm conditions.

Options

Examine the module by checking the option switches and/or headers on the modules. *Figure 4-6 on page 4-13* shows the one new option that has been added to this LIM, the selection of T1 or E1 operation. T1 is selected for either the T1 or CSU T1 LIMs, and E1 is selected for the E1 LIM (Note that the appropriate plug-in module must be installed. Refer to

Figure 4-1, *Figure 4-2*, and *Figure 4-4* as well as *Table 4-1* and *Table 4-2* for optioning information.

Hardware configuration is set at the factory to match your network operation.

Install the module in the enclosure or shelf following the directions below:

With the exception of the power supply modules, all plug-in modules have an insertion and extraction tab on the bottom of the front panel. To insert a plug-in module:

1. Insert the module into its slot with the GDC logo on top, then slide it in until it makes contact.
2. Pull down the insertion/extraction tab and firmly push the module in until it seats in the rear connectors.

To remove a plug-in module, pull down the insertion/extraction tab to unseat the module, then pull on the tab.

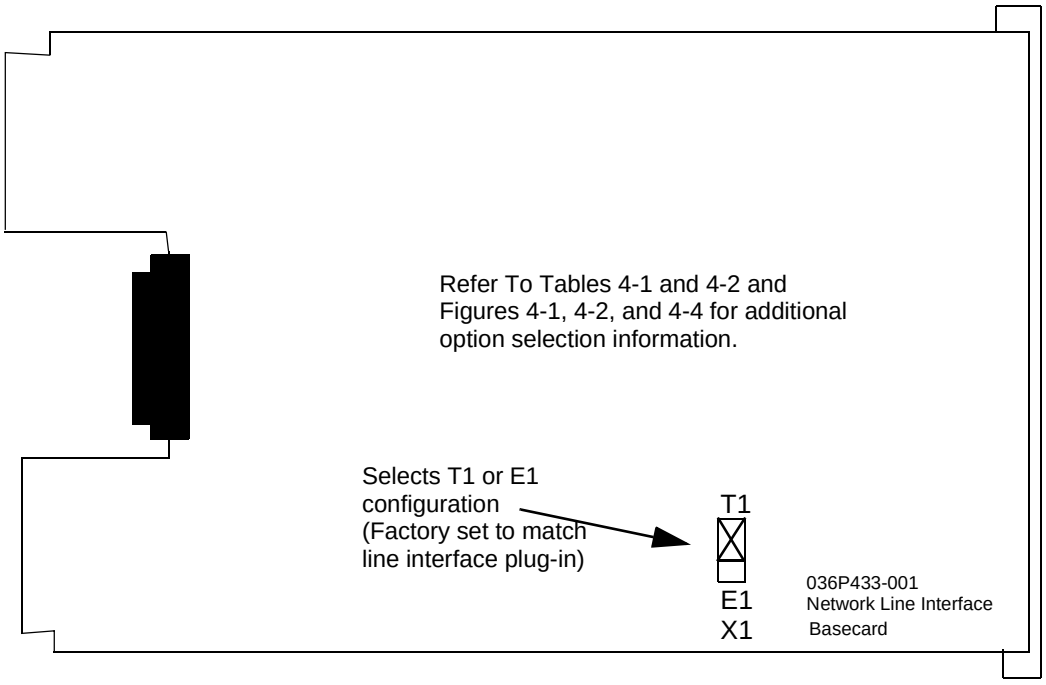


Figure 4-6: Network Line Interface Module

Front Panel

Figure 4-7 shows the Network LIM front panel and explains the function of the front panel switch and indicators. You may check the operation of each unit by monitoring the indicators. The colors of the LED indicators on the front panel are consistent in function:

Red and yellow are used for alarms or “service-affecting” conditions. This includes test modes that are interfering with normal user data. Alarm conditions depend on the modules, but normally, red indicates a Major Alarm (a number of problems), and yellow indicates a Minor Alarm (channel alarms).

The green LED indicators are used for all other conditions. This includes data activity, and E&M signaling leads. Also see *Table 4-7* and *Table 4-8* on page 4-15.

In Service

Green LED indicates when the channel is entered in the currently active TDM configuration. This indicates that the module is operating.

Stand By

Green LED indicates the module is configured, and ready to go into service when needed.

Initialization

Initialization LED indicates that the module is running boot firmware.

Local Alarm

Red LED indicates an aggregate red alarm.

Remote Alarm

Yellow LED indicates that an aggregate yellow alarm Both local and remote LEDs on indicates AIS condition.

Test

Yellow LED indicates module is performing power-up self-test or other diagnostic test.

Card Fail

Red LED indicates that module has detected an internal failure.

Disable

Press to disable module before extracting it.

Test Points

Rx Clk - Receive clock from line.

Tx Clk - Transmit Clock to line.

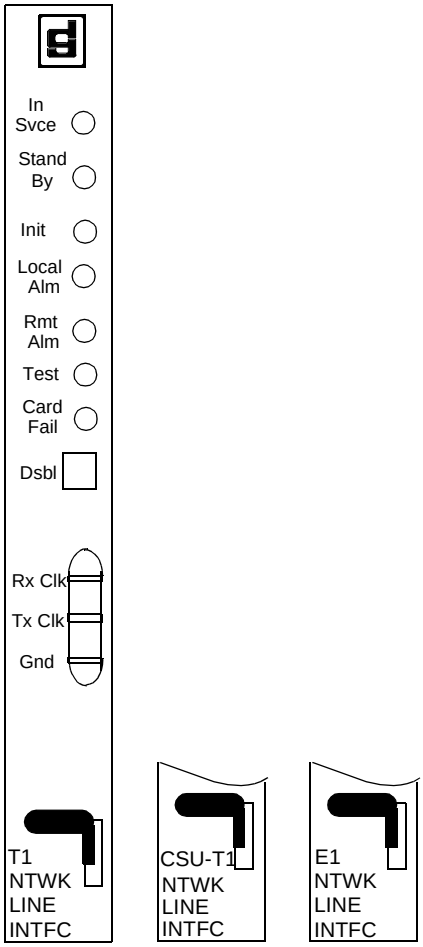


Figure 4-7: Network Line Interface Module

Table 4-7: Technical Characteristics

Item	Characteristic
Network Line Interface Module	
Signaling	CAS and RBS
For other technical characteristics see *Table 4-3* and *Table 4-5*.	

Table 4-8: Network Line Interface Modules (Zone 1 8 position Modular Jack RJ48C) Pinouts

Pin No.	Function
1	Received Data (Ring) to LIM
2	Received Data (Tip) from LIM
4	Send Data (Ring) from LIM
5	Send Data (Tip) from LIM
3, 6, 7, 8	Not Used
When using the modular jacks, Pin 1 is on the bottom and Pin 8 is on the top when facing the rear panel.	

V.11 and V.35 Line Interface Modules

The V.11 and V.35 Line Interface Modules provide the OCM a non-byte-aligned interface to the network through an external DSU/CSU. The V.11 and V.35 LIMs also:

- Recover the clock from line equipment for use in OCM clocking when configured for slave timing.
- Provide visual indicators on the front panel for local alarm, in service or not in service, in sync or not in sync, and diagnostic tests passed or failed.
- Perform diagnostics through TMS Controller or optional Maintenance Console. *Refer to User Guide For Megamux TMS, GDC 036R602-301; Operation Manual for TMS-3000 Controller, GDC 036R603-Vnnn; User Guide for OCM-1000, GDC 036R612-Vnnn; and OCM*TMS Maintenance Console User Guide, GDC 036R611-000*.
- Perform a self-test on power-up, module in slot, or a command from the optional Maintenance Console.
- V.11 only - provides V.11 (RS 422) data and clocks.
- V.35 only - provides V.35 data and clocks, EIA/TIA-232-E controls, RTS, DCD, CTS, RI, DTR, and DSR. Also provides V.54 diagnostic controls LL, RL, and TM.

Options

Examine the module by checking the option switch on the module. *Figure 4-8 on page 4-17* and *Table 4-9 on page 4-18* locate and describe the switch and option settings on theV.11 and V.35 LIM.

The configuration is set at the factory to match your network's operation. The option switch is shown in the normal or default (factory shipped) position.

Check these settings when you first install the unit. You need not repeat the procedure unless you change your network.

When you are satisfied that the option settings are correct, install the modules in the enclosure or shelf following the directions below:

With the exception of the power supply modules, all plug-in modules have an insertion and extraction tab on the bottom of the front panel. To insert a plug-in module:

1. Insert the module into its slot with the GDC logo on top, then slide it in until it makes contact.
2. Pull down the insertion/extraction tab and firmly push the module in until it seats in the rear connectors.

To remove a plug-in module, pull down the insertion/extraction tab to unseat the module, then pull on the tab.

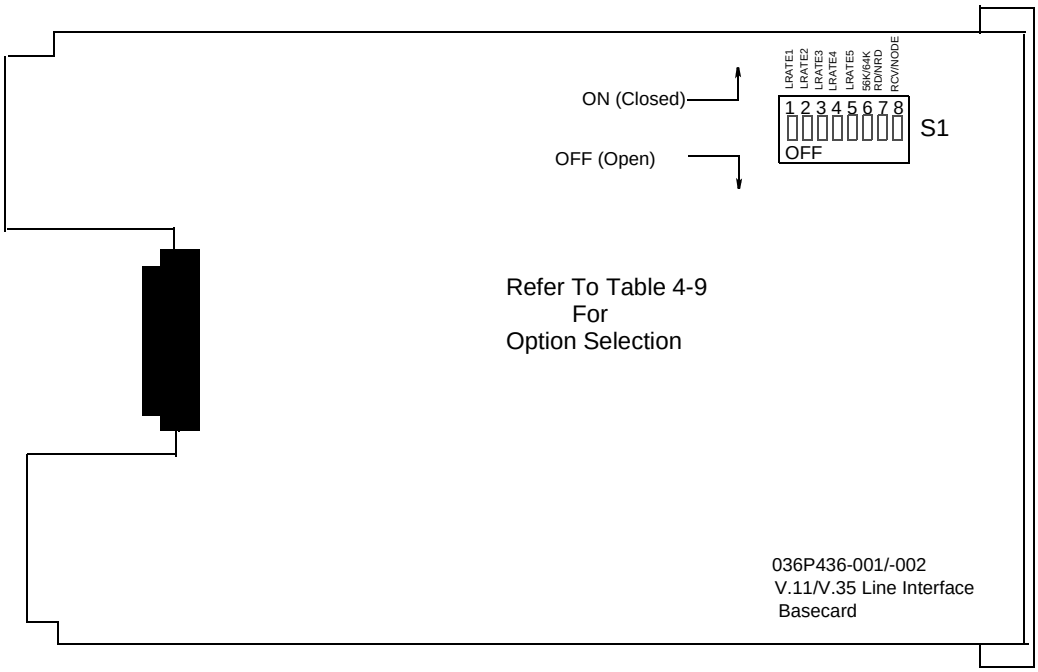


Figure 4-8: V.11/V.35/X.21 Line Interface Module

Table 4-9: V.11/V.35 LIM Option Settings

Options						
S1-1 through S1-6 - Line Rate and 56/64K Select - (LRATE and 56K/64K)						
S1-5 LRATE 5	S1-4 LRATE 4	S1-3 LRATE 3	S1-2 LRATE 2	S1-1 LRATE 1	S1-6 56K/64K (OFF) kbps	S1-6 56K/64K (ON) kbps
OFF	OFF	OFF	OFF	OFF	56	64 (default)
OFF	OFF	OFF	OFF	ON	112	128
OFF	OFF	OFF	ON	OFF	168	192
OFF	OFF	OFF	ON	ON	224	256
OFF	OFF	ON	OFF	OFF	280	320
OFF	OFF	ON	OFF	ON	336	384
OFF	OFF	ON	ON	OFF	392	448
OFF	OFF	ON	ON	ON	448	512
OFF	ON	OFF	OFF	OFF	504	576
OFF	ON	OFF	OFF	ON	560	640
OFF	ON	OFF	ON	OFF	616	704
OFF	ON	OFF	ON	ON	672	768
OFF	ON	ON	OFF	OFF	728	832
OFF	ON	ON	OFF	ON	784	896
OFF	ON	ON	ON	OFF	840	960
OFF	ON	ON	ON	ON	896	1024
ON	OFF	OFF	OFF	OFF	952	1088
ON	OFF	OFF	OFF	ON	1008	1152
ON	OFF	OFF	ON	OFF	1064	1216
ON	OFF	OFF	ON	ON	1120	1280
ON	OFF	ON	OFF	OFF	1176	1344
ON	OFF	ON	OFF	ON	1232	1408
ON	OFF	ON	ON	OFF	1288	1472
ON	OFF	ON	ON	ON	1344	1536
ON	ON	OFF	OFF	OFF	56	1600
ON	ON	OFF	OFF	ON	56	1664
ON	ON	OFF	ON	OFF	56	1728
ON	ON	OFF	ON	ON	56	1792
ON	ON	ON	OFF	OFF	56	1856
ON	ON	ON	OFF	ON	56	1920
ON	ON	ON	ON	OFF	56	1984

Option	Position	Applications
S1-7 Redundancy (RD/NRD)	OFF ON (default)	LIM is part of a redundant pair. LIM is non-redundant (default).
S1-8 Interface Clocking* (RCV/NODE)	OFF ON (default)	Clocking for transmit data is derived from the interface's receive clock. Clocking for transmit data is derived from the OCM node timing.

* The interface clocking options are also available from the TMS Controller, which overrides the switch setting when a configuration is downloaded. The Controller has three options for interface clocking - Node, RCV and XMIT. XMIT uses the interface transmit clock to clock transmit data, and is the recommended clocking for setting software. OCM then gets its clocking on the transmit lead from the CSU.

Front Panels

Figure 4-9 shows theV.11 and V.35 LIM front panels and explains the function of the front panel switch and indicators. You may check the operation of each unit by monitoring the indicators. The colors of the LED indicators on the front panels are consistent in function:

Red and yellow are used for alarms or "service-affecting" conditions. This includes test modes that are interfering with normal user data. Alarm conditions depend on the modules, but normally, red indicates a Major Alarm (a number of problems), and yellow indicates a Minor Alarm (channel alarms).

The green LED indicators are used for all other conditions. This includes data activity, and E&M signaling leads.

In Service

Green LED indicates when the channel is entered in the currently active TDM configuration. This indicates that the module is operating.

Stand By

Green LED indicates the module is configured, and ready to go into service when needed.

In Sync

Green LED indicates that LIM has found subaggregate sync.

Alarm

Red LED indicates a local alarm condition. Possible conditions are line transmit clock bad, loss of subaggregate sync, or power-up self-test.

Test

Yellow LED indicates module is performing power-up self-test or other diagnostic test.

Disable

Press to disable module before extracting it, or to force a redundant switchover.

Test Points

Rx Clk - Receive clock from line.

Tx Clk - Transmit Clock to line.

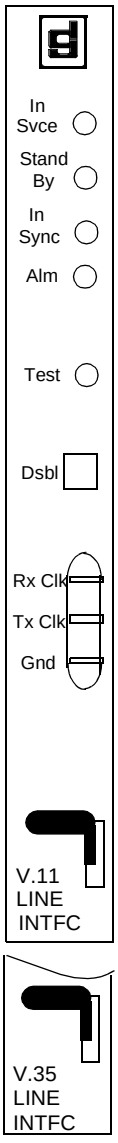


Figure 4-9: V.11 and V.35 Line Interface Module

Table 4-10: Technical Characteristics

Item	Characteristic
V.11 Line Interface Module	
Interface	ITU-T V.11, meets NET 1 (X.21)
Interface Type	DTE
Line Rates	NX56 kbps up to 1344 kbps NX64 kbps up to 2048 kbps
Controls	Supports ITU-T X.21 controls: C (control) and I (indication)
Interface Connector	DB-25 female or DB-15 female with 027H423 adapter cable
Power Consumption (In Service)	+5V 350 mA +12V 14 mA –12V 90 mA Total Power = 3.1W Load Number = 1.1
Power Consumption (Standby)	+5V 380 mA +12V 2 mA –12V 2 mA Total Power = 1.9W

Table 4-11: V.11 Line Interface Module (Zone 3 DB-25) Pinouts

Pin No. DB-25 Conn.	Pin No. DB-15 Conn. *	Function	Input/ Output	X.21 Desig.
2	2	Transmitted Data - A	Output	T-a
3	4	Received Data - A	Input	R-a
4	3	Control - A	Output	C-a
7	8	Signal Ground		G
8	5	Indication - A	Input	I - a
9	13	Signal Element Timing - B (DCE source)	Input	S-b
10	12	Indication - B	Input	I -b
11		Trans. Sig. Element Tmg - B (DTE source)	Output	
14	9	Transmitted Data - B	Output	T-b
16	11	Received Data - B	Input	R-b
17	6	Signal Element Timing - A (DCE source)	Input	S-a
19	10	Control - B	Output	C-b
24		Trans. Sig. Element Tmg - A (DTE source)	Output	
* Use 027H423 adapter cable to provide the DB15 male connector.				

Table 4-12: V.35 Line Interface Module (Zone 3 DB-25) Pinouts

Pin No. DB-25 Hybrid	Pin No. V.35 Hybrid	Function	Input/ Output	Interface Spec.
1	A	Not Connected		
2	P	Transmitted Data - A	Output	V.35
3	R	Received Data - A	Input	V.35
4	C	RTS	Output	232E
5	D	CTS	Input	232E
6	E	DSR	Input	232E
7	B	Signal Ground		
8	F	DCD	Input	232E
9	X	Rec. Sig. Element Timing - B	Input	V.35
10	M	Not connected		
11	W	Trans. Sig. Element Tmg - B (DTE source)	Output	V.35
12	AA	Trans. Sig. Element Timing - B (DCE source)	Input	V.35
13	K	Not connected		
14	S	Transmitted Data - B	Output	V.35
15	Y	Trans. Sig. Element Timing - A (DCE source)	Input	V.35
16	T	Received Data - B	Input	V.35
17	V	Rec. Sig. Element Timing - A	Input	V.35
18	L	Ll	Output	232E
19	BB	Not connected		
20	H	DTR	Output	232E
21	N	RI	Output	232E
22	J	Ring Indicator	Input	232E
23	Z	Not used		
24	U	Trans. Sig. Element Tmg - A (DTE source)	Output	V.35
25	NN	Test Mode	Input	232E

SubRate Line Interface Module (Only available on the OCM-1000)

The SubRate LIM is an ITU-T V.28/EIA/TIA-232-E interface that works at various aggregate rates up to 64 kbps. Typically, it interfaces with the GDC SpectraComm V.F 28.8 modem (G- or higher) and is used over analog lines. The SubRate LIM requires OCM-1000 software V1.3 or higher and E- CCM firmware or higher. Also, the SubRate LIM:

- Provides N times 2400 rates from 9600 to 45,600 bits per second
- Provides N times 8000 rates from 16,000 to 64,000 bits per second

Options

Examine the module by checking the option switch on the module. *Figure 4-10* locates and describes the switch on the SubRate LIM.

The configuration is set at the factory to match your network operation. The option switch is shown in the normal or default (factory shipped) positions.

Check these settings when you first install the unit. You need not repeat the procedure unless you change your network.

When you are satisfied that the option settings are correct, install the modules in the enclosure or shelf following the directions below:

With the exception of the power supply modules, all plug-in modules have an insertion and extraction tab on the bottom of the front panel. To insert a plug-in module:

1. Insert the module into its slot with the GDC logo on top, then slide it in until it makes contact.
2. Pull down the insertion/extraction tab and firmly push the module in until it seats in the rear connectors.

To remove a plug-in module, pull down the insertion/extraction tab to unseat the module, then pull on the tab.

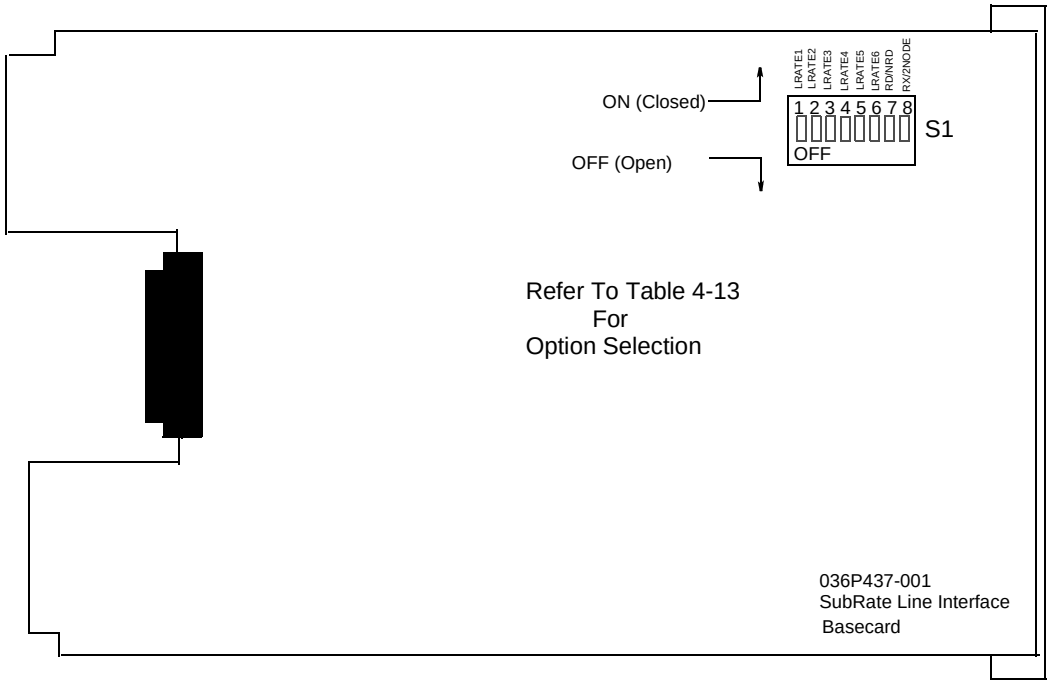


Figure 4-10: SubRate Line Interface Module

SubRate LIM Installation

The following is one example of how you may configure the SubRate LIM to operate with a SpectraComm V.F 28.8 modem over a 2 wire private line at 24 kbps.

SubRate LIM Hard Options

SubRate LIM S1 configuration settings for both the local and remote LIMs:

S1-1	ON	
S1-2	OFF	24 kbps
S1-3	OFF	
S1-4	OFF	
S1-5	OFF	Nx rate = 8k
S1-6	OFF	Nx rate
S1-7	ON	Non-redundant
S1-8	ON	Node Timing

SubRate Clocking Configuration Parameters:

	Local Node	**Remote Node**
Clocking	internal	facility
Timing	node	node

Modem Commands

The following list of commands to the SpectraComm V.F 28.8 modems are required. For other modem commands refer to *SpectraComm V.F 28.8 Manual No. 060R112-000.*

If the switched network is to be used, the OCM shelves require that the SpectraComm dual 8-position modular jack Zone 1 connector panel be installed. The top 8-position modular jack connector is used for private line connections, and the bottom 8-position modular jack connector is used for switched network lines.

Configuration Parameter	**Originate**	**Answer**
2-Wire Private Line	AT&L1	AT&L1
Synchronous Data	AT&M1	AT&M1
Speed (24 Kbps)	AT\T13	AT\T13
External Timing	AT&X1	AT&X1
Answer Mode		AT%O1
Retrain Disable	AT%Q0`	AT%Q0
Store Configuration	AT&W	AT&T

These commands can also be sent as one command as shown below:

Originate	"AT&L1&M1\T13&X1%Q0&W"
Answer	"AT&L1&M1\T13&X1%O1%Q0&W"

The modems connect together through a straight thru 8-position modular jack cable. The modems can be placed in any unconfigured slot. The OCM 1000 Controller does not allow you to configure the SpectraComm card. However, it will tell you if the slot is occupied.

Table 4-13: SubRate LIM Option Settings

Options						
S1-1 through S1-6 - Line Rate						
RATE	S1-6 LRATE6	S1-5 LRATE5	S1-4 LRATE4	S1-3 LRATE3	S1-2 LRATE2	S1-1 LRATE1
Nx 2.4 K						
9600	OFF	ON	OFF	OFF	OFF	OFF
12000	OFF	ON	OFF	OFF	OFF	ON
14400	OFF	ON	OFF	OFF	ON	OFF
16800	OFF	ON	OFF	OFF	ON	ON
19200	OFF	ON	OFF	ON	OFF	OFF
21600	OFF	ON	OFF	ON	OFF	ON
24000	OFF	ON	OFF	ON	ON	OFF
26400	OFF	ON	OFF	ON	ON	ON
28800	OFF	ON	ON	OFF	OFF	OFF
31200	OFF	ON	ON	OFF	OFF	ON
33600	OFF	ON	ON	OFF	ON	OFF
36000	OFF	ON	ON	OFF	ON	ON
38400	OFF	ON	ON	ON	OFF	OFF
40800	OFF	ON	ON	ON	OFF	ON
43200	OFF	ON	ON	ON	ON	OFF
45600	OFF	ON	ON	ON	ON	ON
Nx 8K						
16000	OFF	OFF	OFF	OFF	OFF	OFF
24000	OFF	OFF	OFF	OFF	OFF	ON
32000	OFF	OFF	OFF	OFF	ON	OFF
40000	OFF	OFF	OFF	OFF	ON	ON
48000	OFF	OFF	OFF	ON	OFF	OFF
56000	OFF	OFF	OFF	ON	OFF	ON
64000	OFF	OFF	OFF	ON	ON	OFF

Option	Position	Description
S1-5 Nx Rate Selector (LRATE5)	OFF ON	Allows use of Nx8k rates. Allows use of Nx2.4k rates.
S1-6 Clock (LRATE6)	OFF (default) ON	Used for selecting Nx2.4k or Nx8k rates. Allows use of special rates (rates not listed above). Future use.
S1-7 Redundancy (RD/NRD)	OFF ON (default)	LIM is part of a redundant pair. LIM is non-redundant (default)
S1-8 Interface Clocking (RX/NODE)	OFF ON (default)	Clocking for transmit data is derived from the interface's receive clock. Clocking for transmit clock is derived from the OCM node timing.

Front Panel

Figure 4-11 shows the SubRate LIM front panel and explains the function of the front panel switch and indicators. You may check the operation of each unit by monitoring the indicators. The colors of the LED indicators on the front panel are consistent in function:

Red and yellow are used for alarms or "service-affecting" conditions. This includes test modes that are interfering with normal user data. Alarm conditions depend on the modules, but normally, red indicates a Major Alarm (a number of problems), and yellow indicates a Minor Alarm (channel alarms).

The green LED indicators are used for all other conditions. This includes data activity, and E&M signaling leads.

In Service

Green LED indicates when the channel is entered in the currently active TDM configuration. This indicates that the module is operating.

Stand By

Green LED indicates the module is configured, and ready to go into service when needed.

In Sync

Green LED indicates that LIM has found subaggregate sync.

Alarm

Red LED indicates a local alarm condition. Possible conditions are line transmit clock bad, loss of subaggregate sync, or power-up self-test.

Test

Yellow LED indicates module is performing power-up self-test or other diagnostic test.

Disable

Press to disable module before extracting it, or to force a redundant switchover.

Test Points

Rx Clk - Receive clock from line.

Tx Clk - Transmit Clock to line.

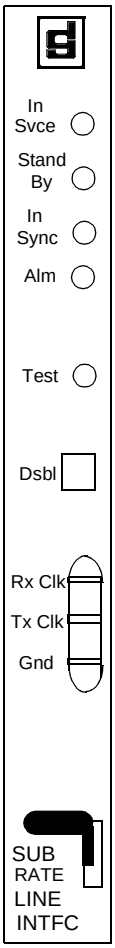


Figure 4-11: V.11 and V.35 Line Interface Module

Table 4-14: Technical Characteristics

Item	Characteristic
SubRate Line Interface Module	
Interface	ITU-T V.28
Interface Type	DTE
Line Rates	Nx2.4 kbps: from 9.6 kbps to 45.6 kbps. Nx8 kbps: from 16 kbps to 64 kbps.
Interface Connector	DB-25 female
Power Consumption (In Service)	+5V 260 mA +12V 68 mA –12V 19 mA Total Power = 2.3W Load Number = 0.64
Power Consumption (Standby)	+5V 260 mA +12V 19 mA –12V 19 mA Total Power = 1.7W

Table 4-15: SubRate Line Interface Module (Zone 3 DB-25) Pinouts

Pin No. DB-25 Hybrid	Function	Input/ Output	Interface Spec.
1	Not connected		
2	Transmitted Data - A	Output	232E
3	Received Data - A	Input	232E
4	RTS	Output	232E
5	CTS	Input	232E
6	DSR	Input	232E
7	Signal Ground		
8	DCD	Input	232E
9	Not connected		
10	Not connected		
11	Not connected		
12	Not connected		
13	Not connected		
14	Not connected		
15	TXC	Input	232E
16	Not connected		
17	RXC	Input	232E
18	LL	Output	232E
19	Not connected		
20	DTR	Output	232E
21	RL	Output	232E
22	Ring Indicator	Input	232E
23	Not used		
24	Ext. Timing	Output	232E
25	Test Mode	Input	232E

BQM (2B1Q Module)

The BQM (2B1Q Module) is a module for the OCM. You may configure it as a LIM or a Channel Module. It uses 2B1Q (Two Binary, One Quaternary) technology to provide 128 kbps of bandwidth over a twisted pair telephone line up to 18,000 feet in length.

The 2B1Q signal is a 4-level digital signal that encodes two bits per cycle. The 160 kbps signal consists of:

- Two 64 kbps B channels
- 16 kbps D channel
- 16 kbps of overhead

Either of the B channels may be used to carry a 64 kbps TMS subaggregate or Network Circuit. Both B channels may be combined to carry a 128 kbps TMS subaggregate or Network Circuit. The D channel is normally not used, but may be carried transparently between BQM Channels by allocating an extra 64 kbps time slot.

Note *The BQM does not perform the functions of an ISDN Basic Rate Adapter, since it does not process messages in the D channel. However, it can transparently pass an ISDN 2B+D signal through the TMS network, by using a total of three timeslots to pass the two B channels and one D channel.*

- The BQM configured as a LIM is similar in function to the OCM T1 or E1 LIM, but with 2 timeslots (DS0s) instead of 24 or 31.
- The BQM configured as a Channel is similar in function to the OCM High Speed Data Channel.
- The BQM configured as a Channel is compatible with the DataComm 610/612 NTU products.
- The BQM configured as a Channel allows multiple remote OCMs (with BQM LIMs) to be groomed for connection to the CDA.
- When the BQM is operated as an NT, it is compatible (refer to Appendix A - Technical Characteristics) with ANSI T1.601 (Integrated Services Digital Network [ISDN] - Basic Access Interface for use on Metallic Loops for Application on the Network Side of the NT).

Options

Figure 4-12 on page 4-28 shows the hard option locations, and *Table 4-16* describes the options.

There are three options that you may set on the BQM:

1. BQM configured as a LIM or BQM configured as a Channel.
2. LIM - redundant or non-redundant.
3. Interface type - LT or NT.

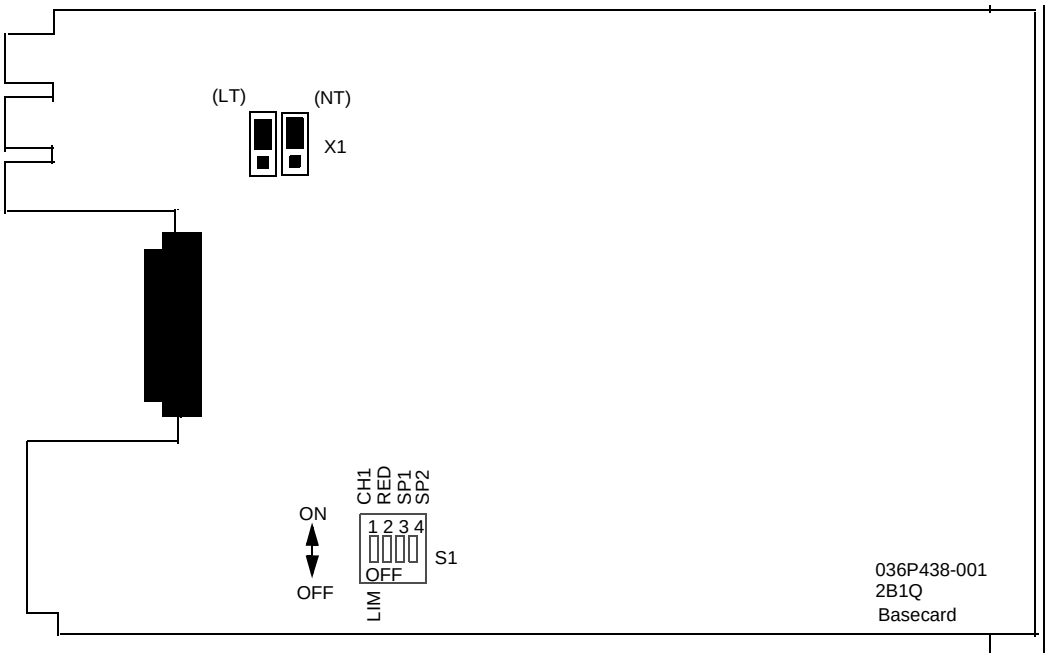


Figure 4-12: BQM (2B1Q Module)

Table 4-16: Option Selection

Options	Positions	Applications
X1 - LT/NT Termination	LT - Line Termination NT - Network Termination (default)	This jumper selects the interface type, either LT (Line Termination) or NT (Network Termination). One end of the 2B1Q line must be an LT, and the other end must be an NT. The BQM LIM must always be set to NT, and for most applications the BQM Channel is set to LT. The DataComm 610/612 NTU is always an NT.
S1-2 - LIM or Channel Select	S1-1 OFF LIM (default) S1-1 ON CH	Selects LIM function. Selects Channel function.
S1-2 - Redundant/-Non-Redundant Operation	S1-2 OFF (default) S1-2 ON RED	Options LIM for non-redundant operation. Not used for Channel. Options LIM for redundant operation. Not used for Channel.
S1-3, S1-4 Not Used. Default is OFF.		

Sealing Current

A BQM configured as an LT interface can provide DC loop current to the line, which may be used as a sealing current. To source loop current requires connection of an external -48V supply. To do this, you need an OCM Zone 1 backplane. The Zone 1 backplane may only be installed in the OCM Shelf. This backplane provides connections for an external -48V supply. Each BQM sources a constant current of nominally 3 mA. This is pulsed to nominally 20 mA for a few seconds, once every 24 hours. This method results in low average power, but sufficient current to provide an effective sealing current.

The BQM configured as an NT sinks any sealing current provided to it, up to a limit of nominally 20 mA.

The 036P438-002 BQM is a depopulated version of the -001 BQM, and does not support DC loop current sourcing when configured as a LT. It also does not support the DC Metallic Termination of ANSI T1.601, when configured as an NT. Instead, it provides a DC short for any DC loop current.

Front Panel

Figure 4-13 illustrates the front panel of the BQM (2B1Q Module) and explains the function of the front panel switch and indicators. You may check the operation of the unit by monitoring the indicators.

The front panel test points provide access to the transmit and receive timing on the 2B1Q loop. The BQM as an LT always originates the transmit timing for the 2B1Q loop derived from the OCM 9.216 Mhz system clock. The BQM as an NT always loops back its received timing to use as its transmit timing. This is done by phase-locking the OCM system clock to the BQM NT receive clock, and deriving the BQM NT transmit clock in turn from the OCM system clock.

The “Rx Clk” test point is the 80 kHz receive clock, recovered from the received 2B1Q signal.

When the BQM (Channel) is set for LT, the “Tx Clk” test point is an 8 kHz signal. This 8 kHz signal is divided down from the 9.216 MHz OCM system clock, and should always be frequency locked to the CCM “8k Ref” front panel test point.

When the BQM (LIM or Channel) is set for NT, the “Tx Clk” test point is an 80 kHz signal. Since the NT always loops its receive timing to transmit timing, the transmit clock is the same as the receive clock.

In Service

Green LED indicates when the channel is entered in the currently active TDM configuration. This indicates that the module is operating.

Stand By

Green LED indicates the module is configured, and ready to go into service when needed.

Alarm

Red LED indicates: loss of incoming signal, loss of frame alignment.

Test

Yellow LED indicates module is performing power-up self-test or other diagnostic test.

Card Fail

Red LED indicates that module has detected an internal failure.

Disable

Press to disable module before extracting it, or to force a redundant switchover.

Test Points

Rx Clk - Receive clock from line.

Tx Clk - Transmit Clock. Isolated test point for 8Khz (LT) or 80 Khz (NT).

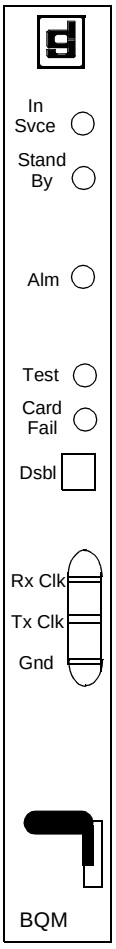


Figure 4-13: BQM

Interface Description

The 2B1Q signal is a 4- level digital signal which encodes two bits per cycle. 2B1Q stands for 2 Binary, 1 Quaternary signal and refers to a digital line code where the binary “0s and 1s” data stream is grouped in 2-bit pairs and coded using a -3 to +3 signal level range. The first bit in the 2-bit group determines the plus or minus sign value of the signal and second bit sets the signal level magnitude. So a “00” pair is assigned a minus value and level 3 magnitude, 01 equals minus 1, 10 equals plus 3, and 11 equals plus one. See *Figure 4-14*.

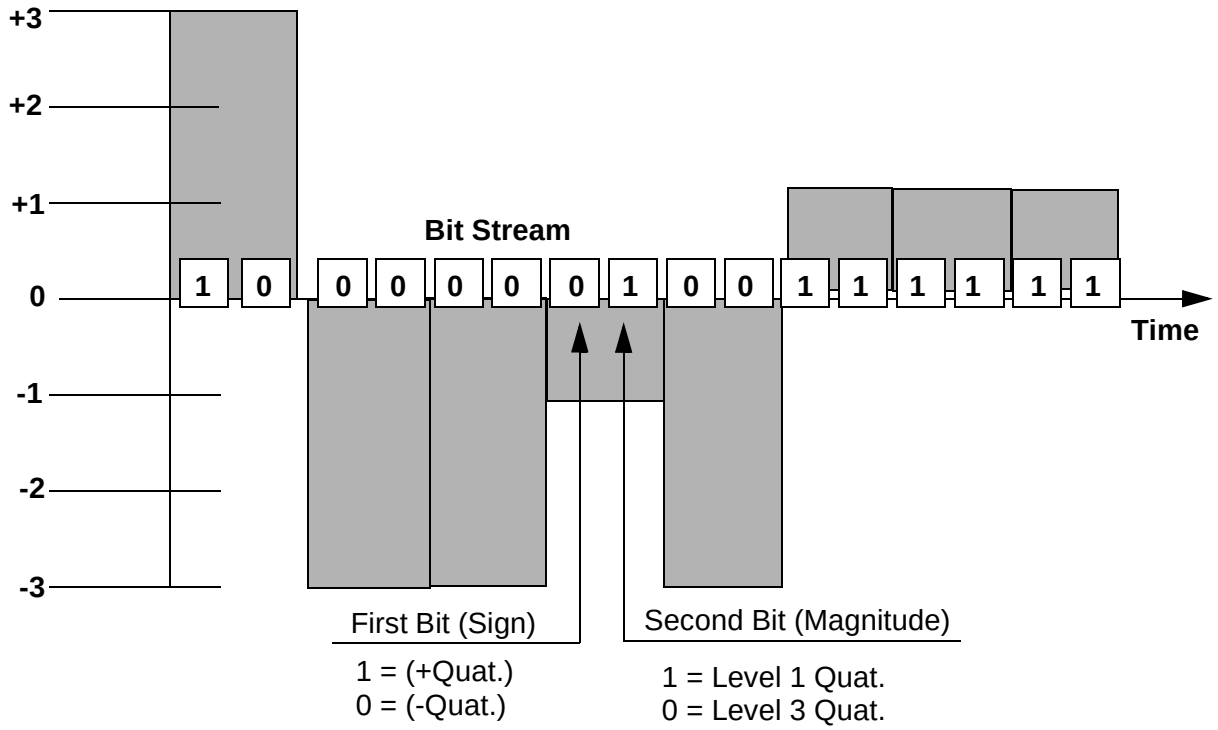


Figure 4-14: 2B1Q Data Stream

The cycle rate, or baud rate, is 80 Kbaud and the bit rate is 160 kbps. The Bottoms physical interface is compliant to that of the U-interface of Basic Rate ISDN. This is an asymmetrical 2-wire interface. One end is called the Line Termination (LT), and the other end is called the Network Termination (NT). The LT originates timing and diagnostic commands, and the NT accepts timing and responds to diagnostic commands. The BQM Channel sends an active signal whenever it is In Service. The In-Service BQM LIM or NTU responds and achieves synchronization with the Channel. If a pair of redundant LIMs is used, the Standby LIM is disconnected from the line through a relay.

Signal Content

The 2B1Q signal consists of two 64 kbps B channels, a 16 kbps D channel, and 16 kbps of overhead.

The D channel may be passed transparently through the BQM by allocating a 64 kbps time slot to carry it. Otherwise it is not used and an all 1s signal is sent in the D channel.

The 16 kbps overhead consists of:

1. Synchronization bits
2. Maintenance bits
3. Cyclic Redundancy Checksum (CRC) error detection bits
4. An Embedded Operations Channel (EOC)

The data is organized into 1.5 ms basic frames and the frames are organized into 12 ms superframes, consisting of eight basic frames. A 12 kbps synchronization pattern is used to identify the content of the basic frames and superframes.

The Maintenance bits (1 kbps) allow start-up and deactivation of the link, and also pass operational information between the LT and NT.

The CRC consists of 12 bits per superframe (1 kbps) and detects transmission errors in the B1, B2, and D channels. Each end of the link calculates the CRC of its received data and compares it to the received CRC (calculated by the transmitter) to detect errors. Each end also informs the other end if it has detected an error in its received data by sending a Far-End Block Error (FEBE) bit. The BQM uses this error detection capability to compare the error rate against a user-defined error rate, and reports the status on the TMS Controller.

The Embedded Operations Channel (EOC) is a 2 kbps data link within the 2B1Q signal, which allows in-band diagnostics. The BQM uses and responds to the standard EOC commands defined in ANSI T1.601, and also uses a proprietary set of EOC commands, compatible with standard EOC commands. The LT always originates the EOC commands, which are initiated by the TMS Controller. The standard EOC commands can be used to perform a loopback in the NT of the B1 or B2 channels or the B1, B2, and D channels as a group. The proprietary EOC commands are used to communicate between the BQM channel and a GDC DataComm 610 or DataComm 612 NTU device for configuring the NTU and for reading back status.

Microprocessor Control

The BQM is controlled by a microprocessor that communicates with the OCM Common Control Module (CCM). Configuration of the BQM is sent via the CCM and status and alarms are returned from the BQM to the CCM. On power-up, the BQM performs it own self-test and reports the result on the BQM front panel Card Fail indicator. The CCM subsequently performs a self-test on the BQM, which also tests the bus interface circuit of the BQM.

Note *Expect a delay for the BQM to go into service after the other cards are already in service.*

The configuration for the BQM is not stored in the CDA like the configuration for the rest of the OCM. Instead, the configuration is stored in the TMS Controller, which has a direct communications path, through the CDA, to the OCM CCM. This "Level 4" communications path takes longer to establish than the normal communications path from the CDA to the OCM.

Table 4-17: Technical Characteristics

Item	Characteristic
General	
Transmission Technique	2B1Q
Data Rate	160 kbps
Operating Mode	Two wire, full duplex, with adaptive echo cancellation.
Interfaces	LT or NT, jumper selectable
Connector	8-position modular jack, ISO 8877
Impedance	135 Ohm
Pulse Amplitude	± 0.83V, ± 2.5V nominal
Signal Power	13.5 dBm nominal
Line Requirements	2-wire, non-loaded metallic circuit
Line Loss	Any of the 16 ANSI T1.601 test loops, or about 42 dB loss at 40 kHz.
Bit Error Rate Performance	BER < $1x10^{-7}$ over the 16 test loops.
Power Consumption	+5V 480 mA Total Power = 2.4W Load Number = 0.5
Overvoltage Protection	UL1459 FCC Part 68
NT	
Compatibility	ANSI T1.601 - 1992. Exceptions: The NT supports cold-start only. Power status bits are not sent to indicate that both primary and secondary power are unavailable. Secondary power is not provided. -002 BQM does not support the DC Metallic Termination of ANSI T1.601.
DC Metallic Termination	
Activate Voltage	30 - 39V
On State Current	At least 20 mA at 15V
Deactivate Current	0.1 - 1.0 mA
Off State Current	Less than 5 uA at less than 20V.
LT	
Loop Current (-001 only)	Optional with connection of external -48V source, typically 3 mA, pulsed to 20 mA for about 3 seconds every 24 hours.

Table 4-18: Zone 1 Pinouts

Modular Jack Pin No.	36-Pin Card Edge Connector	Signal	Notes
1			Not used
2			
3			
4	21	Ring	Tip and Ring are not polarity sensitive - they may be swapped.
5	3	Tip	
6			Not used
7			
8			
-	26	-VBEXT	-48V sealing current source
-	29	GNDBAT	Sealing current source return

Chapter 5: Data Channel Modules

Dual and High Speed Data Channel Modules

The Dual Data Channel (DDC) module supports EIA/TIA-232-E applications only, at a maximum rate of 38.4 kbps on each of its two channels. The two data channels share a common DB-25 connector and must be routed to the first TMS node together on the same subaggregate.

There are two versions of the card: 036P413-001, which is used in most applications, and 036P413-003, which is required for some sync polling applications (see *Figure 5-1 on page 5-3* for options).

The 036P413-003 version is identified on the TMS Controller as feature revision 2.

The High-Speed Data Channel (HSDC) module supports EIA/TIA-232-E, V.35, EIA/TIA-422 (V.11) and EIA-423 electrical interfaces through a DB-25 physical connection. An X.21 (-005) interface is also provided and electrically interfaces with an optional DB25 to DB 15 Adapter GDC Part No. 209-036-019 (see *Table 5-8 on page 5-11*). Any required alterations to this physical connection are accommodated via cable adapters. The HSDC supports synchronous, asynchronous, isochronous, and transition-encoded data, as well as supporting all of the functionality associated with the UDC in its normal application. The maximum synchronous data rate supported by the HSDC module is 1.536/1.920 Mbps.

Module Restrictions

Since each module slot in either a shelf or an enclosure is identical, apart from the backplane slot address signals, any module may be installed in any slot, with the following restrictions:

1. The assignment of modules to the slots must be that of the configuration on the TMS Controller or OCM-1000 Controller.
2. Redundant or diverse pairs of modules, when used, must be in adjacent paired slots in the same shelf (1-2), (3-4), (5-6), etc. (Applies to CCMs or LIMs only)
3. Number and types of modules must not exceed the power rating of the installed power supplies.
4. Rear panel Zone 1 (top) and Zone 3 (bottom) connector panels must meet the module requirements.
5. For maximum system reliability, we recommend that a module be removed from the currently active TMS configuration before it is extracted from its slot.

Options

Examine the module by checking the headers on the modules. *Figure 5-1* locates and describes the headers on the Dual and High-Speed Data Modules.

The configuration is set at the factory to match your network operation. The headers are shown in their normal or default (factory shipped) positions.

Check these settings when you first install the unit. You need not repeat the procedure unless you change your network.

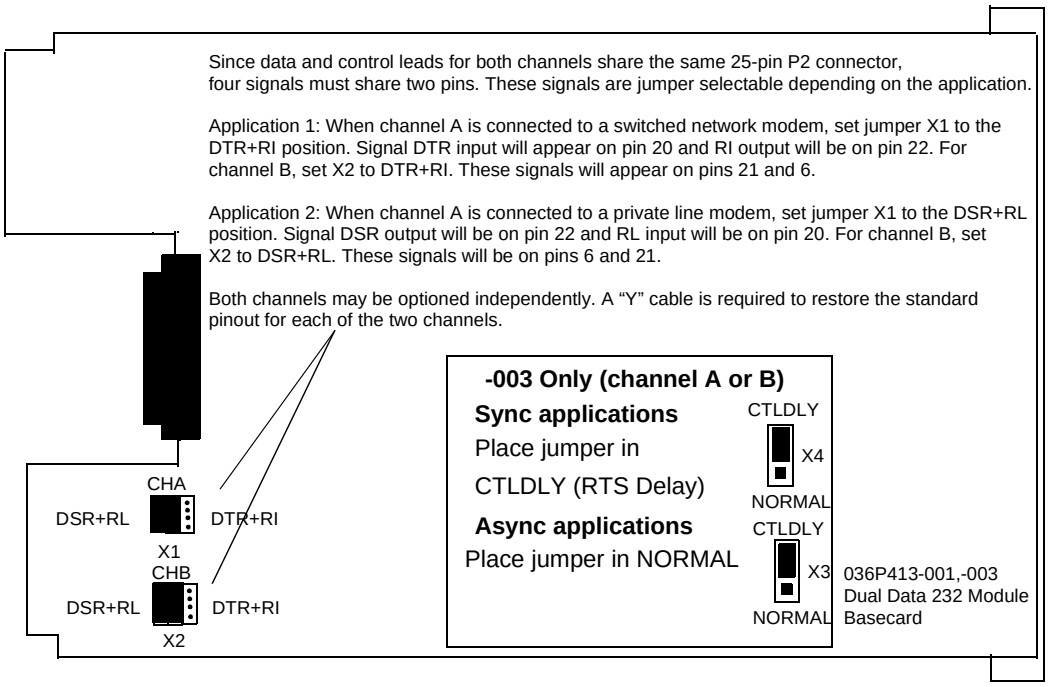
When you are satisfied that the option settings are correct, install the modules in the enclosure or shelf following the directions below:

With the exception of the power supply modules, all plug-in modules have an insertion and extraction tab on the bottom of the front panel. To insert a plug-in module:

1. Insert the module into its slot with the GDC logo on top, then slide it in until it makes contact.

2. Pull down the insertion and extraction tab and firmly push the module in until it seats in the rear connectors.

To remove a plug-in module, pull down the insertion and extraction tab to unseat the module, then pull on the tab.



Assembly	Interface Selection	X1 Position	X2 Position	X3 Position	PP1	PP2 Receive	PP3 Transmit	PP4
036P410-001	RS232	NO TERM	NO TERM	V.35, RS232, RS423	331-001-006	331-002-006	331-001-006	
036P410-002	V.35	NO TERM	NO TERM	V.35, RS232, RS423	331-002-002	331-002-003	331-002-002	
036P410-003	RS422	NO TERM	NO TERM	RS422	331-001-004	331-002-005	331-001-004	
036P410-004	RS423	NO TERM	NO TERM	V.35, RS232, RS423	331-001-005	331-002-004	331-001-005	
036P410-005	X.21 (X.27)	TERM	TERM	RS422	331-001-004	331-002-005	331-001-004	331-002-005

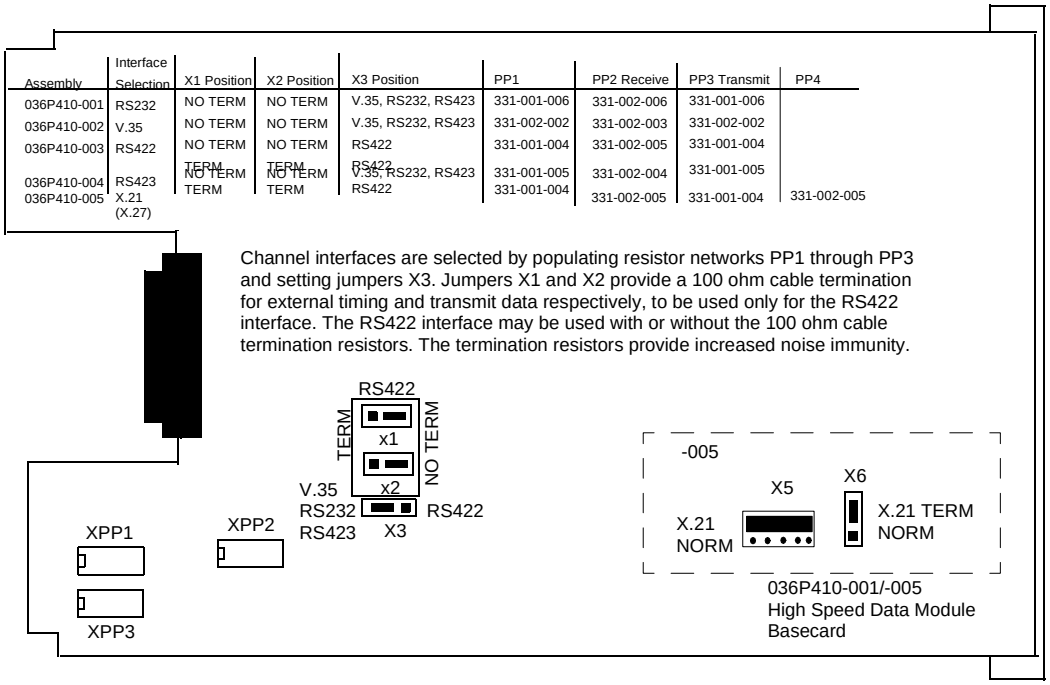


Figure 5-1: Dual and High-Speed Data Modules

Front Panels

Figure 5-2 shows the Dual and High-Speed front panels and explains the function of each front panel indicator. You may check the operation of each unit by monitoring the indicators. The colors of the LED indicators on the front panels are consistent in function:

Red and yellow are used for alarms or "service-affecting" conditions. This includes test modes that are interfering with normal user data. Alarm conditions depend on the modules, but normally, red indicates a Major Alarm (a number of problems), and yellow indicates a Minor Alarm (channel alarms).

The green LED indicators are used for all other conditions.

In Service

Green LED indicates when the channel is entered in the currently active TDM configuration. This indicates that the module is operating.

Data In

Green LED indicates spaces in transmitted data.

Data Out

Green LED indicates spaces in received data.

Alarm

Yellow LED indicates an alarm condition exists in the channel. Possible alarm conditions are: Channel transmit clock bad, channel receive clock bad, loss of subaggregate sync for the channel.

Remote Alarm

Yellow LED indicates an aggregate yellow alarm. Both local and remote LED on indicates AIS condition.

Test

Yellow LED indicates module is performing power-up self-test or other diagnostic test.

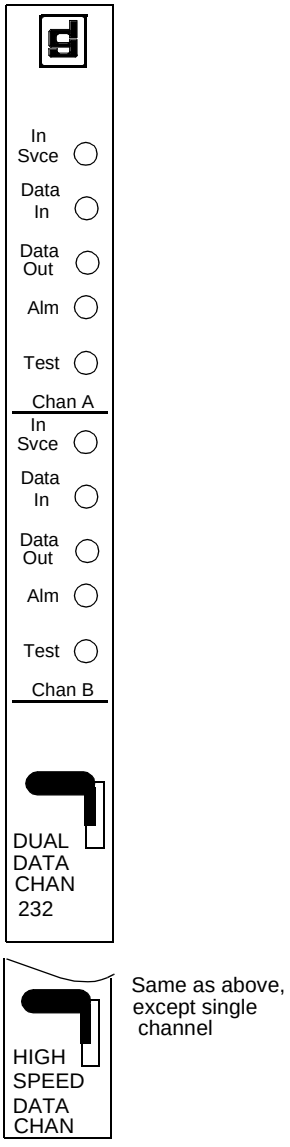


Figure 5-2: Dual and High Speed Data Modules

Table 5-1: Technical Characteristics

Item	Characteristic
Dual Data Module	
Data Rates Synchronous, Asynchronous, Isochronous and Transition Encoding	300 and 600 bps (MSO 3.0.1 release or greater) and 1.2, 1.6, 1.8, 2.0, 2.4. 3.2, 3.6, 4.0, 4.8, 6.4, 7.2, 8.0, 9.6, 12.0, 14.0, 14.4, 16.0, 19.2 kbps 75 bps async data is supported by over sampling at 300-1200 bps synchronously
Interface	EIA-/TIA-232-E/ITU-T V.24, meets NET 2
Interface Type	DCE
Controls	Supports V.54 controls LL, RL and TM. RL not available if jumper selects DTR and RI instead of RL and DSR.
Interface Connector	DB-25F. Use a Y-cable to split the two channels.
Power Consumption	+5V 180 mA +12V 12 mA –12V 17 mA Total Power = 1.2W Load Number = 0.6
High-Speed Data Module	
Data Rates Synchronous	300 and 600 bps (MSO V3.0.1 and later); 1.2, 1.6, 1.8, 2.0, 2.4, 3.2, 3.6, 4.0, 4.8, 6.4, 7.2, 8.0, 9.6, 12.0, 14.0, 14.4, 16.0, 19.2, 24.0, 28.0, 32.0, 36.0, 38.4, 48.0, 56.0, 57.6, 64.0, 72.0, 76.8, 96.0, 112.0, 115.2, 128.0, 144.0, 153.6, 192.0, 224.0, 230.4, 256, 288, 320, 384, 448, 460.8, 512, 576, 640, 704, 768, 832.0, 896.0, and 960.0 Kbps; 1.024, 1.088, 1.152, 1.216, 1.280, 1.344, 1.408, 1.472, 1.536, 1.600, 1.664, 1.728, 1.792, 1.856, 1.920, and 1.984 Mbps.
Asynchronous **(not available on X.21 module (-005)**	Above rates up to 38.4 kbps 75 bps async data supported by over sampling at 300-1200 bps synchronously
Isochronous	Above rates up to 64 kbps
Transition Encoding	Above rates up to 64 kbps
Interfaces	EIA/TIA-232-E/ITU-T V.24 (rates up to 19.2 kbps), meets NET 2. ITU-T V.35, meets NET 2. RS422/ITU-T V.11 Balanced data and timing, EIA-232/V.24 controls RS423/ITU-T V.10 Unbalanced data and timing, EIA-232/V.24 controls
Interface Type	DCE
Controls	Supports V.54 controls LL, RL and TM
Interface Connector	DB-25F or ISO 2593 V.35 connector using adapter cable 027H572

Table 5-1 Technical Characteristics (Cont.)

Item	Characteristic
High-Speed Data Module (Cont.)	
Power Consumption (-001 EIA 232)	+5V 195 mA +12V 10 mA –12V 41 mA Total Power = 1.6W Load Number = 0.4
Power Consumption (-002 V.35)	+5V 228 mA +12V 25 mA –12V 89 mA Total Power = 2.5W Load Number = 0.8
Power Consumption (-003 RS 422)	+5V 298 mA +12V 42 mA –12V 54 mA Total Power = 2.6W Load Number = 0.5
Power Consumption (-004 RS 423)	+5V 214 mA +12V 17 mA –12V 78 mA Total Power = 2.2W Load Number 0.7
Power Consumption (-005 X.21)	+5V 340 mA +12V 42 mA –12V 54 mA Total Power = 2.8W Load Number 0.5

Table 5-2: Dual Data Module (Zone 3 DB-25) Pinouts

Pin No.	ITU-T V.24 No.	EIA Circuit	Channel A Function	Input/ Output
2	103	BA	Transmitted Data (TXC)	Input
3	104	BB	Received Data (RXC)	Output
4	105	CA	Request To Send (RTS)	Input
5	106	CB	Clear To Send (CTS)	Output
7	102	AB	Signal Ground	
8	109	CF	Data Carrier Detect (DCD)	Output
15	114	DB	Transmit Clock (TXC)	Output
17	115	DD	Receive Clock (RXC)	Output
24	113	DA	Ext. Transmit Clock	Input
18	141	LL	Local Loopback (LL)	Input
25	142	TM	Test Mode (TM)	Output
20	108.2/140	CD/RL	Data Terminal Ready/ Remote Loopback (DTR/RL)	Input
22	125/107	CE/CC	Ring Indicator/Data Set Ready (RI/DSR)	Output
Pin No.	**ITU-T V.24 No.**	**EIA Circuit**	**Channel B Function**	**Input/ Output**
14	103	BA	Transmitted Data (TXD)	Input
16	104	BB	Received Data (RXD)	Output
19	105	CA	Request To Send (RTS)	Input
13	106	CB	Clear To Send (CTS)	Output
7	102	AB	Signal Ground	
10	109	CF	Data Carrier Detect (DCD)	Output
12	114	DB	Transmit Clock (TXC)	Output
9	115	DD	Receive Clock (RXC)	Output
11	113	DA	Ext. Transmit Clock	Input
1	141	LL	Local Loopback (LL)	Input
23	142	TM	Test Mode (TM)	Output
21	108.2/140	CD/RL	Data Terminal Ready/Remote Loopback (DTR/RL)	Input
6	125/107	CE/CC	Ring Indicator/Data Set Ready (RI/DSR)	Output

Table 5-3: Dual Data Module "Y" Cables Pinouts

Channel A - Pinout of Connector P2 of Y Cable		
Pin No. (P2)	Ch. A Jumper X1 Set to DSR+RL (Private Line) Use cable 028H603 or 028H604	Ch. A Jumper X1 Set to DTR+RI (Switched Network) Use cable 028H605 or 028H606
2	Transmitted Data	Transmitted Data
3	Received Data	Received Data
4	RTS	RTS
5	CTS	CTS
6	DSR	Not Connected
7	Signal Ground	Signal Ground
8	DCD	DCD
15	Transmit Clock	Transmit Clock
17	Receive Clock	Receive Clock
18	LL	LL
20	Not connected	DTR
21	RL	Not Connected
22	Not connected	RI
24	Ext. Transmit Clock	Ext. Transmit Clock
25	TM	TM
Pins 1, 9-14, 16, 19, 23 not used		
Channel B - Pinout of Connector P3 of Y Cable		
Pin No. (P3)	Ch. B Jumper X2 Set to DSR+RL (Private Line) Use cable 028H603 or 028H605	Ch. B Jumper X2 Set to DTR+RI (Switched Network) Use cable 028H604 or 028H606
2	Transmitted Data	Transmitted Data
3	Received Data	Received Data
4	RTS	RTS
5	CTS	CTS
6	DSR	Not Connected
7	Signal Ground	Signal Ground
8	DCD	DCD
15	Transmit Clock	Transmit Clock
17	Receive Clock	Receive Clock
18	LL	LL
20	Not connected	DTR
21	RL	Not Connected
22	Not connected	RI
24	Ext. Transmit Clock	Ext. Transmit Clock
25	TM	TM
Pins 1, 9-14, 16, 19, 23 not used		

Table 5-4: High Speed Data Module EIA/TIA-232-E (V.24/V.28) Pinouts

Pin No.	ITU-T V.24 No.	EIA Circuit	Function	Input/ Output
1			Not Connected	
2	103	BA	Transmitted Data (TXD)	Input
3	104	BB	Received Data (RXD)	Output
4	105	CA	Request To Send (RTS)	Input
5	106	CB	Clear To Send (CTS)	Output
6	107	CC	Data Set Ready (DSR)	Output
7	102	AB	Signal Ground	
8	109	CF	Data Carrier Detect (DCD)	Output
15	114	DB	Transmit Clock (TXD)	Output
17	115	DD	Receive Clock (RXC)	Output
18	141	LL	Local Loopback (LL)	Input
20	108.2	CD	Data Terminal Ready (DTR)	Input
21	140	RL	Remote Loopback (RL)	Input
22	125	CE	Ring Indicator (RI)	Output
24	113	DA	External Transmit Clock	Input
25	142	TM	Test Mode (TM)	Output

Table 5-5: High Speed Data Module V.35 (Zone 3 DB-25) Pinouts

Pin No.	V.35 Conn.	ITU-T V.24 No.	EIA Circuit	Function	Input/ Output	Interface Spec.
1	A			Not Connected		
2	P	103	BA	Transmitted Data -A	Input	V.35
3	R	104	BB	Received Data -A	Output	V.35
4	C	105	CA	Request To Send (RTS)	Input	232E
5	D	106	CB	Clear To Send (CTS)	Output	232E
6	E	107	CC	Data Set Ready (DSR)	Output	232E
7	B	102	AB	Signal Ground		
8	F	109	CF	Data Carrier Detect (DCD)	Output	232E
9	X	115	DD	Rec. Sig. Element Timing -B	Output	V.35
11	W	113	DA	Trans. Sig. Element Timing - B (DTE Source)	Input	V.35
12	AA	114	DB	Trans. Sig. Element Timing -B (DCE Source)	Output	V.35
14	S	103	BA	Transmit Data -B	Input	V.35
15	Y	114	DB	Transmit Sig. Element Timing -A (DCE Source)	Output	V.35
16	T	104	BB	Balanced Receive Data -B	Output	V.35
17	V	115	DD	Receive Sig. Element Timing - A	Output	V.35
18	L	141	LL	Local Loopback (LL)	Input	232E
20	H	108.2	CD	Data Terminal Ready (DTR)	Input	232E
21	N	140	RL	Remote Loopback (RL)	Input	232E
22	J	125	CE	Ring Indicator (RI)	Output	232E
24	U	113	DA	Trans. Sig. Element Timing - A (DTE Source)	Input	V.35
25	NN	142	TM	Test Mode (TM)	Output	232E
Pins 10, 13, 19 and 23 not used						

Table 5-6: High Speed Data Module RS-422A (Zone 3 DB-25) Pinouts

Pin No.	Function	Input/ Output	Interface Spec.
1	Not connected		
2	Transmitted Data - A	Input	422A
3	Received Data - A	Output	422A
4	RTS	Input	232E
5	CTS	Output	232E
6	DSR	Output	232E
7	Signal Ground		
8	DCD	Output	232E
9	Rec. Sig. Element Timing -B	Output	422A
11	Trans. Sig. Element Timing - B (DTE Source)	Input	422A
12	Trans. Sig. Element Timing -B (DCE Source)	Output	422A
14	Transmit Data -B	Input	422A
15	Trans. Sig. Element Timing -A (DCE Source)	Output	422A
16	Receive Data -B	Output	422A
17	Rec. Sig. Element Timing -A	Output	422A
18	LL	Input	232E
20	DTR	Input	232E
21	RL	Input	232E
22	Ring Indicator	Output	232E
24	Trans. Sig. Element Timing - A (DTE Source)	Input	422A
25	TM	Output	232E
Pins 10, 13, 19 and 23 not used			

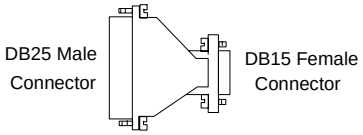
Table 5-7: High Speed Data Module RS-423A (Zone 3 DB-25) Pinouts

Pin No.	Function	Input/ Output	Interface Spec.
1	Not connected		
2	Transmitted Data - A	Input	423A
3	Received Data - A	Output	423A
4	RTS	Input	232E
5	CTS	Output	232E
6	DSR	Output	232E
7	Signal Ground		
8	DCD	Output	232E
9	Rec. Sig. Element Timing -B	Output	423A
11	Trans. Sig. Element Timing - B (DTE Source)	Input	423A
12	Trans. Sig. Element Timing -B (DCE Source)	Output	423A
14	Transmit Data -B	Input	423A
15	Trans. Sig. Element Timing -A (DCE Source)	Output	423A
16	Receive Data -B	Output	423A
17	Rec. Sig. Element Timing -A	Output	423A
18	LL	Input	232E
20	DTR	Input	232E
21	RL	Input	232E
22	Ring Indicator	Output	232E
24	Trans. Sig. Element Timing - A (DTE Source)	Input	423A
25	TM	Output	232E
Pins 10, 13, 19 and 23 not used			

Table 5-8: High Speed Data Module X.21 (Zone 3 DB-25) Pinouts

EIA 530	
DB25 Pin No.	**Signal**
2	TXD A
14	TXD B
3	RXD A
16	RXD B
4	RTS A
19	RTS B
8	DCD A
10	DCD B
15	TXC A
12	TXC B
24	TT A
11	TT B
7	GND

Optional X.21 (X.27) Adapter 209-036-019



X.21 (X.27)	
Signal	**DB15 Pin No.**
T (A)	2
T(B)	9
R (A)	4
R(B)	11
C (A)	3
C (B)	10
I (A)	5
I (B)	12
S (A)	6
S(B)	13
X/B (A)	7
X/B(B)	14
G	8

Table 5-9: Dual Data Module (V.54 Using 54M8) (Zone 3 DB-25) Pinouts

Pin No.	ITU-T No.	EIA Circuit	Channel A Function (Jumper X1 set to DTR+RI S/N)	Input/ Output
2	103	BA	Transmitted Data (TXD)	Input
3	104	BB	Received Data (RXD)	Output
4	105	CA	Request To Send (RTS)	Input
5	140	RL	Remote Loopback (RL)	Output
7	102	AB	Signal Ground	
8	109	CF	Data Carrier Detect (DCD)	Output
15	114	DB	Transmit Clock (TXC)	Output
17	115	DD	Receive Clock (RXC)	Output
24	113	DA	Ext. Transmit Clock	Input
25	107	CC	Data Set Ready (DSR)	Output
20	142	TM	Test Mode (TM)	Input
22	141	LL	Local Loopback (LL)	Output
Pin No.	**ITU-T No.**	**EIA Circuit**	**Channel B Function (Jumper X2 Set To DTR+RI S/N)**	**Input/ Output**
14	103	BA	Transmitted Data (TXD)	Input
16	104	BB	Received Data (RXD)	Output
19	105	CA	Request To Send (RTS)	Input
13	140	RL	Remote Loopback (RL)	Output
7	102	AB	Signal Ground	
10	109	CF	Data Carrier Detect (DCD)	Output
12	114	DB	Transmit Clock (TXD)	Output
9	115	DD	Receive Clock (RXD)	Output
11	113	DA	Ext. Transmit Clock	Input
23	107	CC	Data Set Ready (DSR)	Output
21	142	TM	Test Mode (TM)	Input
6	141	LL	Local Loopback(LL)	Output

Table 5-10: Dual Data Module Y Cable (V.54 Using 54M8) Pinouts

Channel A - Pinout of Connector P2 of Y Cable	
Pin No. (P2)	Ch. A Jumper X1 Set to DTR+RI (Switched Network) use cable 028H610
2	Received Data
3	Transmitted Data
4	DCD
5	Not connected
6	Not connected
7	Signal Ground
8	RTS
15	Not connected
17	Ext. Transmit Clock
18	LL
20	DSR
21	RL
22	Not connected
24	Receive Clock
25	TM
Channel B - Pinout of Connector P3 of Y Cable	
Pin No. (P3)	Ch. B Jumper X2 Set to DTR+RI (Switched Network) use cable 028H610
2	Received Data
3	Transmitted Data
4	DCD
5	Not connected
6	Not connected
7	Signal Ground
8	RTS
15	Not connected
17	Ext. Transmit Clock
18	LL
20	DSR
21	RL
22	Not connected
24	Receive Clock
25	TM
Pins 1, 9-14, 16, 19, 23 not used	

Table 5-11: High Speed Data Module EIA/TIA-232-E (V.24/V.28) (V.54 Using 054M8) (Zone 3 DB-25) Pinouts

Pin No.	ITU-T V.24 No.	EIA Circuit	Function	Input/ Output
1			Not Connected	
2	103	BA	Transmitted Data (TXD)	Input
3	104	BB	Received Data (RXD)	Output
4	105	CA	Request To Send (RTS)	Input
5	140	RL	Remote Loopback (RL)	Output
7	102	AB	Signal Ground	
8	109	CF	Data Carrier Detect (DCD)	Output
15	114	DB	Transmit Clock (TXC)	Output
17	115	DD	Receive Clock (RXC)	Output
20	142	TM	Test Mode (TM)	Input
22	141	LL	Local Loopback (LL)	Output
24	113	DA	External Transmit Clock	Input
25	107	CC	Data Set Ready (DSR)	Output
Pins 6, 9-14, 16, 18, 19, 21, 23 not used				

Table 5-12: High Speed Data Module V.35, 422, 423 (V.54 Using 54M8) (Zone 3 DB-25) Pinouts

Pin No.	V.35 Conn.	ITU-T V.24 No.	EIA Circuit	Function	Input/ Output	Interface Spec.
1	A			Not connected		
2	P	103	BA	Transmitted Data -A	Input	V.35
3	R	104	BB	Received Data -A	Output	V.35
4	C	105	CA	Request To Send (RTS)	Input	232E
5	N	140	RL	Remote Loopback (RL)	Output	232E
7	B	102	AB	Signal Ground		
8	F	109	CF	Data Carrier Detect (DCD)	Output	232E
9	X	115	DD	Rec. Sig. Element Timing -B	Output	V.35
11	W	113	DA	Trans. Sig. Element Timing - B (DTE Source)	Input	V.35
12	AA	114	DB	Trans. Sig. Element Timing -B (DCE Source)	Output	V.35
14	S	103	BA	Transmit Data -B	Input	V.35
15	Y	114	DB	Transmit Sig. Element Timing -A (DCE Source)	Output	V.35
16	T	104	BB	Balanced Receive Data -B	Output	V.35
17	V	115	DD	Receive Sig. Element Timing - A	Output	V.35
20	Nn	142	TM	Test Mode (TM)	Input	232E
22	L	141	LL	Local Loopback (LL)	Output	232E
24	U	113	DA	Trans. Sig. Element Timing - A (DTE Source)	Input	V.35
25	E	107	CC	Data Set Ready (DSR)	Output	232E
Pins 6, 10, 13, 18, 19, 21, and 23 not used						

G.703 Data Module (OCM 2000 only)

The G.703 Data Module provides the OCM with a G.703 co-directional channel interface operating at 64 kbps. (Upgrade kits are available that allow 128, 196, and 256 Kbps - refer to *Chapter 1*).

Transmit timing at 64 kHz is input to the G.703 Data Module. This data is encoded with 64 kHz bit timing and with 8 kHz octet timing. Since the OCM and TMS are bit interleaved multiplexers, the octet timing is not passed through the network. The 64 kHz timing is extracted and used to clock data into a transmit buffer. The only option for transmit timing is External, i.e., the timing always comes from the customer interface.

Receive timing at 64 kHz from the aggregate is clocked into a receive buffer. A 64 kHz clock derived from the OCM node timing is used to clock data from the receive buffer to the customer interface if the Internal Receive timing option is selected. Alternatively, the 64 kHz transmit timing from the customer interface may be used to clock data from the receive buffer to the customer interface. This is the External Receive timing option. The receive timing data is encoded with the selected 64 kHz timing and with an 8 kHz octet timing derived from the 64 kHz timing and is then output to the customer interface. The 8 kHz octet timing may be optionally suppressed if a loss of transmit signal condition is detected.

Note *The terminology for transmit and receive timing is such that transmit data flows towards the OCM aggregate and receive data flows from the OCM aggregate.*

The assignment of controls for the G.703 module to the customer interface is defined as follows:

Function	Pin Number	Control Number
RTS	4	CTLIN1
LL	18	CTLIN3
DTR	20	CTLIN4
RL	21	CTLIN5
DCD	8	CTLOUT1
CTS	5	CTLOUT2
RI	22	CTLOUT3
DSR	6	CTLOUT4
TM	25	CTLOUT5

The G.703 Data Module must be configured as a synchronous data channel. The selected data rate must be 64 kbps. The two valid channel timing selections are Internal Receive and External Transmit, or External Receive and External Transmit.

The Transmit Control 1 (RTS) controls the transmit buffer and Receive Control 1 (DCD) controls the receive buffer on the Data Module. If these controls are not used by the interface, Interface Type CTB1 should be chosen in the TMS or OCM-1000 Controller configuration to force these controls on.

Jumper X1 allows an octet alarm to be generated when a loss of transmit signal condition is detected. An octet alarm suppresses the 8 kbps octet timing in the receive data path.

Electromagnetic interference (EMI) from the OCM is minimized with the use of a shielded cable for the G.703 Data Module. The shield of the cable is grounded to the OCM chassis via the connector mounting screws.

Module Restrictions

Since each module slot in either a shelf or an enclosure is identical, apart from the backplane slot address signals, any module may be installed in any slot, with the following restrictions:

1. The assignment of modules to the slots must be that of the configuration on the TMS Controller. For example, the CCM should be placed in the first slot following the power supply module(s) if that is what the configuration shows.

2. Rear panel Zone 1 (top) and Zone 3 (bottom) connector panels must meet the module requirements.

3. Number and types of modules must not exceed the power rating of the installed power supplies.

4. For maximum system reliability, we recommend that a module be removed from the currently active TMS configuration before it is extracted from its slot.

Options

Examine the module by checking the header on the module. *Figure 5-3 on page 5-17* locates and describes the header on the G.703 Data Module.

The configuration is set at the factory to match your network's operation. The header is shown in the normal or default (factory shipped) position.

You need to check these settings when you first install the unit. You need not repeat the procedure unless you change your network.

When you are satisfied that the option settings are correct, install the modules in the enclosure or shelf following the directions below:

With the exception of the power supply modules, all plug-in modules have an insertion and extraction tab on the bottom of the front panel. To insert a plug-in module:

1. Insert the module into its slot with the GDC logo on top, then slide it in until it makes contact.

2. Pull down the insertion/extraction tab and firmly push the module in until it seats in the rear connectors.

To remove a plug-in module, pull down the insertion/extraction tab to unseat the module, then pull on the tab.

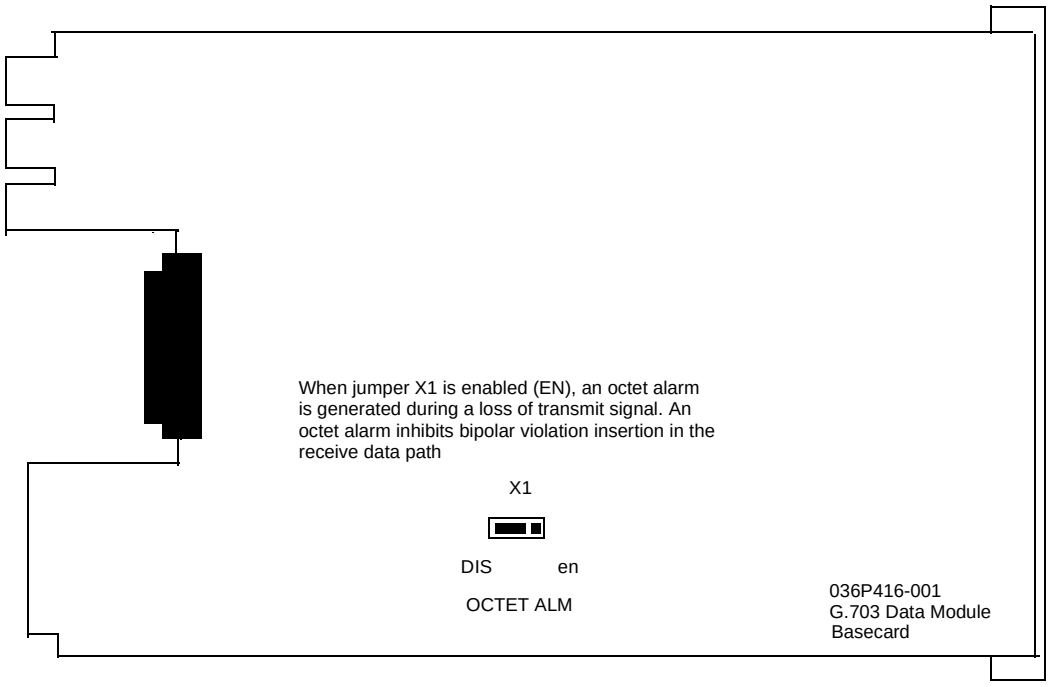


Figure 5-3: G.703 Data Module

Front Panel

Figure 5-4 on page 5-18 shows the G.703 front panel and explains the function of each front panel indicator. You may check the operation of each unit by monitoring the indicators. The colors of the LED indicators on the front panel are consistent in function:

Red and yellow are used for alarms or "service-affecting" conditions. This includes test modes that are interfering with normal user data. Alarm conditions depend on the modules, but normally, red indicates a Major Alarm (a number of problems), and yellow indicates a Minor Alarm (channel alarms).

The green LED indicators are used for all other conditions. This includes data activity, and E&M signaling leads.

In Service

Green LED indicates when the channel is entered in the currently active TDM configuration. This indicates that the module is operating.

Data In

Green LED indicates spaces in transmitted data.

Data Out

Green LED indicates spaces in received data.

Alarm

Yellow LED indicates an alarm condition exists in the channel. Possible alarm conditions are: Channel transmit clock bad, channel receive clock bad, loss of subaggregate sync for the channel.

Test

Yellow LED indicates module is performing power-up self-test or other diagnostic test.

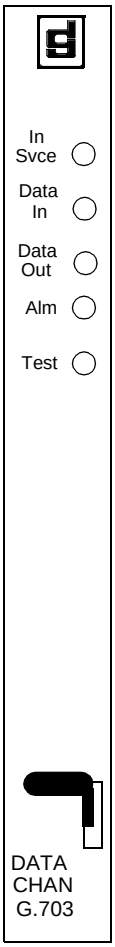


Figure 5-4: G.703 Data Module

Table 5-13: Technical Characteristics

Item	Characteristic
G.703 Data Module	
Data Rate	64 kbps synchronous (128, 192, 256 kbps available as upgrade kits)
Interface	ITU-T G.703 64 k co-directional, 9-EIA/TIA -232-E (V.28) controls
Interface Type	DCE
Controls	EIA/TIA-232-E (V.28)
Interface Connector	DB-25F
Power Consumption	+5V 384 mA +12V 5mA –12V 5mA Total Power = 2W Load Number = 0.4

Table 5-14: G.703 Data Module (Zone 3 DB-25) Pinouts

Pin No.	Function	Input/ Output	Interface Spec.
1	Not connected		
2	Transmitted Data - A	Input	G.703
3	Received Data - A	Output	G.703
4	RTS	Input	232E
5	CTS	Output	232E
6	DSR	Output	232E
7	Signal Ground		
8	DCD	Output	232E
14	Transmit Data -B	Input	G.703
16	Receive Data -B	Output	G.703
18	LL	Input	232E
20	DTR	Input	232E
21	RL	Input	232E
22	Ring Indicator	Output	232E
25	TM	Output	232E
Pins9, 10, 11, 12, 13, 15, 17, 19, 23 and 24 not used			

X.50 Data Module (only available on the OCM-2000)

The X.50 Data Module provides the OCM-2000 the capability of supporting the ITU-T X.50 series of recommendations. It provides the following features:

- Terminates up to four circuits from a X.50 type of subaggregate at speeds of 600, 1.2, 2.4, 4.8, 9.6, and 19.2 kbps.
- Provides visual indicators on the front panel for monitoring In Service, Data In, Data Out, Test (self-test pass or fail), and Alarm indications.
- Provides local and remote loopback capability.

The X.50 Data Module is compatible with ITU-T recommendations X.50, X.50 bis, X.57 and X.58 (Fundamental Parameters of a Multiplexing Scheme for the International Interface between Synchronous Data Networks). It is also compatible with the framing structure specified in the those recommendations.

The X.50 Data Module supports the Status bit (As defined in the ITU-T specification).

Channels A and B appear on a DB-25 female connector on Zone 1 and channel C and D appear on a DB-25 female connector on Zone 3. The 028H619-X06 is a 6-inch Y cable that separates the channels to individual DB-25 connectors. If only one channel on a connector is used, channel A and channel C signals appear on the correct pins, allowing a direct connection without Y cables if channel B or channel D is not used.

In order to use the X.50 module, the OCM shelf must be modified to accept a DB-25 connector panel in Zone 1.

Two kits are available for this purpose: a rear panel with eight DB-25 connectors or a rear panel with six DB-25 connectors and two dual 8-position modular jacks. The choice depends on the configuration of your system. For example, the 8-position modular jacks can be used for LIMs.

8-Slot DB-25 Kit - 036K338-001

6-Slot DB-25 /8-position modular jacks Kit - 036K339-001

Both kits include the panel and instructions for installation.

Module Restrictions

Since each module slot in either a shelf or an enclosure is identical, apart from the backplane slot address signals, any module may be installed in any slot, with the following restrictions:

1. DB-25 connectors must be provided at Zone 1 when this module is used.
2. The assignment of modules to the slots must be that of the configuration on the TMS Controller. For example; the CCM should be placed in the first slot following the power supply module(s), if that is what the configuration shows.
3. Number and types of modules must not exceed the power rating of the installed power supplies.
4. For maximum system reliability, we recommend that a module be removed from the currently active TMS configuration before it is extracted from its slot.

Options

There are no options on this card

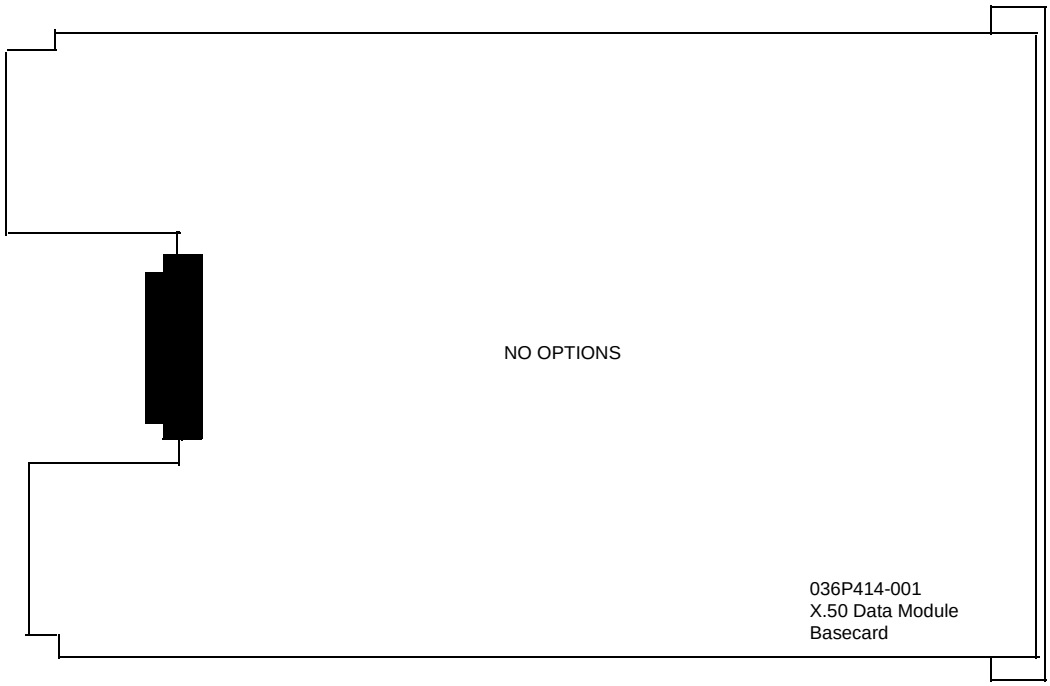


Figure 5-5: X.50 Data Module

Front Panel

Figure 5-6 on page 5-22 shows the X.50 front panel and explains the function of each front panel indicator. You may check the operation of each unit by monitoring the indicators. The colors of the LED indicators on the front panel are consistent in function.

Red and yellow are used for alarms or "service-affecting" conditions. This includes test modes that are interfering with normal user data. Alarm conditions depend on the modules, but normally, red indicates a Major Alarm (a number of problems), and yellow indicates a Minor Alarm (channel alarms).

The green LED indicators are used for all other conditions, including data activity and E&M signaling leads.

In Service

Green LED indicates when the channel is entered in the currently active TDM configuration. This indicates that the module is operating.

Data In

Green LED indicates spaces in transmitted data.

Data Out

Green LED indicates spaces in received data.

Alarm

Yellow LED indicates an alarm condition exists in the channel. Possible alarm conditions are: Channel transmit clock bad, channel receive clock bad, loss of subaggregate sync for the channel.

Test

Yellow LED indicates module is performing power-up self-test or other diagnostic test.

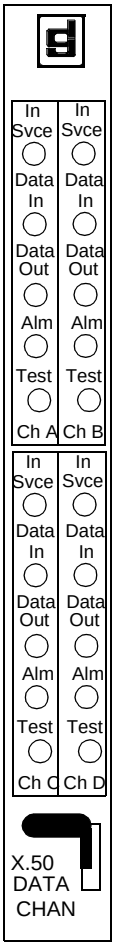


Figure 5-6: X.50 Data Module

Table 5-15: Technical Characteristics

Item	Characteristic
X.50 Data Module	
Interface	EIA/TIA-232-E, ITU-T (V.24/V.28)
Interface Type	DCE
Interface Connector	DB25F. Use a Y cable at Zone 1 and Zone 3 to split the two channels.
Data Rates Synchronous or Asynchronous	600, 1200, 2400, 4800, 9600 and 19200 bps
Power Consumption	+5V 600 mA +12V 35 mA –12V 35 mA Total Power = 3.9W Load Number = 0.7
Alarm Conditions	Transmit buffer failure Receive buffer failure

Table 5-16: X.50 Data Module (Zone 1 or 3 DB-25) Pinouts

Pin No.	ITU-T V.24 No.	EIA Circuit	Channel A or C Function	Input/ Output
2	103	BA	Transmitted Data (TXD)	Input
3	104	BB	Received Data (RXD)	Output
4	105	CA	Request To Send (RTS)	Input
5	106	CB	Clear To Send (CTS)	Output
6	107	CC	Data Set Ready (DSR)	Output
7	102	AB	Signal Ground	
8	109	CF	Data Carrier Detect (DCD)	Output
15	114	DB	Transmit Clock (TXC)	Output
17	115	DD	Receive Clock (RXC)	Output
20	108.2	CD	Data Terminal Ready (DTR)	Input
22	125	CE	Ring Indicator/ (RI)	Output
24	113	DA	Ext. Transmit Clock	Input
Pin No.	**ITU-T V.24 No.**	**EIA Circuit**	**Channel B Or D Function**	**Input/ Output**
14	103	BA	Transmitted Data (TXD	Input
16	104	BB	Received Data (RXD	Output
19	105	CA	Request To Send (RTS)	Input
13	106	CB	Clear To Send (CTS)	Output
18	107	CC	Data Set Ready (DSR)	Input
7	102	AB	Signal Ground	
10	109	CF	Data Carrier Detect (DCD)	Output
12	114	DB	Transmit Clock (TXC)	Output
9	115	DD	Receive Clock (RXC)	Output
21	108.2	CD	Data Terminal Ready (DTR	Input
6	125	CE	Ring Indicator (RI)	Output
11	113	DA	Ext. Transmit Clock	Input

Table 5-17: X.50 Data Module “Y” Cable Pinouts

Channel A or C - Pinout of Connector P2 of Y Cable (028H619-X06)	
Pin No. (P2)	**Function**
2	Transmitted Data (TXD)
3	Received Data (RXD)
4	Request To Send (RTS)
5	Clear To Send (CTS)
6	Data Set Ready (DSR)
7	Signal Ground
8	Data Carrier Detect (DCD
15	Transmit Clock (TXC)
17	Receive Clock (RXC)
20	Data Terminal Ready (DTR)
22	Ring Indicator (RI)
24	External Transmit Clock
Channel B Or D - Pinout Of Connector P2 Of Y Cable (028H619-X06)	
Pin No. (P2)	**Function**
2	Transmitted Data (TXD)
3	Received Data (RXD)
4	Request To Send (RTS)
5	Clear To Send (CTS)
6	Data Set Ready (DSR
7	Signal Ground
8	Data Carrier Detect (DCD)
15	Transmit Clock (TXC)
17	Receive Clock (RXC)
20	Data Terminal Ready (DTR)
22	Ring Indicator (RI)
24	External Transmit Clock
Pins 1, 9-14, 16, 18, 21, 23, 25 not used	

Chapter 6: Voice Channel Modules

Voice Channel Module (VCM)

On the transmission side, Voice Channel Modules convert voice grade signals to digital data for transmission through the system and convert the digital data to voice signals on the receive side. FXO, FXS, and E&M signaling can be provided by separate plug-in cards.

Three types of voice compression, ADPCM, VLBRV, and CELP are available. ADPCM compression resides on the basecard while VLBRV or CELP compression is provided by a plug-in card. FXS and FXO modules are 2-wire interfaces, while E&M modules can be either 2-wire or 4-wire.

The VLBRV and CELP types also have optional internal FAX modems. ADPCM echo cancellation requires an optional echo canceller plug-in card (refer to *Chapter 2* for more information on echo cancellation) while VLBRV and CELP echo cancellation is internal to the plug-in cards.

Voice compression is intended for voice signals and not for modem or FAX tones. Additionally, echo cancellers should be disabled if passing modem or FAX signals.

ADPCM (Adaptive Differential Pulse Code Modulation) compression on basecard provides ADPCM compression to 32, 24 or 16 kbps.

ADPCM Echo Canceller is a plug-in card that provides echo cancellation for use on voice circuits with long delays. A built-in residual echo suppressor provides additional attenuation of echo signals.

VLBRV (Very Low Bit Rate Voice) provides voice compression to bit rates of 9.6, 4.8, and 2.4 kbps.

CELP (Codebook Excited Linear Predictive) provides voice compression to bit rates of 9.6, 6.4, and 4.8 kbps.

Voice Channel Modules also provide:

- Compliance with FCC part 68 requirement
- End-to-end compatibility with UVC/ADPCM, UVC/VLBRV, and CELP terminations in TMS
- ADPCM encoding compatible with ITU-T G.721 at 32 kbps, and GDC proprietary ADPCM encoding at 32, 24, and 16 kbps
- Programmable transmit and receive levels
- Internally generated ringing and battery for short loops
- Optionally, external battery and ringing for long loops

Several versions of the Voice Channel Module are available. These versions differ with respect to compression algorithms and signaling. Some choices (*Table 1-1 on page 1-6* describes others) for signaling are 4-wire E&M, 2-wire E&M, 2-wire FXS and 2-wire FXO. The analog 2-wire voice capability is used to support 2-wire to 4-wire (loop start and ground start) interconnections.

The VCMs support PCM, ADPCM and VLBRV encoding algorithms. ADPCM rates are the same as those supported by the UVC, for example, 64 kbps PCM, and 32 kbps, 24 kbps and 16 kbps ADPCM. Each ADPCM voice channel includes 800 Hz of signaling overhead. The VLBRV supports the same operating rates (9.6/4.8 kbps) as the existing TMS VLBRV card.

FAX Bypass remains an option. The OCM VLBRV module requires no additional bandwidth for signaling, which is done in-band.

VCM Level Adjustment

It is important that you adjust the VF level of the voice modules correctly. A level that is too high produces distortion, and a level that is too low produces poor volume and excessive noise.

Note	*The voice channel module has its transmit gain adjustment and base levels set by hardware switches on the card (refer toTable 6-1 on page 6-6) and its receive gain adjustment set by the TMS Controller.*

Echo Cancellation

The subjective effect of echo depends on two things — the magnitude of the signal reflection at a 2W/4W hybrid, and the round-trip delay to the talker. An echo canceller can be used to prevent echoes. Most echo cancellers also contain a residual echo suppressor to attenuate any echo signals that were not completely canceled.

Note	*The ADPCM VCM has an optional echo canceller plug-in which is recommended for round-trip circuit delays of over 35 ms. The VLBRV and CELP VCMs have built-in echo cancellers.*

The VCMs SLAC (Subscriber Line Audio Circuit) device has an adaptive hybrid balance feature. This adapts within limits to the impedance of the 2-wire port, minimizing the magnitude of the reflected signal. The adaptive hybrid may reduce the need for the echo canceller in applications with round-trip delays of less than 35 ms, but its performance in increasing the echo path loss is not as good as an echo canceller.

The adaptive hybrid may be enabled or disabled by means of a switch on the VCM basecard. It should always be disabled if any echo canceller is present in the circuit, otherwise poor performance may result. It is automatically disabled for VLBRV applications. The adaptive hybrid or echo canceller may not work properly if modem tones are sent over a voice channel.

The ADPCM or VLBRV echo canceller may be enabled or disabled by a pair of switches on the VCM basecard. The CELP echo canceller is always enabled. The switches also allow an external control signal to enable or disable the echo canceller when needed on a per-call basis. Either an open or short on the external echo canceller control leads may be selected to enable the echo canceller. The residual echo suppressor may also be enabled or disabled by means of a switch. Generally, it should be enabled when the echo canceller is enabled.

The ADPCM echo canceller can cancel echoes with a maximum delay of 16ms. This delay is not the circuit round-trip delay, but the delay from the echo canceller to the source of the signal reflection - the 2W/4W hybrid. The echo canceller adapts to any echo or series of echoes in a 0-16 ms window. The delay window may be increased to 7-23 or 14-30 ms by means of the bulk delay switches on the VCM basecard. The 0 ms setting is suitable for almost all applications.

The DPV echo canceller can cancel echoes with a maximum delay of 8ms. This delay is not the circuit round-trip delay, but the delay from the echo canceller to the source of the signal reflection - the 2-wire to 4-wire hybrid. Echo cancellation is designed to eliminate near-end, local loop echoes, but also cancels any echo present within the 8 ms window.

Module Restrictions

Since each module slot in either a shelf or an enclosure is identical, apart from the backplane slot address signals, any module may be installed in any slot, with the following restrictions:

1. The assignment of modules to the slots must be that of the configuration on the TMS Controller or Point-to-Point Controller.
2. Redundant or diverse pairs of modules when used, must be in adjacent paired slots, in the same shelf (1-2), (3-4), (5-6), etc.
3. Rear panel Zone 1 (top) and Zone 3 (bottom) connector panels must meet the module requirements.
4. Number and types of modules must not exceed the power rating of the installed power supplies.
5. For maximum system reliability, recommend that a module be removed from the currently active TMS configuration before it is extracted from its slot.

Options

Examine the module by checking the option switches and/or headers on the modules. *Figure 6-1 on page 6-5* and *Table 6-1 on page 6-6* locate and describe the switches and headers on the voice channel modules.

The configuration is set at the factory to match your network operation. The option switches and/or headers are shown in their normal or default (factory shipped) positions.

You need to check these settings when you first install the unit. You need not repeat the procedure unless you change your network.

When you are satisfied that the option settings are correct, install the modules in the enclosure or shelf following the directions below:

With the exception of the power supply modules, all plug-in modules have an insertion and extraction tab on the bottom of the front panel. To insert a plug-in module:

1. Insert the module into its slot with the GDC logo on top, then slide it in until it makes contact.
2. Pull down the insertion/extraction tab and firmly push the module in until it seats in the rear connectors.

To remove a plug-in module, pull down the insertion/extraction tab to unseat the module, then pull on the tab.

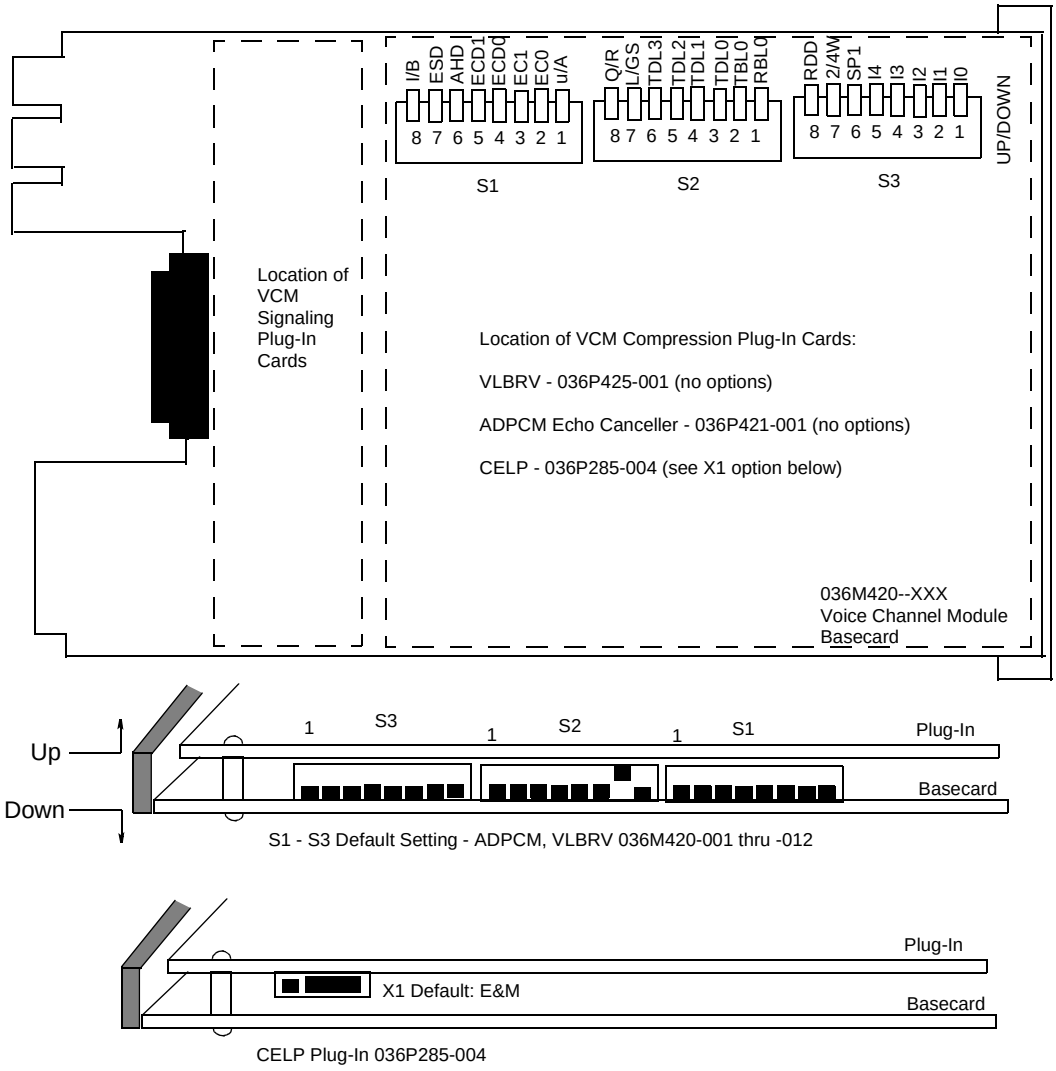


Figure 6-1: Voice Channel Module

Table 6-1: Voice Channel Option Settings

Options	Position	Applications
S1-1 PCM Coding (u/A)	A-Law - Down (default) Mu- Law - Up	Selects either A-Law (International) or Mu-Law (U.S.) PCM encoding of voice signals. Select A-Law when using VLBRV or CELP compression, or when terminating in a TMS UVC card.
S1-2/3 Echo Canceller Control (EC0/EC1)	Disable - 2 Down, 3 Down (default) Enable - 2 Up, 3 Down Enable External/Open - 2 Down, 3 Up Enable External/Ground - 2 Up, 3 Up	Enables or disables echo canceller. Refer to sub-paragraph “Echo Canceller". Not supported by CELP. Enable if round trip delay is greater than 35 ms.
S1-4/5 Echo Canceller Bulk Delay (ECD0/ECD1)	0ms Delay - 4 Down, 5 Down (default) 7ms Delay - 4 Up, 5 Down 14ms Delay - 4 Down, 5 Up Not Used - 4 Up, 5 Up	This option selects the time of the echo canceller delay window. Not supported by CELP.
S1-6 Adaptive Hybrid Disable (AHD)	Disabled - 6 Down (default) Enabled - 6 Up	Enables the 2 to 4 wire hybrid to automatically adapt to the 2-wire impedance. This reduces the echo caused by the hybrid. Automatically disabled when using VLBRV, since it may interfere with the VLBRV echo canceller. Always defaults to disabled for CELP.
S1-7 Echo Suppressor Disable (ESD)	Disabled - 7 Down (default) Enabled - 7 Up	Allows quiet intervals to be muted. This eliminates background noise from interfering with normal voice. Not supported by CELP.
S1-8 Idle/Busy (I/B or SP1)	Idle - Up Busy - Down (default)	Conditions voice channel when out-of-service. Idle sets E-lead idle (E&M) or on-hook (FXO). Busy sets E-lead busy (E&M) or off-hook (FXO).
S2-1 Receive Base Level (RBL0)	0 dB - 1 Down (default) 7 dB - 1 Up	This selection depends on the nominal input level specified for the telephone equipment connected to the channel. PBX systems normally require 0 dB. Automatic ringdown or Tellabs and other voice termination systems normally require +7 dB. 4W E&M only.
S2-2 Transmit Base Level (TBL0)	0 dB - 2 Down (default) -16 dB - 2 Up	This selection is determined by the nominal output level of the telephone equipment connected to the voice channel. PBX systems normally transmit 0 dBm. Automatic ringdown or Tellabs and other voice termination systems normally transmit –16 dB. 4W E&M only.

Table 6-1 Voice Channel Option Settings (Cont.)

Options	Position	Applications
S2-3-6 Transmit Delta Level (TDL0-TDL3)	0dB - 3 Down, 4 Down, 5 Down, 6 Down (default) +0.5dB- 3 Up, 4 Down, 5 Down, 6 Down +1.0dB- 3 Down, 4 Up, 5 Down, 6 Down +1.5dB- 3 Up, 4 Up, 5 Down, 6 Down -6.0dB - 3 Down, 4 Down, 5 Up, 6 Down -5.5dB - 3 Up, 4 Down, 5 Up, 6 Down -5.0dB - 3 Down, 4 Up, 5 Up, 6 Down -4.5dB - 3 Up, 4 Up, 5 Up, 6 Down -4.0dB - 3 Down, 4 Down, 5 Down, 6 Up -3.5dB - 3 Up 4 Down, 5 Down, 6 Up -3.0dB - 3 Down, 4 Up, 5 Down, 6 Up -2.5dB - 3 Up, 4 Up, 5 Down, 6 Up -2.0dB - 3 Down, 4 Down, 5 Up, 6 Up -1.5dB - 3 Up, 4 Down, 5 Up, 6 Up	These option switches select attenuation or amplification levels for the voice input level. This compensates for cable losses or improper output levels from connected telephone equipment. Receive gain adjusted via the Controller.
S2-7 Loop or Ground Start (L/GS)	Ground Start - 7 Down (supported on DPV cards only) Loop Start - 7 Up (default)	Selects the signaling mode of the FXS VF interface to be loop start or ground start. Loop start is the normal mode. Ground start is used to prevent call collisions on busy groups of central office trunks.
S2-8 Quiet or Reorder (Q/R)	Reorder - 8 Down (default) Quiet - 8 Up	Selects the VF conditioning audio output of the FXS to be either a quiet or reorder tone.
S3- 1-5 International Selection (I0-I4)	Down (default)	Not Defined.
S3-6 (SP1)	Down	Spare
S3-7 Two or Four-Wire (2/4W)	Four Wire - 7 Down (default) Two Wire - 7 Up	Selects the E&M audio interface to be either two-wire or four-wire.
S3-8 Remote Disconnect Disable (RDD)	Disable - 8 Down (default) Enable - 8 Up	Not supported.
Some early cards may have the silkscreen designations reversed. This does not affect the operation of the switches. UP/DOWN was DOWN/UP: ESD was ESEN, AHD was HBEN, u/A was A/U, Q/R was R/Q, L/GS was G/LS, RDD was RDE, 2/4W was 4/2W.		

Front Panels

Figure 6-2 shows the voice channel module front panel and explains the function of each front panel indicator. You may check the operation of each unit by monitoring the indicators. The colors of the LED indicators on the front panels are consistent in function:

Red and yellow are used for alarms or “service-affecting” conditions. This includes test modes that are interfering with normal user data. Alarm conditions depend on the modules, but normally, red indicates a Major Alarm (a number of problems), and yellow indicates a Minor Alarm (channel alarms). The green LED indicators are used for all other conditions. This includes data activity, and E&M signaling leads.

In Service

Green LED indicates when the channel is entered in the currently active TDM configuration. This indicates that the module is operating.

Supervision In

Green LED indicates that a busy state is detected from the customer equipment. For E&M, this is a busy condition on the M lead. For FXS, this is an Off-Hook condition. For FXO, this is the detection of a ringing signal.

Supervision Out

Green LED indicates that a busy state is being applied to the customer equipment. For E&M, this is a busy condition on the E lead. For FXS, this is application of a ringing signal. For FXO, this is application of an Off-Hook condition.

Alarm

Yellow LED indicates that one of the following conditions exist: remote or local out-of-sync, power-on self-test failed, hardware configuration mismatch, or download failure.

Test

Yellow LED indicates that one of the following diagnostic tests are being performed: power-on self-test, full-feature self-test, or data path test.

The test LED is also turned on if a diagnostic forced command is issued which differs from the configured values.

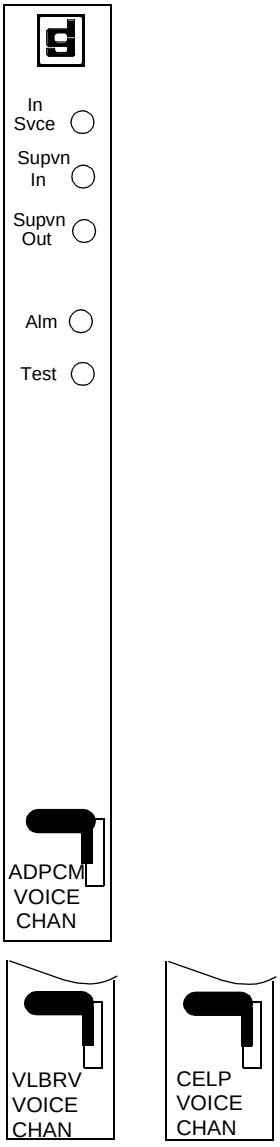


Figure 6-2: Voice Channel Modules

Table 6-2: Technical Characteristics

Item	Characteristic
Voice Module	
Voice Compression	
PCM	64 kbps PCM, no compression A-law or Mu law encoding, ITU-T G.711
ADPCM	32 kbps ADPCM ITU-T G.721, 1985 ANSI, 1986 ANSI 32, 24, 16 kbps ADPCM compatible with TMS UVC/AD-PCM
VLBRV	9.6, 4.8 and 2.4 kbps compatible with TMS UVC/VLBRV Integral echo cancellation. Optional FAX bypass for group 3 FAX signals.
CELP	(-013, -014, -015) - 6.4 or 4.8 kbps. (-023, -024, -025) - 9.6, 6.4, or 4.8 kbps. Compatible with TMS UVC/CELP. Integral echo cancellation. FAX bypass for Group-3 FAX signals. E&M or 4-state signaling.
Signaling and Synchronization Overhead Bandwidth	CELP 0 bps ADPCM 800 bps VLBRV 0 bps
Signaling Interfaces, 2W FXS	
Battery Feed	Internal, –37.5 VDC
Max loop resistance (loopstart)	1200 ohms maximum loop resistance
Max loop length (loopstart)	9000 feet of 26 AWG wire
Max loop resistance (ground start)	600 ohms
Loop current	25 mA
Signaling	Loop start or ground start (DPV only). Dial pulse or DTMF
Ringing voltage	75 VRMS 20 Hz
Ringing cadence	2 seconds on, 4 seconds off or transparent (FXO-FXS)
Drive capability	1.5 REN (1 2500- type phone)
Registration	Meets FCC Part 68, DOC CS-03 (on-premise only), UL1459
Impedance	600 ohms
Return loss	14 dB min., 200-3400 Hz, 600 ohm reference

Table 6-2 Technical Characteristics (Cont.)

Item	Characteristic
Voice Module (Cont.)	
Signaling Interfaces, 2W FXO	
DC loop resistance	100 ohms (approx.)
Max loop current	100 mA
Signaling	Loop start operation only
Ringing detector	FCC Part 68 Type B ringer
Impedance	600 ohms
Return loss	14 dB min., 200-3400 Hz, 600 ohm reference
Registration	Meets FCC Part 68, DOC CS-03, UL1459
Signaling Interfaces, 2W/4W E&M	
Signaling types supported	Type 1, type 2, type 5, SSDC5A (U.K.)
Interface type	"B" side E&M
M-lead current detector	2.4 mA
E-lead driver	250 mA max.
Impedance	600 ohms, 2W and 4W
Return loss	14 dB minimum, 200-3400 Hz, 600 ohm reference
Registration	Meets FCC Part 68, DOC CS-03
Maximum Input Level	+3dBm0
Echo Cancellation	
Typical increase in echo path loss with 2W port terminated in 1200 ohm (return loss of 9.5dB) (white noise)	
Adaptive Hybrid	10dB
ADPCM Echo Canceller	35dB

Table 6-2 Technical Characteristics (Cont.)

Item	Characteristic
Voice Module (Cont.)	
Power Consumption (2W FXS ADPCM)	
Idle	+5V 410 mA +12V 22 mA –12V 47 mA Total Power = 2.9W
Off-Hook	+5V 410 mA +12V 83 mA –12V 112 mA Total Power = 4.4W
Ringing	+5V 410 mA +12V 56 mA –12V 68 mA Total Power = 3.5W Load Number = 1
Power Consumption (2W FXO ADPCM)	
On-Hook	+5V 380 mA +12V 80 mA –12V 18 mA Total Power = 3.1W
Off-Hook	+5V 380 mA +12V 48 mA –12V 18 mA Total Power = 2.7W Load Number = 0.8
Power Consumption (2W/4W E&M ADPCM)	
Type 1 signaling	+5V 400 mA +12V 23 mA –12V 25 mA Total Power =2.6 W
Other signaling types	+5V 400 mA +12V 36 mA –12V 50 mA Total Power =3.0W Load Number =0.5

Table 6-2 Technical Characteristics (Cont.)

Item	Characteristic
Voice Module (Cont.)	
Power Consumption of VLBRV Versions	
VLBRV without Fax	+5V 580 mA +12 — –12 — Power = 2.9W Load Number: FXS = 1.2 FXO = 0.9 E&M = 1.0
VLBRV with Fax	+5V 660 mA +12 — –12 — Power = 3.3W Load Number: FXS = 1.2 FXO = 0.9 E&M = 1.0
Additional Power Consumption of Echo Canceller on ADPCM cards only.	+5V 240 mA +12 ----- –12 ----- Additional Power = 1.2W Load Number: FXS = 1.1 FXO = 0.7 E&M = 0.7
Power Consumption of CELP versions (with or without FAX)	
FXS	+5V 1.03 A +12V 83 mA –12V 112 mA Total Power = 7.5 W Load Number: 1.3
FXO	+5V 1.00 A +12V 80 mA –12V 18 mA Total Power = 6.2 W Load Number: 1.0
E&M	+5V 1.02 A +12V 36 mA –12V 50 mA Total Power = 6.1 W Load Number: 1.0

Dual Private Voice (DPV) Module

DPV (Dual Private Voice) is a two-channel analog voice compression module that operates at speeds of 4.8, 6.4, 8 or 9.6 kbps. FXS, FXO, and E&M signaling interfaces with or without FAX bypass are available. The FXS and FXO interfaces provide loop start and ground start signaling options.

The following paragraphs describe the FXO, FXS and E&M versions of the OCM Dual Private Voice (DPV) modules. It details key features, a description, typical applications, and an equipment list describing the component parts. The DPV is supported in TMS-3000 networks GTS 2.2 or higher, and in OCM-1000 networks OMS (OCM Management System) V2.0 and higher.

The DPV modules provide:

- FXS and FXO Loop Start and Ground Start, and E&M telephony interfaces
- CS-ACELP voice compression at 9600, 8000 bps
- IMBE voice compression at 9600, 8000, 6400, 4800, and 2400 bps (OCM-1000 or OCM-2000 with GTS 2.2 only)
- FAX bypass (ITU-T Group 3)
- Integral echo cancellers
- Software programmable transmit and receive levels
- Internally generated ringing and battery for short loops
- Optionally, external battery and ringing for long loops
- Downloadable software

Note *The DPV cards are not end-to-end compatible with previous OCM and TMS voice channel cards.*

DPV modules convert incoming voice signals into compressed speech using CS-ACELP (Conjugate Structure Algebraic Code Excited Linear Prediction) or IMBE (Improved Multiband Excitation) speech encoding. The compressed voice is transported within the OCM network and terminates on another DPV or VTP module at a remote location.

The DPV modules provide FAX modem compatibility and FAX bypass (ITU-T Group 3) which allows interconnection of FAX machines. FAX documents may be transmitted across the network at a rate up to the voice compression rate specified. The FAX machines may be directly connected to an FXS port or indirectly through a PBX or the public network. FAX mode of operation is automatically entered upon detection of the 2100 Hz tone generated by the answering FAX machine. Machines which exclusively use the DIS method of handshake are not supported. The FAX machines may be either set to auto answer or manually initiated during a voice call. For purposes of the automatic routing of FAX calls, the 1100 Hz calling tone will pass through the voice algorithm.

There are six DPV cards, one for each signaling interface: FXS, FXO and E&M with or without FAX bypass. Additionally, there is a seventh DPV version which provides ground start signaling on an FXO interface. The FXS interface handles both loop start and ground start signaling. Each provides two independent channels per module occupying one slot in an OCM enclosure or shelf.

Echo cancellation is standard on all versions, and the DPVs require no additional bandwidth for signaling.

The DPV modules accept configuration, status, and diagnostic commands from the TMS Controller and reports status and alarms back to the TMS Controller. *Refer to Operation Manual for TMS-3000 Controller, GDC 036R603-Vnnn, User Guide for OCM-1000, GDC 036R612-Vnnn, and OCM*TMS Maintenance Console User Guide, GDC 036R611-000*.

Figure 6-3 on page 6-15 shows the signal path of the Dual Private Voice module. Refer to the following paragraphs for a description.

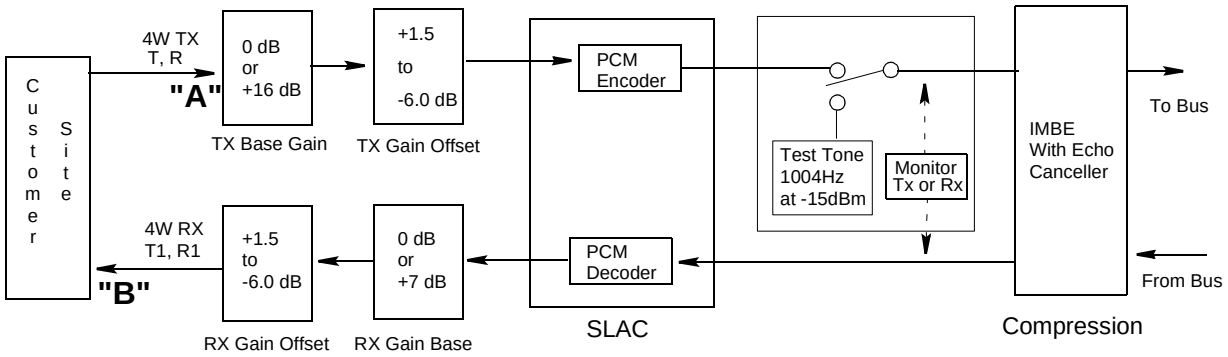
Note	*The Dual Private Voice (DPV) module has both transmit and receive gain adjustments set from the TMS Controller.*

The voice modules have both transmit and receive gain adjustments. The OCM is generally used at the 0 dB test level point in a voice network but is customer dependent. For example, PBX systems generally transmit at 0dBm, other voice systems may transmit at -16 dB (4W E&M). The nominal receive input level from a PBX is 0 dB but other voice systems may require a +7 dB (4W E&M) input level. These levels may be adjusted through the TMS Controller to match the customers nominal input and output levels. To measure and set the transmit and receive levels, the measuring device should be inserted at points A (by breaking into the appropriate rear panel RJ jack), or B (at the receive customer site) in the diagram.

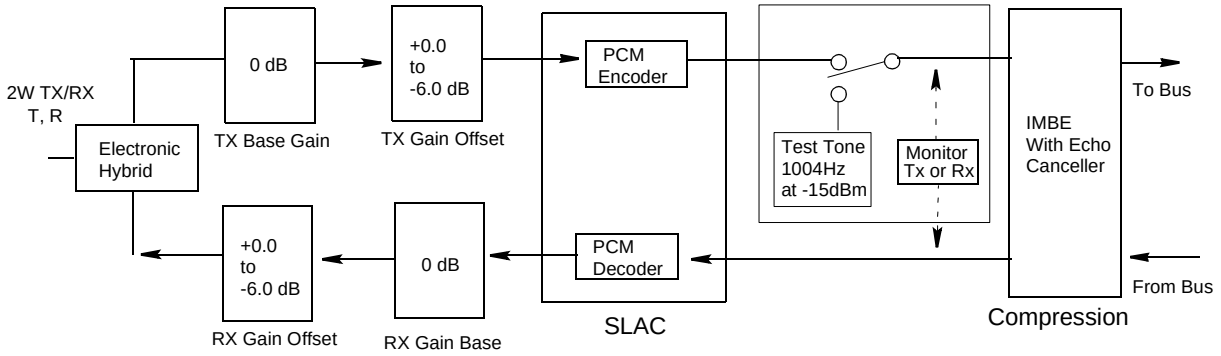
The transmit or receive gain offset can be adjusted in 0.5dB steps from +1.5 dB (gain) to -6.0 dB (loss) for four wire E&M. To avoid instability, two wire circuits don't have any net gain, so the gain adjustment is limited to 0.0 dB to -6.0 dB.

For diagnostic purposes, a 1004 Hz at -15 dBm0 test tone can be generated by the voice channel modules under TMS control (Test Tone in *Figure 6-3 on page 6-15*) and injected in the transmit direction. This nominal level is subject to receive gain adjustments at the remote end, but not to transmit gain adjustments. For example, if the 1004 Hz test tone is injected with the remote receive base and offset gains set to 0 dB, a -15 dBm signal level should be measured at the two wire or four wire remote receive port. If the receive base gain is set to +7 dB, a level of -8 dBm should be measured at the remote receive port.

Voice channel modules can also measure the peak PCM transmit or receive level and display it on the TMS or OCM Controller (Monitor in *Figure 6-3 on page 6-15*). The Monitor function should not be used for setting up levels or for accurate measurements. It functions only as continuity checker to show that the signal did get to the other side.



4-Wire E&M DPV Signal Path



2-Wire FXS, FXO or E&M DPV Signal Path

Figure 6-3: Voice Channel Levels

Figure 6-4 on page 6-16 and *Figure 6-5 on page 6-17* illustrate applications of the Dual Private Voice module.

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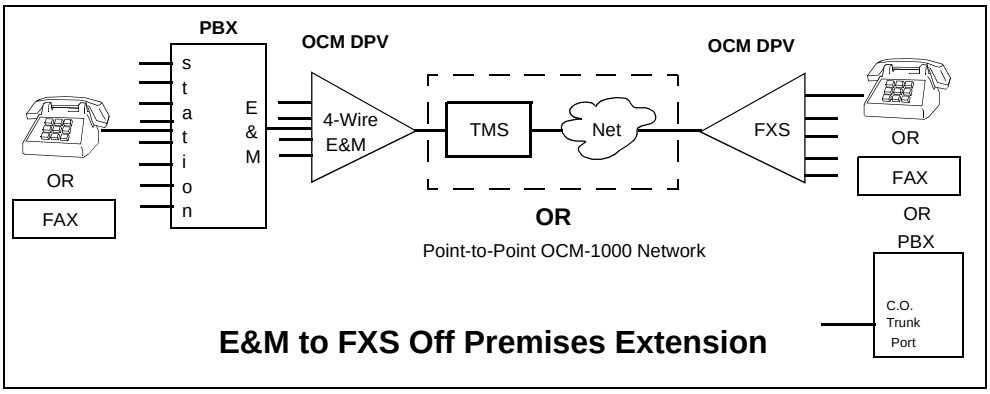
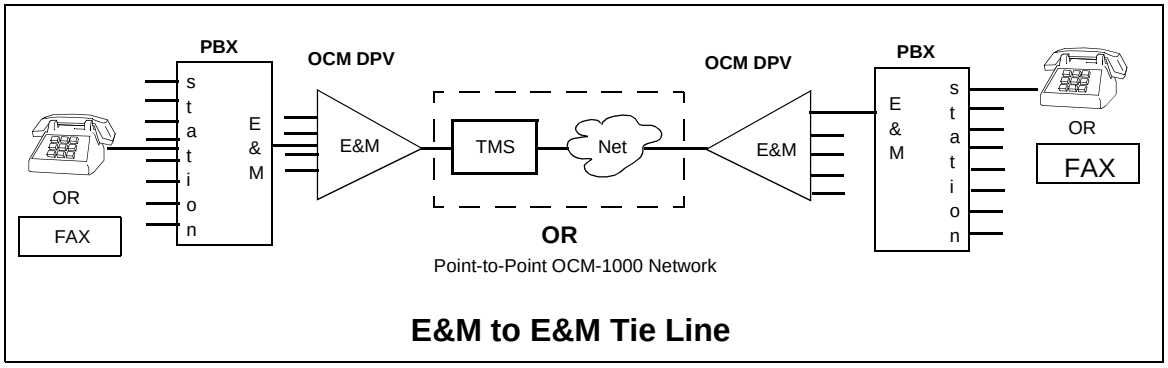




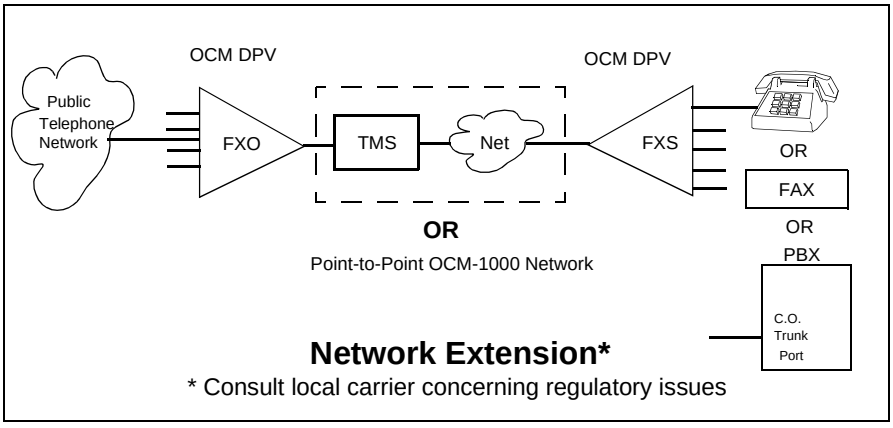
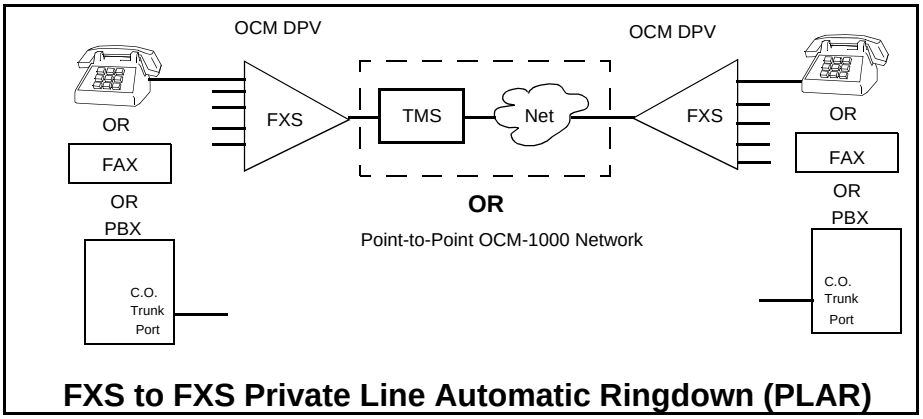


Figure 6-4: DPV Typical Applications



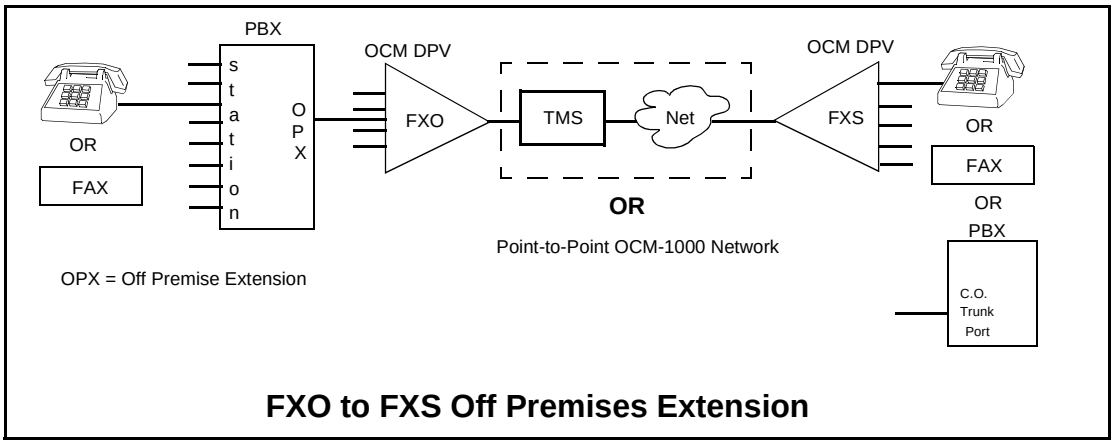


Figure 6-5: DPV Typical Applications

Module Restrictions

Since each module slot in either a shelf or an enclosure is identical, apart from the backplane slot address signals, any module may be installed in any slot, with the following restrictions:

1. The assignment of modules to the slots must be that of the configuration on the TMS Controller or Point-to-Point Controller. For example, the CCM should be placed in the first slot following the power supply module(s) if that is what the configuration shows.

2. Redundant or diverse pairs of modules when used, must be in adjacent paired slots, in the same shelf (1-2), (3-4), (5-6), etc.

3. Rear panel Zone 1 (top) and Zone 3 (bottom) connector panels must meet the module requirements.

4. Number and types of modules must not exceed the power rating of the installed power supplies.

5. For maximum system reliability, we recommend that a module be removed from the currently active TMS configuration before it is extracted from its slot.

Connector Panels

In order to support the Dual Private Voice modules in early enclosures and shelves (shipped prior to 1996 with only one 8-pin modular connector at Zone 1), shielded 8-position modular jack connector panels 010C369-001 (enclosure) and 010C342-003 (shelf) must be used in Zone 1. Installation kits are listed below:

036K064-001 - enclosure

036K065-001 - shelf

036K066-001 - expansion shelf

These kits include the panels and instructions for installation. Later enclosures and shelves are shipped with the new panels.

Options

Examine the module by checking the option headers on the modules. *Figure 6-6 on page 6-19* locates and describes the headers on the dual private voice channel modules.

The configuration is set at the factory to match your network operation. The headers are shown in their normal or default (factory shipped) positions.

You need to check these settings when you first install the unit. You need not repeat the procedure unless you change your network.

When you are satisfied that the option settings are correct, install the modules in the enclosure or shelf following the directions below:

With the exception of the power supply modules, all plug-in modules have an insertion and extraction tab on the bottom of the front panel. To insert a plug-in module:

1. Insert the module into its slot with the GDC logo on top, then slide it in until it makes contact.
2. Pull down the insertion/extraction tab and firmly push the module in until it seats in the rear connectors.

To remove a plug-in module, pull down the insertion/extraction tab to unseat the module, then pull on the tab.

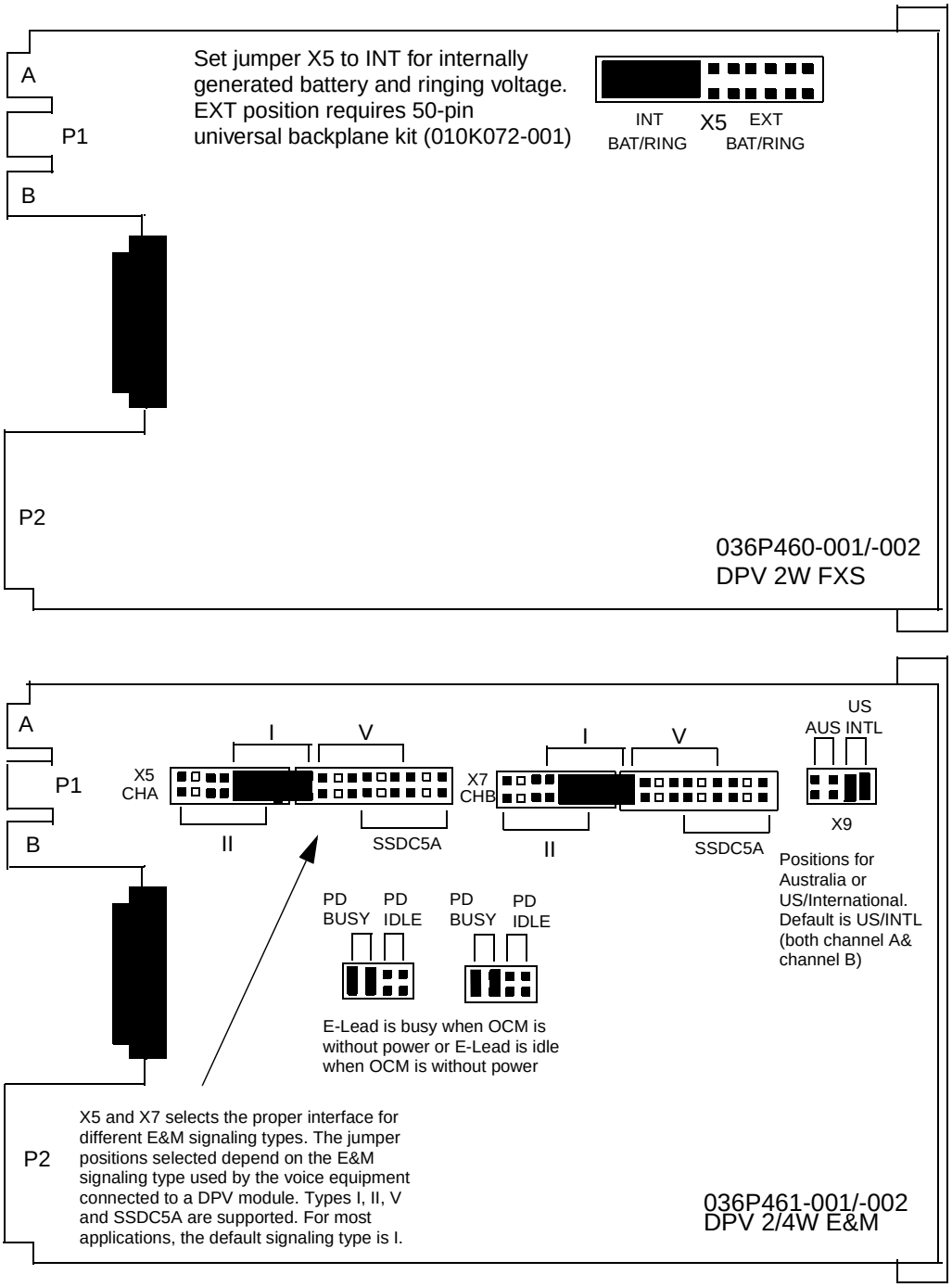


Figure 6-6: Voice Channel Module

Front Panels

Figure 6-7 illustrates the front panels of the modules and explains the function of each front panel indicator. You may check the operation of each unit by monitoring the indicators.

The colors of the LED indicators on the front panels are consistent in function:

Red and yellow are used for alarms or “service-affecting” conditions. This includes test modes that are interfering with normal user data. Alarm conditions depend on the modules, but normally, red indicates a Major Alarm (a number of problems), and yellow indicates a Minor Alarm (channel alarms).

The green LED indicators are used for all other conditions.

In Service

Green LED indicates when the channel is entered in the currently active TDM configuration.

Alarm

Yellow LED indicates if any of the following conditions exist: Remote or local out-of-sync, power-on self-test failed, hardware configuration mismatch, or download failure.

Test

Yellow LED indicates that one of the following diagnostic tests are being performed: Power-on self-test, full-feature self-test, or data path test.

The test LED is also turned on if a diagnostic forced command is issued which differs from the configured values.

Off Hook

Green LED is turned on if off-hook input is detected by FXS, or off-hook is output by FXO.

Ring/Ring Detect

Green LED is turned on if ringing is output by FXS, or if ringing input is detected by FXO.

M-Lead Busy

Green LED is turned on if M-lead is busy.

E-Lead Busy

Green LED is turned on if E-lead is busy.

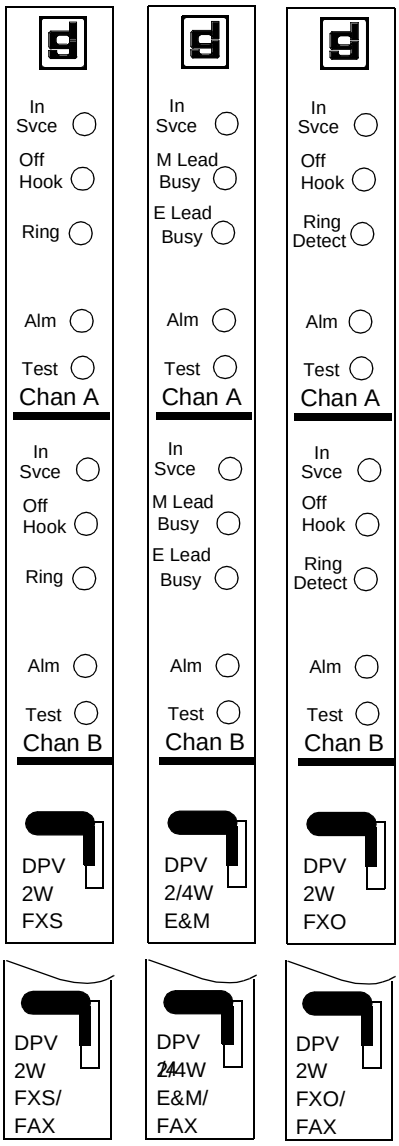
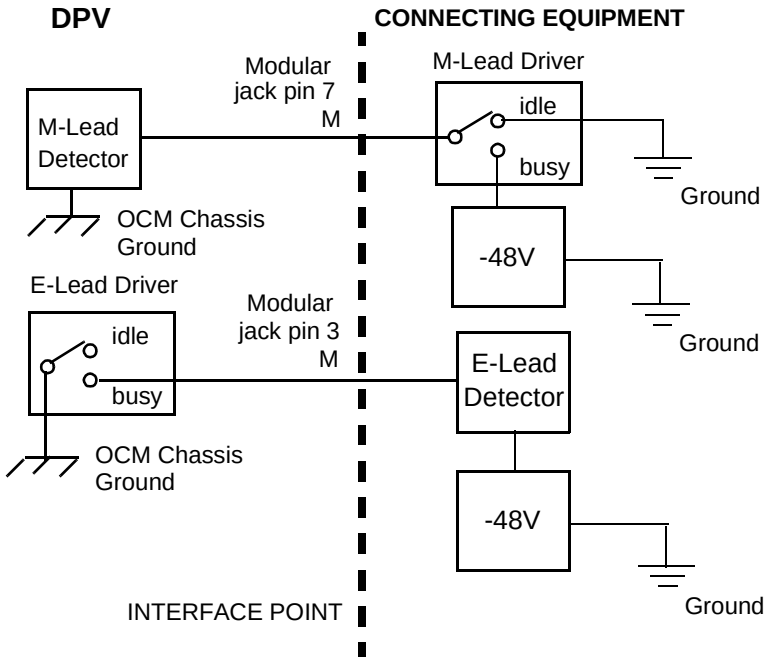


Figure 6-7: DPV Modules

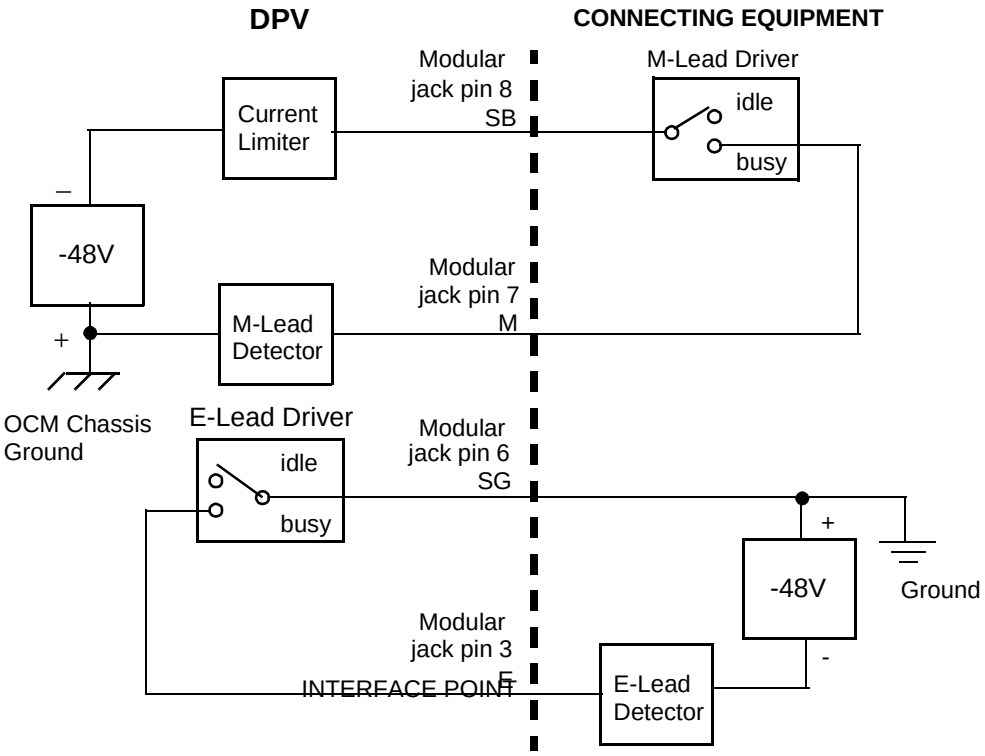
E&M Signaling

E&M Types I, V and SSDC5A signaling uses an implicit ground connection between the switching equipment (PBX) and the transmission equipment (OCM), for the return current in the E and M signaling leads. On the OCM, this return path is via chassis ground. Make sure that a connection is made between the OCM's chassis ground and the reference ground of the switching equipment when using E&M Type I, V or SSDC5A signaling. *Figure 6-8* through *Figure 6-10* show the E&M signaling types and their busy and idle states



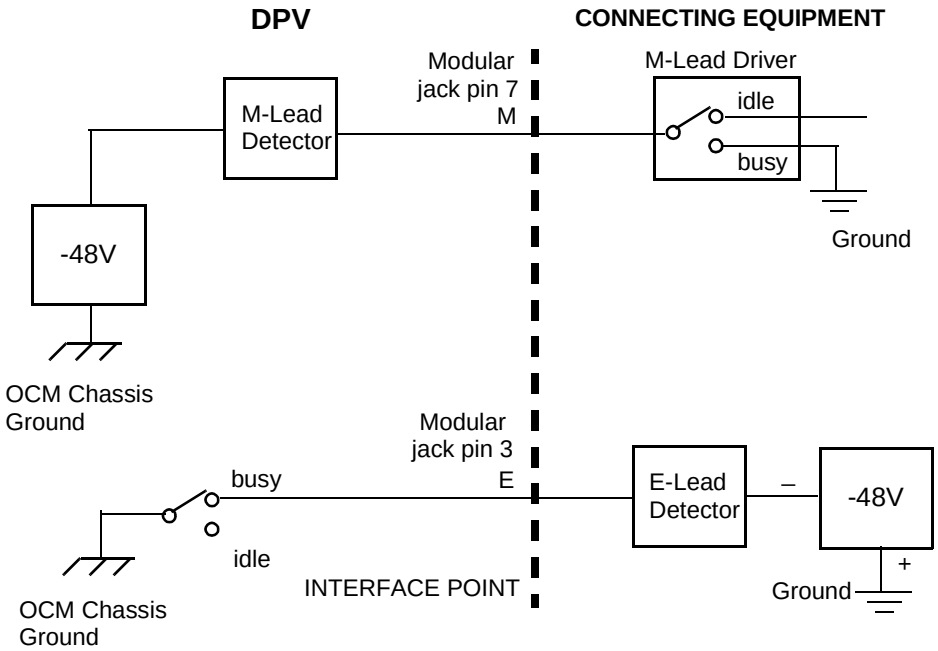
Note: The connecting equipment ground must be connected to the OCM chassis ground.

Figure 6-8: Type I E&M Signaling Connections



Note: The DPV and connecting equipment may use separate grounds

Figure 6-9: Type II E&M Signaling Connections

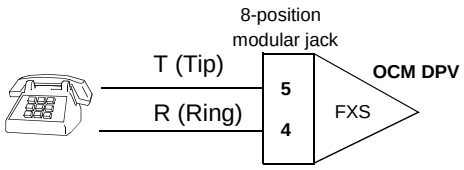


Note: The connecting equipment ground must be connected to the OCM chassis ground

Figure 6-10: Type V and SSDC5A E&M Signaling Connections

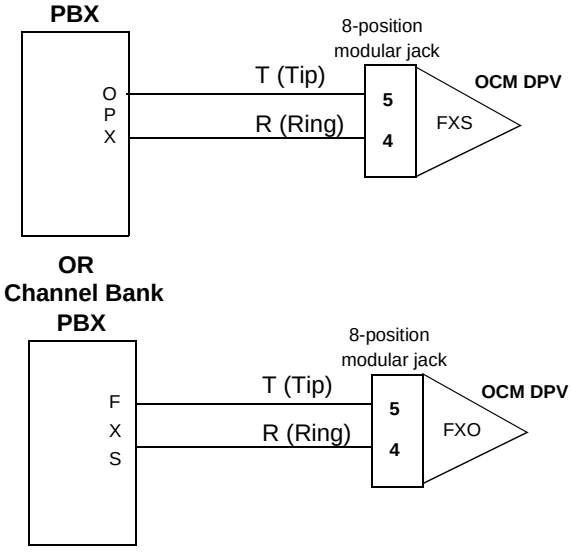
Application Notes

DPV FXS Connection



For signaling, the DPV sources the negative battery voltage on R (Ring) with respect to T (Tip) which is near ground potential. The voice frequency (VF) audio sounds are I-directional on Tip and Ring, superimposed over the signaling voltages and currents.

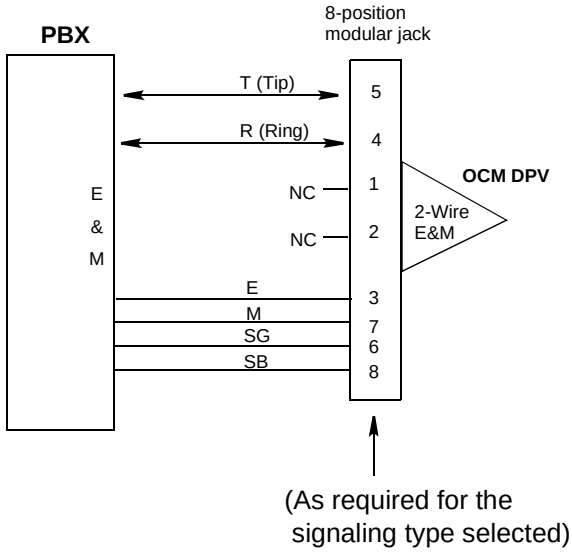
DPV FXO Connections



For signaling, the DPV sinks current provided by the connecting equipment battery, which may be applied to either Tip or Ring (i.e. the DPV FXO will work with Tip/Ring reversed). The voice frequency (VF) audio signals are I-directional on Tip/Ring superimposed over the signaling voltages and currents.

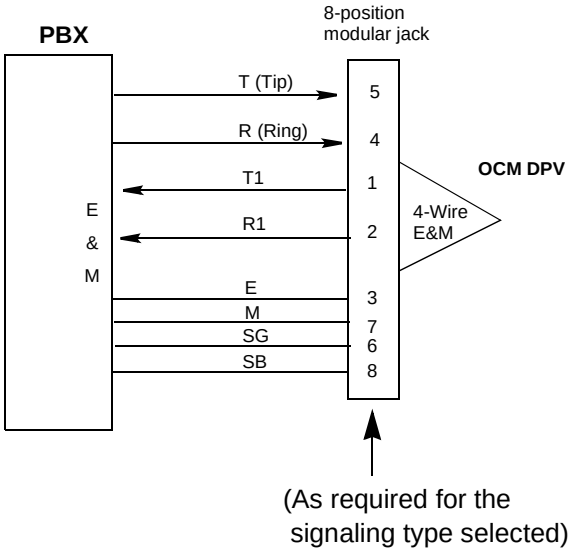
DPV E&M Connections

2-Wire E&M



The voice frequency audio signals are I-directional on T/R with separate leads used for signaling.

4-Wire E&M



The voice frequency audio signals are input on T/R and output on T1/R1, with separate leads used for signaling.

Table 6-3: Technical Characteristics

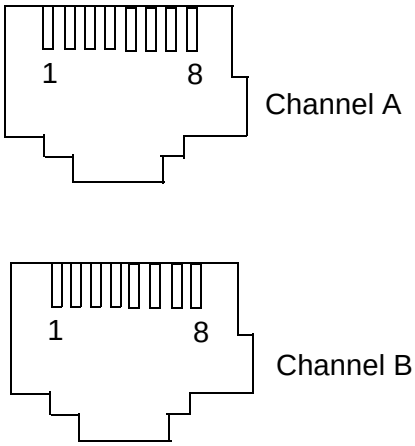
Item	Characteristic
Dual Private Voice (DPV)	
Compatibility	DPV and VTP
Interface	2-wire FXS, 2-wire FXO, 2 or 4-wire E&M
Interface Connector	Zone 1 dual 8-position modular jacks
Voice Compression:	
CS-ACELP	8.0, 9.6 kbps. Integral 16ms echo canceller (10 ms with tone bypass enabled).
IMBE	2.4, 4.8, 6.4, 8.0, 9.6 kbps. Integral 8 ms echo canceller.
Signaling and Synchronization Overhead Bandwidth	CS-ASELP/IMBE 0 bps (all signaling is inband)
FAX Bypass	ITU-T Group 3 (activated upon detection of the 2100 Hz answer tone)
Signaling Interfaces	
2W FXS	
Battery Feed	Internal, -37.5 VDC
Max loop resistance (loopstart)	1200 ohms maximum loop resistance
Max loop resistance (groundstart)	600 ohms maximum loop resistance
Max loop length (loopstart)	9000 feet of 26 AWG wire
Max loop length (groundstart)	4500 feet of 26 AWG wire
Loop current	25 mA
Signaling	Loop start. Dial pulse or DTMF
Ringing voltage	1.0 REN at 66VRMS. 20 Hz or country selectable
Ring cadence	2 seconds on, 4 seconds off or country selectable
Drive capability	1.5 REN (1 - 2500-type phone)
Registration	Meets FCC Part 68, DOC CS-03 (on-premise only), UL1459
Impedance	600 ohms, 900 ohms or complex
Return loss	14 dB min., 200-3400 Hz, 600 ohm reference
2W FXO	
DC loop resistance	100 ohms (approx.)
Max loop current	100 mA
Signaling	Loop start
Ringing detector	FCC Part 68 Type B ringer
Registration	Meets FCC Part 68, DOC CS-03 (on-premise only), UL1459
Impedance	600 ohms, 900 ohms or complex
Return loss	14 dB min., 200-3400 Hz, 600 ohm reference
2W/4W E&M	
Signaling types supported	Type 1, type 2, type 5, SSDC5A (U.K.)
Interface type	“B” side E&M
M-lead current detector	2.4 mA
E-lead driver	250 mA max.
Impedance	600 ohms, 2W and 4W
Return loss	14 dB minimum, 200-3400 Hz, 600 ohm reference
Registration	Meets FCC Part 68, DOC CS-03, UL1459
Maximum Input Level	0 dBm
Maximum output level	0 dBm on all 2-wire interfaces, +7 dBm on 4-wire E&M
Echo Cancellation	Meets ITU-T G.165 requirements

Table 6-3 Technical Characteristics (Cont.)

Item	Characteristic
Power	
Power Consumption (2W FXS)	+ 5V @ 550ma +12 V @ 170ma -12 V @ 199ma Total Power = 7.18 watts Load Number = 1.9
Power Consumption (2W FXO)	+ 5V @ 550ma +12 V @ 30ma -12 V @ 30ma Total Power = 3.47 watts Load Number = 0.6
Power Consumption (2W/4W E&M)	+ 5V @ 550ma +12 V @ 61ma -12 V @ 102ma Total Power = 4.71 watts Load Number = 1.0

Table 6-4: Dual Private Voice (Zone 1 8 position Modular Jack) Pinouts

Pin No.	2-Wire FXS/FXO	2-Wire E&M	4-Wire E&M
1			T1 (VF output)
2			R1 (VF output)
3		E (signaling output)	E (signaling output)
4	R (VF bi-directional)	R (VF bi-directional)	R (VF input)
5	T (VF bi-directional)	T (VF bi-directional)	T (VF input)
6		SG (signal ground)	SG (signal ground)
7		M (signaling input)	M (signaling input)
8		SB (signal battery)	SB (signal battery)



Viewed from shelf rear panel

Voice Transcoder Platform (VTP)

VTP (Voice Transcoder Platform) is based on the DPV, the major difference being that the VTP operates on four channels in a server capacity between network voice and private voice, versus terminating two private voice circuits for the DPV.

The VTP module resides in the OCM environment. It provides the means for a network circuit (64k PCM voice), to be compressed, via software loadable compression techniques and then transported in a subaggregate, in bit format. Termination of the voice circuit occurs on a GDC Dual Private Voice Card (DPV) or a network circuit via another VTP.

Use of the VTP allows compression of multiple (as many as four) voice channels, affording a substantial bandwidth savings over 64K PCM. This bandwidth savings can be utilized for transporting data traffic on the same pipe that previously carried voice alone. Furthermore, during disaster recovery and fallback, and through the use of Intelligent Automatic Rerouting (IAR), the voice channels can be compressed further, to occupy even less bandwidth, thus allowing more circuits to remain active.

The VTP also allows DPV cards to be converted to public network compatibility, (byte oriented, 64K PCM), allowing a Digital PBX, to be transported via the OCM and terminated at an analog PBX.

Features

- Voice Compression
  - Downloadable Voice Algorithm
  - Variable Rates
- A-law/u-law conversion
- Echo Cancellation
- Signalling Transport
- DPV circuit compatibility
- Network Circuit compatible
- Full Rate FAX Bypass
- Failure Conditioning
- Supports 4 Channels
- Single Card Slot

Module Restrictions

Since each module slot in either a shelf or an enclosure is identical, apart from the backplane slot address signals, any VTP may be installed in any slot, with the following restrictions:

1. The assignment of modules to the slots must be that of the configuration on the TMS Controller.
2. The VTP is nonredundant only.
3. For maximum system reliability, remove a module from the currently active TMS configuration before extracting it from its slot.

Options

Examine the module by checking the option switches and/or headers on the modules. *Figure 6-11* and *Table 6-5*, *on* page 6-29, locate and describe the switches and headers on the voice channel modules.

The configuration is set at the factory to match your network operation. The option switches and/or headers are shown in their normal or default (factory shipped) positions.

You need to check these settings when you first install the unit. You need not repeat the procedure unless you change your network.

When you are satisfied that the option settings are correct, install the modules in the enclosure or shelf following the directions below:

With the exception of the power supply modules, all plug-in modules have an insertion and extraction tab on the bottom of the front panel (See *Figure 6-12 on page 6-30*). To insert a plug-in module:

1. Insert the module into its slot with the GDC logo on top, then slide it in until it makes contact.

2. Pull down the insertion/extraction tab and firmly push the module in until it seats in the rear connectors.

To remove a plug-in module, pull down the insertion/extraction tab to unseat the module, then pull on the tab.

For technical characteristics, see *Table 6-6 on page 6-31*.

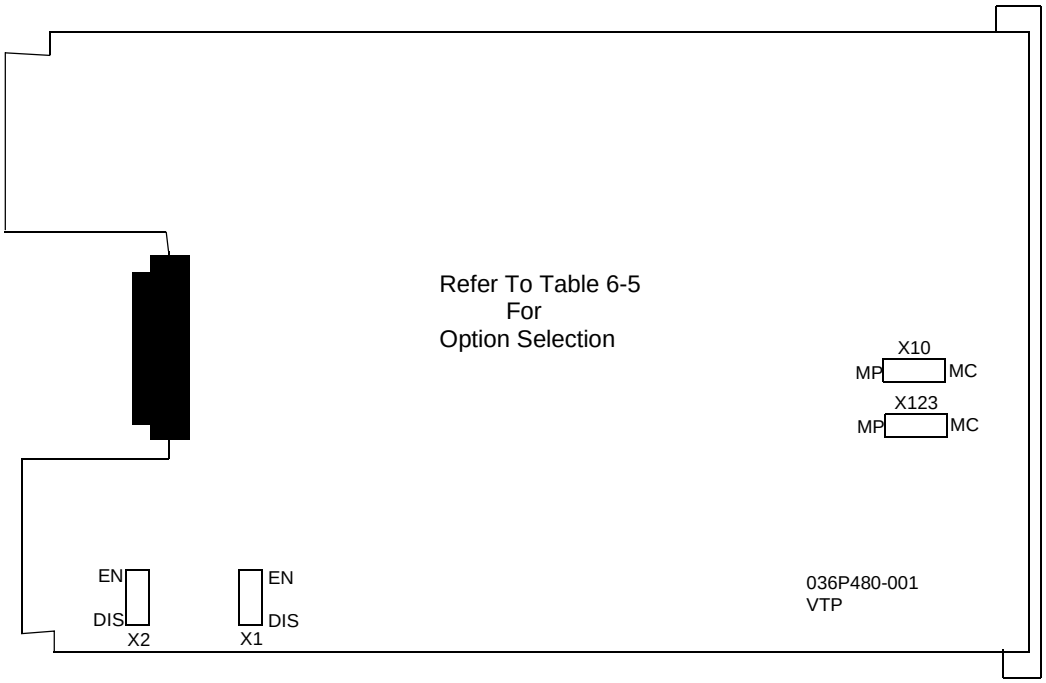


Figure 6-11: Voice Transcoder Platform

Table 6-5: Option Selection

Options	Position	Applications
X1 (DSP #1)	EN	Watchdog enabled for DSP.
	DIS	Watchdog disabled for DSP.
X2 (DSP #2)	EN	Watchdog enabled for DSP.
	DIS	Watchdog disabled for DSP.
X10 (DSP #1)	MP	Microprocessor mode. For test purposes only.
	MC	Microcomputer mode. Internal program code is mapped into program memory space.
X123 (DSP #2)	MP	Microprocessor mode. For test purposes only.
	MC	Microcomputer mode. Internal program code is mapped into program memory space.

In Service

Green LED indicates when the channel is entered in the currently active TDM configuration. This indicates that the module is operating.

Init

Yellow LED indicates that the module is running boot firmware or a code download is in progress (blinking).

Alarm

Yellow LED indicates that an alarm condition exists in one of the configured channels. Possible alarm conditions are: local or remote out-of-sync and network out-of-sync.

Test

Yellow LED indicates that the module is performing power-up self-test or other diagnostic test on one of the configured channels.

Card Fail

Red LED indicates that the module has detected an internal failure.

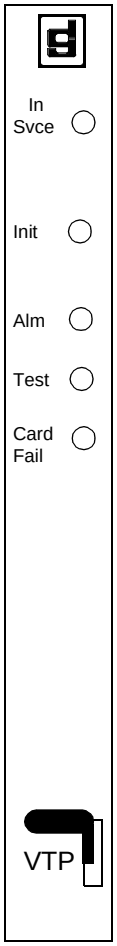


Figure 6-12 VTP Front Panel

Table 6-6: Technical Characteristics

Item	Characteristic
Voice Transcoder Platform	
Voice Algorithm	CS-ACELP
Rates	Variable, User programmable 8K, 9.6K
Alarm Conditions	Hardware Failure Alarm RAM Parity Error Flash Error DFP Error DSP Reset Channel Failure Alarm: Channel Out of Sync.
Signaling	16 State Signaling (A,B,C and D) 4 State Signaling (A and B) 2 State Signaling (A only) No Signalling Forced Signaling
Power Consumption, Typical (4 channels)	+5V, .9 A Load number = 1.0

Chapter 7: Alarm Card

Alarm Card (only provides alarms for power supplies)

The alarm function is accomplished using the plug-in Alarm Card along with the existing shelf or enclosure alarm bus, and the associated modules. The card:

- Provides contacts to activate local and remote customer alarm systems.
- Provides local and remote indication of alarms in a system.
- Provides separate cutoff controls for local and remote systems.
- Resides in either an OCM Shelf, or 10 card OCM Enclosure.

Typically, the alarm outputs are used to drive the visual and audible alarms within a central office. There are four types of alarms: Major, Minor, Power Good (Major), and power status (Minor). Major and Minor alarms are defined depending on the module(s) used in the system. When an alarm is detected, the associated module activates circuitry on the Alarm Card. To assure that transient signals do not trigger the alarm, there is a built-in time delay of approximately 100 ms. When an alarm exsists, front panel LED indicators light, providing a local indication (minimum on-time of approximately 0.75 seconds). At the same time internal relays are activated, providing external control of visual and/or audible indications.

The Alarm Card receives power when you insert it into the shelf or the enclosure. Inserting or extracting it does not cause any errors in the system. You may make Major, Minor and Audible Alarm connections by wire wrapping to connectors on the Alarm Interface Adapter (refer to *Table 7-3 on page 7-5*). The Alarm Interface Adapter mounts on the rear of the shelf or enclosure at Zone 3 at the position assigned to the Alarm Card slot. An Alarm Card power failure sets all alarms except the Audible Alarm. To deactivate the alarms, extract the Alarm Card from the shelf or enclosure. Use the ACO front panel switch to cut-off the external audible alarms; the front panel alarm indicators remain ON.

Note *1.When inserting an Alarm Card into a powered shelf or enclosure, Major, Minor and Audible Alarms go ON for approximately 0.75 seconds then OFF.*

2.When applying power to a shelf or enclosure, the Major, Minor, and Audible Alarms go ON for approximately 0.75 seconds then OFF.

Options

Examine the module by checking the option switch on the module. *Figure 7-1 on page 7-3* locates and describes the switch on the Alarm Card Module.

The configuration is set at the factory to match your network operation. The option switch is shown in their normal or default (factory shipped) positions.

Check these settings when you first install the unit. You need not repeat the procedure unless you change your network.

When you are satisfied that the option settings are correct, install the modules in the enclosure or shelf following the directions below:

With the exception of the power supply modules, all plug-in modules have an insertion and extraction tab on the bottom of the front panel. To insert a plug-in module:

1. Insert the module into its slot with the GDC logo on top, then slide it in until it makes contact.
2. Pull down the insertion/extraction tab and firmly push the module in until it seats in the rear connectors.

To remove a plug-in module, pull down the insertion/extraction tab to unseat the module, then pull on the tab.

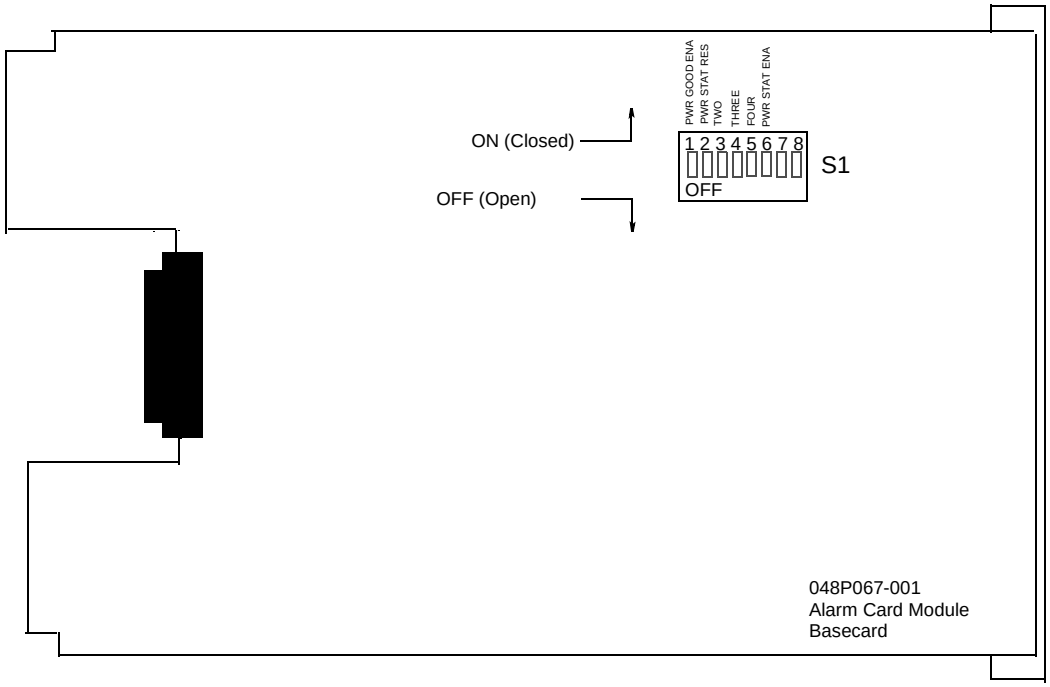


Figure 7-1: Alarm Card

Table 7-1: Alarm Card Option Settings

S1 Option Settings	Description
PWR GOOD ENA (Position 1 on switch S1)	Power Good Enable - This option can be set to detect a power supply failure. You can select either ON (Closed) or OFF (Open). This is a Major alarm.
PWR STAT RES (Position 2 on switch S1)	Power Status Resistor - This option should always be set to OFF (Open) when an alarm card is installed in the OCM shelf.
TWO (power supplies) (Position 3 on switch S1) THREE (power supplies) (Position 4 on switch S1) FOUR (power supplies) (Position 5 on switch S1)	TWO, THREE or FOUR - Power Status Threshold - When set to ON (Closed), this option sets the threshold on the power status detector depending on how many power supplies (2, 3, or 4) are installed in the system. When one power supply is used, set 2, 3, and 4 to OFF (Open).
PWR STAT ENA (Position 6 on switch S1)	Power Status Enable - This option is used when multiple power supplies are installed in the shelf. Select ON (Closed) or OFF (Open). When one power supply is used, set to OFF (Open). Example: If two power supplies are installed, and one power supply fails, or is removed, the alarm is activated. This is a Minor alarm.
Positions 7 and 8 not used.	

Front Panel

Figure 7-2 shows the Alarm Card front panel and explains the function of the front panel switch and indicators. You may check the operation of each unit by monitoring the indicators. The colors of the LED indicators on the front panel are consistent in function:

Red and yellow are used for alarms or "service-affecting" conditions. This includes test modes that are interfering with normal user data. Alarm conditions depend on the modules, but normally, red indicates a Major Alarm (a number of problems), and yellow indicates a Minor Alarm (channel alarms).

The green LED indicators are used for all other conditions, including data activity and E&M signaling leads.

ON

Green LED is on when power is supplied to the Alarm Card.

AUDIBLE

Green LED is on when front panel ACO switch is on.

MIN

Yellow LED is on when a minor alarm is active.

MAJ

Red LED is on when a major alarm is active.

AUDIBLE ACO

This 3-position switch has the following functions:

ENBL - Permanently on. Major or minor alarms do not activate the audible alarm.

DSBL - Permanently off. All major or minor alarms do activate the audible alarm.

RESET - Momentary on. The first alarm does not activate the alarm relay. When the first alarm is deactivated, the ACO circuit is reset to ACO “OFF,” allowing the next alarm to activate the audible alarm relay.

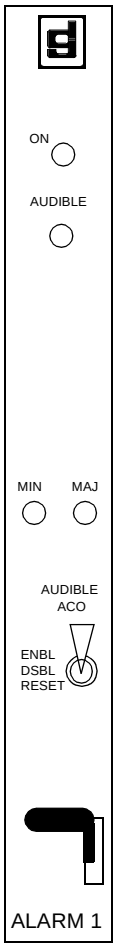


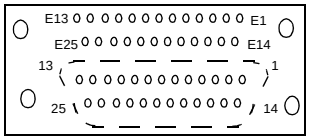
Figure 7-2: Alarm Card Module

Table 7-2: Technical Characteristics

Item	Characteristic
Alarm Card	
Alarm Contact Rating	1 amp at 48 VDC
Power Consumption	+5V 0.2W +12V 0.9W Load Number = 0.4

Table 7-3: Alarm Adapter Card (048P061-001) Connector Pinouts

*Contact closures are shown in power-up condition (No Alarm)***.**



		Shelf/Enclosure DB25 Pin No.	Alarm Adapter Card (wire-wrap pin No.)
Major Alarm	Common	1	E1
	Normally Open	2	E2
	Normally Closed	3	E3
Minor Alarm	Common	7	E7
	Normally Open	8	E8
	Normally Closed	9	E9
Audible	Normally Closed	20	E20
	Normally Open	21	E21
	Common	22	E22
Wire-wrap pins - press fit,.045 sq., Auto-Splice 8-452 F52240 Contact closures are shown in power-up condition (No Alarm)			

Chapter 8: OCM Packet Processor

OCM Packet Processor (OPP)

The OPP is a high-performance packet processor, LAN router, and Frame Relay Access Device for LAN/WAN networks. OPP modules are designed to operate in the GDC OCM 16-slot shelf or the GDC OCM 10-slot enclosure. GDC's unique Address Processor and Directory provides fast packet forwarding and storage of end-station (PC, workstation, host, etc.) information.

For detailed information refer to the *Installation and Operation Instructions for OCM Packet Processor (OPP) - 036R342-000, and the User Guide for OCM-1000, GDC Publication No. 036R612-Vnnn*.

The OPP module provides a Frame Switching Network within the OCM/TMS 3000 environment. This permits LAN interconnection and Frame Relay support within the existing office communications system. In addition, it provides high speed interconnection between multiple compatible modules in a node via the OCM Packet Bus.

There are two types of OPP router modules: EN (Ethernet) and TR (Token Ring). The EN router module provides one Ethernet IEEE 802.3 10 Base-T LAN interface and one Frame Relay/HDLC interface. The TR router module provides one Token-Ring IEEE 802.5 LAN interface (UTP or STP) and one Frame Relay/HDLC interface. Both OPP modules are double-slot cards. The OCM shelf or enclosure may contain up to four EN router modules, or four TR router modules. The OCM shelf or enclosure may contain a mix of both EN and TR modules if Heterogeneous Bridging software is used.

Each card has a LAN interconnect, two WAN interconnects, and a Packet Bus interconnect. The Packet Bus provides connections to other Hops within the OCM and has a maximum bandwidth of 36 Mbps. The primary WAN interconnect is through the OCM's link (LIM) to either a TMS or another OCM. The LAN data is allocated bandwidth (a circuit) on the link along with other circuits for other cards in the OCM. The maximum bandwidth for OPP is one selection slower than the actual line rate.

The secondary WAN interface provides a Frame Relay/HDLC interface to public network services and switching interfaces for private networks at data rates up to 2.048 Mbps. It uses the DB-25 connector associated with the OPP slot to provide connectivity.

Front Panels

Figure 8-1 shows the OPP front panels and explains the function of each indicator and the front panel maintenance jack. You may check the operation of each unit by monitoring the indicators. The colors of the LED indicators on the front panels are consistent in function:

Red and yellow are used for alarms or "service-affecting" conditions. This includes test modes that are interfering with normal user data. Alarm conditions depend on the modules, but normally, red indicates a Major Alarm (a number of problems), and yellow indicates a Minor Alarm (channel alarms).

The green LED indicators are used for all other conditions, including data activity and E&M signaling leads.

In Service

Green LED indicates that the module is entered in the currently active configuration. This indicates that the module is operating.

Initialization

Yellow LED indicates that the module is running boot firmware. Also flashes during software download.

Alarm

Red LED indicates any major OPP node alarm.

Test

Yellow LED indicates the module is performing power-up self-test or other diagnostic test.

Transfer

Green LED lights when packets are being processed and address found and forwarded.

Management Active

Green LED flashes to indicate CPU is running management code.

Data In

Green LED lights to indicate data is being received from primary WAN (LIM).

Data Out

Green LED lights to indicate data on primary WAN (LIM) is being transmitted.

LAN Receive

Green LED lights to indicate packet of LAN data is being received.

LAN Transmit

Green LED lights to indicate packet of LAN data is being transmitted.

Maintenance

Miniature 3-conductor phono jack for connecting ASCII terminal.

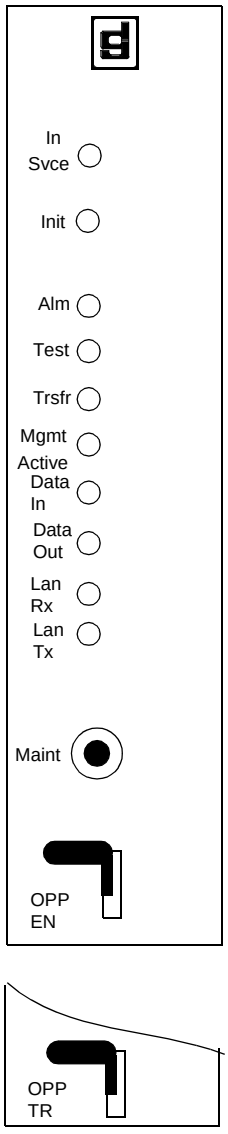


Figure 8-1: OPP Card

Glossary of Terms

ADPCM

Adaptive Differential Pulse Code Modulation: A standard technique of compressing 64 kbps PCM to 32, 24, or 16 kbps.

AIS

Alarm Indication Signal. Used by the communications company to indicate a line break or loss of service.

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 a problem that affects the whole node. Minor alarms indicate a problem that affects one or more channels.

Backpanel

This is the back panel of the OCM enclosure and shelves. It holds the external Zone 1 and Zone 3 connectors used by all the modules and covers the Zone 2 backplane, which provides power and bussing to the modules.

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 converting strings of 8 zeros, into a B8ZS character, and placing them back into the aggregate bit stream.

bps

bits per second transmitted or received.

Board

A printed circuit board (PCB) with no components on it.

Buffer

A storage device used to streamline data transfer when there is a slight difference in data rates, or to compensate for propagation delays.

Card

A printed circuit board with components on it. May be a basecard or a plug-in (piggyback) card.

CCITT

Refer to ITU-T.

CDA

Combined Digital Aggregate. A TMS module that provides compatibility with a DCS (Digital Cross-Connect) network, or a DTE device with a DS0 structured aggregate.

CELP

Codebook Excited Linear Prediction - A proprietary GDC voice compression algorithm.

Channel

The termination point of a circuit path. A circuit can transverse several entities in a communication system. A circuit runs between two nodes.

Circuit

An end-to-end data path which can pass through several entities in a communication system. A circuit is described or referred to by the node/channel names which become connected by the existence of the circuit. A circuit connects channel to channel.

dB

Decibel. A logarithmic expression, usually of a power ratio.

dBm

Decibel relative to one milliwatt. A measure of absolute power, relative to one milliwatt. For example, 0dBm is one milliwatt.

dBm0

dBm relative to a point of 0 TLP. Signal levels in a telephone system are usually expressed in dBm0.

DACS Network

DACS (Digital Access Cross-connect System) is a byte oriented (DS0) digital T1/E1 network service, capable of routing individual 64K DS0s to meet customers requirements.

DPV

DPV (Dual Private Voice) is a two-channel analog voice compression module that operates at speeds of 4.8, 6.4, 8 or 9.6 kbps. FXS, FXO, and E&M signaling interfaces with or without FAX bypass are available.

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 bps D4 framing bits into a 1.544 Mbps data stream.

DSX-1 Interface

Converts a formatted data signal into the proper signal levels for the digital T1 network. Also called a cross-connect.

E1

A 2.048 Mbps digital line system. A G.703/G.704 international application.

E&M

A two- or four-wire telephone interface that has separate leads for signaling and voice. OCM supports E&M Type I, II, V, and SSDC5A signaling.

EPROM

Erasable Programmable Read Only Memory. Integrated circuit that stores software for a microprocessor. Often stores bootstrap software that downloads full-feature software which is stored in RAM.

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. ESF allows a greater amount of access to digital network services. ESF uses every other 193 bit for framing, for a frame rate of 4000 bps, it leaves 4000bps (every other 193 bit) for other functions, i.e.,. 2000 bps for ESF statistics, 2000 bps for data link usage.

Fourwire Circuit

Usually a telephone circuit consisting of four insulated electrical conductors, a transmit and receive pair.

FT1

Fractional T1. Uses some or all of the 24 DS0 timeslots of a T1 aggregate.

FXO

Foreign Exchange Office. A two-wire telephone interface that sinks loop current and detects ringing.

FXS

Foreign Exchange Station. A two-wire telephone interface that provides battery and ringing and detects loop current.

ITU-T

International Telecommunications Union - Telecommunications Standardization Sector. Designation for telecommunications recommendations written by IUT (International Telecommunication Union); an international telecommunication agency involved in formulating international standards for data communications. (Formerly CCITT - International Telegraph and Telephone Consultative Committee.)

Local Area Network (LAN)

A type of high-speed data communications arrangement wherein all segments of the transmission medium (typically, coaxial cable, twisted-pair wire, or optical fiber) are under the control of the network operator.

LED

Light Emitting Diode. Used as an indicator on OCM front panels.

Module

An assembly that has definable performance characteristics so that it can be tested, removed, and replaced as a unit. In an OCM system a module can reside in a slot of either the shelf or enclosure. A module may be a single card (e.g. DDM) or it may be a basecard and one or more piggyback or plug-in cards (e.g. CCM).

Network

Term used to refer to a group of nodes connected together with aggregate trunks. Not all the nodes in a network will necessarily be MEGAMUX TMS nodes.

Node

Any addressable location within a network capable of carrying circuit data. In a MM-TMS network, a MEGAMUX TMS in Philadelphia or a MEGAMUX PLUS in Boston are considered “nodes”.

OPP

OCM Packet Processor. A module installed in an OCM Enclosure or Shelf that provides local area network bridging and routing functions.

Piggyback Card

A card that plugs into a base card. The piggyback (or plug-in card) is a separate assembly that can be tested, removed, and replaced as a unit. The task of replacing should be left in the hands of qualified technicians.

Plug-in Card

Also called a piggyback card.

RAM

Random Access Memory. Integrated circuit used to store information and software for a microprocessor. The CCM stores full-feature code in RAM. This RAM has a capacitor backup which maintains downloaded code intact for up to 48 hours with power removed.

Red Alarm

A network alarm that is produced by the receiving device to indicate that it has lost its input signal or frame alignment and is therefore out of sync, or that it has an error rate exceeding a predetermined level.

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 DCS network.

SF (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.

System

The collection of power supply, shelf/enclosure, and plug-in modules which form a OCM tail node.

0TLP

Zero - dB Transmission Level Point. A point in a telephone system picked as a reference point for signal levels. A signal level measured at 0TLP is always 0dBm0.

T1

A 1.544 Mbps digital line system. Often used to refer to the 1.544 Mbps DS1 digital signal itself.

TDM

A Time Division Multiplexer. A unit that has the ability to propagate two or more circuits of data for transmission over a shared trunk.

TMS-3000 Controller

A personal computer that is connected to the Enterprise System Control Card in a TMS-3000 node via an external connection on the Main Harness Card. 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. For TMS-4000, the controller is a Sunsparc station.

Two-wire circuit

Usually a telephone circuit consisting of two insulated electrical conductors, typical of most local loops.

VLBRV

Very Low Bit Rate Voice. A proprietary GDC voice compression algorithm.

WAN

Wide Area Network; a synchronous serial interface (i.e., a non-LAN interface).

Yellow Alarm

A network alarm that is returned to the transmitting terminal to report a loss of frame alignment (red alarm) at the receiving terminal. A yellow alarm is considered a network alarm.

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