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Tradenet MX
Technical Reference Manual 14.1

Part Number B0108800003

Release 14.1

IPC Information Systems, Inc.
777 Commerce Drive
Fairfield, CT 06432 USA

Produced by IPC Technical Publications

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IPC Information Systems, Inc.
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Fairfield, CT 06432 USA

Produced by IPC Technical Publications

IPC Information Systems, Inc., the world's leading supplier of voice trading systems to the financial community, is based in New York City and has operations in the U.S., Canada, Europe, and the Far East.

IPC Information Systems, Inc. warrants Tradenet MX to be free from defects in materials and workmanship, and that Tradenet MX, if operated properly, will perform within applicable specifications during the warranty period.

The above warranty is expressly in lieu of any other expressed or implied warranty, including any implied warranty of merchantability, and of any other obligation on the part of IPC Information Systems, Inc. IPC Information Systems, Inc. does not warrant that the equipment can be used for any particular purpose other than that covered by the applicable published specifications. IPC Information Systems, Inc. assumes no liability in any event, including negligence of IPC Information Systems, Inc., for consequential damages, for anticipated or lost profits, incidental damages, or loss of time or other losses incurred by any party in connection with equipment covered by this warranty or otherwise.

IPC Corporate Headquarters: Wall Street Plaza, 88 Pine Street, New York, NY 10005. Telephone (212) 825-9060

IPC United States Offices: Atlanta, Boston, Chicago, Cincinnati, Dallas, Los Angeles, New York, Philadelphia, and San Francisco.

IPC European Headquarters: 67-73 Worship Street, London, EC2A2DU. Telephone 011 44 171 979 7200.

IPC Asian Headquarters: 10 Charter Road, Suite 1408, Prince's Building, Central, Hong Kong. Telephone 011 852 2530 3453.

IPC International Distribution: Canada, Frankfurt, Hong Kong, London, Singapore, Tokyo, and Zurich.

Printed in U.S.A.

United States Regulatory Section

The Tradenet MX Telephone System complies with Part 68 of the FCC Rules. On the front of the equipment cabinet is a label that contains, among other information, the FCC registration number and ringer equivalence number (REN) for the equipment. The following information must be provided to the telephone company if requested.

FCC Registration No. USA: 2GKUSA-73740-KF-E and 2GKUSA-75523-MF-E

Ringer Equivalence Number (REN): 1.7B

USOC: RJ21X, RJ2DX, RJ2GX, RJ2HX, RJ48C

FIC (2 wire local switched access loop start): 02LS2

FIC (2 wire private line manual ringdown): 02AC2

FIC (2 wire private line automatic ringdown): 02LR2

FIC (4 wire private line no signalling): 04NO2

FIC (1.544 Mbs Superframe Format): 04DU9-BN

FIC (1.544 Mbs Superframe Format with B8ZS): 04DU9-DN

FIC (1.544 Mbs Extended Superframe Format with B8ZS): 04DU9-ISN

SOC: 9.0F, 6.0Y, 6.0N

Notes: Metallic pairs services might not be available from the telephone company at all locations.

The REN is used to determine the quantity of devices that can be connected to the telephone line. Excessive RENs on the telephone line can result in the devices not ringing in response to an incoming call. In most, but not all areas, the sum of the RENs should not exceed five. To be certain of the number of devices that can be connected to the line, as determined by the total RENs, contact the telephone company to determine the maximum REN for the calling area.

If the Tradenet MX System causes harm to the telephone network, the telephone company will notify you in advance that service might need to be temporarily discontinued. But if advance notice isn't practical, the telephone company will notify the customer as soon as possible. You will be advised of your right to file a complaint with the FCC if you believe it is necessary.

The telephone company can make changes in its facilities, equipment, operations, or procedures that could affect the operation of the equipment. If this happens, the telephone company will provide advance notice for you to make the necessary modifications to maintain uninterrupted service.

If trouble is experienced with the Tradenet MX Telephone System, contact IPC Information Systems, (203) 339-7800 for repair and/or warranty information. If the trouble is causing harm to the telephone network, the telephone company might ask you to remove the equipment from the network until the problem is resolved.

This equipment cannot be used on public coin service provided by the telephone company. Connection to Party Line Service is subject to state tariffs. (Contact the state public utility commission, public service commission, or corporation commission for information.)

The Tradenet MX System is hearing-aid compatible (HAC).

This equipment is capable of providing access to interstate providers of operator services through the use of equal access codes. Modifications by aggregates to alter these capabilities might be a violation of the telephone operator consumer services improvement act of 1990 and Part 68 of the FCC Rules.

This equipment complies with the requirements in Part 15 of FCC Rules for a Class A computing device. Operation of this equipment in a residential area might cause unacceptable interference to radio and TV reception, requiring the operator to take whatever steps are necessary to correct the interference.

United Kingdom Regulatory Section

This equipment complies with the EMC directive for Class A as well as the safety compliance EN60950.

Registration No. UK: NS-2666-23-M-602603

Germany Regulatory Section

This equipment complies with the EMC directive for Class A as well as the safety compliance EN60950.

Registration No.: A122500F

Canada Regulatory Section

Model Number: Tradenet MX Telephone System

Type of Equipment: Key Telephone System

Certification Number: 632 4980 A

Interface(s): LS/B/CT/D1/D1E/D2/D3/D4

Connecting Methods: CA21A/CA2GA/CA2HA/CA21A

Load Number: 16

Equipment Attachment Limitations

CP-01, Part I

Section 10.1

The Canadian Department of Communications label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational, and safety requirements. 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 connections. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions might not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility 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.

CP-01, Part I

Section 10.2

The **Load Number (LN)** assigned to each terminal device denotes the percentage to the total load to be connected to a telephone loop which is used by the device, to prevent overloading. The termination on a loop may consist of any combination of devices subject only to the requirement that the total of the Load Numbers of all the devices does not exceed 100.

Netherlands Regulatory Section

This equipment complies with the EMC directive for Class A as well as the safety compliance EN60950.

HTP No.: NL 95051101.

Switzerland Regulatory Section

BAKOM No.: 96.0737.P.N.

Contacting Systems Support Engineering

If you require technical assistance, contact your local IPC branch office or distributor. If you additional assistance, call IPC Systems Support Engineering: in the USA and Canada, dial 1-800-NEED-IPC; elsewhere, dial the North America country access code, then 203-339-7800.

Before contacting Systems Support Engineering, please have the following information available:

- *modem telephone number*—Each System Center is installed with a modem on-site so that the System Center can be remotely accessed for diagnostics and troubleshooting.
- *software release*—Systems Support Engineering will ask you what software release you are using with your Tradenet MX System. To find out the software release on a stand-alone System Center, take the following steps:
    1. At the System Center workstation, open a shell tool window.
    2. Move your mouse cursor inside the shell tool window so the window is active.
    3. Type **`ckversion`** and press ENTER. Your software version will be listed.
- *system size*—Systems Support Engineering will ask you how large your system is: Compact, Mini, half-triplet, triplet, or multi-triplet. To determine how large your system is, go into your back room where the Tradenet MX System resides and look at the cabinets. If you have one cabinet plus the short VME tower cabinet, you have a Compact or Mini system; a Compact system has one large fan at the top of the cabinet and a Mini system has fan trays between its shelves in the cabinet. If you have two cabinets plus the optional short VME tower cabinet, you have a half-triplet. If you have three cabinets plus the optional short VME tower cabinet, you have a triplet. If you have more than three cabinets, you have a multi-triplet.
- *system power*—Systems Support Engineering will ask you what type of power you are using to power your Tradenet MX System. You need to tell them whether you are using AC or DC power. If you are using AC power, you need to tell them whether you are using HC or KEPCO equipment; if you are using DC power, you need to tell them whether you are using HC or Unipower equipment.

In addition, be prepared to provide a description of the problem and what steps you took leading up to the problem.

Reader's Comments

Tradenet MX Technical Reference Manual 14.1	Release 14.1	May 1999

In a continuing effort to improve our manuals, the Technical Publications department invites all readers to use this form for submitting comments and suggestions. We appreciate your feedback.

Instructions: fill out this form, fold along the dotted lines, tape form closed, place stamp where indicated, and mail this form.

Identify any words in the manual that we used incorrectly or used instead of more suitable words.

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Provide examples of text that you misunderstood on the first reading or that you could not understand.

Indicate any terms that you could not find easily using the table of contents and index.

Indicate any illustrations that were difficult to understand (for example, blurry or small text).

Identify any concepts that would have been easier to understand with an illustration.

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What IPC training classes have you attended?

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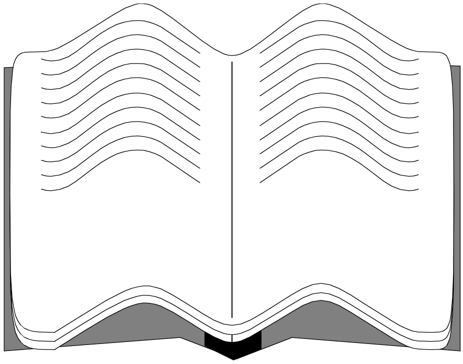


DESCRIPTION OF MANUAL

This manual is divided as follows:

- *Chapter 1 Introduction* on page 1-1—This chapter describes this manual.
- *Chapter 2 Tradenet MX System Architecture* on page 2-1—This chapter describes the architecture of the Tradenet MX System.
- *Chapter 3 System Power* on page 3-1—This chapter describes the power requirements of the Tradenet MX System.
- *Chapter 4 Specifications* on page 4-1—This chapter describes the specifications of the Tradenet MX System.
- *Chapter 5 Cabinets and Shelves* on page 5-1—This chapter describes the cabinets and shelves (back room equipment) used in the Tradenet MX System.
- *Chapter 6 Cards* on page 6-1—This chapter describes the cards (back room equipment) used in the Tradenet MX System.
- *Chapter 7 Miscellaneous Equipment* on page 7-1—This chapter describes some of the miscellaneous equipment used with the Tradenet MX System, including protocol converters, Open Call servers, power supply status boards, ring generators, and distribution panels.
- *Chapter 8 Station Equipment* on page 8-1—This chapter describes the station equipment, or trader equipment, you can use with the Tradenet MX System.

AUDIENCE

This document is intended for system managers of the Tradenet MX System (such as site administrators), IPC field personnel (installers and Systems Support Engineering), and IPC technical sales support.

REFERENCES

For more information about the Tradenet MX System, refer to the *Tradenet MX System Center Manual 14.1* (part number B0086185104) and the *Tradenet MX Platform User Manual 14.1* (part number B0087686104). Release Notes for the particular software version you have are also helpful.

NOTES, CAUTIONS, AND WARNINGS

Notes, cautions, and warnings are included in this document. They have been designed to provide useful information or to help direct your attention to specific text or required action.

Note *Notes highlight information to which you should pay special attention. The note will often significantly qualify previously presented procedures or descriptions.*

Caution **A caution tells you about something that could have unpredictable results. Cautions indicate unexpected behavior or something of which you might not otherwise be aware.**

Warning! ***Warnings indicate there is a possibility of input error, database damage, or serious process interruption.***

DEFINITION OF TERMS

2B+D	2B+D is the basic rate interface (BRI) in an integrated services digital network (ISDN). A single ISDN circuit is divided into two 64 kpbs digital channels for voice or data and one 16 kbps channel for low-speed data (up to 9600 baud) and signaling. Depending on the interface, the BRI is carried on one or two pairs of wire.

AC backup	During an AC power failure, the System Center fails unless powered by some form of un-interruptible power supply (UPS) system. If the System Center is powered from the DC-powered UPS system on site (and not by some other separate UPS system on the AC power line), an inverter is required to provide 120 voice activity compression (VAC) for these devices. If other AC-powered equipment is to be protected from AC power failure by this UPS system (for example, a Dictaphone system), then the voice activity requirements should be specified. Inverter loss must be included for all AC loads.
ALIC	The analog line interface card (ALIC), also called a common battery or a Figure 1 card, provides the interface between common battery or dialtone lines and the Tradenet MX System.
API	The application programming interface (API) is software used by an application program to request and carry out lower-level services performed by the operating system of either the computer or the telephone system. It is a set of standard software interrupts, calls, and data formats that initiate contact with network services, mainframe communications programs, telephone equipment, or program-to-program communications. Common APIs include NetBIOS, Berkeley Sockets, and Named Pipes.
ASIC	An application specific integrated circuit (ASIC), also known as a gate array, is a chip that has been designed for a specific application. It is often used to consolidate many chips into a single package, reducing board size and power requirements.
ATIC	The analog turret interface card (ATIC) provides the interface between the Tradenet analog turret and the Tradenet MX System.
ATM	Asynchronous transfer mode (ATM) is a high bandwidth, low-delay, packet-like switching and multiplexing transfer mode in which the information is organized into cells. It is asynchronous in the sense that cell recurrence containing information from an individual user is not necessarily periodic. The International Telecommunications Union (ITU) has selected ATM as the basis for the future broadband network in view of its flexibility and suitability for both switching and transmission. ATM allocates bandwidth on demand, making it suitable for high-speed transmission of voice, data, and video services. ATM services will be available at access speeds up to 622 mbps.
BABT	The British Approvals Board for Telecommunications (BABT) is analogous to the Federal Communications Commission (FCC) in the United States.
Balun	An impedance matching transformer the converts the impedance of a coaxial cable to that of a twisted pair. Stands for BALanced/UNbalanced.
Bandwidth	Bandwidth is the range of electrical frequencies a device can handle; also used to describe the capacity to move information. Bandwidth capacity determines the type of services that can be carried. For example, a wide band circuit that can provide one video channel can also provide 1,200 telephone voice channels.
Battery service disconnect	Using the battery service disconnect option on your un-interruptible power supply (UPS), you can disconnect your UPS from the MX System for routine service. This avoids the possibility of an inadvertent short-circuit during battery system service or cell replacement. Such a short circuit would probably not damage the MX System but might cause unpredictable results, such as card resets or dropped calls.

BRI	Basic rate interface (BRI) is one of the two subscriber interfaces in ISDN, containing two bearer B-channels at 64 kbps and one data D-channel at 16 kbps. The bearer channels are designed for pulse code modulation (PCM) voice, video conferencing, group-4 facsimile machines, and so on. The data D-channel is used to access slow-speed data networks (like videotex and packet switched networks), as well as bringing in information about incoming calls and taking out information about outgoing calls. See the definitions of ISDN and PCM.
BRIC	The basic rate interface card (BRIC) provides the interface between Tradenet MX digital turrets or TradePhone MX and the MX System.
BSIC	The basic speaker interface card (BSIC) provides the interface between the Tradenet MX digital turret with speaker modules and the MX System. The BSIC is a BRIC with a digital speaker daughter board (DSBD).
Call Forward (Call Divert)	Call forward (call divert) is a feature that allows incoming calls to be sent to a destination other than the one dialed. Stations in the Tradenet MX System are capable of: • no call forwarding • immediate call forwarding • call forwarding on ring no answer using a system wide timer • call forwarding on busy using a system wide timer
Caller ID	The caller ID feature uses the calling line identity (CLI) from the central office (CO) to display the number of the calling party.
CCFL	IPC uses cold cathode fluorescent lamp (CCFL) technology to light the liquid crystal display (LCD) on the Tradenet MX digital turret.
CCITT	The Comite Consultatif Internationale de Telegraphique et Telephonique (CCITT), or Consultative Committee on International Telegraphy and Telephony, is one of the four permanent parts of the International Telecommunications Union (ITU), which is based in Geneva Switzerland.
CEMF panel	The CEMF panel is required for earlier analog turrets.
CEPT	The Conference des administrations Europeenes des Postes et Telecommunications, or European Conference of Postal and Telecommunications Administrations (CEPT), is the standard setting body whose membership includes European Post, Telephone, and Telegraphy Authorities (PTTs).
Channel bank	A channel bank is a multiplexer that sits between a digital circuit and up to 24 voice-grade lines coming out of a PBX; it puts many slow-speed voice or data conversations onto one high-speed line and controls the flow of those conversations. One side of the channel bank is connections for terminating two pairs of wires or a coaxial cable—those bringing in the T-1 carrier. On the other side are connections for terminating multiple, tip-and-ring, single-line, and analog phone lines.
CLI	With calling line identity (CLI), a number is passed from the central office (CO) to the receiving end that identifies the calling party. CLI enhanced routing identifies the line, channel, and/or extension from where the call originated. CLI is often referred to as caller ID.

CSU	A channel service unit (CSU) is a device used to terminate a digital channel (T-1 or switched 56) on a customer's premises. It performs certain line-conditioning and equalization functions, and responds to loopback commands sent from the central office. A CSU sits between the digital line coming in from the central office and devices such as channel banks or data communications devices. It regenerates digital signals, monitors them for problems, and provides a way of testing the digital circuit.
CODEC	COder-DECoder (CODEC) equipment converts voice signals from their analog form to digital signals acceptable to more modern digital PBXs and digital transmission systems. It then converts those digital signals back to analog so that you can hear and understand what the other party is saying.
CPIC	The CEPT/Primary ISDN interface card (CPIC) provides the interface between European E-1 wires, which have 30 channels, and the MX System.
Current	The total DC current (@48 V DC) for the MX System can be calculated from the power in watts. That is, $\text{amps} = \frac{\text{watts}}{48\text{V}}$.
D1, D1D, D2, D3, D4, and D5	These are the T-1 framing formats developed for channel banks. All formats contain a framing bit in every 193rd bit position. The Superframe (introduced in D2 channel banks) is made up of twelve 193-bit frames, with the 193rd bit sequence being repeated every 12 frames. D2 framing also introduced *robbed bit signaling*, where the eighth bit in frames 6 and 12 were *robbed* for signaling information (like dial pulses). D1D was introduced after D2 to allow backwards compatibility of Superframe concepts to D1 banks.
D3 Format	The D3 Format is a standard (North American) T1/D3 span line containing 24 data channels; each data channel is 8-bits wide and has a bandwidth of 8Khz. See the definition of DS-1.
D4 Format I	The D4 Format I is the fourth-generation channel bank in T-1 digital transmission technology. See the definition of channel bank.
D4 Framing	D4 Framing is the most popular framing format in the T1 environment. The D-4 framing bit is used to identify both the channel and the signaling frame.
DASS2	Digital access signaling (DASS2) is a message-based signaling system following the ISO-based model developed by British Telecom (BT) to provide multi-line integrated digital access (IDA) interconnections to the BT network.
DC (other than 48 V DC) backup	If any other equipment that operates on a DC voltage potential other than 48 V DC needs to be protected (for example, an analog FTS requires 12 V DC), then its voltage and current requirements should be specified, along with the conversion loss from 48 V DC to the required voltage. Where this loss is not known, double the required wattage to estimate the load on the UPS.
DDI	Direct dialing inward (DDI) is a British term that describes a service where an external or internal call arrives directly at an extension without the intervention of an operator.
Digital	Digital refers to the use of a binary code to represent information in telecommunications, recording, or computing. Analog signals like voice or music are encoded digitally by sampling the voice of music analog signal many times a second and assigning a number to each sample. Recording or transmitting information digitally has two major benefits. First, the signal can be reproduced

precisely. In a long telecommunications transmission circuit, the signal progressively loses its strength and progressively picks up distortions, static, and other electrical interference noises. See the definition of PCM.

Digital meter panel	Using the digital meter panel option on your UPS, you can read voltage and current on the UPS system without using a digital multi-meter. Even with this option, you still need to voltage test at key locations in the Tradenet MX System cabinets.
DLIC	The digital line interface card (DLIC) provides the interface between T-1 circuits and the MX System.
DPNSS	Digital private network signaling system (DPNSS) is a standard in Britain that enables PBXs from different manufacturers to be tied together with E-1 lines and pass calls transparently between each—as easily as if the phones were extensions off the same PBX and were making intercom calls. The international version of DPNSS is called Q.SIG.
DS-0	Digital service, level 0, is 64,000 bps, the world standard speed for digitizing one voice conversation using pulse code modulation (PCM).
DS-1	Digital service, level 1, is 1.544 mbps in North America, 2.048 mbps elsewhere. The 1.544 standard is an old Bell Systems standard. The 2.048 standard is a CCITT standard. The standard for 1.544 mbps is 24 voice conversations each encoded at 64 kbps. The standard for 2.048 mbps is 30 conversations. DS-1 is also called T-1. See the definition of T-1.
DS-1C	Digital service, level 1C (DS-1C), is 3.152 mbps in North America and is carried on T-1.
DS-2	Digital service, level 2 (DS-2), is 6.312 mbps in North America and is carried on T-2.
DS-3	Digital service, level 3 (DS-3), is the equivalent of 28 T-1 channels and operates at 44.736 mbps. DS-3 is also called T-3.
DS-4	Digital service, level 4 (DS-4), operates at 274.176 mbps. It is the equivalent of 168 T-1 channels or 4032 standard voice channels.
DSDB	A digital speaker daughter board (DSDB) is a daughter board that plugs onto a BRIC to allow the use of digital speakers with a digital turret.
DSP	A digital signal processor (DSP) is a specialized computer chip designed to perform speedy and complex operations on digitized waveforms, useful in processing sound and video. DSPs are used extensively in telecommunications for tasks such as echo cancellation, call progress monitoring, voice processing, and for the compression of voice and video signals.
DTP	Dual talk path (DTP) indicates two handsets on a turret or keyset.
DXIC	The digital cross connect card (DXIC) optimizes the configuration of the E1 links that connect STICs with digital recording devices. The DXIC concentrates outputs from STICs so that each E1 link that terminates at a recording device is used to its maximum capacity.
E-1	E-1 is the European equivalent of the North American 1.544 mbps T-1, except that E-1 carries information at the rate of 2.048 mbps. This is the rate used by European CEPT carriers to transmit thirty 64 kbps digital channels for voice or data calls, plus a 64 kbps channel for signaling, and a 64 kbps channel for framing

	(synchronization) and maintenance. Because robbed bit signaling is not used (as it is for T-1 in North America) all eight bits per channel are used to code the waveshape sample.
E2	E2 is the data signal that carries four multiplexed E-1 signals. An effective data rate is 8.448 mbps.
E3 CEPT	E3 CEPT is a signal that carries 16 CEPT E-1s and overhead. An effective data rate is 34.368 mbps.
EMI	Electromagnetic interference (EMI) is leakage of radiation from a transmission medium due to high-frequency energy.
Erlang	An Erlang is a measurement of telephone traffic. One Erlang is equal to one full hour of use (for example, conversations), or $60 \times 60 = 3600$ seconds of phone conversation. $1\mathrm{Erlang} = \frac{\mathrm{CCS \ x\ 100}}{3600}$. Erlang is named for the father of queuing theory, A.K. Erlang, a Danish telephone engineer who, in 1908, began to study congestion in the telephone service of the Copenhagen Telephone Company. A few years later he arrived at a mathematical approach to assist in designing the size of telephone switches.
ESD	Electro-static discharge (ESD) is the discharge of a static charge on a surface or body through a conductive path to ground. ESD can be damaging to integrated circuits.
ESF	Extended Super Frame (ESF) is a T-1 format that uses the 193rd bit as a framing bit. ESF provides frame synchronization, cyclic redundancy checking, and data link bits. Frames consist of 24 bits instead of the previous standard 12 bits as in the D4 format. The standard allows error information to be stored and retrieved easily, facilitating network performance monitoring and maintenance.
Ethernet	Ethernet is a local area network used for connecting computers, printers, workstations, terminals, and so on, within the same building. Ethernet operates over twisted wire and over coaxial cable at speeds up to 10 mbps.
EuroISDN	European integrated services digital network (EuroISDN) is the European version of public ISDN.
FCCC	A fiber cable connection card (FCCC) is used in the MX System to connect two or more triplets together when using fiber cables.
FLIC	A four-wire line interface card (FLIC) is used to interface to four-wire circuits in the MX System.
Fractional T-1	Fractional T-1 refers to any data transmission rate between 56 kbps (DSO rate) and 1.544 megabits per second (mbps), which is a full T-1. Fractional T-1 is a digital line that is not as fast as a T-1. Fractional T-1 is popular because it is typically provided by a phone company (local or long distance) for less money than a full T-1. Fractional T-1s are typically used for LAN interconnection, video conferencing, high-speed mainframe connection, and computer imaging. Fractional T-1 is typically provided on four-wire (two pairs) copper circuits.
Hours of battery service	Hours of battery service refers to the length of time that the customer specifies they must be able to operate the MX System after a commercial power failure.

IPIC

The TradePhone MX interface card (IPIC) is used to interface the TradePhone MX to the MX System. The IPIC is a BRIC with a different software load (IPIP). The IPIC can support up to 10 TradePhone MX keysets (6 with a single DSP BRIC).

ISDN

Integrated services digital network (ISDN) is the new concept of what the world's public telephone system should be. ISDN's vision is to overcome the limitations of the public switched phone network in four ways:

- by providing an internationally accepted standard for voice, data and signaling
- by making all transmission circuits end-to-end digital
- by adopting a standard out-of-band signaling system
- by bringing significantly more bandwidth to the desk top

An ISDN central office delivers four basic ISDN services to the user's office or factory. These services are also called interfaces.

- *The 2B+D S interface (also called the T interface).* The 2B+D is called the basic rate interface (BRI). The S interface uses four unshielded normal telephone wires (two twisted wire pairs) to deliver two *bearer* 64 kbps channels and one *data* signaling channel of 16 kbps. Each of the two 64 kbps bearer or B channels can be used to carry a voice conversation, one high speed data, or several data channels, which are multiplexed into one 64 kbps high speed data line. The D channel of 16 kbps carries control and signaling information to set up and break down the voice and data calls. The D channel can also carry data up to 9600 bits per second in addition to the control and signaling information. Signaling and control on the D channel conforms to a protocol (LAPD) and a messaging structure (Q.931). These two allow intelligent endpoints and switching nodes from different vendors to talk a common language and thus be able to transfer features across a network from one switch to another.
- *The 2B+D U interface.* This U interface delivers the same two 64 kbps bearer channels and one 16 kbps data channel, except that it uses two wires (one pair) and can work at 5–10 kilometers from the central office switch driving it. The U interface is the most common ISDN interface.
- *The 23B+D or 30B+D interface, or primary rate interface (PRI).* At 23B+D, it is 1.544 mbps, which is the standard T-1 line in the US that operates on two pairs. At 30B+D, it is 2.048 mbps, which is the standard E-1 line in Europe, which also operates on two pairs.
- *A standard single line analog phone.*

Tradenet MX digital turrets communicate with the back room over an industry standard S reference point ISDN basic rate interface as follows: analog to digital coding takes place at a sample rate of 8 kilohertz, forming a 64 kilobit-per-second (kbps) data stream. The outgoing data, consisting of two such 64 kbps B channels (used in the MX System for dual handsets) and a 16 kbps signalling D channel, is combined with 48 kbps of control to form the outgoing 19.2 kbps stream. CCITT, an international telephone regulatory group, defines this type of ISDN basic rate interface as the S reference point. This is carried back to the basic rate interface card (BRIC) in the terminal unit (TU) or terminal shelf. Other vender's S reference point-compatible equipment can also be connected to a BRIC.

ISIC	The ISDN station interface card (ISIC) is used to interface standard AT&T ISDN keysets to the MX System. The ISIC is a BRIC with a different software load (ISIP).
LAC	A logical address code (LAC) is a unique number used to identify lines, stations, and cards in the MX System.
Latch time	Latch time is measured from when you push a button until you are connected.
LCN	A logical channel number (LCN) is used for circuit identification for digital lines; T-1 and E-1 in the MX System. LCN always starts with channel zero.
Line Networking	If you are using the line networking feature, you can access remote Tradenet MX sites. Up to 97 sites can be included in a Tradenet MX network.
MAC	Moves, adds, and changes (MAC) are performed by a System Center administrator to maintain the MX System.
MDF	The main distribution frame (MDF) is a wiring arrangement that connects the telephone lines coming from outside to one side and the internal lines on the other. A main distribution frame can also carry protective devices as well as function as a central testing point.
Menu	A menu indicates a group of lines used with a particular group of Series II or Tradenet (analog) turrets.
MSIC	A multiple speaker interface card (MSIC) is a Tradenet MX interface card that provides a digital output link which is used for remote speaker applications. The MSIC is a line card type which installs in a conventional terminal shelf (TU). the MSIC provides up to five digital links, each having 24 audio channels. The MSIC can provide up to 84 individual speaker channels.
Network	Computer networks connect all types of computers and computer related things—terminals, printers, modems, door entry sensors, temperature monitors, and so on. The networks we are most familiar with are long distance ones, like telephones and trains. But there are also local area networks (LAN) that exist within a limited geographic area, such as a few hundred feet of a small office, and entire buildings or even a campus, such as a university or industrial park. There are also metropolitan area networks (MAN).
NLBC	The network loopback card (NLBC) is used in large MX Systems of two or more triplets to connect the section shelf to the reflection shelf. Each connection requires two cards and two cables.
North American PRI	North American primary rate interface (NA PRI) is the North American version of public ISDN. At 23B+D, it is 1.544 mbps, which is the standard T-1 line in the US that operates on two pairs.
Number of branch circuits	The number of branch circuits is determined by adding the number of power supply shelves and TU cabinets in the system because *each power supply shelf and each TU cabinet* is protected with its own circuit breaker.
ORE	Order receiving equipment (ORE) is used to indicate a group of lines used with a particular group of Series I turrets.
PCD	A Paper Copy Display (PCD), or fixed page, module has labels printed on paper and then placed onto the module.

PCM

Pulse code modulation (PCM) is the most common method of encoding an analog voice signal into a digital bit stream. First, the amplitude of the voice conversation is sampled. This is called pulse amplitude modulation (PAM). This PAM sample is then coded (quantized) into a binary (digital) number. This digital number consists of zeros and ones. The voice signal can then be switched, transmitted, and stored digitally. These are the three basic advantages of digital switching and transmission.

- It is less expensive to switch and transmit a digital signal than an analog signal.
- By making an analog voice signal into a digital signal, you can interleave it with other digital signals—such as those from computers or facsimile machines.
- A voice signal that is switched and transmitted ene-to-end in a digital format will usually come through cleaner (it will have less noise) than one transmitted and switched in an analog format.

PCM refers to a technique of digitalization. It does not refer to a universally accepted standard of digitizing voice. The most common PCM method is to sample a voice conversation at 8000 times a second. The theory is that if the sampling is at least twice the highest frequency on the channel, then the result sounds okay. Thus, the highest frequency on a voice phone line is 4,000 hertz and it must be sampled at 8,000 times a second. In North America the most typical channel is called the T-1. It places 24 voice conversations on two pairs of copper wires (one for receiving and one for transmitting). It contains 8000 frames each of 8 bits of 24 voice channels plus one framing (synchronizing) bit that equals 1.544 mbps.

PLAR

Private line automatic ringdown (PLAR) is the leased voice circuit that connects two single instruments together. When either handset is lifted, the other instrument automatically rings.

PLIC

The private line interface card (PLIC) is used in the MX System to interface to manual ringdowns.

PRI

Primary rate interface (PRI) is the ISDN equivalent of a T-1 circuit. The PRI provides 23B+D (in North America) or 30B+D (in Europe) running at 1.544 mbps and 2.048 mbps, respectively.

PTT

Post Telephone & Telegraph (PTT) organizations are usually controlled by their governments and provide telephone and telecommunications services in most foreign countries. In ITU-T documents, these are the administrations referred to as *Operating Administrations*. The term *Operating Administrations* also refers to *Private Recognized Operating Agencies* that are the private companies that provide communications services in those very few countries that allow private ownership of telecommunications equipment.

Q.931

Q.931 is the powerful message-oriented signaling protocol in the PRI ISDN D-channel. It is also referred to as ITU-T Recommendation 1.451. This protocol describes what goes into a signaling packet and defines the message type and content. Specifically, Q.931 provides:

- call setup and take down
- called party number, with type of number indication (private or public)

- calling party number information (including privacy and authenticity indicators)
- bearer capability to distinguish, for example, voice versus data for compatibility check between terminals
- status checking for recovery from abnormal events, such as protocol failures or the manual busying of trunks
- release of B-channels and the application of tones and/or announcements in the origination switch upon encountering errors

QSIC

A QSIG interface card (QSIC) is a CPIC with a different software load (QSIP). The QSIC provides the interface between a PBX using the QSIG protocol and the MX System.

QSIG

QSIG is intended to be a global signaling and control standard for use in private ISDN networks. Multiple vendors can design and manufacture private integrated network exchange (PINX) equipment that can be integrated with other vendor equipment using the QSIG standard. QSIG provides:

- a multi-vendor standard that allows individual vendors to provide special features
- independence from a single vendor
- a platform for future growth
- synergy with public ISDN

Rectifier redundancy

This factor should be the same as the MX System redundancy. This is $N + 1$ for all equipment except triplets; triplets can have $N + 2$ redundancy.

RISC

Reduced instruction set computer (RISC) refers to a computer based on an unusual high speed processing technology that uses a simple set of operating commands. These commands greatly speed a computer’s performance, especially for calculation-intensive operations such as those performed by scientists and computer-aided design (CAD) and computer-aided manufacture (CAM) engineers. RISC is a design that achieves high performance by doing the most common computer operations very quickly. In contrast, the microprocessors used in most PCs are based on a design called complex instruction set computing (CISC). CISC does not execute instructions as quickly as RISC but it has more commands and accomplishes more with each command. Programs written for RISC are typically not compatible with those written for CISC processors. RISC is the prevailing technology for workstations today.

RJ45C

RJ45C refers to single-line, 4-wire, T/R, T1/R1, 1.544 mbps, 8 position. In the MX System, the RJ daughter board has nine RJ45C connectors, which are what the T-1s plug in to.

S2IC

The Series II interworking card (S2IC) is used in the MX System to interface to a Series II or Tradenet System.

SCAC

The System Center access card (SCAC) provides termination for the System Center to the MX network. This card is always located in cabinet 1, shelf 1, slot 14 (1:1:14).

SCGC

The System Center gateway card (SCGC) is located in the VME tower.

SCSI	The small computer system interface (SCSI) is the brain of a computer in its microprocessor. That microprocessor does the computer's primary work. There must be a way for information to get in to and out of the microprocessor. SCSI is a way for a device, such as magnetic hard drives, optical disk drives, tape drives, CD-ROM drives, printers, and scanners to communicate with the computer's main processor. SCSI is a bus and interface standard.
SCSI-2	The small computer system interface 2 (SCSI-2) is a 16-bit implementation of the 8-bit SCSI bus. Using a superset of the SCSI commands, the SCSI-2 maintains downward compatibility with other standard SCSI devices while improving upon reliability and data throughput. SCSI-2 is capable of transferring data at rates up to 10 megabytes per second, twice as fast as the original SCSI. SCSI-2 defines more than a speed. It defines a command set and electrical characteristics.
SELC	The switch element card (SELC) is the basic building block for the network in the MX System.
Site ID	If you are using the line networking feature, you can access remote Tradenet MX sites. Each site has its own unique, two-digit site ID.
SNIC	A SNIC is a STIC without the recording option.
SNMP	The simple network management protocol (SNMP) is a standard protocol used to monitor network activity on *agent* nodes from management stations. In 1988, the Department of Defense and commercial transmission control protocol/internet protocol (TCP/IP) implementors designed a network management architecture for the needs of the average Internet (a collection of disparate networks joined together with bridges or routers). Although SNMP was designed as the TCP's stack network management protocol, it can now manage virtually any network type and has been extended to include non-TCP devices such as 802.1 Ethernet bridges. SNMP is widely deployed in TCP/IP networks, but actual transport independence means it is not limited to TCP/IP. SNMP has been implemented over Ethernet as well as open systems interconnection (OSI) transports. SNMP became a TCP/IP standard protocol in May 1990. SNMP operates on top of the internet protocol, and is similar in concept to IBM's NetView and ISO's CMIP.
SPARC	The SPARC is a proprietary RISC microprocessor designed and marketed by Sun Microsystems and included in all Sun SPARCstations.
SQL	Structured Query Language (SQL) was invented by IBM. SQL is a powerful database language used for creating, maintaining, and viewing database data. It is becoming somewhat of a standard in the mainframe and minicomputer world, and it is on its way to becoming a PC standard. When it is a fully accepted standard, different computer systems running different database management systems will easily be able to communicate and exchange data with each other by trading SQL commands. SQL is commonly used with database servers, that is, those running on a local area network. There is now an ANSI standard SQL definition for all computer systems. The largest purveyors of SQL databases are Gupta, Informix, Microsoft, Powersoft, Oracle, and Sybase.
SSLC	The section shelf loopback card (SSLC) is used in the MX System to connect or loop back cabinet #1 to cabinet #3. This card is used only when there are 6–10 terminal shelves, or terminal units (TU). Cards install in the back of the section shelf, also called the section loopback shelf.

STIC — The station interface card (STIC) offers increased speaker capacity and enhanced digital recording. The STIC provides expanded speaker-to-line connections for up to 64 speaker channels, in addition to 20 handset channels, for a total of 84 channels.

SycAp — The System Center Application (SycAp) software includes an Informix relational database.

T Carrier — T carrier is the generic name for any of several digitally multiplexed carrier systems. The designators for T carrier in the North American digital hierarchies correspond to the designators for the digital signal (DS) level hierarchy. T carrier systems were originally designed to transmit digitized voice signals. Current applications also include digital data transmission. The table below lists the designators and rates for current T carrier systems.

TABLE 1-1 T Carrier Systems

North American Designator (DC Level)	T1 (DS 1)	1.544 mbps	24 voice channels
	T1C	3.152 mbps	48 voice channels
	T2 (DS 2)	6.312 mbps	96 voice channels
	T3 (DS 3)	44.736 mbps	672 voice channels
	T4 (DS 4)	274.176 mbps	4032 voice channels
Japanese Hierarchy	DS 1	1.544 mbps	24 voice channels
	DS 2	6.312 mbps	96 voice channels
	DS 3	32.064 mbps	480 voice channels
	DS 4	97.728 mbps	1440 voice channels
	DS 5	400.352 mbps	5760 voice channels
European Hierarchy	DS 1	2.048 mbps	30 voice channels
	DS 2	8.448 mbps	120 voice channels
	DS 3	34.368 mbps	480 voice channels
	DS 4	139.268 mbps	1920 voice channels
	DS 5	565.148 mbps	7680 voice channels

T-1 — T-1 is a digital transmission link with a capacity of 1.544 mbps. T-1 uses two pairs of normal twisted wires. T-1 normally can handle 24 voice conversations, each one digitized at 64 kbps.

UNIX — Unix is an immensely powerful and complex operating system for computers for running data processing and for running telephone systems. Unix provides multi-tasking, multi-user capabilities that allow both multiple programs to be run simultaneously and multiple users to use a single computer. On a single-user system, such as MS-DOS, only one person at a time, on an individual task basis, can use a computer’s files, programs, and other resources. Unix works on many different computers. This means you can often take applications software that runs on Unix and move it—with few changes—to a bigger, different computer, or to a smaller computer. This process of moving programs to other computers is known as porting. Today, the Unix operating system is available on a wide range of hardware, from small personal computers to the most powerful mainframes, from a multitude of hardware and software vendors.

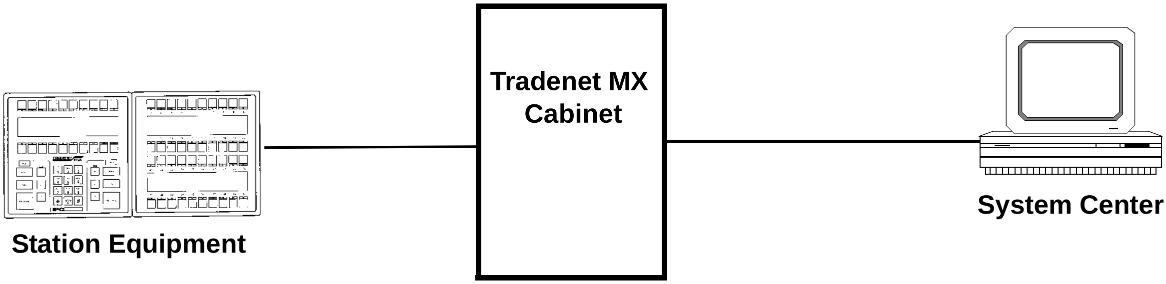
Voice Mail Notification
Using the customers voice mail system, and the infinite ring feature of the Tradenet MX, traders can be notified when they have a voice mail message. The customer can retrieve a message by pressing the Voice Mail Notification button on his turret when it is displaying ring lamping.

VME
Versa Module-Europa (VME) is a 1–21 slot, mechanical, and electrical bus standard originally developed by the Munich, Germany division of Motorola in the late 1970s. VME uses most of the bus structure from then current Motorola’s VersaBus board standard along with the newly developed DIN 41612 standard pin-in-socket connector for enhanced reliability. After years of work, VME was finally adopted by the ANSI/IEEE in 1987. VME is known in Europe as the IEC 821 bus. This makes it an open standard. The VME backplane runs at 80 mbytes per second. It is the most common bus on computers larger than the PC.

VPL
A virtual private line (VPL) is a software-defined line that offers the appearance of a dedicated private line. A VPL allows an incoming DDI (DID) call to be matched to a registered CLI and sent to a specific extension.

Watts
Watts is the total 48 V DC power for the Tradenet MX System. Power for any equipment that does not run directly on 48 V DC (that is, System Center, Dictaphone, analog FTS, and so on) should not be included in this figure. When this equipment is run from an inverter that *is* connected to the 48 V DC bus, then the inverter’s full load draw must be included.

Chapter 2 Tradenet MX System Architecture



INTRODUCTION TO THE TRADENET MX SYSTEM

Trading floors have unique system requirements that cannot be met by standard key systems or by PBX architectures. Financial institutions require significantly higher call throughput (foreign exchange applications can approach two calls per second per trader) and shorter call *latching times*[1]. These features cannot be provided by general business telecommunication equipment.

The IPC Tradenet MX turret and speaker communication system meets this market's demand for faster and more efficient communication. Integral interface capabilities allow an existing site with IPC equipment to be upgraded with Tradenet MX.

Tradenet MX turrets are reliable, high density telephones designed for the trading environment of the financial community. However, the Tradenet MX (Media Exchange) System is applicable to any situation with heavy traffic and a high line-to-station ratio requirement where you need many line appearances on the user's station equipment.

The Tradenet MX turret and speaker communication system allows traders universal line access to any line in the system. That is, any line (either analog or digital) can appear on any turret in the Tradenet MX System. The Tradenet MX System has a fully-distributed, fault-tolerant, mesh architecture featuring powerful processing, switching, and bandwidth capabilities.

With advanced digital switching and custom software, the MX System provides a platform for the future integration of various communication media, such as voice, data, and video, as well as other emerging technologies, like ISDN and ATM. The Tradenet MX hardware handles line and station interfaces and the system software controls call processing, features, and functions. Enhancements to Tradenet MX features are delivered through software upgrades from the System Center (the MX administrative device).

The unique Tradenet MX architecture provides:

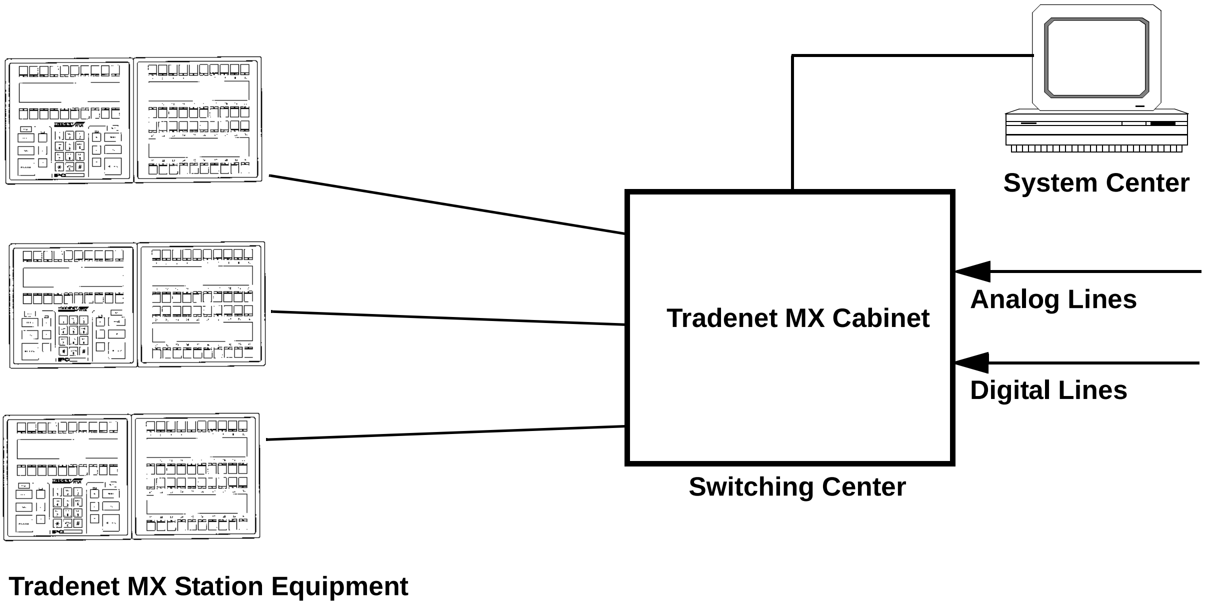
- a fault-tolerant, mesh network that ensures that the system can withstand up to two failures without loss of any service, providing $N + 2$ redundancy
- a reliable, non-blocking, high speed network with a large number of interconnection paths through which voice and data can be routed
- the ability to interface efficiently with existing IPC equipment as well as with other vender's equipment
- the distribution of processors onto all system cards providing tremendous parallel computing power, allowing the Tradenet MX System to establish multiple calls simultaneously
- the computing horsepower (25 million instructions per second, MIPS, per card) capable of meeting today's requirements and future applications, such as ISDN and video communications
- processing power that increases proportionally with system size
- the capacity to grow and provide universal line access without expanding the switch proportions geometrically
- virtually unlimited growth without compromising performance or functionality
- an extremely high bandwidth, designed specifically for voice/data integration and ISDN applications

The Tradenet MX System main components are defined as:

- station equipment
- switching center back room equipment
- System Center

1. Latch time is the period of time required to process a call through a switching architecture between button press and line seizure. A slow latch time results in voice clipping during fast trading. The Tradenet MX System provides a fast latch time of 80 ms.

FIGURE 2-1 Tradenet MX Functional Areas



The *station equipment* is defined as all compatible IPC user equipment found on the trading floor. This includes digital and analog turrets, digital speakers modules, Flexible Trading Speaker (FTS) modules used with analog turrets, and handsets. ISDN telephone sets that are not usually located on the trading floor, but in trader's offices, are included. The non-IPC supplemental equipment compatible with the MX System, such as recording equipment and intercoms, can also be defined as station equipment. For more information about station equipment, see *Chapter 8 Station Equipment* on page 8-1.

The *switching center back room equipment* includes MX cabinets, shelves, distribution panels, power supplies, and cards. For more information about the Tradenet MX cabinets and other back room equipment, see *Chapter 5 Cabinets and Shelves* on page 5-1.

The System Center is the administrative terminal used by the on-site system administrator of the MX System. The System Center consists of the following elements:

- the Sun workstation
- the operating system
- the MX System Center Application software (SycAp) including an Informix relational database and Wingz spreadsheet application
- the customer database

Note *Tradenet MX Release 11.2 and later is year 2000 compliant.*

For more information about the Tradenet MX System software, refer to the *Tradenet MX System Center Manual 14.1* (part number B0086185104).

Other components of the Tradenet MX System include its interface connections to the public telephone network and other telephone system equipment. These connections include, but are not limited to:

- public telephone network lines
- manual ringdown lines
- digital telephone lines (T1/E1)

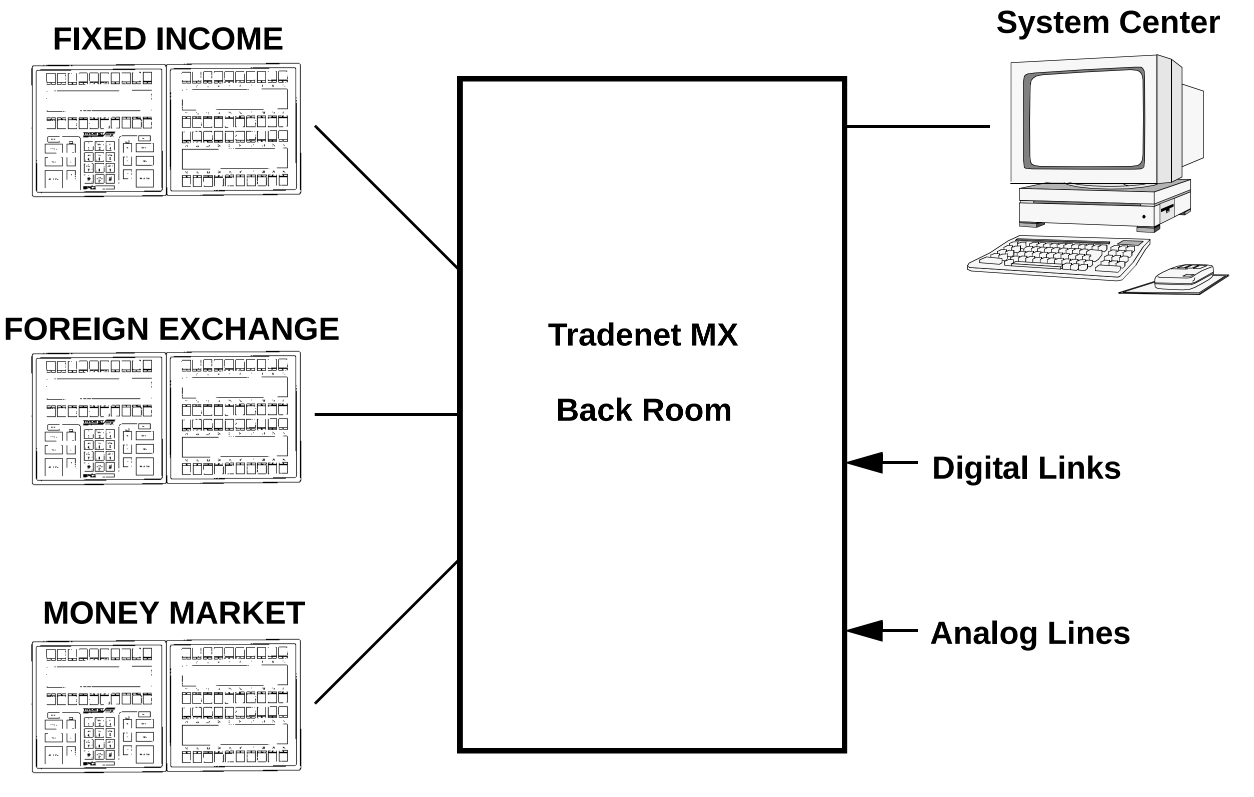
- four-wire lines (hoot lines)
- interconnection with other IPC telephone equipment
- interconnection with other telephone system equipment

BENEFITS OF THE TRADENET MX SYSTEM

To meet the trading environment's performance and functional requirements, the Tradenet MX System was designed to provide the following major benefits.

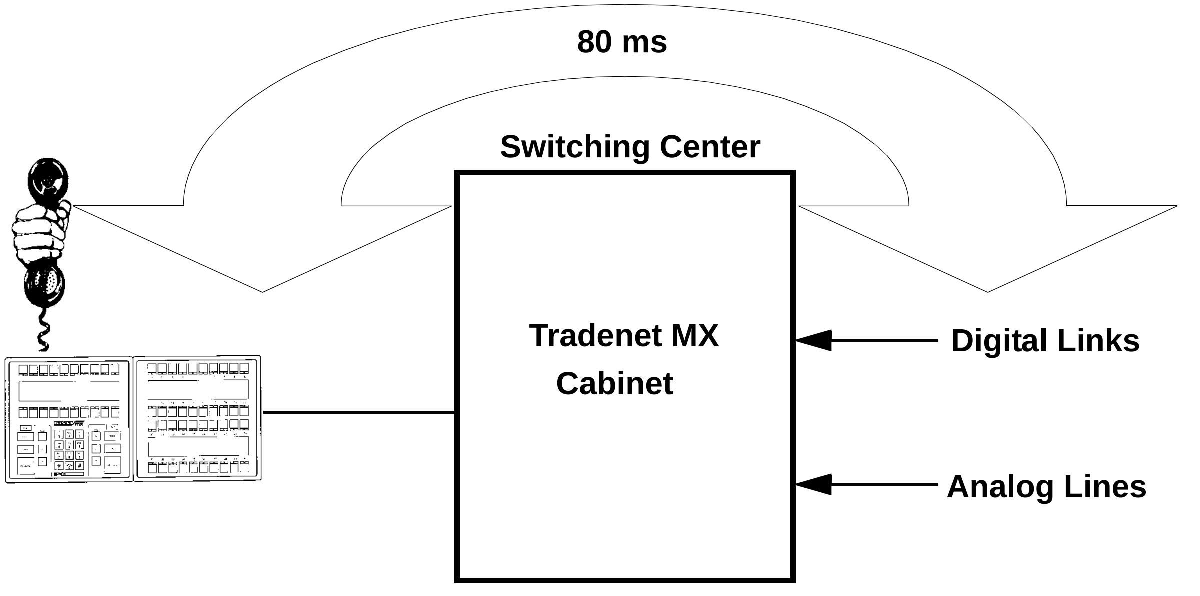
Universal Line Access—*All* lines (analog and digital) are accessible from *all* turrets regardless of system size, thus eliminating line access limitations, such as OREs (Series I) or menus (Series II/Tradenet).

FIGURE 2-2 Universal Line Access



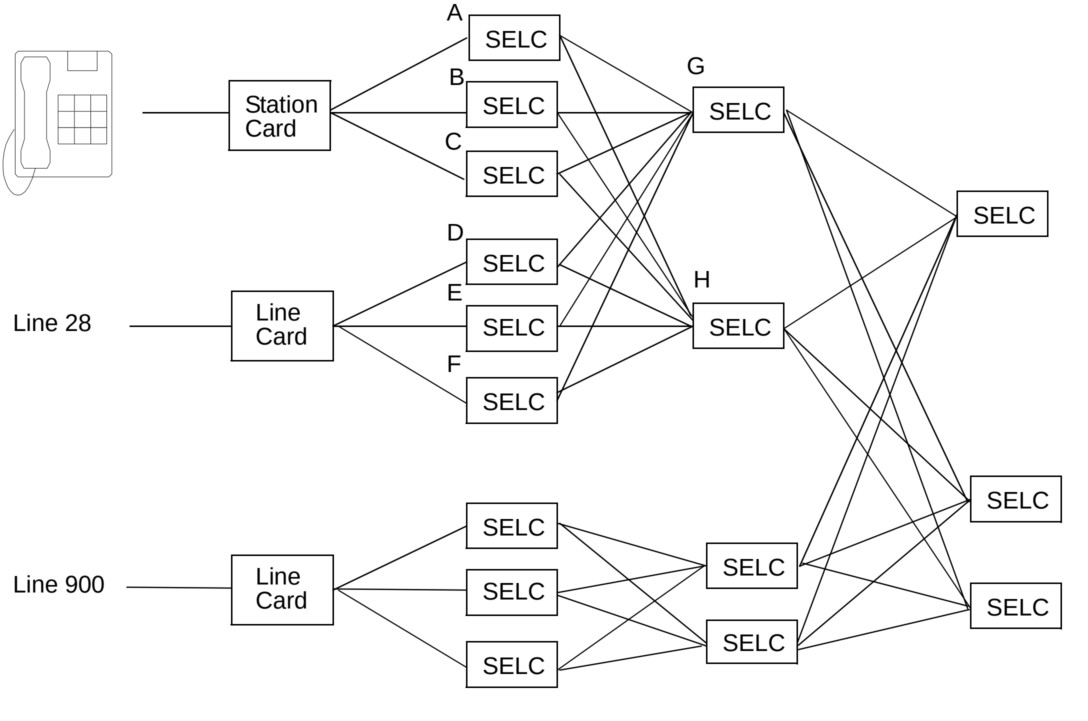
Latch Time—Tradenet MX latch times average less than 80 milliseconds.

FIGURE 2-3 Fast Latch Time



Fault Tolerance—The system is capable of withstanding multiple failures without compromising the integrity and performance of the switch. No two faults can affect any major section of the trading floor. The system is protected with a built-in maintenance strategy that includes self-healing abilities and remote diagnostics.

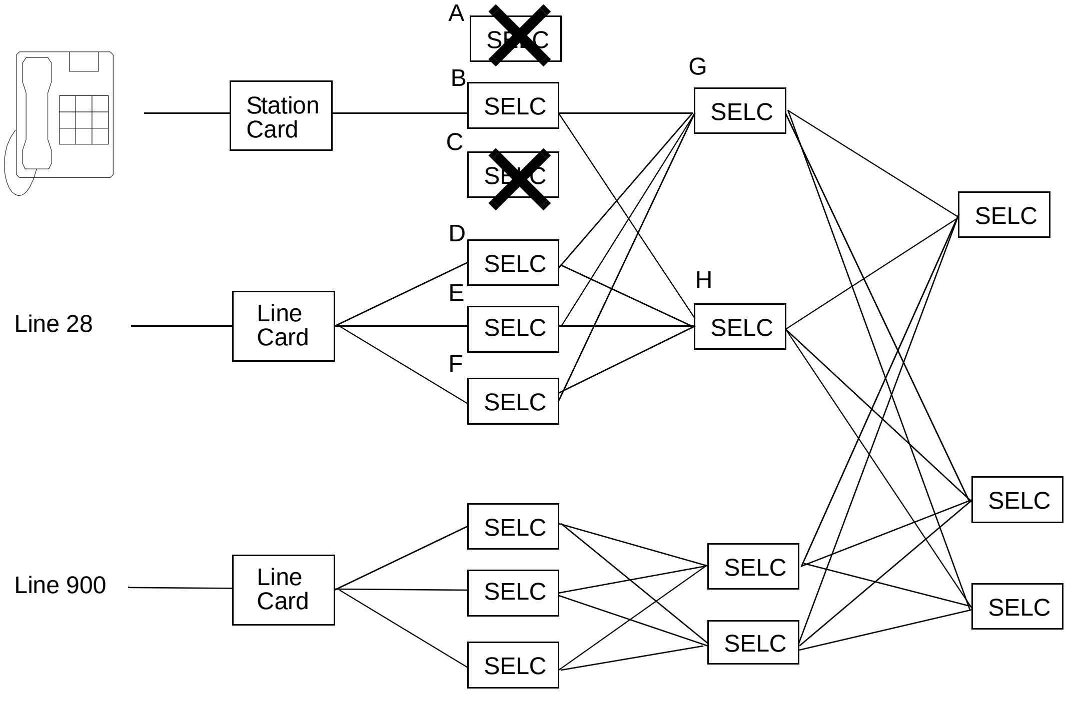
FIGURE 2-4 Fault Tolerant Mesh Switching Network



In the above example, if two switch element cards (SELC) fail, for example A and C, you will experience *no* loss of calls. To establish a call from the turret to line 28, a number of paths can be chosen. For example, a route can be set through switch element card (SELC) A, G, and D or C, G, and F. However, an alternate path can be selected through SELC B, H, and E. The multiple paths protect the users in the unlikely event that a card or link fails. Furthermore, the multiple paths allow voice and switching data to be switched independently.

Note *There is no single processing point determining the call setup. Instead of central control, calls are processed autonomously and self-routed with a destination address.*

FIGURE 2-5 Two Failures With No Loss of Service



The destination address is a logical identification code signifying the desired line or station. For example, if the turret requests access to line 28, the following steps are taken: (1) The turret sends the call request to the station card. (2) The station card processes the request and then selects a link to one switch card (SELC A, B, or C). (3) The selected switch card then chooses another link until a connection to line 28 is established. The call setup time is completed in microseconds to comply with latch time requirements.

Non-blocking—The Tradenet MX System functions even with *panic trading*, two calls per second per trader. The system can handle 195 Erlangs (one full hour of use).

System Capacity—A Tradenet MX System can have up to 11,990 analog lines or 23,000 digital channels and include up to 2,880 analog turrets or 3,840 digital turrets (with no speakers). The system can include up to 12 triplets; 48 cabinets in an AC system or 36 cabinets in a DC or Kepco system. Processing power and switching bandwidth expands linearly with system size. The linear addition of computing power ensures that latch time and universal line access are maintained for even the largest systems.

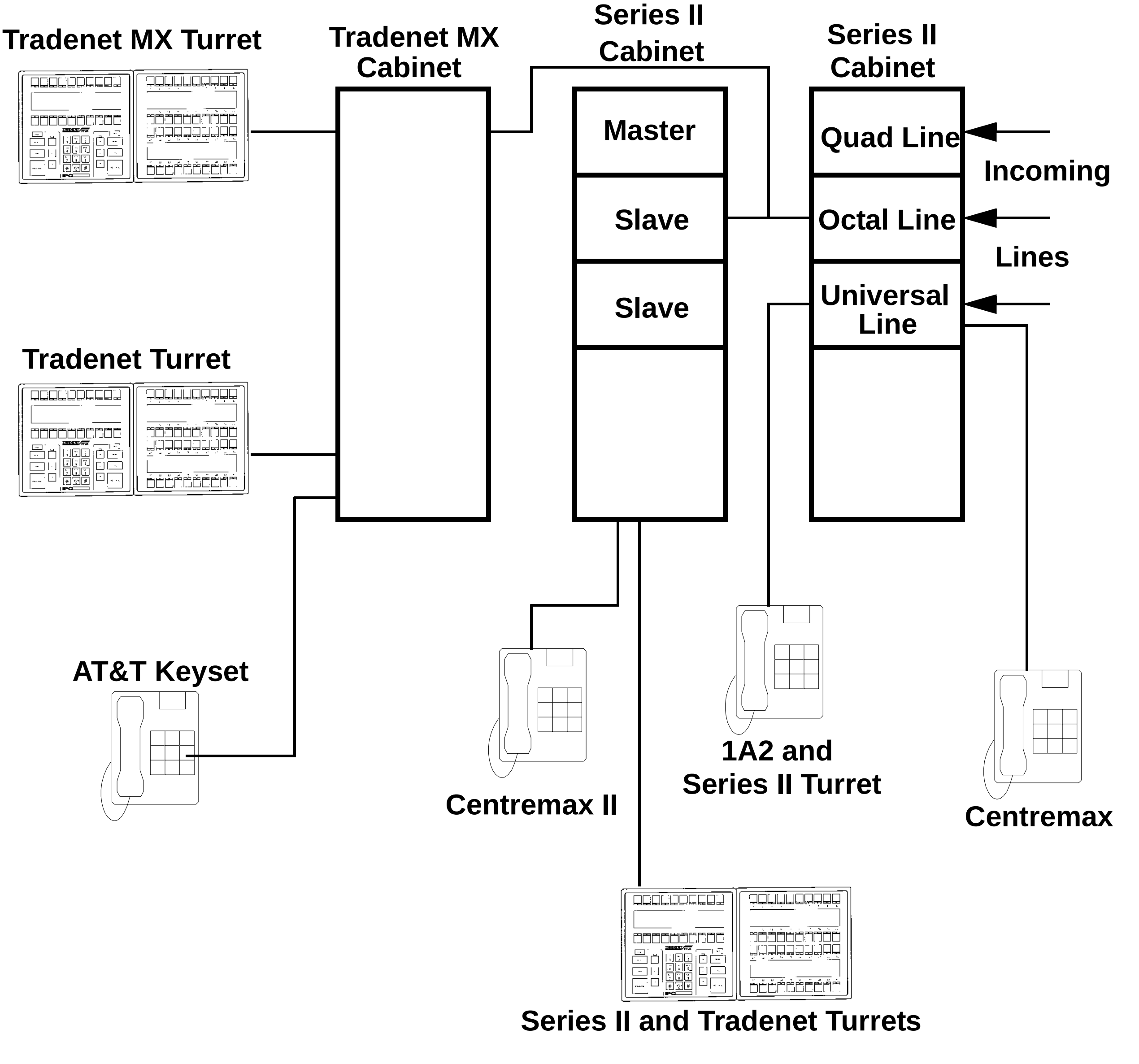
Software Loadable—New features and functions are added to installed systems with software downloading, not by modifying hardware. Likewise, the turrets are RAM-based, allowing you to change turret features by upgrading software. This feature provides for low cost, low risk upgrades. As a software-based product, the Tradenet MX System is dynamic and supports changing business requirements and serves as a platform into the future. New interfaces are compatible to existing systems due to a consistent hardware platform.

With Release 11.1 and later, station operating code resides on the System Center instead of at the station card. This allows you to perform certain software enhancements without loading a new tape. Also, new station equipment does not necessarily require new station types.

Conference—Any number of simultaneous conferences can be supported in the MX System. Up to 30 turrets can be bridged onto an incoming call, giving a total of 31 bridged parties. Default values allow up to 10 outside lines plus the originator of the conference to be part of a conference. Unlike analog systems, audio quality does not suffer as the conference expands up to the limits.

Product Interworking—Tradenet MX is compatible with the existing installed base of Tradenet station modules and cabling. The digital switch provides interworking with Series I, Series II, and CentreMax II systems, as well as with other vender's equipment.

FIGURE 2-6 Product Interworking



For existing Tradenet, Series II, and Series I customers, IPC has developed a clear migration path to Tradenet MX. By direct compatibility and interworking, customers can bridge lines between analog and digital switches.

The flexibility of the migration plan provides many attractive options. Clients can choose to migrate their equipment and do any of the following tasks: upgrade a section at a time, expand with digital technology, and replace an entire analog trading floor.

Migration strategies that call for continued use of prior IPC products are accomplished by interworking lines and/or turrets.

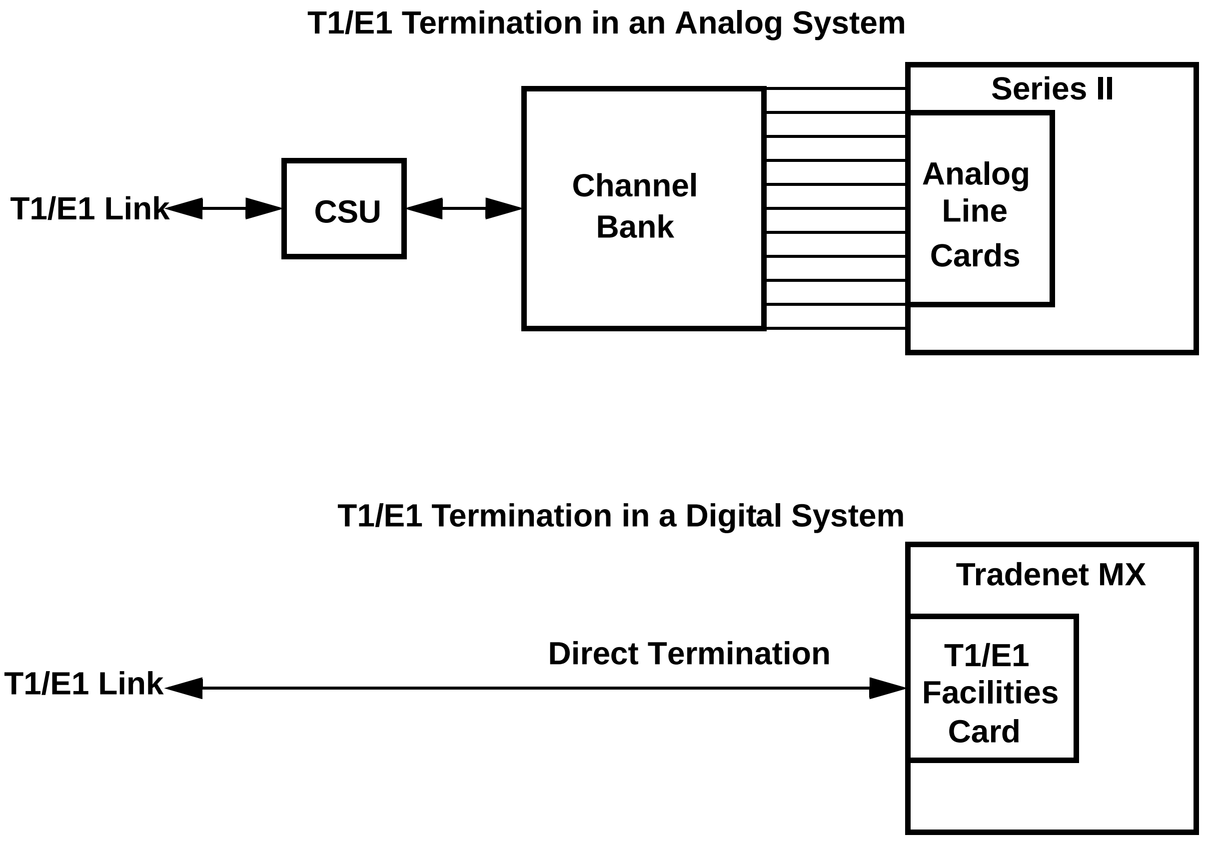
The Series II interworking cards (S2IC) are the Tradenet MX System’s window to previous generations of IPC products. These cards do not directly interface with the network, rather they interface with installer defined lines already terminated on Series II/Tradenet line cards, or on IPC universal interface cards. The universal interface allows the MX System to share lines with Series I, early Centremax, and other IPC products, as well as with any other vendor’s 1A2-compatible products. In addition, variations of the universal line card are available to share lines with certain other vendor’s products that are not 1A2 compatible.

The Tradenet MX System is compatible with Tradenet analog turrets and cabling when you use the analog turret interface card (ATIC). Tradenet turrets can be upgraded by moving the station cables onto the new system.

A firmware replacement is necessary in the Tradenet control module to access new features. Among the new features available are: dynamic speaker features, user controlled privacy, enhanced conferencing, call queuing, internal call, and internal transfer (dialtone and private lines).

Direct Digital Line Interface—The financial community uses digital facilities to receive cost effective voice service from the local operating companies. The cost of a digital line is generally half the cost for an equivalent number of analog circuits. Digital facilities are typically delivered to the customer site in the form of T1 links (E1 in Europe). T1 is used for CO-to-MX transmission and for bulk delivery of lines to customers. Each T1 has 24 channels (E1 has 30) for either voice or data. Tradenet MX simplifies digital line connection and costs by terminating T1 and E1 lines without intermediate equipment. The links are wired directly onto the distribution panel of the terminal units (TU) or terminal shelves. Each TU can support up to 10 T1 cards or 9 E1 cards (depending on the system configuration). T1 lines use RJ48C connectors and E1 lines use BNC connectors. Auxiliary equipment such as channel service units (CSU) and channel banks are not needed.

FIGURE 2-7 Direct Digital Line Interface



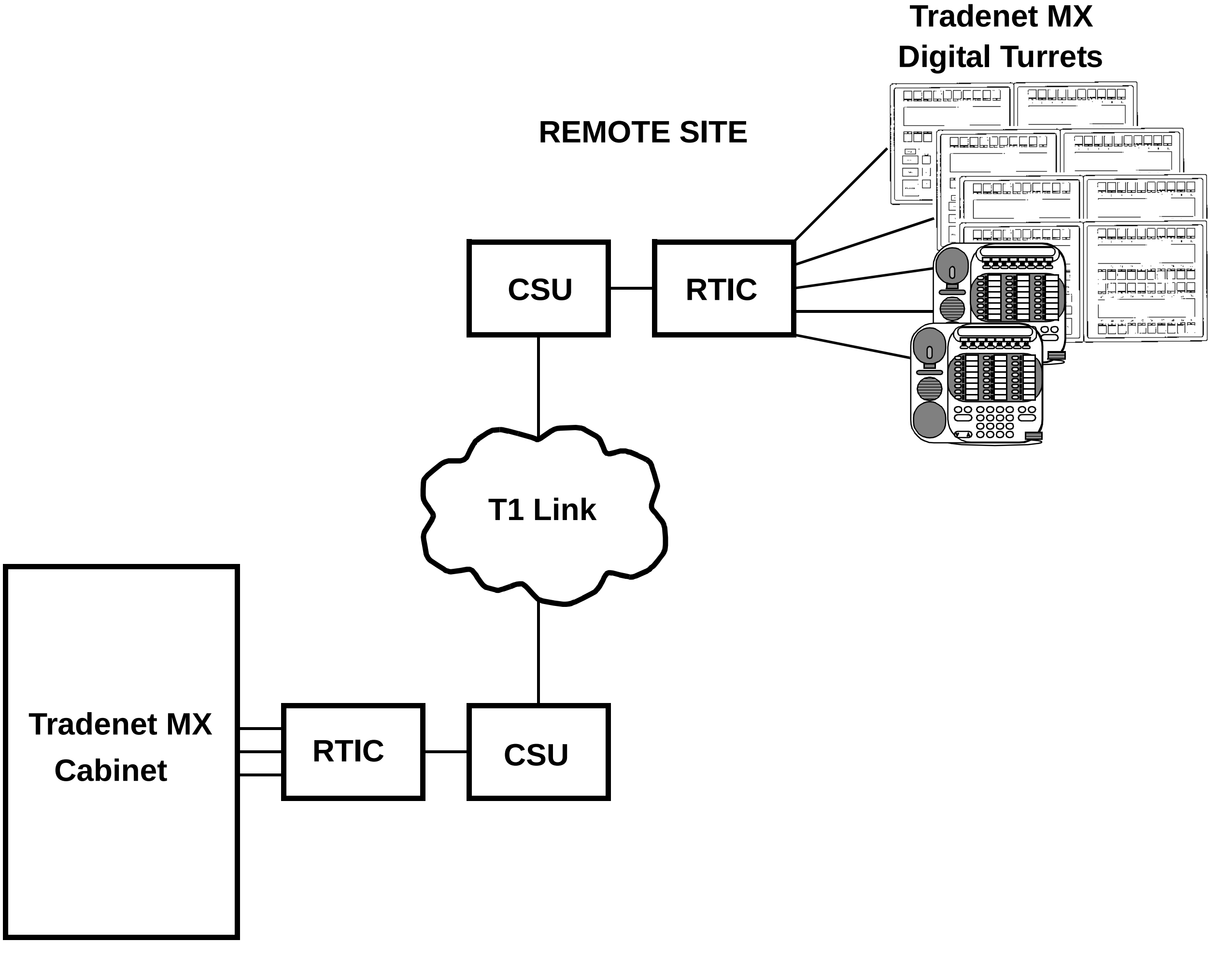
ISDN Support—The digital design of the Tradenet MX switch supports DASS2, DPNSS, and QSIG technology in two ways. First, the system directly supports ISDN incoming lines (with Release 8.0.3 and later). Second, the MX back room currently supports several proprietary ISDN instruments as Tradenet MX supplemental user instruments.

Speakers—Traders can program their own speakers and can add or reassign lines from their turrets.

Reduced Backroom Space—The Tradenet MX System uses 50%–70% less space in its back room equipment area than Series II equipment.

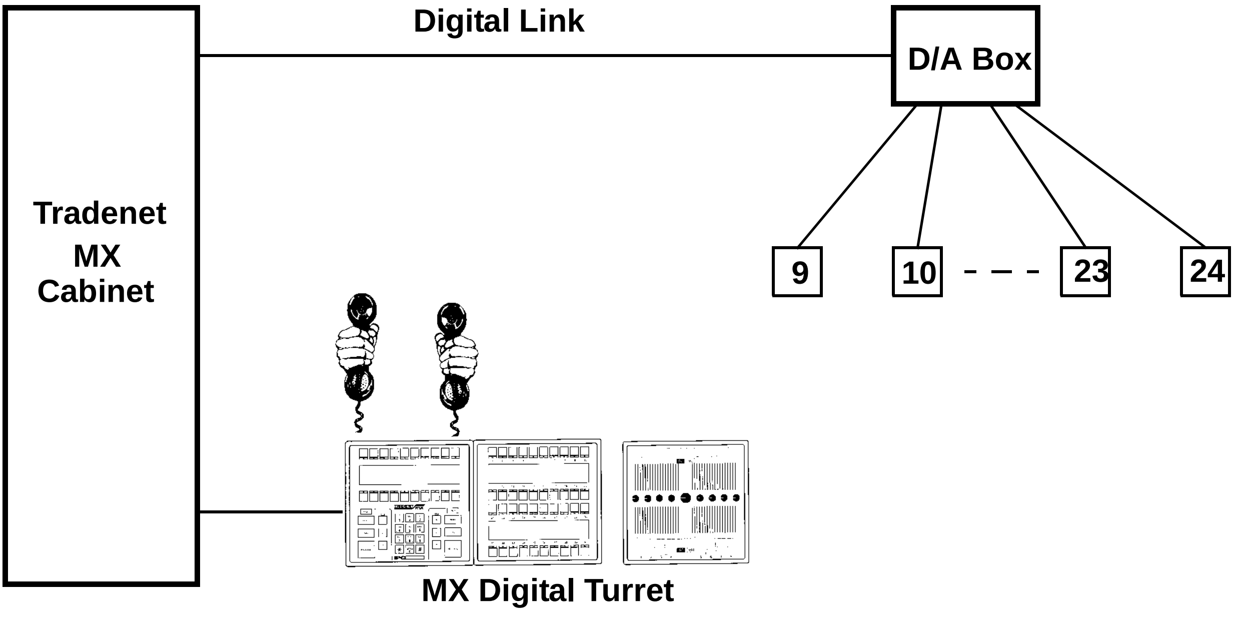
Remote Turret Interface—Turrets can be located up to 900 feet from the MX cabinet. If you have turrets further away than that and you are using Tradenet MX Release 9.0.1 or later, you can use remote turret interface cards (RTIC) to connect turrets to the MX System, and with Release 10.1 Maintenance and later, you can use RTICs to connect TradePhone MXs to the MX System. RTICs support eight turrets each.

FIGURE 2-8 Remote Turret Interface



Multiple Speaker Interface—If you have Release 9.0.1 or later, the Multiple Speaker Interface Card (MSIC) allows you to use remote speakers to get up to 24 speaker channels. With remote speakers, multiple traders can use the same speakers, providing you with a cost savings.

FIGURE 2-9 Multiple Speaker Interface



API—If you are using Release 9.0.1 or later, you can use an application programming interface (API) with Microsoft Windows™ NT or UNIX™. There is also an application available that allows you to use a contact manager on your PC to dial from your attached turret or TradePhone MX.

Call Forwarding—If you are using Release 14.1 or later, the call forwarding feature allows you to route incoming calls to an extension or line other than the one dialed. Three options are available, call forward immediate, call forward on ring no answer, and call forward on busy.

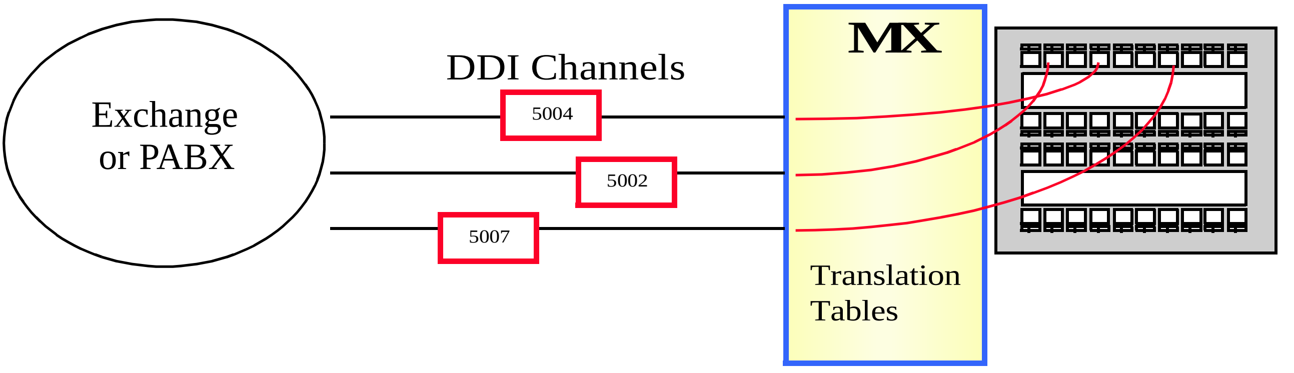
Caller ID—If you are using Release 14.1 or later, the Caller ID feature allows your turret to display the number of the incoming call. With calling line identity (CLI), a number is passed from the central office (CO) to the receiving end that identifies the calling party. This number is displayed as a four or eight digit button descriptor. By pressing the rCLI button a centerline message of up to 18 digits is displayed.

Voice Mail Notification—If you are using Release 14.1 or later, the customers voice mail system, and the infinite ring feature of the Tradenet MX can be used to notify traders when they have a voice mail message. The customer can retrieve a message by pressing the Voice Mail Notification button on his turret when it is displaying ring lamping.

Music on Hold—If you are using Release 9.2 or later, the Music on Hold feature allows you to connect an external music source to the Tradenet MX System, providing music to users placed on hold.

DDI/CLI—Direct Dialing Inward (DDI) increases the number of telephone numbers in a Tradenet MX System. Physical channels are not programmed directly on the turret, but are referenced by virtual logical address codes (vLac). Without the DDI/CLI feature, each telephone number has a dedicated channel. With the DDI/CLI feature, each telephone number comes in on a packet (allowing you to have fewer lines) and the telephone number can be dynamically assigned to any button on the turret.

FIGURE 2-10 Setup Including the DDI/CLI Feature



Note *DDI is supported for E1 lines only, not T1 lines.*

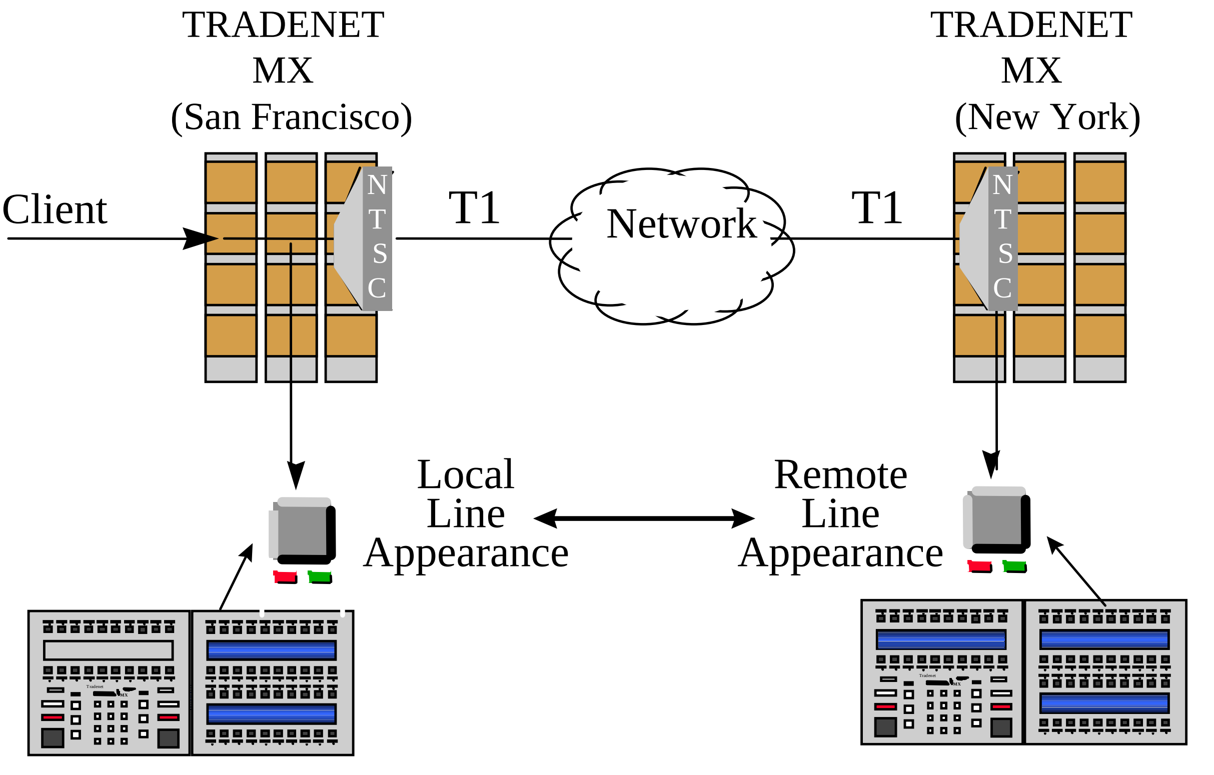
Line Networking—Line networking feature allows you to access different logical address codes (LAC) on different MX sites. This can be useful in the following situations:

- When you want to be able to trade 24 hours a day without providing 24 hours a day coverage at your local MX site, you can connect to other sites in different time zones.
- When certain traders experience excessive load during certain times of the day, that load can be picked up by a distant site.
- When certain issues are traded 24 hours a day, you can hand off your book to an active market that can trade if conditions change rapidly overnight.
- If your trading floor is involved in a disaster where the MX System is still running but traders cannot get to the floor, you can use networking lines to connect to other MX sites.
- You can gain access to emerging markets without maintaining a local MX site. Instead, the coverage and manpower can be located at another site.

Line networking allows you to use more than one trading floor to support heavy periods or issues as they occur.

The line networking signaling channel provides status of up to 200 lines and requires 64K clear channel.

FIGURE 2-11 Line Networking



For more information about the line networking cards, see *NEMC, NESC, NTMC, NTSC* on page 6-50.

For more information about setting up line networking and using Netconfig and NetMan, refer to the *Tradenet MX System Center Manual 14.1* (part number B0086185104).

Telephone Handset Dual Talkpath—Each MX turret can support two handsets (left and right). Each handset terminates a separate voice path through the system.

Full Duplex Voicepaths—The system provides full duplex voicepaths (transmit and receive) for all of its digital and four-wire analog line interfaces and for all digital turrets.

For digital turrets, analog voice is digitized in a linear fashion in the turret. Digital voice is transmitted between the module and the backroom equipment in a basic rate format. At the basic rate interface card (BRIC), the digital voice is placed in a time slot on the digital stream for forwarding using the switch element card to the addressed line interface card.

For analog turrets, a hybrid in the turret converts the four-wire from the handset to two-wire, which is carried to the analog turret interface card (ATIC), where a second hybrid provides analog four-wire to be digitized in the ATIC. There the digital voice is placed in a time slot on the digital stream for forwarding using the switch element card to the addressed line interface card.

At the line card a D/A and A/D conversion is made for analog connections and a digital algorithm is made for digital connections (linear to A-law or mu-law, depending on country).

Multiple Line Selection—Each user position offers the user one-button access to 600 lines from the entire system's line capability. When users log on to the system, the lines applicable to them are brought to their turret. When allowed to, the trader can program any line in the system as one of their 600 lines.

Point-to-Multipoint dFTS—Algorithms in the DSP in the BRIC allow it to combine the digital receive paths (from the line cards) for up to eight incoming lines into a single B channel for transmission to the dFTS module. The same DSP is further able to selectively pass the transmit signal from the dFTS, which originates at the dFTS microphone, to whichever line or lines the user has selected for answer back. Combining eight lines into one B channel saves B channel ports to the turrets, but it can impose large traffic burdens on the TU unless there are multiple traders sharing common lines on their speakers. Otherwise IPC's configuration program (CGEN) might require some depopulation of the TU in order to maintain traffic capacity.

ALIC Access to PSTN—Turret line selection provides access to the public service telephone network (PSTN). The PSTN connection, supported by the MX analog line interface cards (ALICs), performs the following functions:

On/Off Hook—A relay connects the network to a DC gyrator when the user presses a line button on the turret. That command is acted upon by a line interface card which sends the new status from the requested line through the switch back to the turret. Release of the line with the turret's RELEASE button raises a command signal transferred using the data path through the switch network to the applicable line for execution of the command. The line can be released by the line card should an interruption of a set period occur to the DC feed from the network. This information is passed through the system to the turret so the user is informed.

Ring Detection—An opto-coupler fed by a capacitive-resistive network detects ring cadence, and alerts the line interface card to change the line status bit passed through the switch to the turrets.

Hold—The user presses the turret's HOLD button to put a call on hold. An off-hook condition is then maintained to the line, while the digital voice transmission connection on the card is disconnected and replaced with a silence condition.

Auto Hold—When the user accesses another line without pressing the RELEASE button to release the previous line, MX will put an accessed line in a hold state whenever this option is enabled in software.

Signaling (DTMF)—The user selects a PSTN line and presses the dial pad buttons to initiate signaling. A command word, relating to the number pressed, is forwarded to the turret interface card, which opens the transmit and receive path to the turret and passes the command word to the line interface card using a preset path. The command processor then opens the transmit/receive path to the system, and the on-board DSP produces the appropriate digital representation of the tone. This is sent to the DSLAC, converted to analog, and placed on tip and ring. During this same time period, the DSP on the line interface card produces a similar digital representation that is converted to analog for user feedback as though it were receive audio.

Signaling (Dial Pulse)—This is achieved in much the same way as DTMF, in that only data is sent from the turret to the line card. After the user selects a PSTN line and presses the dial pad buttons, a command word, relating to each number pressed, is forwarded to the turret interface card, which opens the transmit and receive path to the turret and passes the command word to the line interface card using a preset path. The command processor then actions the line relays to open and close at the pulse rate specified for the local network.

Analog Voice Transmission—Analog voice is coded into digital at the user end, addressed with the pointer of the analog line, and passed through the network switch for decoding at the Analog Line Interface Card to an analog signal, and vice versa.

Figure 6 Lines—Access to Figure 6 private wire turrets, when programmed with line access to Figure 6 private lines, use the Series II interworking card to operate the Tradenet Figure 6 line interface card. The Figure 6 line interface card, originally developed in compliance with Figure 6 of the series of British line type diagrams, has found applications elsewhere, based on its unique ability to terminate a subscriber line to a standard telephone. The connection from MX to this card performs the following functions:

On/off Hook Distant Terminal—The Tradenet Figure 6 line card senses line current drawn from its battery feed circuit by the distant terminal. When the current-drawn status has been passed to the MX Figure 6 line card processor, it changes the line status bit which is passed through the switch to all those applicable turrets to indicate ringing in. The distant terminal releasing the line is also sensed the same way, and is also signaled through the system for indication at the turrets that the line is now idle.

Ring Generation—This can be configured in the MX System to be an auto ring-down signal (as soon as the user selects a line the ringing is sent), or manual ring-down (the user must press the signal button on their turret to signal the distant end). The manual or automatic commands are transferred through the MX System and ultimately passed to the Figure 6 Line Card, which closes a relay, thereby placing ring voltage (generated by a ringing supply) onto the tip and ring network circuits, and opening tip and ring to the MX system.

PLIC Access to Private Wire—The private network GEN/GEN type signalling system can also be supported by the MX System, by use of the private line interface card (PLIC).

On/off Hook—The user presses a line relay to seize a line: this command is acted upon by the BRIC which commences the setting of a data path through the switch to the applicable line. The PLIC then closes a relay connecting the network to the voice path transformer.

The user releases the line by pressing the RELEASE key on the turret, which then raises a command signal transferred using the path through the switch network to the applicable line interface card.

Ring Detection—An opto-coupler fed by a capacitive-resistive network detects ring cadence, and alerts the line interface card to change the line status bit passed through the switch to the turrets.

Dialing DTMF—All analog line interface cards (PSTN) are capable of supporting DTMF dialing.

Dial Pulse Dialing—All analog line interface cards (PSTN) are capable of supporting Dial Pulse dialing.

Speed Dialing—The MX System is capable of dialing numbers which have been programmed into memory for simplified dialing. This is known as speed dialing. This can be set up by the trader by programming his own numbers into the system, or can be set from the System Center. The trader uses speed dial by pressing a single key that they or the system administrator have already programmed as a speed dial key.

All speed dialing is achieved from the turret as digital signals sent to the analog line interface card for DTMF generation. Should the dialing be loop disconnect, it would be performed much the same way as DTMF dialing, except that the feature processor actions the line relays to open and close accordingly. Speed dialing can be achieved by either human intervention on recognizing a dialtone on the selected line or automatically by a dialtone detection circuit releasing the number after dialtone has been detected within the Tradenet turret.

Index Dialing—Index dialing is achieved by dialing a two-digit code at the turret.

Last Number Redialing—Last number redialing is accessed by pressing the SIG button on the Tradenet turret (PSTN lines only).

Hunt—Hunting allows a group of outgoing line to be pooled together for section when placing an outgoing call. Hunt groups can be set up by either the trader or the System Center. Hunt normally takes place across a maximum of 16 lines (digital turret) or 10 lines (analog turret) after pressing a line key. A group of lines is checked for their system status (busy or free) and hence the availability and capability of the system to place the call. The first free line that is also found to provide dialtone is offered to the user. If the first free line in the Hunt group does not provide dialtone the next free line will be accessed. If all lines in the Hunt group are in use, a busy indication is sent to the turret. Dialtone recognition can be set for any Hunt or speed dial number. Dialtone recognition is achieved by the Tradenet turret after a voice path has been set from the selected line. The switch does not detect dialtone.

Privacy—A user or System Center can make a call private to all other users of the system (no intrusion). The user can override his own instruction for privacy but cannot override that of the System Center. Privacy is achieved by blocking any user selection of a busy line.

Intrusion Tone—Any user can intrude (or barge in) on another call by placing a parallel path through the system switch to the call that is already in progress. If intrusion takes place, it is possible for the system to generate an intrusion warning tone that is passed both to the network and to the user. The intrusion tone is an option set from the System Center.

Conference—Conference is set up by a user between one PSTN network connection and, under optimal line conditions, up to 30 users of the system (the default setting is 11 conferencing parties). The switch element card does a simple addition of the linear coded voice data from and to each turret to form this conference path. Up to 10 lines can be conferenced to one user of the system in the same manner as above (addition of linear coded voice by the switch element card).

Broadcast—Private lines can be broadcast to in multiples of up to five (open line dealing) by pressing a pre-programmed line key at the turret. Broadcast keys can be user- or System Center-programmed, to broadcast to up to five private network lines. These lines are acted upon, and the voice path is catered for, in the same manner as conference. Up to 32 broadcast groups are available per turret.

Mute—When a switch on the rear of some handsets is pressed, it places a short on the handset transmitter, which disables the transmit. The distant call is still heard in the ear-piece.

Voice Recording—The recorder output at the backroom is on a handset-by-handset channel method (one record voice channel per talk path), provided at connectors on the turret distribution panel on each TU, or at connector on the back of the turret itself. Voice recording pairs are presented as two-wire analog, regardless of the turret or line type involved. It is possible for the system to generate a record warning tone that is passed both to the network and to the user when voice recording is taking place.

Receive Volume Control—The receive volume control at the handset is normally set when logging onto the system or when initializing the system. The receive level can be adjusted at the turret by the user down to zero or up to a given level by the programmed volume up or volume down buttons. Volume control changes accessed by the turret are not switching center derived.

Incoming Call Indication—Incoming call information is broadcast by the switching center on the control words to all applicable turrets. The user is informed of incoming calls by visual illumination of the associated line key and, when set, by an audio ringer.

Line Busy Indication—Lines being used at other positions are indicated at user position by a *red* LED on the associated line key.

Line on Hold Indication—Lines placed on hold by the user are shown as user position *green* flashing LEDs on the associated line keys. Lines placed on hold by other users are shown as on other user position *red* flashing LEDs on the associated line keys.

Dialtone Recognition—Dialtone recognition can be set for any Hunt or speed dial number. Dialtone recognition is achieved by the Tradenet turret after a voice path has been set from the selected line. The switch does not detect dialtone.

Log On—If set by the System Center, each user might need to log on to the system at his chosen position by entering a trader identification (TRID) number. After logging on, the lines, speed dial numbers, and other trader configuration data applicable will be drawn forward to that turret from system memory. It is not necessary for a trader to log off from a prior position as this will be done as he logs onto the new position.

Internal Transfer—An incoming call on a line appearing at a specific turret can be transferred to another turret by pressing the transfer key and entering the destination user’s TRID. The line would then appear at the destination as an incoming ring on a floating answer key, showing the transferrer’s identification. The transferred line need not be one of the destination turret’s programmed lines.

Internal Call—Each trader is given a TRID. By pressing either L or R on the turret, **MXF**, **3**, and a TRID, the destination turret will ring and flash on an Internal Answer button. The destination turret must have an Internal Answer button programmed. At the destination turret, the trader presses the Internal button and the call is completed.

Pagination—It is impractical to fit 400 line buttons and 200 speed dial buttons into a desk mountable module. Pagination, using the 40-button pagination module, gives the trader access to these 600 keys in 15 pages of 40 buttons each, presented to the trader 1 page at a time. Changing pages gives access to alternate groups of 40 buttons and descriptors. If a call is placed from one page, the trader can go to another page while continuing the first call.

Floating Keys—Incoming calls programmed to pages not currently being viewed by the trader will appear on a set of floating keys on the control module.

Forced Floating—This option allows incoming calls on specific lines to be always sent to the floating keys, regardless of whether they are already showing on the page currently being viewed by the trader. This option allows the trader to always answer important lines at the floating keys.

Line Key Assignments—A description is shown below the corresponding button for each line or speed dial.

Messages—The System Center can send a message to be displayed on the turret control module for all system users, or for specific users. This message can be deleted after being read by pressing the associated key. Up to 10 messages can be queued for each user or users.

Ringer Volume—The user can adjust the ringer volume to all lines. If you turn ringing off, incoming calls will still be shown by visual indication at their line key, or at a floating key.

Display Brightness—Display brightness on the control and line modules can be adjusted to suit user requirements.

Oldest Call Waiting—This feature is used where there is a high volume of incoming calls. The incoming calls are routed to the floating keys and the oldest of these calls has a unique identification (for example, simultaneous flashing the red and green LEDs).

Swap—Line assignment buttons can be swapped.

Viewing of User Programming—The trader can view any programming he has made to the turret, for example, speed dial numbers. This is used to find a spare button, to view current information prior to making a change, or to just refresh a user's memory.

DISTRIBUTED ARCHITECTURE

The Tradenet MX System has a distributed architecture based on a folded hierarchical switching network. The folded hierarchical network provides a fault tolerant structure that is not vulnerable to system outage due to isolated component failures. Using a distributed, fault-tolerant architecture, the Tradenet MX System provides processing power, bandwidth, and reliability. To meet IPC's reliability criteria, the Tradenet MX System has no central processing. Instead, each circuit card is equipped with its own independent processors and controls its own small section of the switch.

The distributed folded hierarchal architecture used in the MX System provides great flexibility in system size, through the use of building blocks. The line and station interface cards are the smallest building blocks in the system, and are the largest non-redundant single unit failure points. IPC has worked closely with their customers to reach an optimal size for these cards, both to reduce system costs, and to reduce the effects of a single failure. The digital station interface cards serve up to 8 turrets or 10 TradePhone MXs, while their analog equivalents serve 6. The digital line cards each handle a single T1 or E1 span, while the analog line cards serve no more than 10 lines. Thus, no possible single failure can affect more than 10 stations or more than 10 analog lines or one T1 or E1 span. These cards are built of the highest quality components using the best technology available.

The Tradenet MX architecture is a distributed architecture. Distributed systems spread call and feature processing throughout the switch whereas a centralized system has a single point of control that supervises call setup and switching.

TABLE 2-1 Differences Between Centralized and Distributed Architecture

Centralized	Distributed
greater flexibility at lower product cost	faster and more reliable because multiple tasks can be processed in parallel
system vulnerability to a single hardware or software failure (single point of failure)	processing dispersed throughout the architecture providing protection against a single hardware failure

IPC has always designed its products utilizing distributed architectures. Series I was distributed, although it had no system processing at all. Series I was not programmable, but provided a robust backroom that never failed nor blocked calls. Series II and Tradenet introduced microprocessor-controlled, solid-state crosspoint switching. These systems provided greater system flexibility and additional features while maintaining the distributed architecture.

The Tradenet MX System was IPC's first digital system. It maintains this distributed architecture, without any of the limitations of the nodal systems. This is accomplished by *digital distributed folded hierarchical architecture*, which eliminates the shortcomings of the nodal systems while maintaining the advantages of the distributed systems. This architecture connects numerous small nodes, each of which affects only a few lines (no more than 10 analog lines or 1 T1/E1 span) or turrets (no more than 10), with multiple redundant links. The small size of the nodes reduces the effects of a failure at any single node, while the multiplicity of links eliminates the effects of single link failures, and virtually eliminates the effects of multiple link failures.

Independent switching control protects the users from experiencing an entire system failure due to isolated hardware or software failures. The distribution of processors onto all system cards provides tremendous parallel computing power, allowing the Tradenet MX System to establish many calls simultaneously.

Two Sun processors reside on each circuit card for a combined 25 million instructions per second (MIPS) of processing power per card. One Sun processor is dedicated to controlling interface requirements (lines, stations, and so on), and the other is devoted to switch network processing.

The folded hierarchal architecture is the key to providing a reliable, non-blocking, fast network. The strength of this architecture is the large number of interconnection paths through which voice and switching data can be routed.

This diversity of routes is necessary to ensure that the switch is not at risk from a single failure. When a voice path is being established from a turret on the first TU to a line on the tenth TU, a large number of links and switch cards are available. The System Center acts as a central information source for all cards, but its function is not essential to an operating MX System.

The Tradenet MX System can be configured for trading floors of any size. It can expand from a system using one TU in one cabinet with 24 analog stations and 90 analog lines, to a huge exchange floor multi-triplet system in 36 equipment cabinets. Enlarging a system adds hardware instead of replacing it.

Extending a trading floor usually involves considerable planning. To aid project management, software expansion tools are used to calculate system expansion. Based on new size requirements, the new hardware requirements are determined. The expansion tools also direct technicians where to install new cards and shelves. Then the site database is automatically reconfigured with the new information, such as lines and hardware.

Each system can be expanded until it reaches the limits of its configuration. In most cases, adding a new line or instrument, or even a new card, can be done without significant concern. When a system is expanded to become a larger configuration, the system database must be reconfigured for proper placement of the additional equipment. This can include moving some existing connections or card hardware should the new configuration require it.

The Tradenet MX System Center provides MX system administration support throughout a system's installed life. The System Center provides installation support, system administration (moves, adds, and changes), and traffic analysis. As the maintenance terminal, it monitors system status, providing both local and remote service and diagnostic access.

Terminal Units (TU)

Card shelves of 17 cards, called terminal shelves or terminal units (TU), are the basic building block of every MX System, and are also used to help describe the size of the system. Each TU has a maximum hardware defined capacity of up to 100 analog lines or 9 E1 or T1 lines, and 40 digital turrets/TradePhone MXs or 24 analog turrets. However, depending on the ratio between lines, stations, and speakers, the actual usage of a TU is always less than this theoretical maximum, both to provide the required line or station or speaker count, and to ensure traffic capacity at every point in the system. In addition, in every system at least one TU must use one line interface card slot to accommodate the dedicated card used to communicate with the System Center. The TU also has the first layer of redundant switching cards in the system: thus adding additional TUs automatically adds additional switching capability at the first layer.

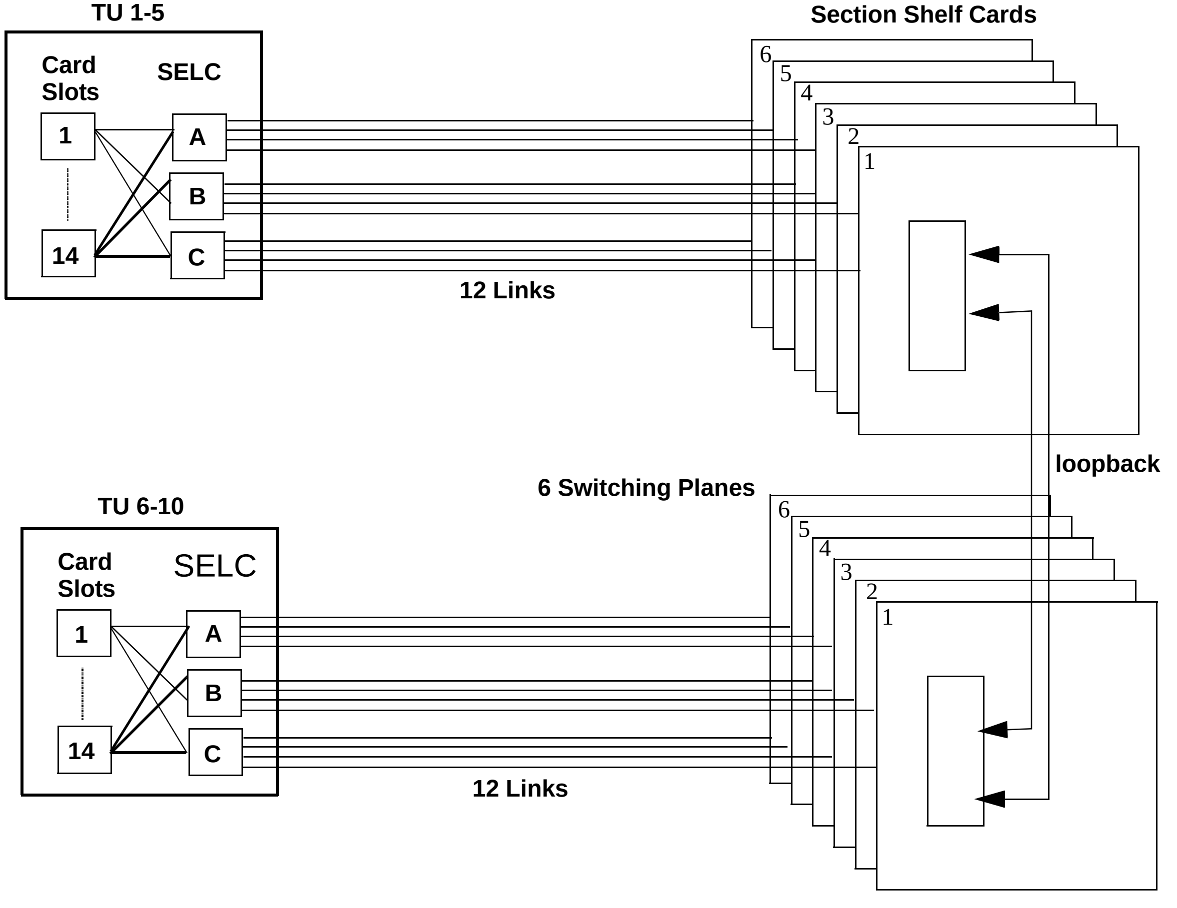
Systems with one and two TUs are called Mini or Compact systems and have a capacity of 48 analog or 64 digital stations and 190 analog lines or 432 T1 channels, all accommodated in one cabinet. Because these systems do not have to communicate beyond two TUs, they can come closest to the theoretical maximum capacity of a TU.

Triplets

The largest building block in the MX System is the triplet, a set of three cabinets. Systems requiring 3–5 TUs can be accommodated in a set of 2 attached cabinets, while those requiring from 6–120 TUs use 1 or more sets of 3 attached cabinets. Both the two and three cabinet sets are referred to as triplets. Systems using more than one set of three attached cabinets are referred to as multi-triplet systems. Cabinet #2 in a two or three cabinet system contains the next one or two layers of redundant switching cards; thus adding triplets to a system also enlarges the switch matrix proportionally.

A functional layout of a triplet is shown in the following figure. (For more information about triplets and other Tradenet MX System configurations, see *Chapter 5 Cabinets and Shelves* on page 5-1.)

FIGURE 2-12 Switch Functional Layout



In a triplet, TUs 1–5 are contained in cabinet #1, the section shelf cards are contained in cabinet #2, and TUs 6–10 are contained in the cabinet #3. On the left side of the previous figure, each TU is represented by a block with 3 switch element cards, SELC, (A, B, and C) and 2 of the 14 interface cards. For clarity of the drawing, only two TUs with two interface cards each are shown.

The SELC within each shelf is linked to the section shelf. There are 12 links from each TU (4 per SELC) to the section shelf. The links are evenly distributed to section shelf cards 1–6 to maintain the mesh architecture, thereby safeguarding the system against the failure of one or two links or cards.

TUs 1–5 are connected to the first six section shelf cards. TUs 6–10 are connected to the next six section shelf cards. The two groups of cards are then connected together in a loopback, providing the flexible switching links. The above figure shows the distribution of the 12 links to multiple section shelf cards and the arrangement of SELCs into isolated *planes* achieves a multiplicity of paths.

Planes

Triplet systems use sets of SELCs that function together as a plane. Each plane is independent of the other planes in the system; the only connections between planes are at the access switches, each of which can communicate with four planes. Maintaining the separation between planes is important to ensure that a fault in one plane cannot be transmitted to another plane: in this way only one plane at a time is affected by a fault, providing ample protection against loss of switching capacity. The SELCs in each plane are considered *peers* when they are in the same layer of the switch: the concept of separating planes is also referred to as lack of peer-level communication, or as peer-level isolation. The four planes linked to each access switch vary, depending on the position of the access switch and on the number of planes in the system.

To allow customers with limited speaker requirements to reduce the cost of their systems, IPC has designed the triplet to be functional with four planes, as well as with the hardware defined maximum of six. Four-plane systems have two access switches per TU. As is done for access switches in smaller systems, IPCs configuration software, CGEN, looks at the number of speakers and turrets/TradePhone MXs in relation to lines, and determines if the system can function efficiently with four planes. This option also uses no special hardware other than the cables between the TUs and the section shelves, so you can elect to save the cost of the unneeded planes at initial installation, while reserving the option to upgrade to six planes and to three access switches per TU whenever the traffic requires it.

In a six-plane system there are three access switches in each TU, each of which has links to a different, overlapping subgroup of four planes. A four-plane system has only the two outer access switches in each TU, each of which has links to all four installed planes. The first and fourth section switch cards in each section switch shelf are removed, to reduce the total to four without hardware alteration. Special cables that help re-distribute the links are used between the TUs in a triplet and the section shelf in the same triplet.

The diversity of routes is necessary to ensure that the switch is not at risk to a single failure. When a voice path is being established from a station on the first TU to a line on the tenth TU, a large number of links and switch cards are available. Calls route themselves through the network and select links using a designation address. For example, the request for a speech path originates on the station card and then routes itself through one of three SELCs and one of six switching planes. From the section shelf, the request steers itself to the designation TU and then onto the appropriate line interface card. In the rare event of a link or card failure, the originating interface card continually re-attempts the call through alternate paths until it is successful. Call processing occurs in milliseconds. The planes are isolated from each other, preventing peer-level communications, which eliminates the possible propagation of errors. For more information about planes, see *System Physical Layer* on page 2-24.

DIGITAL TECHNOLOGY

The Tradenet MX System uses digital technology, where the voice signal is represented as a series of numerical values that can be switched in a purely digital environment and that can be manipulated mathematically. Digital technology has replaced analog solid-state crosspoints as the preferred platform for telecommunications products.

Digital advantages include:

- *Footprint Reduction*—The Tradenet MX System offers 70% back room footprint reduction from analog back rooms, which frees floor space for other purposes.
- *Increased System Flexibility*—Analog switches, having the required reliability and traffic capacity, usually have hard-wired line access (as does IPC Series I equipment), or have, at best, line access limited to hard-wired groups, as does IPC Series II and Tradenet equipment. In contrast, *universal line access* is a basic characteristic of digital switches. Access restrictions are eliminated while cross-connect frames are virtually nonexistent.
- *More Features*—Using the digital data signaling channel provided by integrated services digital network (ISDN) technology, features like call forwarding, calling line identity (CLI), and voice mail notification are available at the desktop.
- *Universal Line Access*—Universal line access allows re-assigning lines or moving users through programming. Manual moves, adds, and changes (MACs) are eliminated, and system administration is simplified.
- *Dynamic Speaker Feature*—Universal line access allows the dynamic speaker feature, which gives traders control of their speakers. Traders can program line assignments and make changes immediately, improving their access to information. Administrative costs are reduced because user programming replaces the rewiring.
- *Voice/data Integration*—Voice/data integration becomes possible, which implies combining or interfacing speech and computer systems. This includes linking turrets and workstations at the desk or switching voice and data through the same facilities.

SYSTEM PHYSICAL LAYER

Tradenet MX uses a folded hierarchical, multi-stage, modular, synchronous digital switch, based on the multiple use of a time-space-time module, built from gate array technology.

The internal system data speed is 7.68 mbits/second. Each link between switch elements has 960 bits made up of 32 channels of 30 bits each. These 30 bits result from 24 bits of true data that have been multiplied by an expansion factor of 4-to-5 (by a dedicated link interface integrated circuit) to facilitate error detection. The format of data for each link is as follows:

- Channel 0 of each link holds a 10-bit frame synchronization symbol, followed by 20 bits containing the data broadcast sub-channel and the clock synchronization sub-channel. This channel does not receive 4-to-5 expansion.
- Following this first channel are 31 channels, each containing an encoded control byte that is composed of a 5-bit command code and three parity bits. The remaining 16 true data bits either contain a 13–16 bit linear code voice sample, or a 16-bit data word for data packets.
- Path set commands use the 16-bit data word to contain a destination/source address, and so on. In the case of the voice sample, each single point-to-point (for example, turret to on-line) sample is 13 bits, whereas a point to eight point conference (for example, turret to eight lines) sample has 16 bits, because eight 13-bit words require 16 bits. After applying the 4-to-5 conversion factor, this becomes 20 used bits of code for which error detection is possible.

Each interface port (line or turret) is given a logical address code (LAC) that is the designation address used in the path set operation to find a path from the source interface port to the destination interface port. The path established in this way can be used for a data packet (short duration) or for a voice path (long duration). Designation addresses can also identify switching cards or other facilities within the system.

Each card in the system has a defined number of links, as follows:

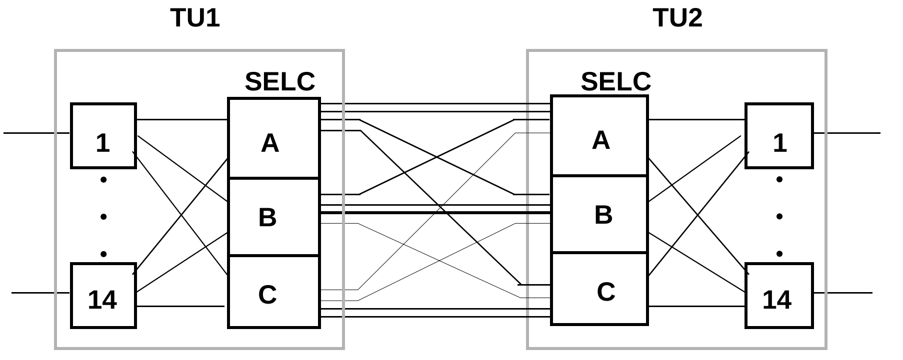
- station interface card (3 links)
- line interface card (3 links)
- switch element card (19 links)
- System Center gateway card (3 links)

The MX folded hierarchal network is assembled by the interconnection of switch elements with the above links. The switch element card (SELC) consists of 19 bi-directional switch ports, a real time controller, and a feature processor. These are combined to provide callpath switching and routing, initialization, fault recovery, and maintenance. SELCs can be used in three roles in the MX System. The line and station interface cards can be viewed as depopulated switch element cards having only three bi-directional switch network ports, but are not considered SELCs.

One and Two Cabinet Configurations

The MX folded hierarchal network is the heart of the system, and has a number of configurations covering differing ranges of system sizes. The smallest of these configurations is called the Mini or Compact system. The Mini and Compact systems can have one or two terminal units (TU), also called terminal shelves. *FIGURE 2-13 Mini and Compact System Functional Layout (N+2 Redundancy)* on page 2-25 shows the functional layout of the Mini and Compact systems with N+2 redundancy.

FIGURE 2-13 Mini and Compact System Functional Layout (N+2 Redundancy)

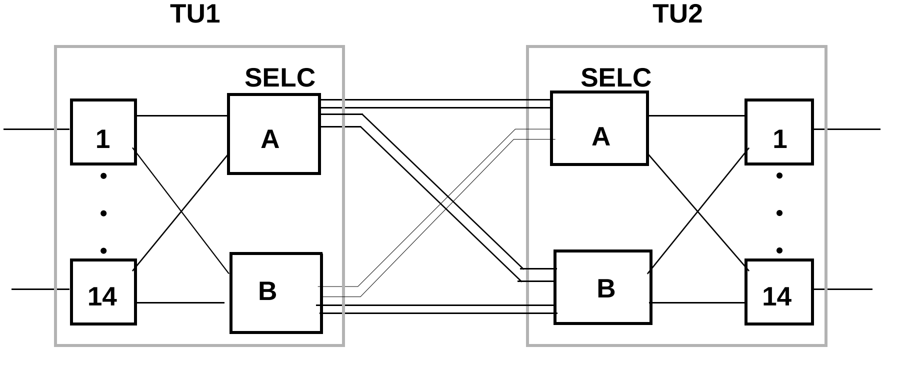


With N+2 redundancy, you can lose two of your SELCs and the Tradenet MX System is still running.

Note *When you set up a Compact system using DataMan's AutoQuote tool, it defaults to use N+1 redundancy but you can change it to N+2. For more information about DataMan, refer to the* ***Tradenet MX DataMan Manual 11.1*** *(part number B-01087-0-00-01).*

The following figure shows the functional layout of the Mini and Compact systems with N+1 redundancy.

FIGURE 2-14 Mini and Compact System Functional Layout (N+1 Redundancy)

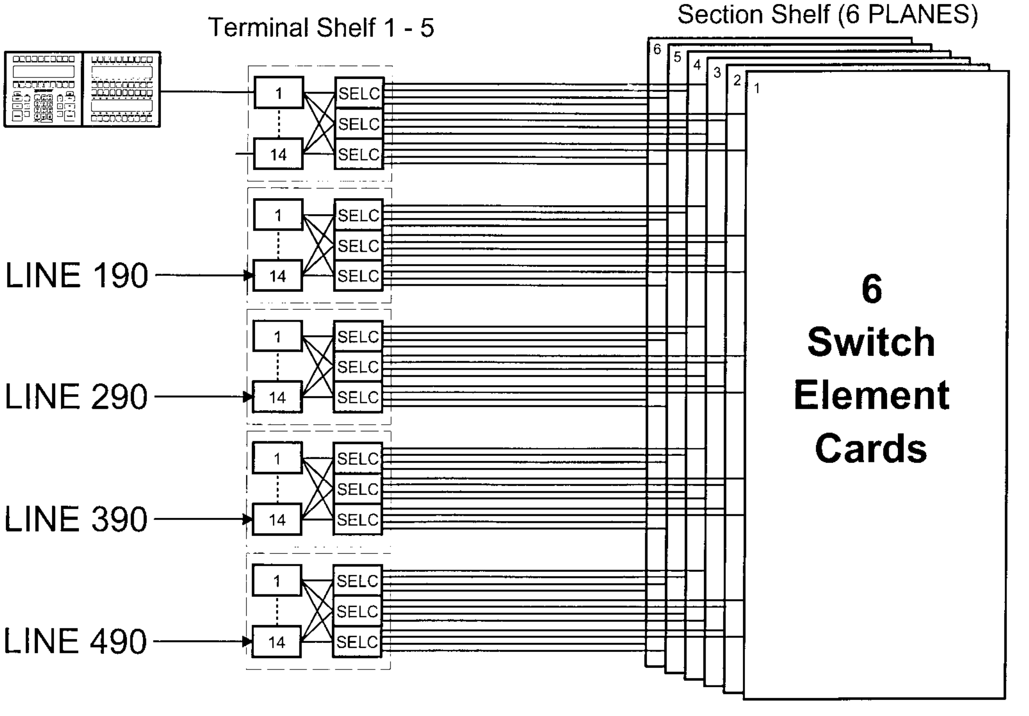


With N+1 redundancy, you can lose one SELC and the Tradenet MX System is still running.

In a Mini or Compact system, SELCs are used as access switches and are interconnected. Both the Mini and Compact systems can have up to two TUs.

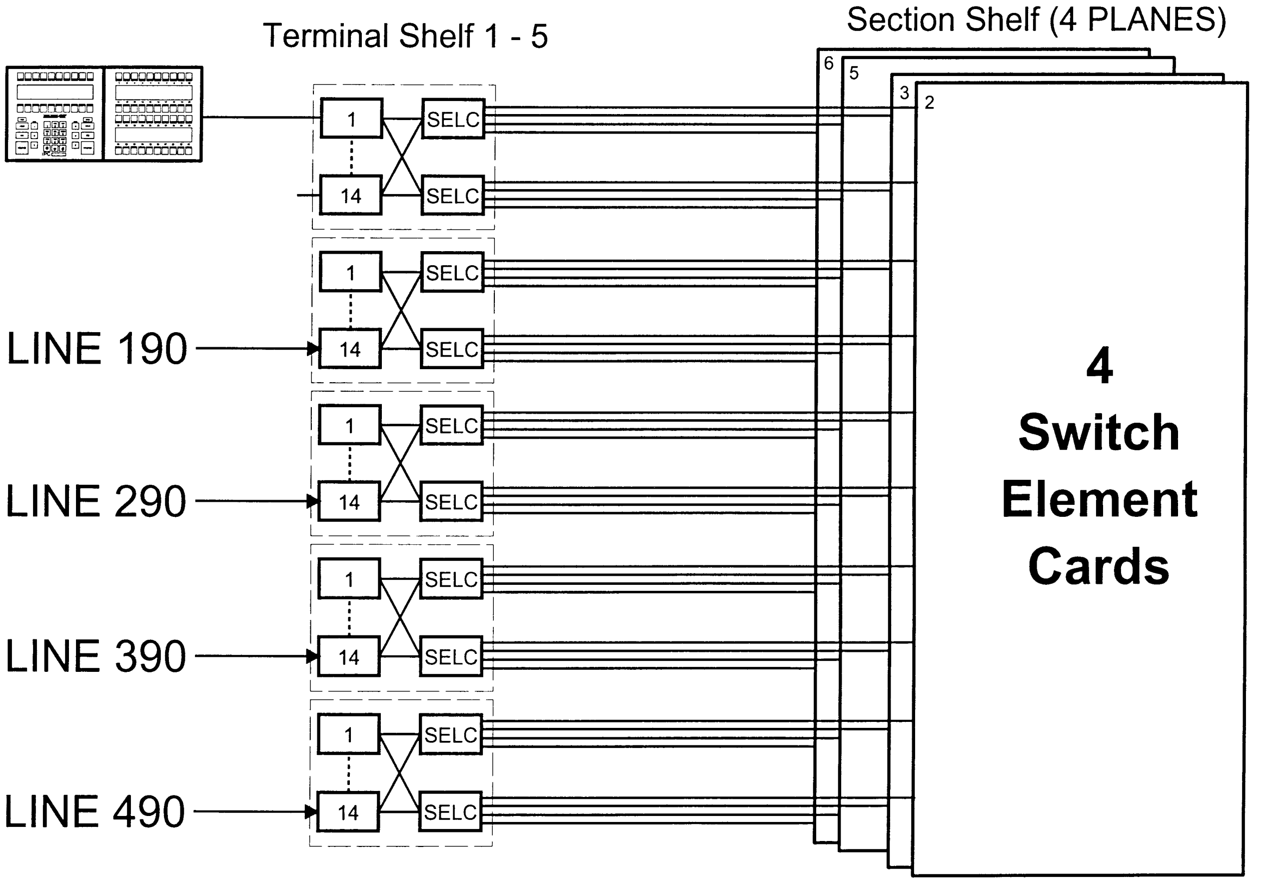
Another configuration introduces SELCs used as section switches, which are connected back-to-back in a similar way to the connection of access switches. *FIGURE 2-15 Two Cabinet Triplet System With N+2 Redundancy* on page 2-26 shows a two cabinet triplet system with N+2 redundancy.

FIGURE 2-15 Two Cabinet Triplet System With N+2 Redundancy



The following figure shows a two cabinet triplet system with N+1 redundancy.

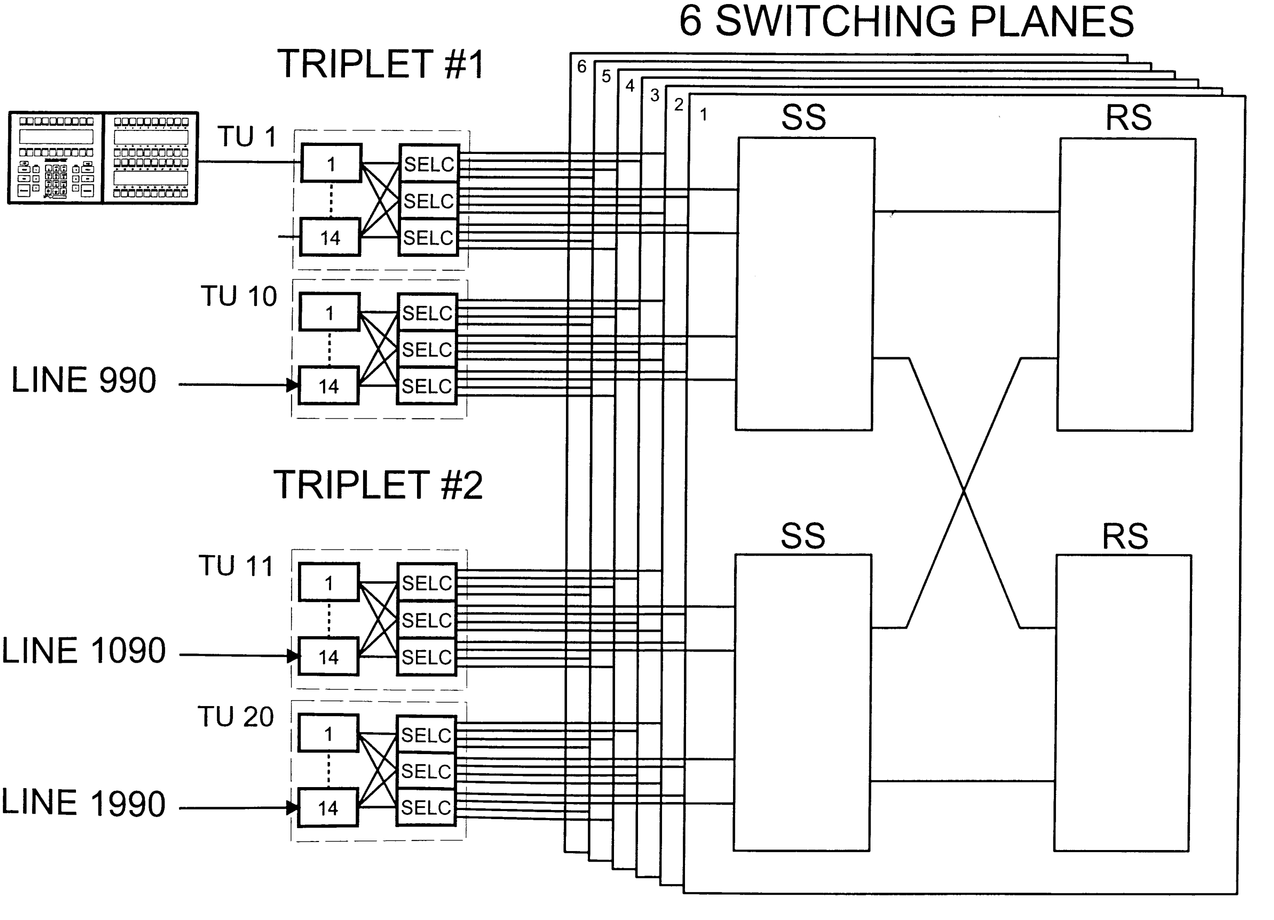
FIGURE 2-16 Two Cabinet Triplet System With N+1 Redundancy



Three Cabinet (Triplet) and Larger Configurations

In a triplet system, there are nine links joining each pair of section switches. A subset of this configuration has only two cabinets, five TUs, and six section switches. Larger configurations consist of multiple triplets connected together, with a varying number of links from each section switch to each reflection switch and with a varying number of the third use of SELCs, reflection switches. The largest system of this configuration is *FIGURE 2-17 Larger Multiple Triplet System* on page 2-28.

FIGURE 2-17 Larger Multiple Triplet System



In the above figure, the SELCs are used as section switches (SS) and reflection switches (RS).

Large configurations can be *double sided* where there are two regular systems built with less than the maximum possible number of TUs, connected together by links between the reflection switches. The number of links between each corresponding pair of reflection switches is always six. These are links that are otherwise unused when each side is depopulated to become one half of a double sided system.

Double-sided systems use two complete sets of reflection switches, but they are still organized into four or six planes. The difference is that the two sets of reflection switches in each plane are themselves interconnected. To design a double-sided system, you set up two separate systems, or *sides*, and then remove enough TUs (while keeping the same number of reflection switches) to free up enough links to provide an acceptable number of links *between* reflection switches. For example, the largest system possible with 120 TUs is formed around two systems that would have 95 TUs if they were separate systems. This largest system possible has six separate reflection switch backplanes, in six triplets, and none in the remaining triplets. Each reflection shelf has connectors for all 10 triplets, although the tenth connector is only half used. When we eliminate the triplets without reflection switch shelves, we make 3 connectors with 18 links and 1 with 9 links available on each reflection switch backplane in both sides. Remember that the links from every section switch are evenly distributed within the reflection switch backplane: thus the unused connectors each have links to all nine reflection switches in the plane. By linking all the vacant connectors on each reflection switch backplane in one side to the same connectors on the reflection switch backplane for the same plane in the other side, we are conveniently able to provide redundant distributed links between every reflection switch card and its equivalent in the other side, on a plane-by-plane basis.

Double-sided systems can not only be used to gain the maximum MX System capacity, they can also be used to provide you with two systems that can be separated in different locations or floors, and which will still provide complete universal access between the two systems, with all the redundancy and reliability of a single system. Customers who have concerns about fire or sabotage can thus divide their system, to reduce the danger to the entire system.

PORT-TO-PORT MAPPING

A diagram that shows the interconnections between cards in the Tradenet MX System is called a port-to-port map. Port-to-port maps are very useful in troubleshooting problems such as lost communications between cards, shelves, and cabinets in the Tradenet MX System.

FIGURE 2-18 Plane 1 (3 Triplet, 3 Link, 6 Plane) Mapping on page 2-31 through *FIGURE 2-23 Plane 6 (3 Triplet, 3 Link, 6 Plane) Mapping* on page 2-36 show the port-to-port mapping of a 3 triplet, 3 link, 6 plane system.

FIGURE 2-18 Plane 1 (3 Triplet, 3 Link, 6 Plane) Mapping

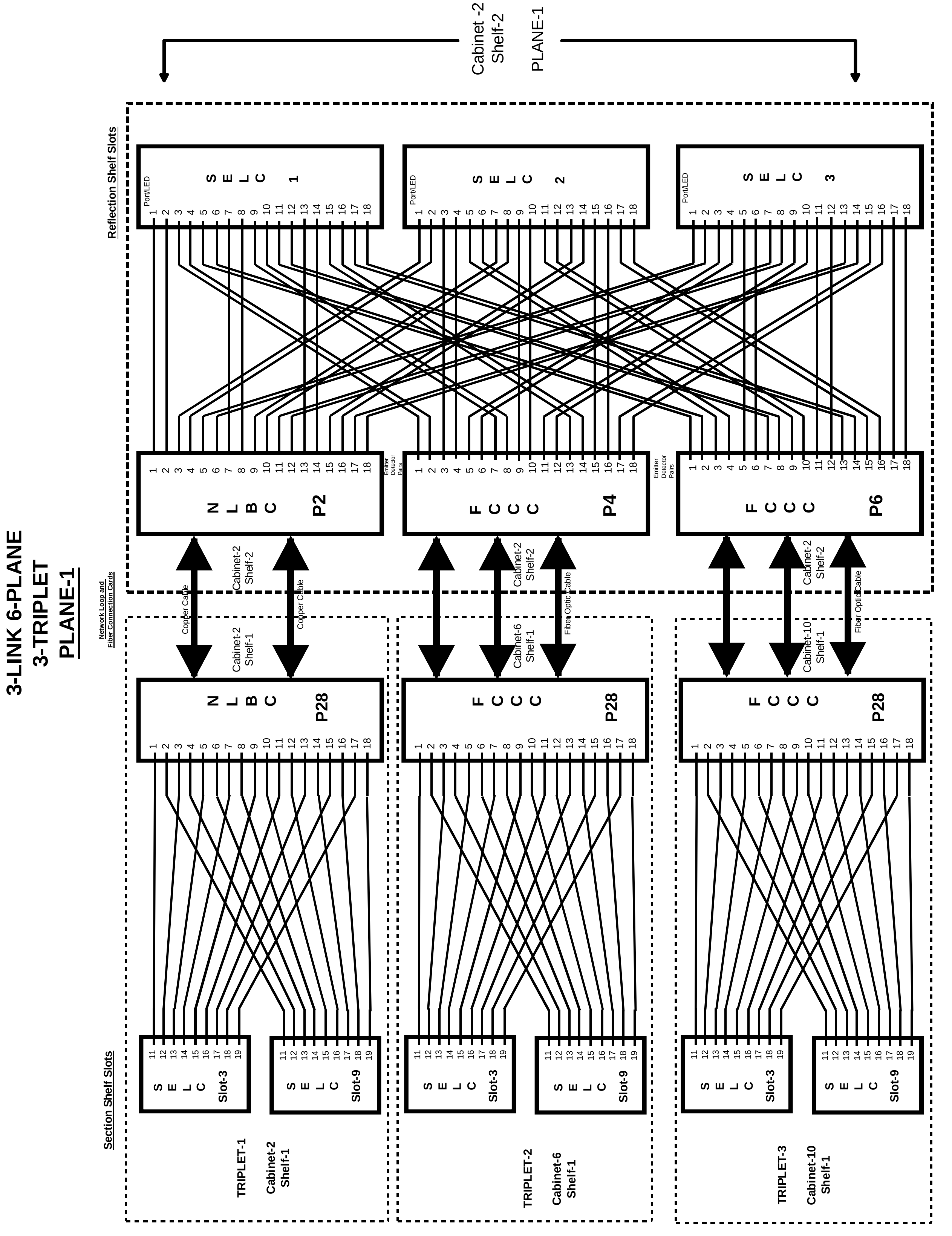


FIGURE 2-19 Plane 2 (3 Triplet, 3 Link, 6 Plane) Mapping

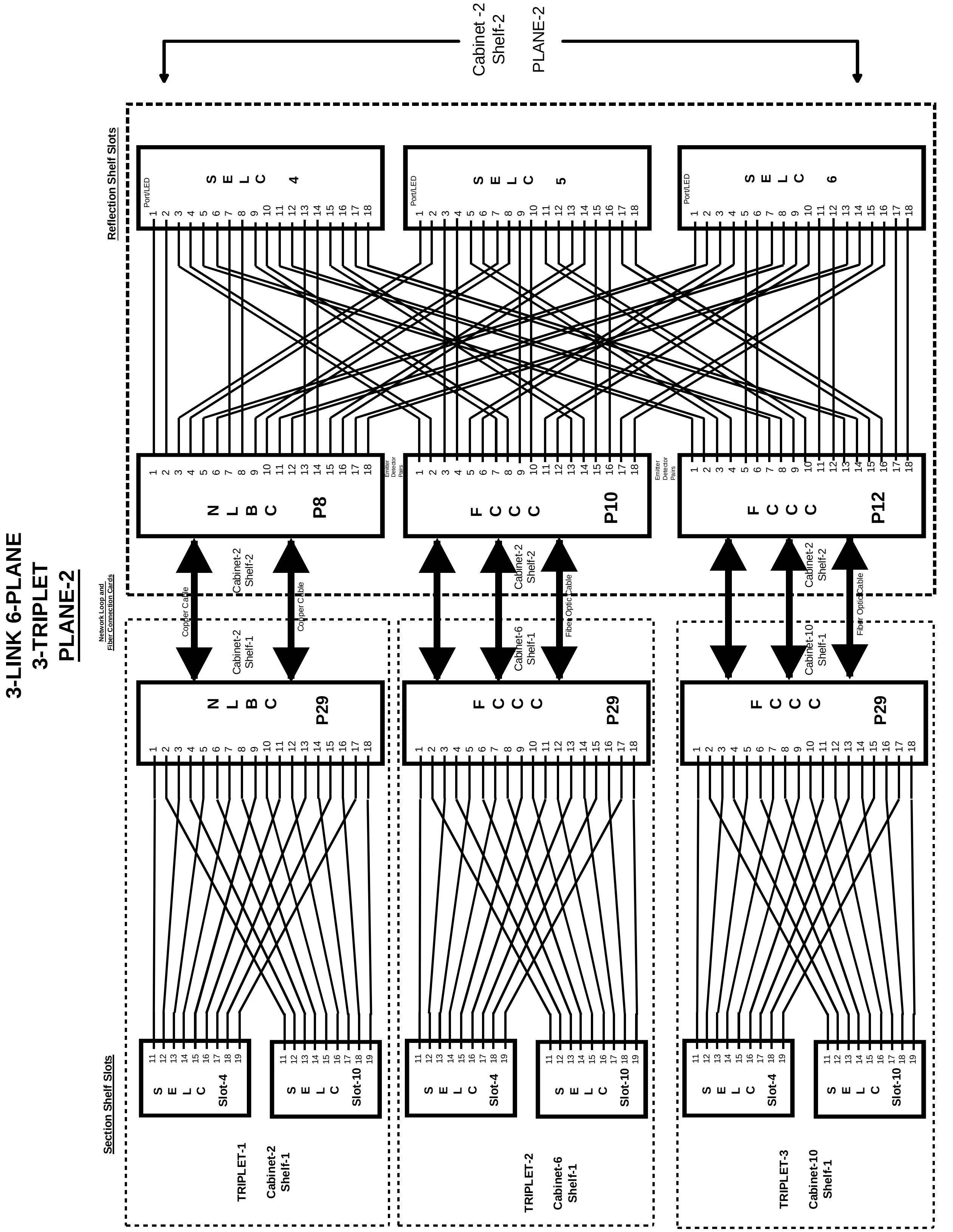


FIGURE 2-20 Plane 3 (3 Triplet, 3 Link, 6 Plane) Mapping

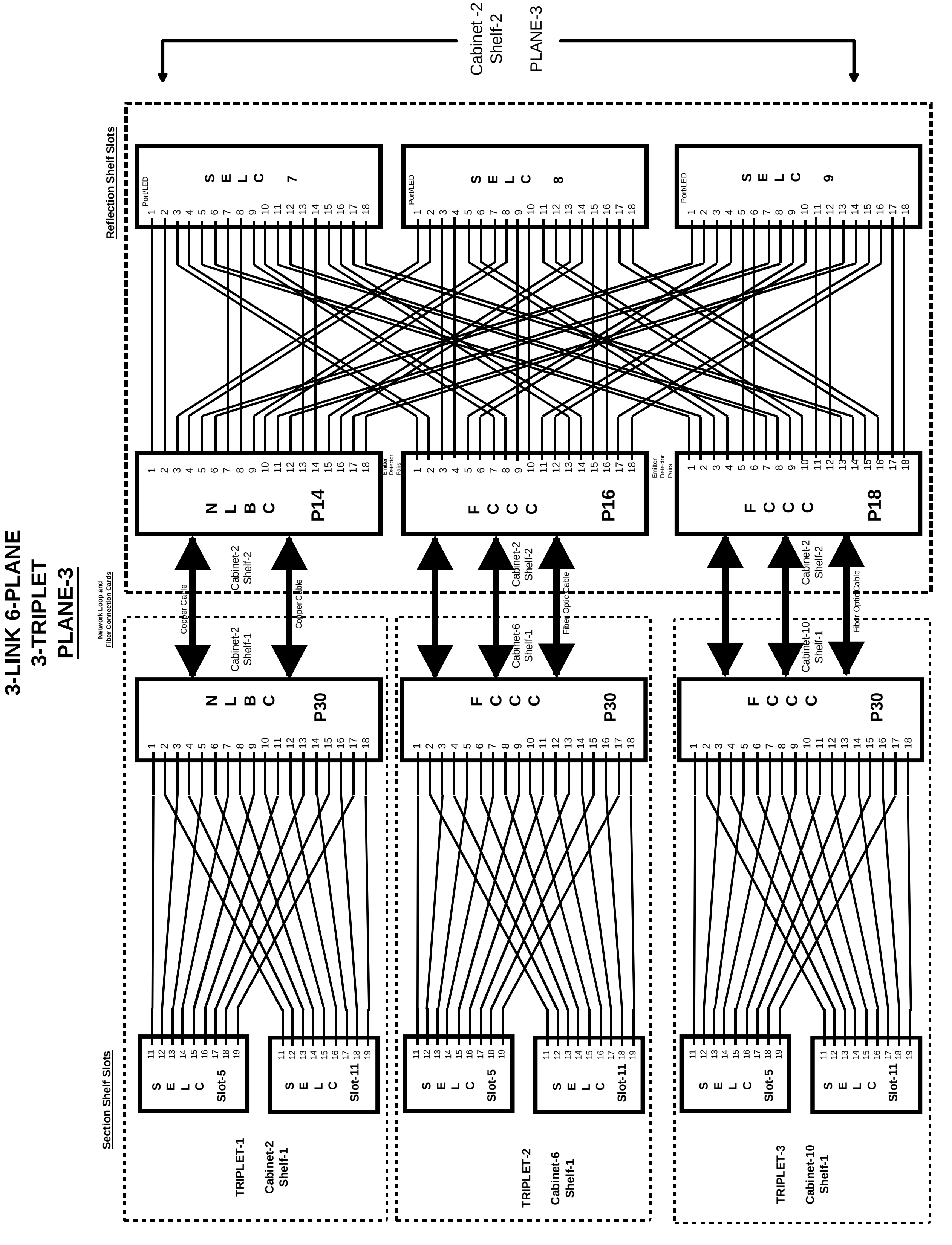


FIGURE 2-21 Plane 4 (3 Triplet, 3 Link, 6 Plane) Mapping

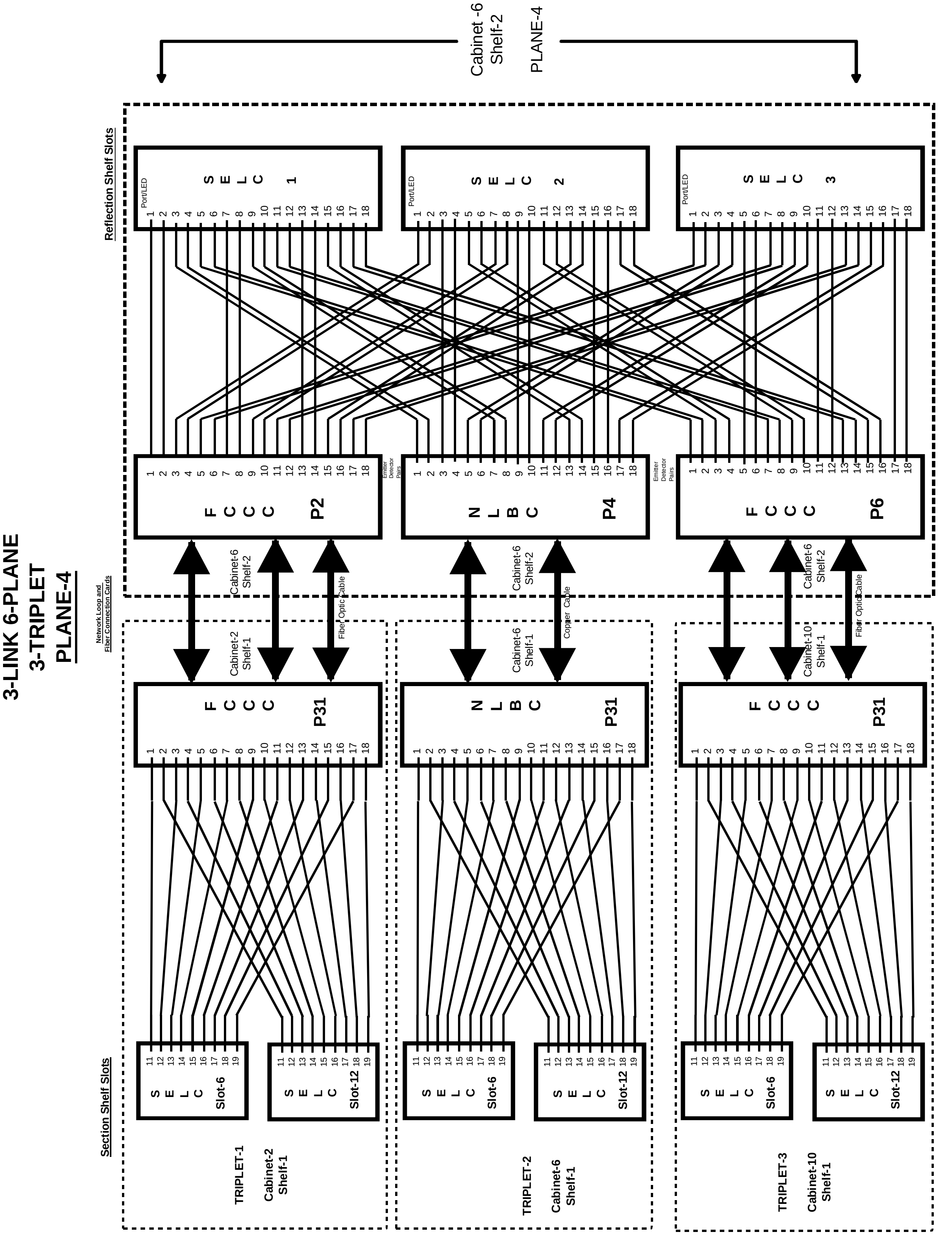


FIGURE 2-22 Plane 5 (3 Triplet, 3 Link, 6 Plane) Mapping

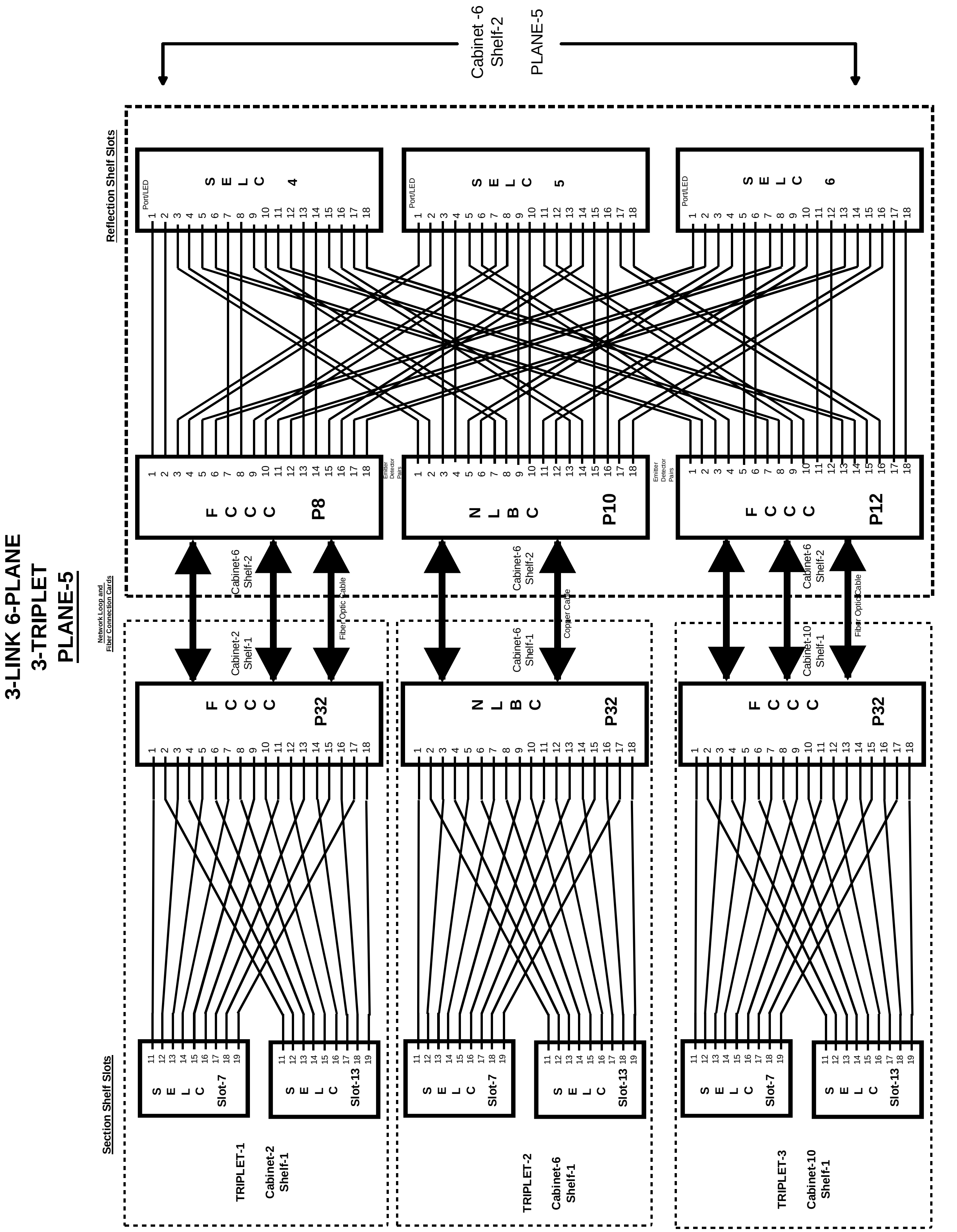


FIGURE 2-23 Plane 6 (3 Triplet, 3 Link, 6 Plane) Mapping

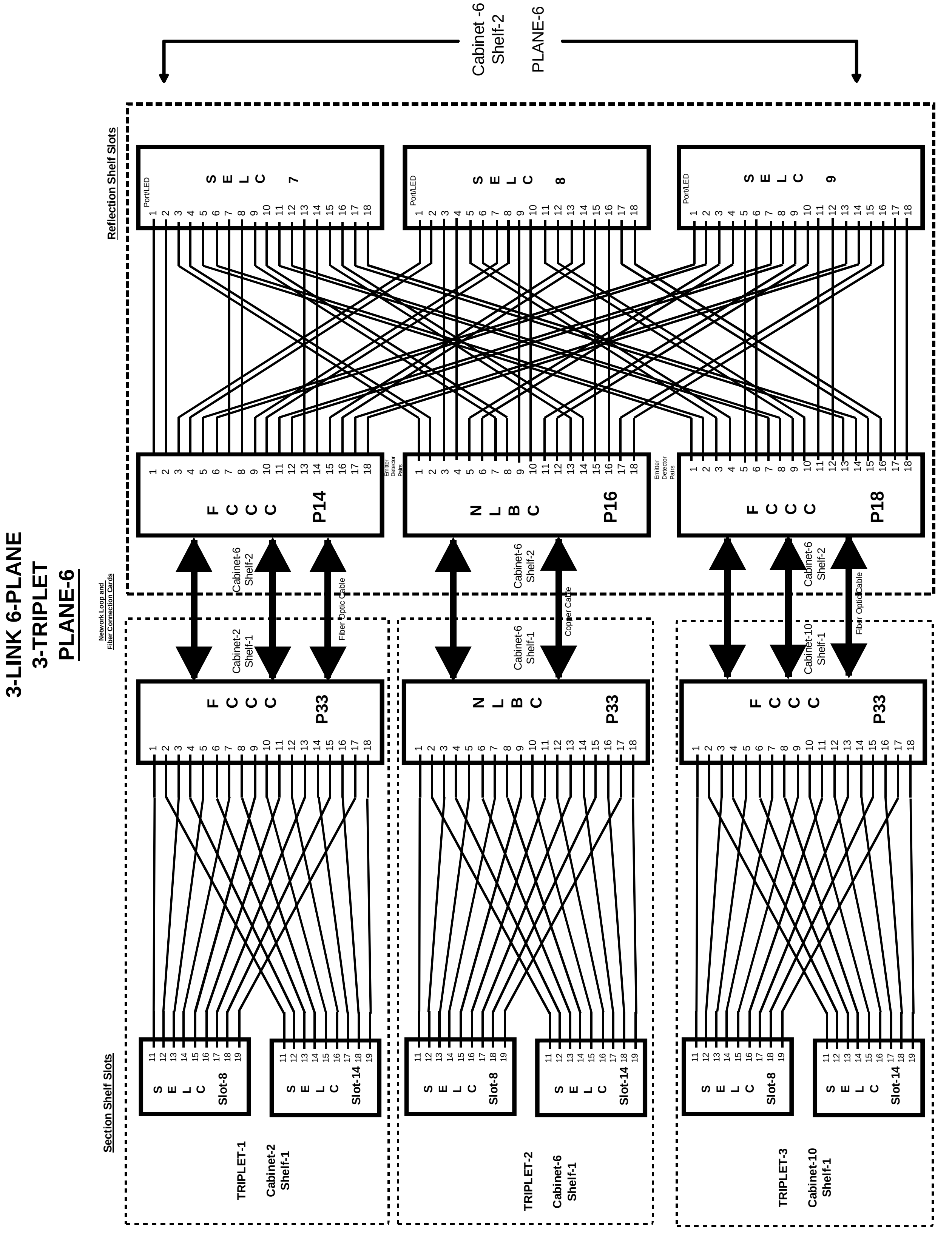


FIGURE 2-24 Plane 1, Triplets 1-3 (6 Triplet, 2 Link, 6 Plane) Mapping on page 2-38 through *FIGURE 2-35 Plane 6, Triplets 4-6 (6 Triplet, 2 Link, 6 Plane) Mapping* on page 2-49 show the port-to-port mapping of a 6 triplet, 2 link, 6 plane system.

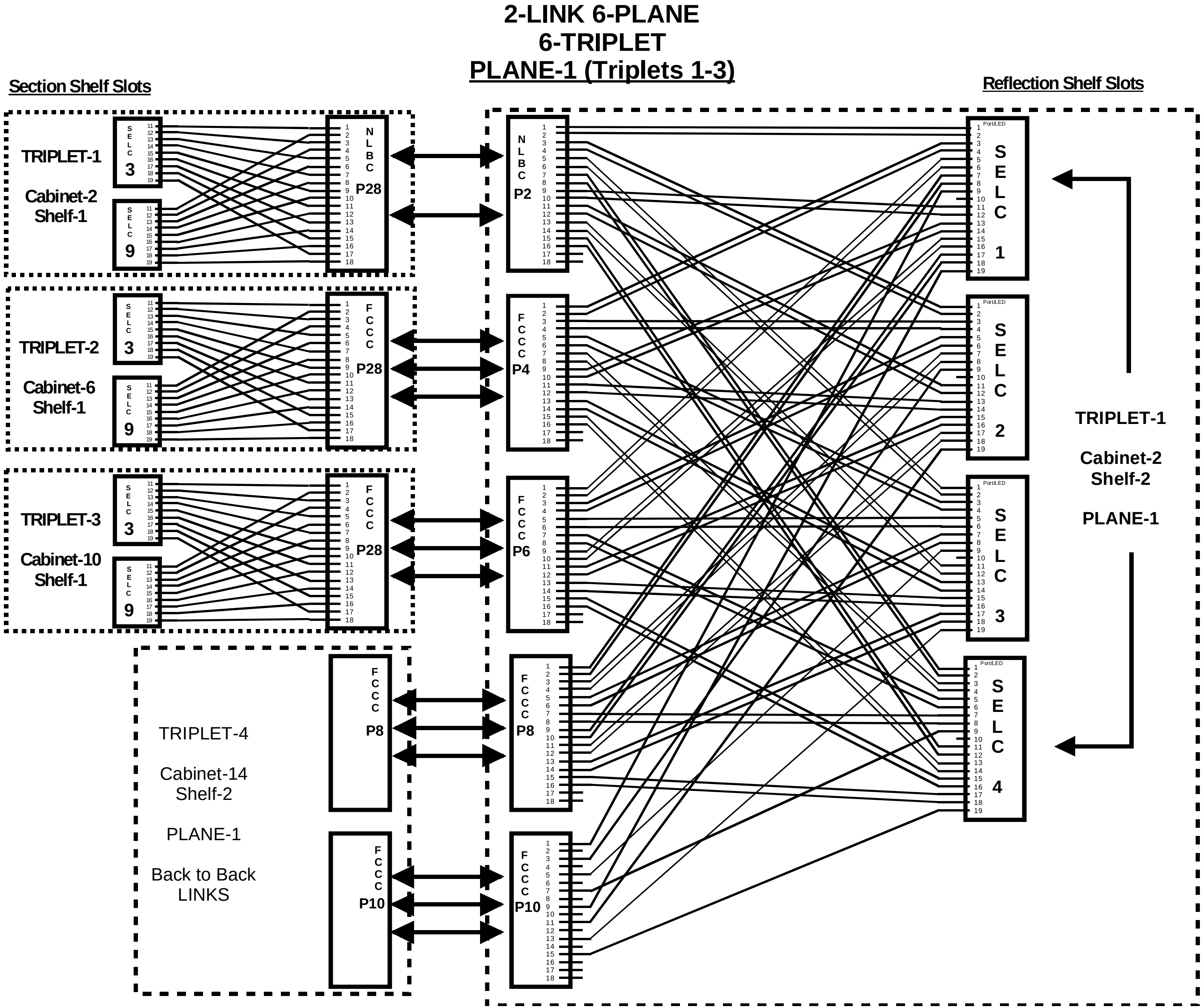


FIGURE 2-24 Plane 1, Triplets 1-3 (6 Triplet, 2 Link, 6 Plane) Mapping

2-LINK 6-PLANE
6-TRIPLET
PLANE-1 (Triplets 4-6)

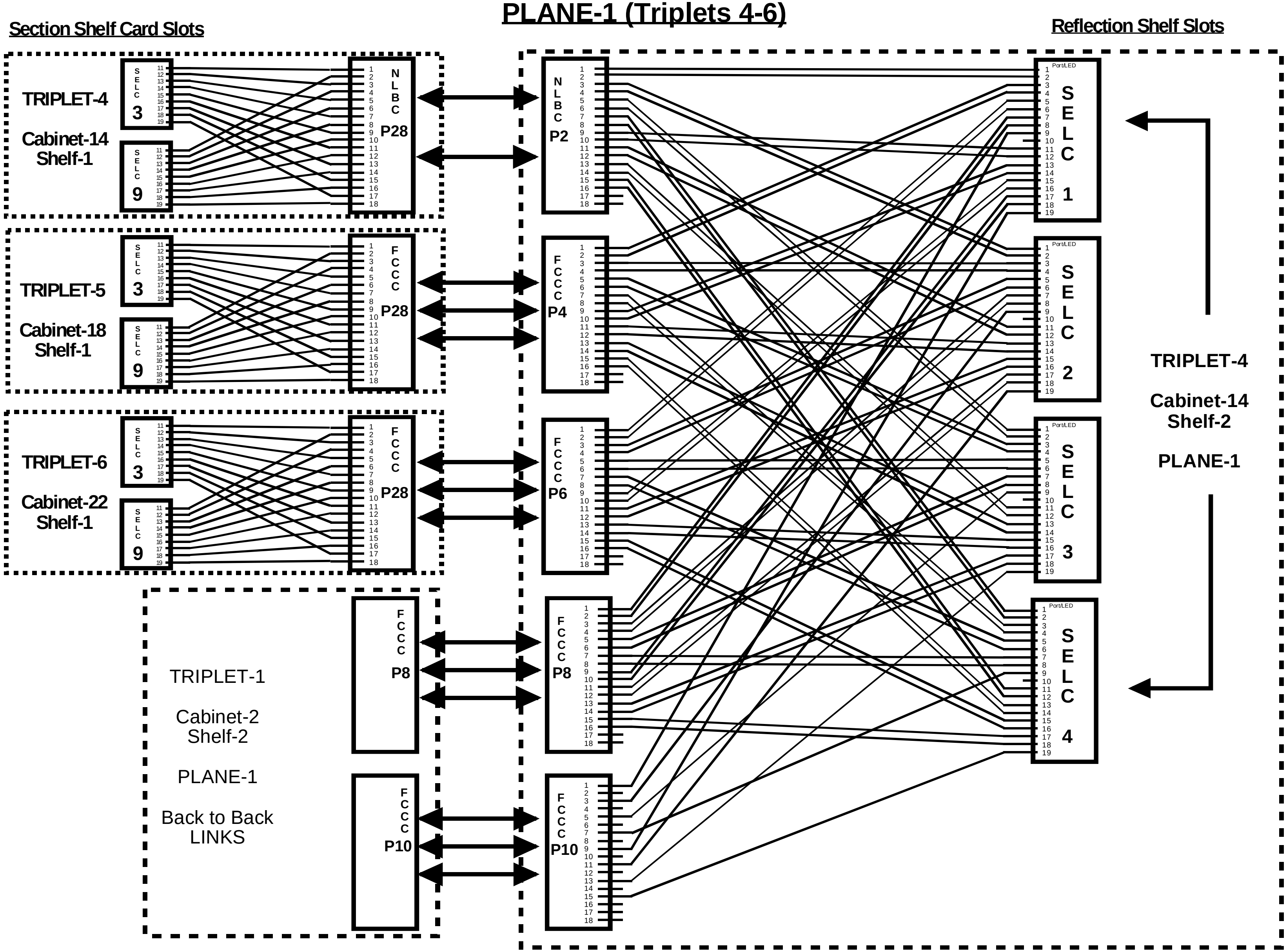


FIGURE 2-25 Plane 1, Triplets 4-6 (6 Triplet, 2 Link, 6 Plane) Mapping

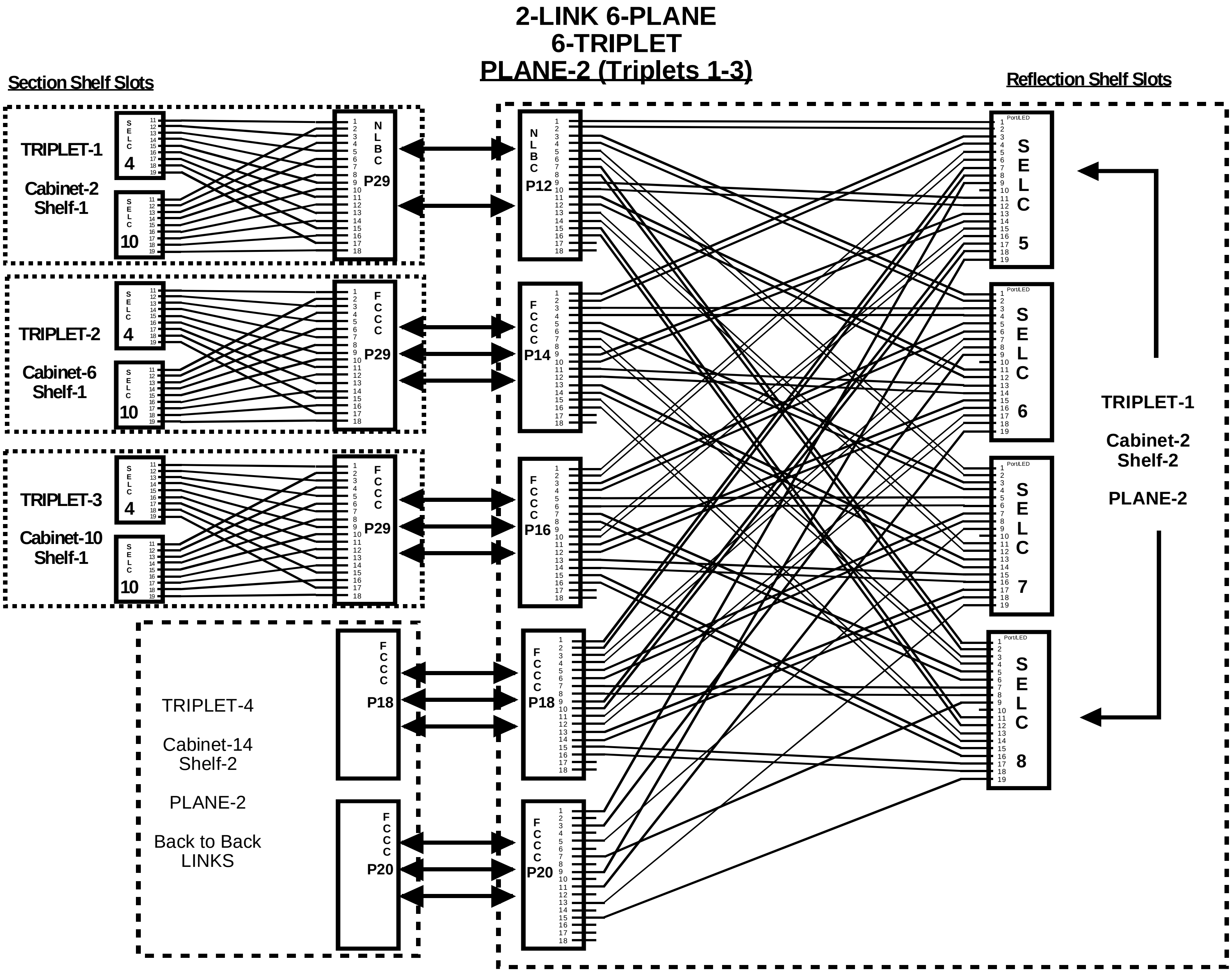


FIGURE 2-26 Plane 2, Triplets 1-3 (6 Triplet, 2 Link, 6 Plane) Mapping

2-LINK 6-PLANE
6-TRIPLET
PLANE-2 (Triplets 4-6)

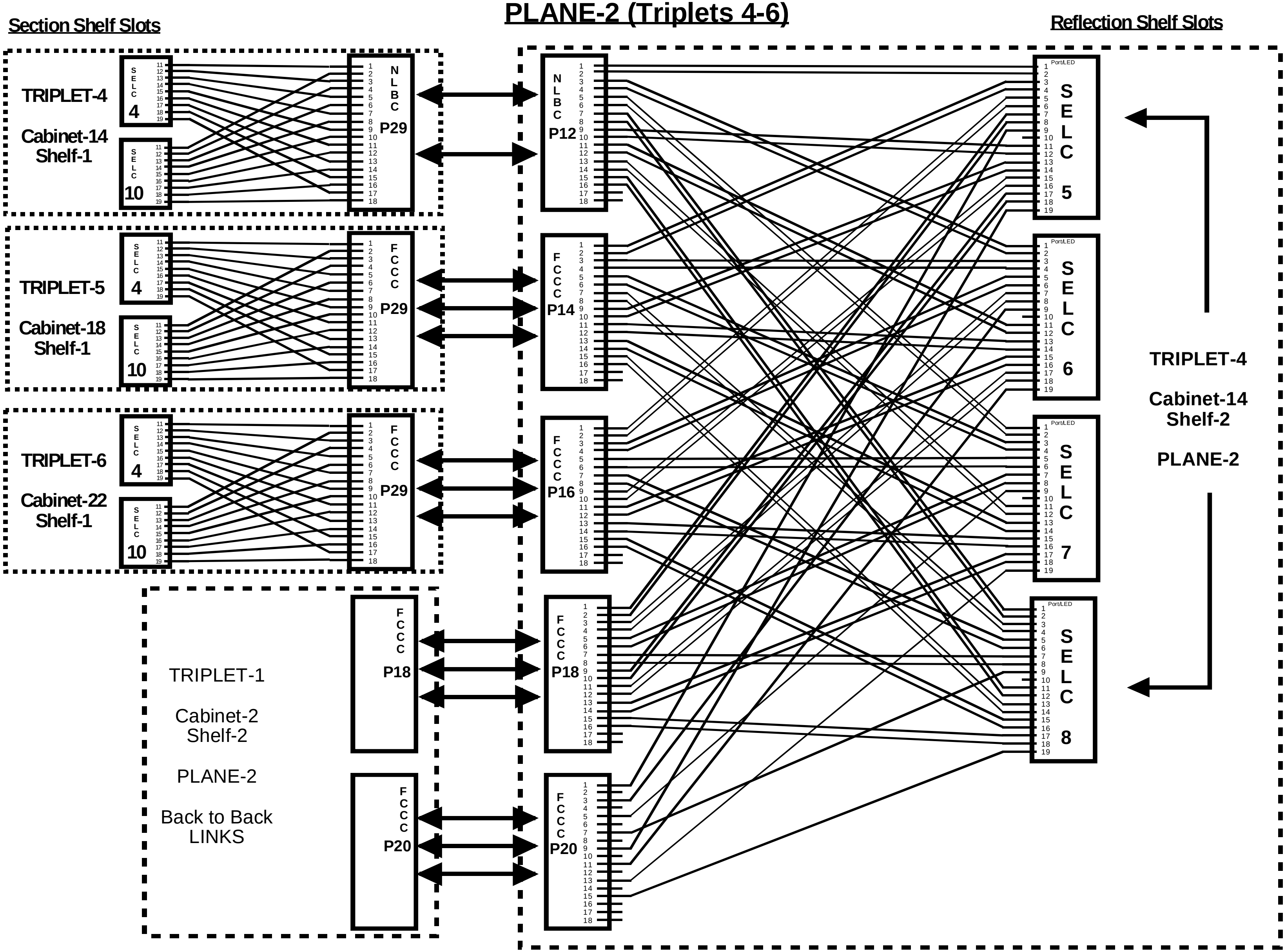


FIGURE 2-27 Plane 2, Triplets 4-6 (6 Triplet, 2 Link, 6 Plane) Mapping

2-LINK 6-PLANE
6-TRIPLET
PLANE-3 (Triplets 1-3)

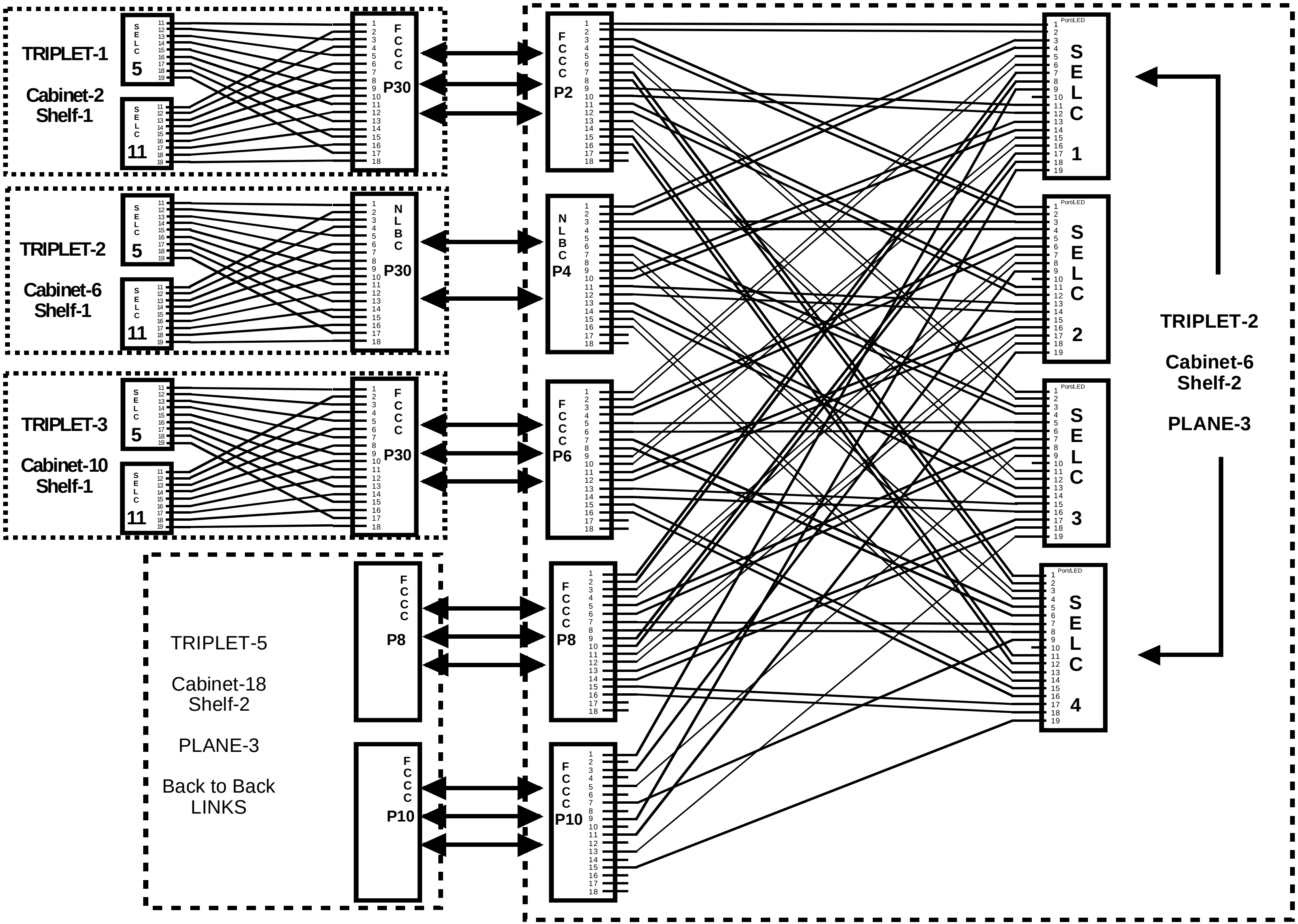


FIGURE 2-28 Plane 3, Triplets 1-3 (6 Triplet, 2 Link, 6 Plane) Mapping

2-LINK 6-PLANE
6-TRIPLET
PLANE-3 (Triplets 4-6)

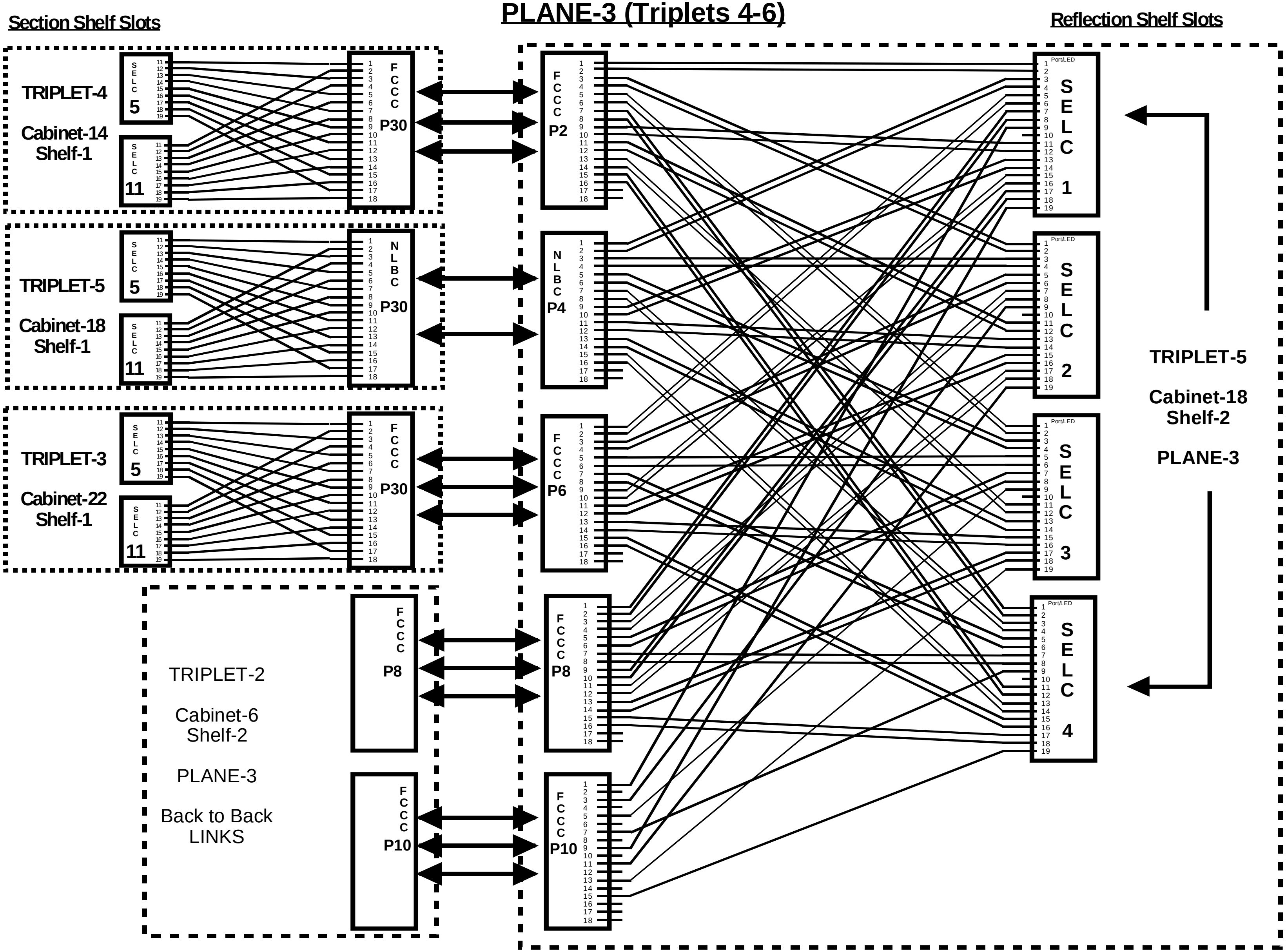


FIGURE 2-29 Plane 3, Triplets 4-6 (6 Triplet, 2 Link, 6 Plane) Mapping

2-LINK 6-PLANE
6-TRIPLET
PLANE-4 (Triplets 1-3)

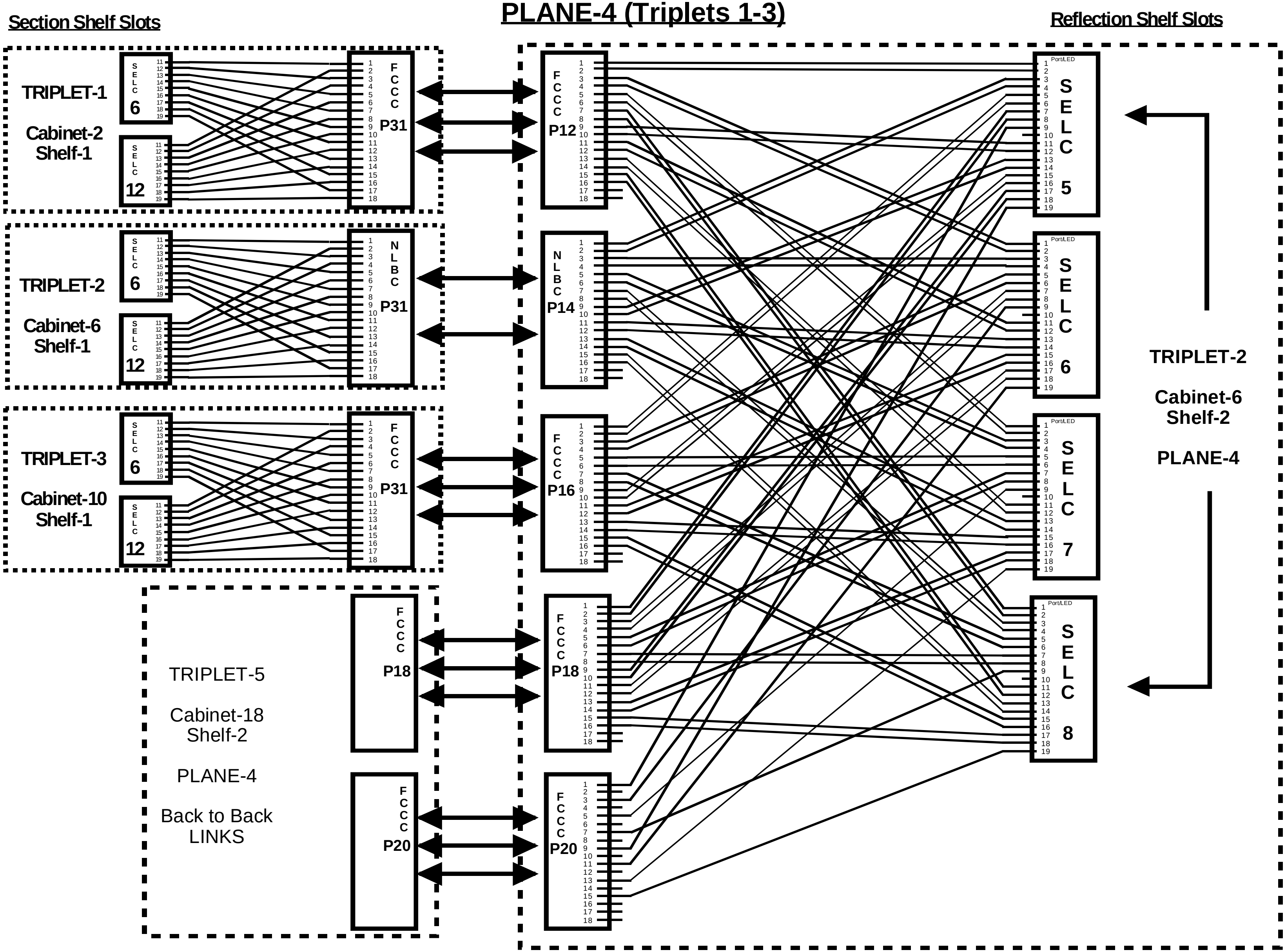


FIGURE 2-30 Plane 4, Triplets 1-3 (6 Triplet, 2 Link, 6 Plane) Mapping

2-LINK 6-PLANE
6-TRIPLET
PLANE-4 (Triplets 4-6)

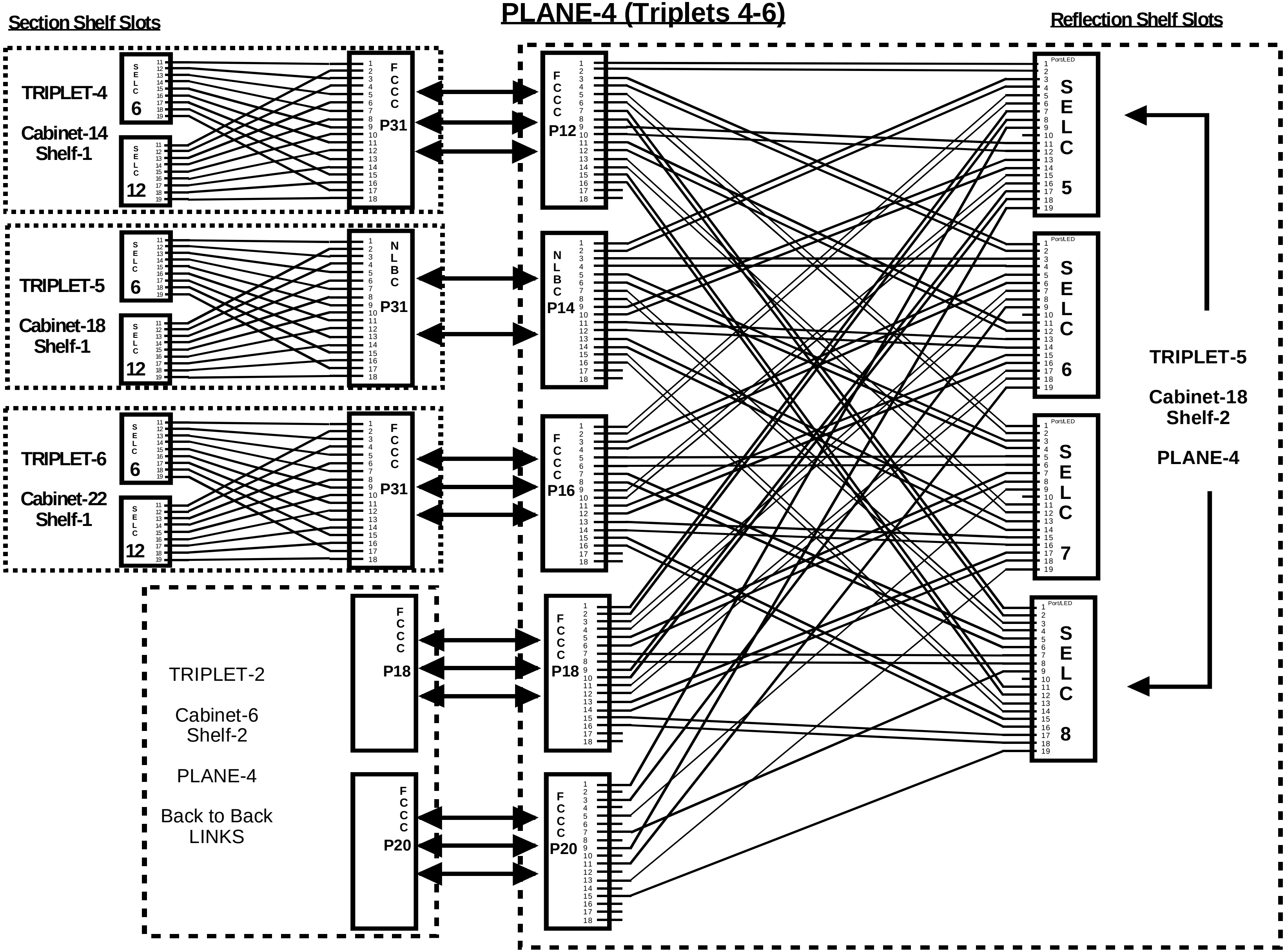


FIGURE 2-31 Plane 4, Triplets 4-6 (6 Triplet, 2 Link, 6 Plane) Mapping

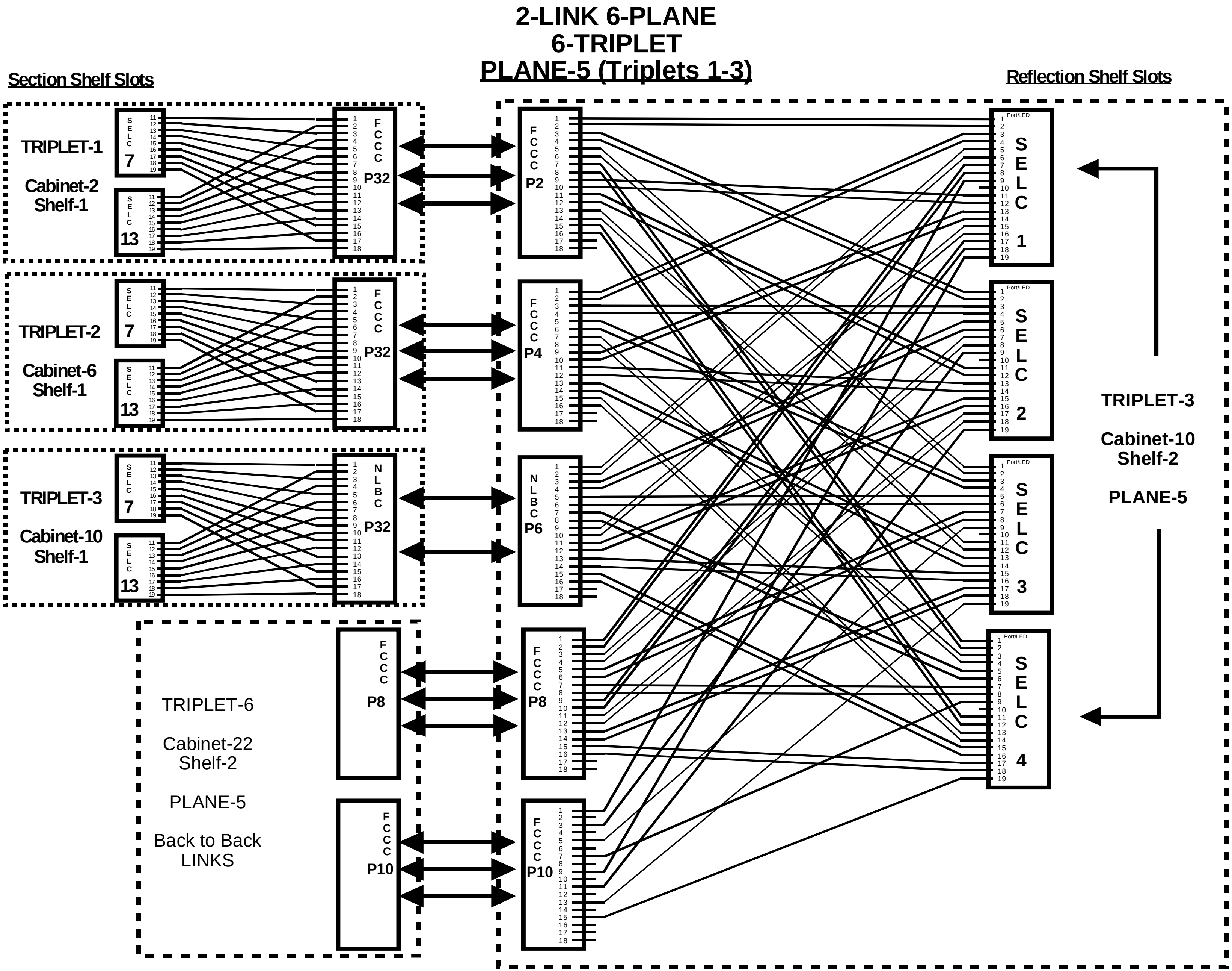


FIGURE 2-32 Plane 5, Triplets 1-3 (6 Triplet, 2 Link, 6 Plane) Mapping

2-LINK 6-PLANE
6-TRIPLET
PLANE-5 (Triplets 4-6)

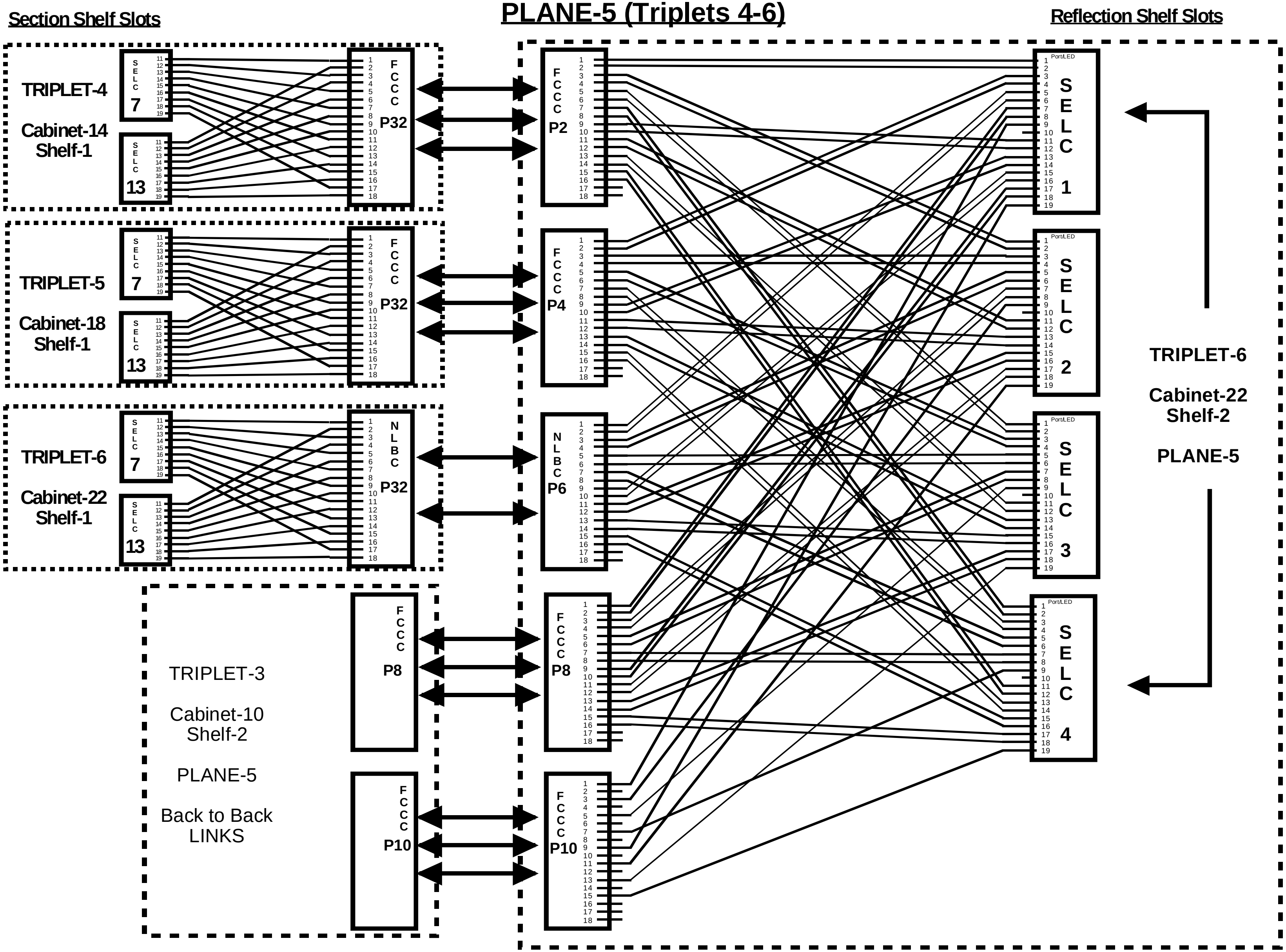


FIGURE 2-33 Plane 5, Triplets 4-6 (6 Triplet, 2 Link, 6 Plane) Mapping

2-LINK 6-PLANE
6-TRIPLET
PLANE-6 (Triplets 1-3)

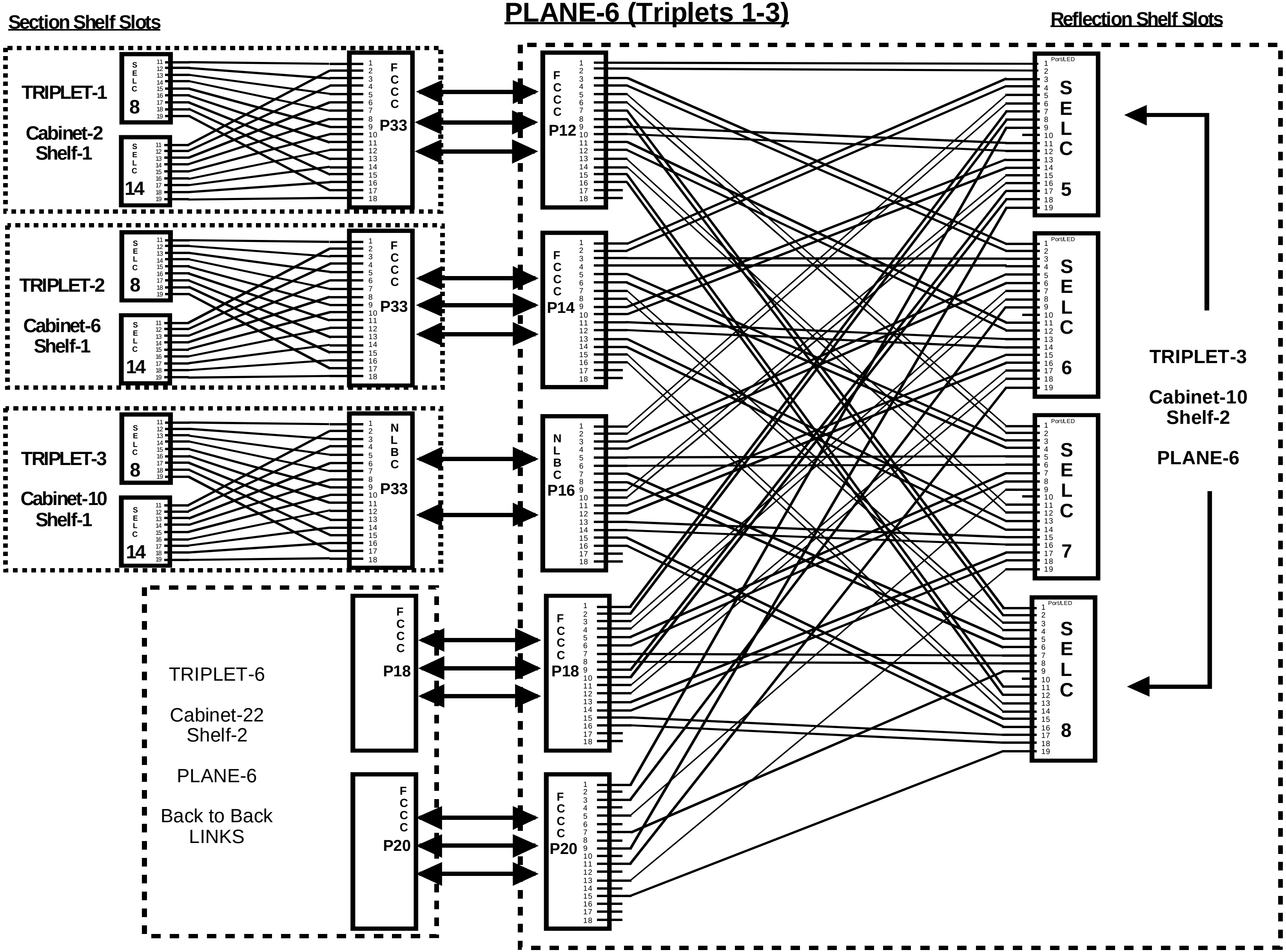


FIGURE 2-34 Plane 6, Triplets 1-3 (6 Triplet, 2 Link, 6 Plane) Mapping

2-LINK 6-PLANE
6-TRIPLET
PLANE-6 (Triplets 4-6)

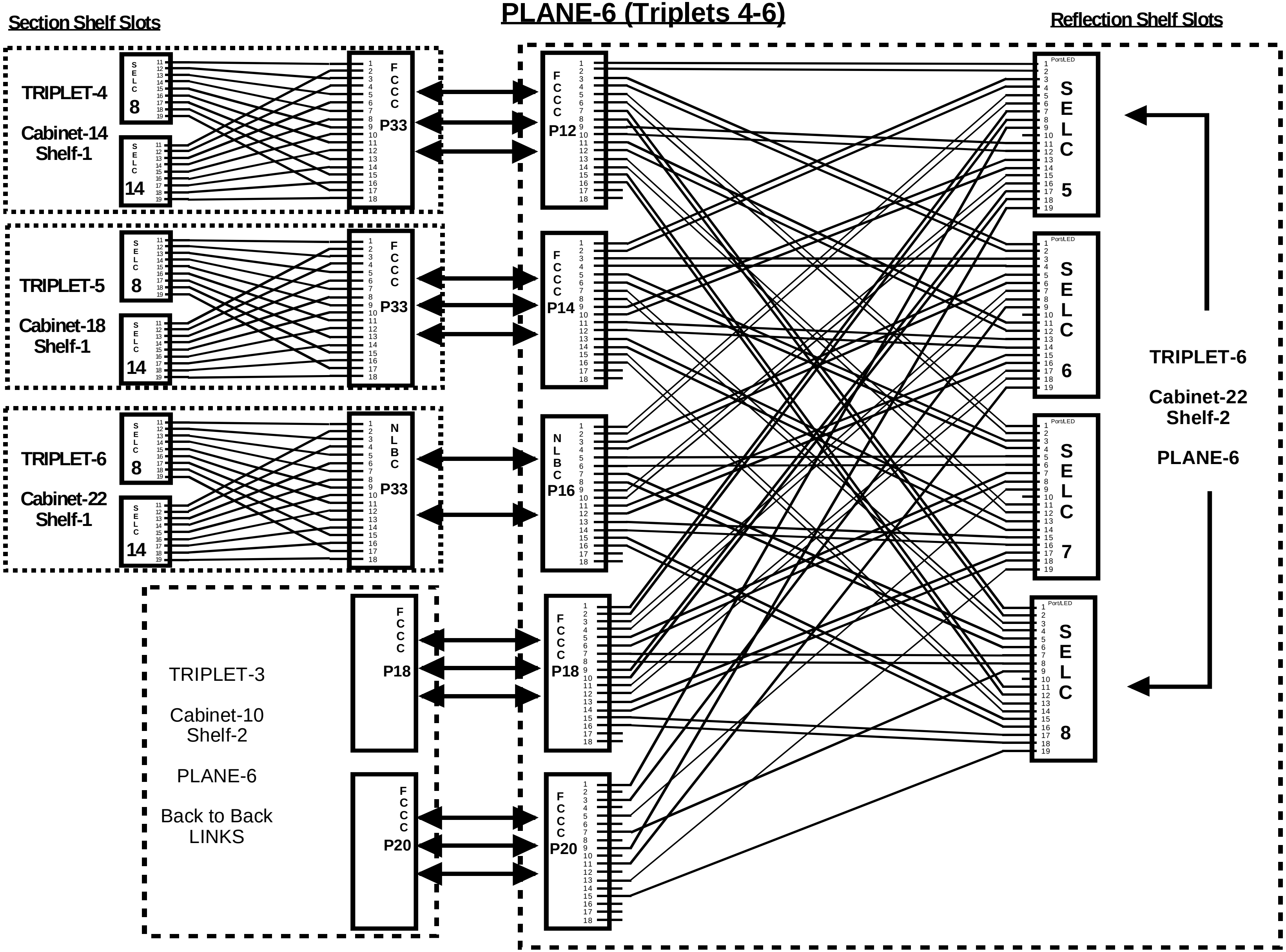


FIGURE 2-35 Plane 6, Triplets 4-6 (6 Triplet, 2 Link, 6 Plane) Mapping

SYSTEM CENTER

The System Center is an on-line, real-time administrative and maintenance terminal for the MX System. The System Center's Sun workstation is linked to the backroom cabinets using a fiber optic cable and an Ethernet connection. The Sun workstation is a UNIX-based bi-directional system terminal, displaying system status and traffic activity while accepting programming changes from the System Administrator. It is also used by installation personnel to set up the MX System and by the System Administrator to obtain reports and track events (or alarms) within the MX System.

In a system with anywhere from one cabinet to six triplets there is only one System Center required for the entire system, although duplicate System Centers with duplicate connections to the MX can be specified at the customer's option. For systems of seven or more triplets, two System Centers and two connections to the MX System are required.

For a detailed description of the System Center, refer to the *Tradenet MX System Center Manual 14.1* (part number B0086185104).

The System Center software consists of many different files in a database. These files provide menus, download data to cards and turrets, and restart and reload cards in the system. The database also contains customer data, country specific data, and configuration data.

During the life of an MX System installation, the System Center mirrors its configuration. Data files are automatically updated and saved whenever a user makes a change. Other files maintain the setup of each turret including face layouts, speed dials, and feature configuration. The database also tracks call activity and system status. Call activity is sorted and compressed and turned into traffic reports. System status records are stored for maintenance and diagnostics and can activate alarms.

The System Center is a critical part of the Tradenet MX system and must be protected from power failure. The Tradenet MX switch can operate without the System Center but no diagnostics or user changes can occur without it.

In addition to the System Center, you can have a remote terminal, or X terminal, if you are using Tradenet MX Release 8.0.3 or later. This second terminal can be used for administrative convenience when the MX system is split up over multiple floors, or it can be used to provide an administrator or manager with access to the System Center in their office. The remote terminal must be on the same network as the System Center Gateway and the System Center itself. Any of the functions described in the following sections can be done from either the System Center or from a remote terminal, if one is installed.

System Center Functions

The major functions of the System Center are:

- *Database Production*–The System Center is used by IPC personnel to develop the database for the entire system, before installation or during major changes or additions.
- *System Administration*–Administrative changes (moves, adds, and changes) are executed on the System Center. The Tradenet MX System replaces cross-connected connections with flexible station-to-line assignment providing universal line access. Logging on is also supported by the System Center, which stores and provides to the turrets the configuration information associated with each trader.
- *Traffic Analysis*–Data concerning every call is captured and stored in the site database. The raw data is rearranged into usable traffic reports to help control network costs.
- *Maintenance and Diagnostics*–Internal MX maintenance capabilities include automatic call recovery and self-healing. The System Center complements these internal system capabilities by providing diagnostics (local and remote) and alarm reporting.

Database Production

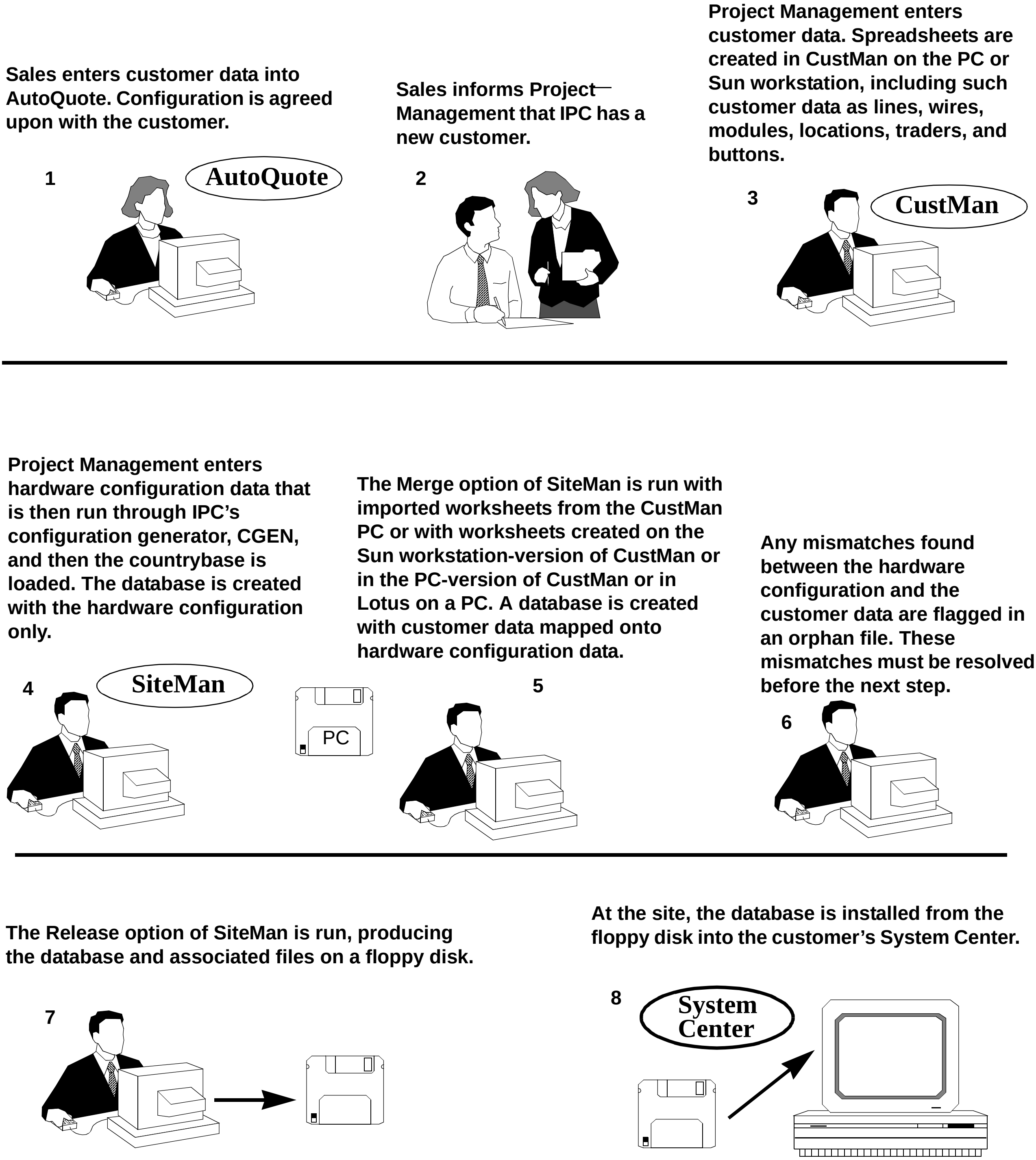
The customer’s database is built in advance of cut-over by IPC personnel, using customer-supplied information about the site. IPC’s database production software is called DataMan. It is used to quote and build Tradenet MX Systems. Using basic system parameters, such as lines and stations, the configuration generator (CGEN) portion of DataMan determines the necessary system size. It then calculates the required number and configuration of cabinets, card shelves, cables, and system power supplies. After the customer’s unique information is entered into DataMan by IPC Project Management, DataMan determines which type and quantity of interface cards are needed, and specifies their location on each shelf. DataMan also provides input power and air conditioning specifications.

DataMan contains the following tools:

- *AutoQuote*–IPC’s Marketing and Sales departments use AutoQuote for estimates on hardware configurations in terms of the type and number of components needed. This assists Sales when quoting prices to potential customers. After the price is accepted by the customer, the configuration is agreed upon, based on information from AutoQuote. This tool can be installed on an IPC branch office’s Sun workstation, or it can be remotely accessed on a machine at the IPC Engineering department located in Stamford, CT, USA.
- *CustMan*–This tool is used by Project Management to enter the customer specific data after the customer has committed to purchasing a Tradenet MX System. This data consists of trader information, line information, and so on. Custman creates worksheets used by Siteman. There is a PC-version of Custman and a Sun workstation version of Custman.
- *SiteMan*–This tool is also used after a customer has committed to purchasing a Tradenet MX System. This does the actual database production. When you use SiteMan, the hardware configuration is run through IPC’s CGEN, and then the countrybase is loaded. A database is created with a hardware configuration only. Next, customer information is either accessed from CustMan or imported from the PC-version of CustMan or from a Lotus spreadsheet on a PC. All information must be completed before a merge step is done. The merge step takes the customer information and maps it to the hardware configuration to update the database. Any mismatches found between the hardware configuration and customer data are flagged in an orphan file. Once all the mismatches are resolved, the database is released. This automatically runs three other steps that are needed when loading the database into the customer site System Center, including copying the database to a floppy disk.

The following figure illustrates the flow of database production within IPC.

FIGURE 2-36 Database Production



For more information about DataMan, refer to the *Tradenet MX DataMan Manual 11.1* (part number B-01087-0-00-02).

After using AutoQuote to quote a Tradenet MX System, and SiteMan and CustMan to build a Tradenet MX System, you use the Database Reconfigurator tool to make changes to a Tradenet MX System. (Like AutoQuote, SiteMan, and CustMan, the Database Reconfigurator tool also uses CGEN software.) For more information about making changes to Tradenet MX Systems, refer to the *Tradenet MX Database Reconfigurator Manual 14.1* (part number B0098986304).

System Administration (Moves, Adds, and Changes)

After installation, the System Administrator manages the trading floor equipment and the back room switch. This includes reassigning station buttons, moving and adding lines, moving traders, and other moves, adds, and changes (MAC). In the past, MAC work meant cross-connect rewiring and, as a result, manual labor. In the Tradenet MX System, button attributes are stored in the site database and are downloaded into the stations during installations. Whenever a programming change is necessary, the System Administrator accesses the files within the database, updates the records, and then programs the positions.

To ease system administration and to reduce Operation's costs, many utilities are included in the System Center. These include:

- *Log On*–When a trader logs on, the System Center downloads the trader's face layout and feature configuration to the respective position. The trader's previous position is logged off. Different shifts can use the same station over the course of the day, or the same trader can move to different locations, depending on his activities, and still keep the same face layout and personnel information.
- *Automatic Backup of Changes*–Whenever a trader makes a programming change (for example, speed dial numbers), the new data is sent to the System Center and is stored in the database. Users logging on and off is tracked and turret face layouts are updated.
- *Global Changes*–Typically, common face layouts are used within business groups. For example, traders on a government bond desk usually have identical line-to-button assignments. However, separate files must be maintained for each user to allow for customized speed dial numbers and for unique feature setup. The System Center provides a utility that executes programming changes to user-defined groups with a minimum of data entry. The System Center also supports batch downloading, such as transmitting new button assignments to multiple stations in parallel.
- *On-line Programming*–The Tradenet MX System supports system programming during the business day. While the system administrator is performing programming changes, the System Center continues to capture and store traffic and system status records. Program files can be downloaded to positions during trading hours without affecting system operation.
- *Security and Testing*–To alter a turret's configuration, the system administrator must first reprogram the site database and then download the modified file to the station. This two-step process provides the trader with the opportunity to check programming changes before implementation. Furthermore, through password protection, the System Center can block unauthorized personnel from accessing the files, altering the database, or interacting with the system.

Traffic Analysis

The System Center's traffic analysis package has been specifically designed to capture the usage of private lines and thereby identify potential savings. Every call completed by the Tradenet MX System is recorded and stored in the site database. The call record includes:

- line number
- station
- direction (incoming or outgoing)
- duration of the connection

The data is stored and sorted for traffic reports, which can then be compiled by hourly, daily, or monthly usage. The raw traffic information is systematically compressed, eliminating the need for excess data storage.

There are many reports available from the System Center. For more information about these reports, refer to the *Tradenet MX System Center Manual 14.1* (part number B0086185104).

Maintenance and Diagnostics

The objective of the Tradenet MX maintenance strategy, as supported by the System Center, is to recover from system errors as quickly as possible, with no human intervention.

The Tradenet MX System’s unique distributed system is based on a folded hierarchal network of independent switching cards. This fault-tolerant architecture ensures that two simultaneous failures will not affect system operation down to the shelf level. There is no central processing nor is there a single point of control. Instead, each circuit card has its own independent processor, and calls are processed autonomously, and self-route themselves through the switch with a destination address. The robustness of the network lies in the multiple paths through the switch. In the event of a switch element card failure, call requests automatically bypass the failed component. As a result, trading continues without disruption. Fault tolerance is accomplished within the architecture and does not require intervention by maintenance personnel nor by the system administrator.

The entire application insulates traders from troubles and, in most cases, repairs the system automatically. Maintenance capabilities include:

- diagnostics
- fault recovery
- fault reporting and alarms

Diagnostics

There are a wide variety of diagnostic tools available to either the system itself, or to personnel working on the system. These tools include programs that isolate hardware failures by looking for patterns in link failure and other reports, as well as programs that tell idle line circuits to implement their own built-in test functions.

Whenever the System Center has cause to believe there is a fault, it will implement the diagnostic programs automatically. If, however, an authorized person wants to, they can manually implement any diagnostic program, including those that cause interruptions in service.

Whenever a fault has been isolated to a card, the card and then the system will attempt fault recovery.

Fault Recovery

The Tradenet MX System implements fault recovery procedures automatically. When a circuit card malfunctions due to software failure, it independently re-starts itself. The re-start is complete within seconds and the circuit card re-joins the system. If repeated software re-starts do not restore a card, the System Center reloads the card’s software and data. A reload is accomplished within minutes. Neither the re-start nor reload affects system operation, and both can be done during business hours, although there might be isolated line or turret outages during a TU card restart or reload. Restarting and reloading occur automatically without a system administrator, as a result of the diagnostics programs isolating a fault to a card, or they can be initiated manually by pressing the restart or reload button on a card in the MX System. Manual restarts or reloads are also possible from the System Center or from the remote terminal, provided the user has the required authorization.

Warning! ***If either the restart or reload button is pressed on an ALIC or PLIC, the lines on that card are not accessible from any station. During the restart or reload process, lines cannot be accessed until the process is complete. Anytime a restart or reload button is pressed, all lines are dropped from that card.***

During a reload, all three green link LEDs go dark. The red receive LEDs stay lit. The second and third feature processor LEDs alternately flash very quickly. This indicates that the card has requested information from the System Center and is loading it. During this load process, all six stations on the ATIC display *No communications* on the control modules. Shortly thereafter, you might notice one of the transmit links on the card light, indicating that communications with an access switch has been established. After 60 to 90 seconds, all three link port LEDs light steadily. Shortly after this, the three feature processor LEDs start to flash normally, indicating that the load is successful. Then, the stations display, *configuring, line buttons loading, etc*. Restart does not require a full download of code and data from the System Center: the card restarts using much of the existing code and data stored in its memory. For information about cards, see *Chapter 5 Cabinets and Shelves* on page 5-1.

Fault Reporting and Alarms

The System Center complements the switch's fault-tolerant architecture by constantly monitoring system status. Whenever a system error occurs, the System Center records the event and stores it in its fault log. Restarts and reloads are detected and stored. The alert to the system administrator can be as subtle as a trouble log entry or as conspicuous as an audible alarm.

The System Center also monitors system power supplies, ventilation fans, and station consoles for faults. In the event of a major fault, such as a card failure, the System Center generates an alarm. Alarms include visual and audible alerts. The System Center has the capability to activate remote alarms through a relay contact.

Note *On-site preventative maintenance is required for fan trays and filters. Proper scheduled preventive maintenance can reduce or eliminate fault conditions.*

To aid on-site personnel, the System Center permits remote access through a modem link. The distant end appears as a terminal to the Sun workstation and can perform all administrative functions.

System testing is designed to isolate problems and to direct service personnel to swap out field replaceable components.

System Center Hardware

For information about the System Center hardware, refer to the *Tradenet MX Platform Manual 14.1* (part number B0087686104).

The VME tower[2], if present, contains the site-installed System Center gateway card, the Ethernet interface card, and interconnecting cables. The link converter card box, which is installed in TU 1 of the system, is connected by fiber optic cables to the VME tower. The VME tower requires a dedicated 110 V AC outlet, 15 amp computer-grade circuit. Although an operating MX System can carry traffic without the System Center, the System Center is critical to the Tradenet MX System. Therefore, as the critical link between the System Center and the Tradenet MX switching equipment, the VME tower 110 V circuit should also be protected from power failure by battery backup or by UPS in the same way as the System Center workstation. For use where this voltage predominates, 220 V AC power configurations for the VME tower are also available. For information about system power, see *Chapter 3 System Power* on page 3-1.

System Center to Tradenet MX Connection

When your system includes a VME tower, the Sun workstation is linked to the MX System through the VME tower as follows: the VME tower is connected to the Sun workstation using an Ethernet local area network (LAN). Then the VME tower is connected to the designated TU by way of a fiber optic cable. Compact systems use an RS422 cable from the TU to the Ethernet converted (mounted within the cabinet) and an Ethernet connection from there to the System Center.

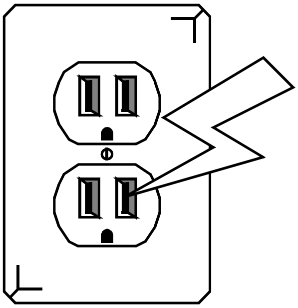
2. Compact systems, KEPCO MX Systems, and newer full- size Tradenet MX Systems do not have a VME tower.

System Center Gateway Card (SCGC)

When your system includes a VME tower, the System Center gateway card (SCGC) is contained within the stand alone VME tower and is the interface card between the Sun workstation and the Tradenet MX equipment. The System Center gateway converts MX protocol to that used by the Sun workstation, and vice versa.

Warning! ***The VME tower is not a field serviceable unit. Its fiber optic cable is susceptible to damage from mishandling.***

Chapter 3 System Power



AC AND DC POWER

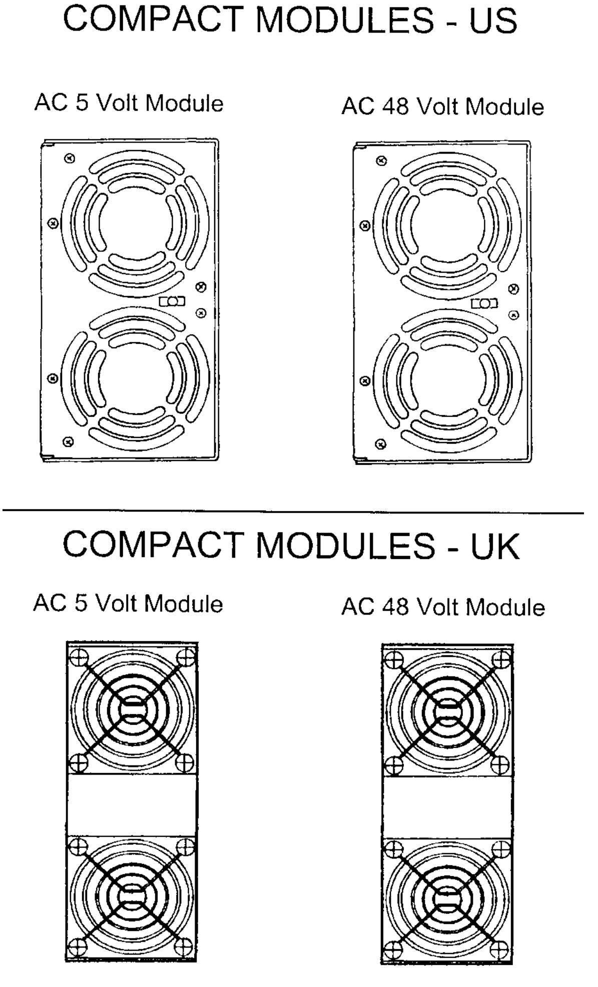
With the Tradenet MX System, there are two basic power supply input options: 90–240 volts (V) alternating current (AC) or +48 V direct current (DC). (Compact systems can be AC-powered only.) With the Tradenet MX System, there are two vendors that provide AC power: HC and KEPCO, and there are two vendors that provide DC power: HC and Unipower.

Note *In an AC system, the electrical green wire is used for ground. The green wire is connected to the negative side of the 48 V DC bus bar. No other additional or separate grounding is necessary.*

For information about the Tradenet MX System power specifications, see *Power Consumption* on page 4-32 and *UPS System Configuration Guidelines* on page 4-34.

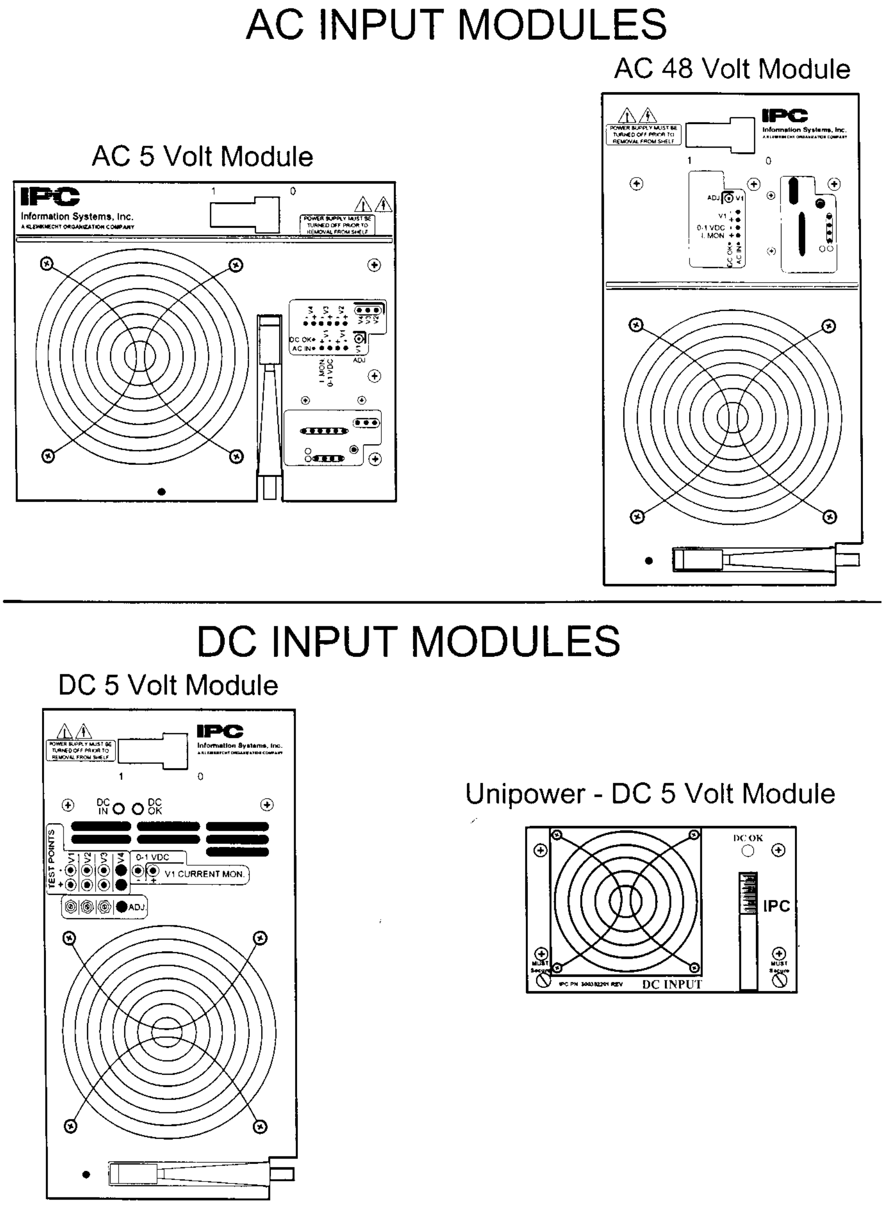
The following figure shows what the AC (HC) power supply modules in a Compact system look like.

FIGURE 3-1 AC (HC) Power Supply Modules in a Compact System



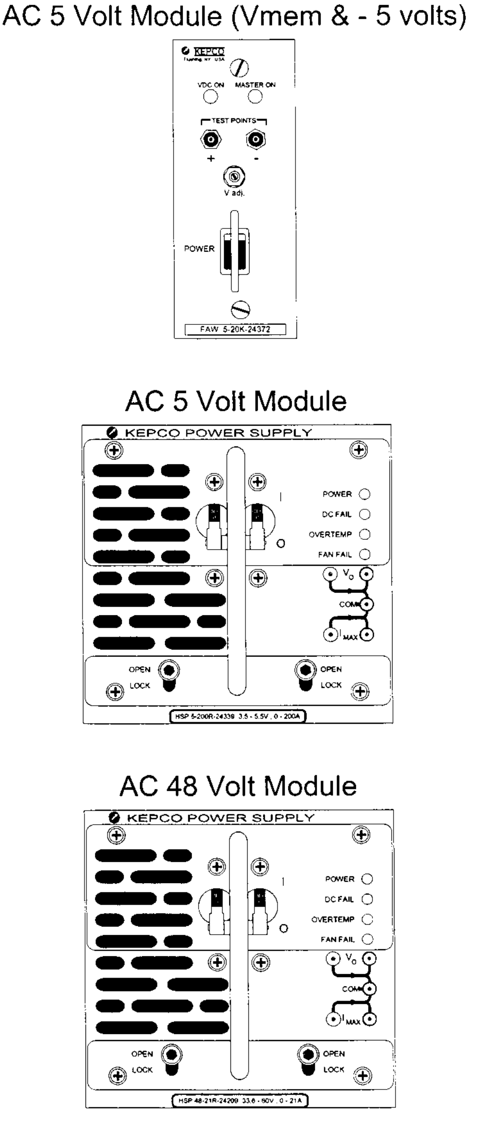
The following figure shows what the non-Compact AC (HC) power supply modules and DC (HC and Unipower) power supply modules look like in Tradenet MX Systems.

FIGURE 3-2 AC (HC) PSMs in Non-Compact Systems and DC (HC and Unipower) PSMs



The following figure shows what the AC (KEPCO) power supply modules look like.

FIGURE 3-3 AC (KEPCO) Power Supply Modules



You can configure the MX System for AC or DC input power. The MX System input power options are:

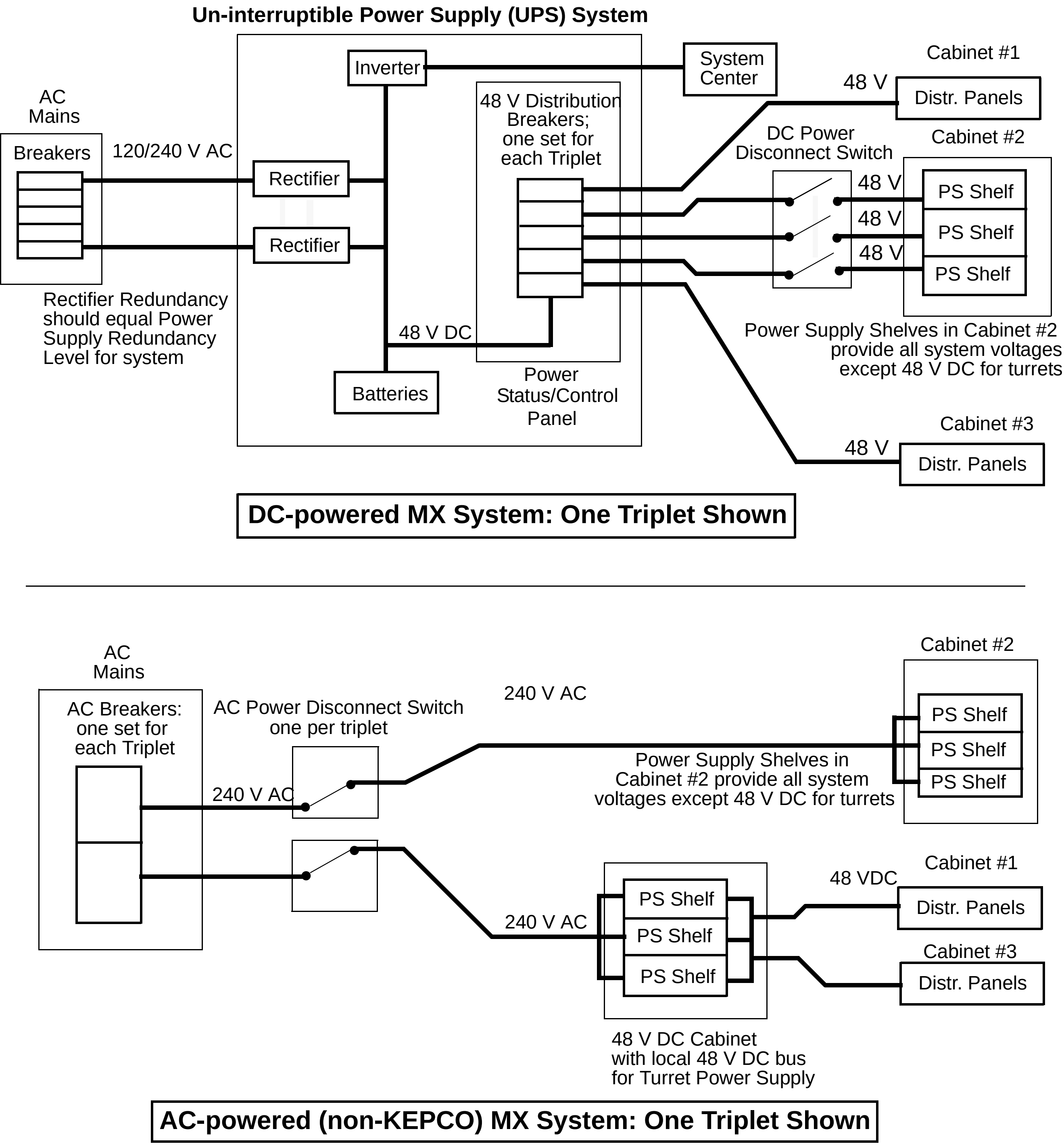
- 48 V DC power
- 120/240 V 50/60 Hz AC power

Note *When using AC power, it is less expensive to use 208 V–240 V AC instead of 120 V AC because the higher voltage reduces current requirements proportionately, thus reducing wiring costs.*

The MX System Center requires AC power outlets available to it regardless of whether the MX System is AC- or DC-powered, and the stations must have 48 V DC regardless of how the back room equipment is powered. When the back room is AC-powered, then 48 V DC output and 120/240 V AC input power supplies are used to power the stations. These power supplies are not required if the entire system is powered from 48 V DC.

The following figure shows both a DC-powered (HC) and an AC-powered (HC) MX System. Both configurations shown are for triplets; however, the same basic configurations also apply to smaller systems.

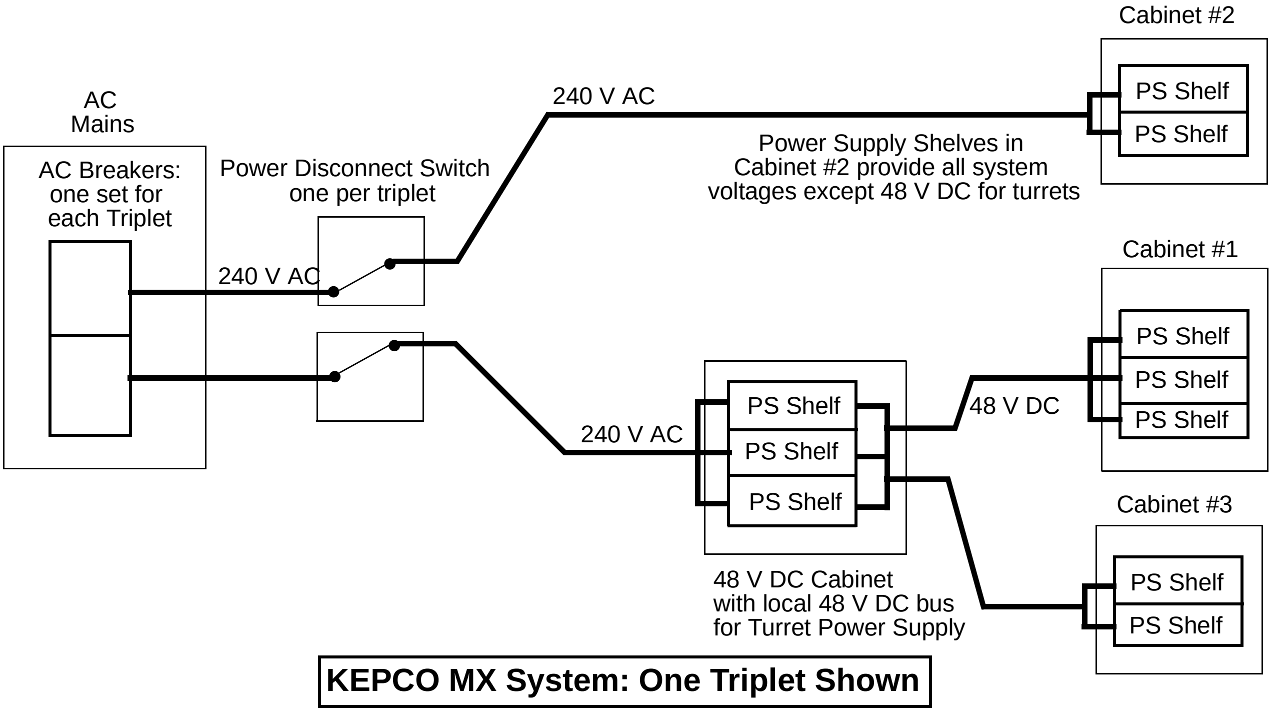
FIGURE 3-4 DC-powered (HC) and AC-powered (HC) MX System[1]



1. For information about un-interruptible power supplies, see *Un-interruptible Power Supplies* on page 3-13.

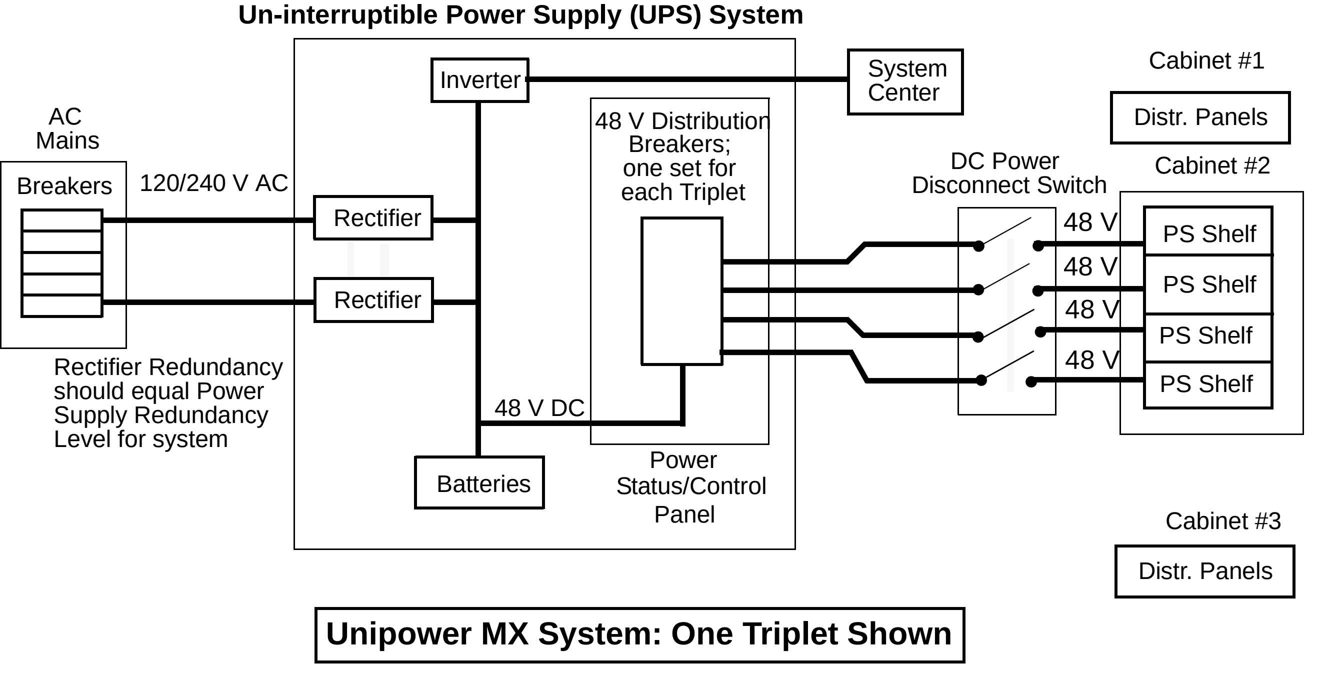
The following figure shows a KEPCO MX System. This configuration shown if for triplets; however, the same basic configurations also apply to smaller KEPCO MX Systems.

FIGURE 3-5 KEPCO MX System



The following figure shows a DC-powered (Unipower) MX System. Unipower systems can be used only with triplet systems or larger.

FIGURE 3-6 DC-powered (Unipower) MX System[2]



To prevent a single power supply failure from affecting the operation of an MX cabinet or triplet, Tradenet MX Systems use redundant diode-isolated power supplies for all voltages except the ring generator, for which a hot standby power supply is provided. To alert you to any potential problem before it affects the operation of the cabinet or triplet, every MX System has dedicated hardware to monitor power supply failure alarms and all system voltages. All Tradenet MX power supplies and PSMs are field-replaceable units.

Warning! ***IPC recommends that you replace PSMs during non-trading hours. For help with replacing PSMs, contact Systems Support Engineering.***

There are two types of power supplies used in MX Systems. Compact systems use bolted in PSMs, and all other Tradenet MX Systems use hot insertable PSMs. Hot insertable PSMs can be replaced while the Tradenet MX Systems is running, after you turn off power to the PSM.

Hot Insertable PSMs

Warning! ***Each hot insertable module must be calibrated for the system into which it will be installed, to properly share current in the system. If you are not sure that a replacement module is correctly calibrated for the system, then do not insert it if a potential calibration error could cause problems to the users.***

Hot insertable PSMs can be replaced without disrupting power to the rest of the system. Each PSM is plug-in mountable from the front of the cabinet. Removal or insertion of a PSM in any system except a Compact system does not require any connections to be removed or made at the rear of the cabinet. Guides on the shelf direct modules into their proper seating within the cabinet. The front of each hot insertable PSM has a handle, PEN plunger, captive screws, and a DC out ok LED and AC or DC in ok LED to indicate acceptable input.

There are two high-current voltages in an MX System: +5 logic power and +48 V DC turret power. There is an AC powered module for both voltages, and a +48 V DC powered module for +5 V DC. Each hot insertable +5 V DC PSM provides multiple output voltages, as follows: the AC powered modules each have three secondary outputs, and the DC powered modules each have two secondary outputs. Because these outputs are floating, they can be biased as required to provide either negative or positive voltages. Every output for every module has an isolation diode, built into the module, preventing a failure in one module from affecting other modules.

Warning! ***When powering up the 48 V DC cabinet with turrets connected, all PSMs must be in the on position. Turn on the power from the main breaker feeding the cabinet. Never turn on one PSM at a time or they will go into trip mode due to the overload of trying to power a cabinet alone. Only after all PSMs are operating can a single PSM be turned on or off.***

Note *The PSM’s output voltage must be calibrated a few seconds after plugging a new module into a running system.*

2. For information about un-interruptible power supplies, see *Un-interruptible Power Supplies* on page 3-13.

Bolted In PSMs

The Compact systems uses bolted in PSMs. You cannot hot swap a bolted in PSM, that is replace it in a running systems. Compact systems must be powered down before you replace the PSMs.

Warning! ***If you try to remove a bolted in PSM in a running system, you could get an electrical shock or you could cause arcing across contacts or to ground while attaching cables to the lugs on the PSMs.***

Tradenet MX System Voltages

The following table lists the voltages used in the Tradenet MX System.

TABLE 3-1 Tradenet MX System Voltages

Voltage	Use
+5 V DC	powers each card
-5 V DC	bias analog circuits on analog line interface cards (ALIC) and basic rate interface cards (BRIC)
5V VMEM	powers the memory components on the cards
+4.7 V DC battery (system)	charges the backup battery for VMEM to prevent data loss due to an intermittent power outage
+48 V DC	powers the turrets and TradePhone MXs, and powers DC-input supplies for the voltages described above, as well as DC-input ring generators
ring generator	outgoing signaling on analog private lines— US: 100 V AC, 20 or 30 Hz (selectable on newest generators) UK: 85 V AC, 30 Hz

An additional voltage used in the MX System but *not* provided by the MX System supplies is +6.4 V DC. This voltage is used to power the Series II section of the Series II interworking cards, and is brought from the Series II equipment or from Series II power supplies, when required. It connects at an input on the TU backplane that can also be used for -48 V DC (which is used for signalling and loop current on certain analog line types, and supported through the interworking card).

The System Center is available in either of two nominal voltages:

- 110 V AC[3]
- 220 V AC (UK)

3. The 110 V AC power with five receptacles is required in the US for the System Center (including VME tower, printer, tape drive, and modem.

The System Center’s VME tower requires a 110 AC outlet, 15 amp. IPC recommends that you use a separate dedicated computer grade feed for the VME tower.

TABLE 3-2 System Center Power Requirements

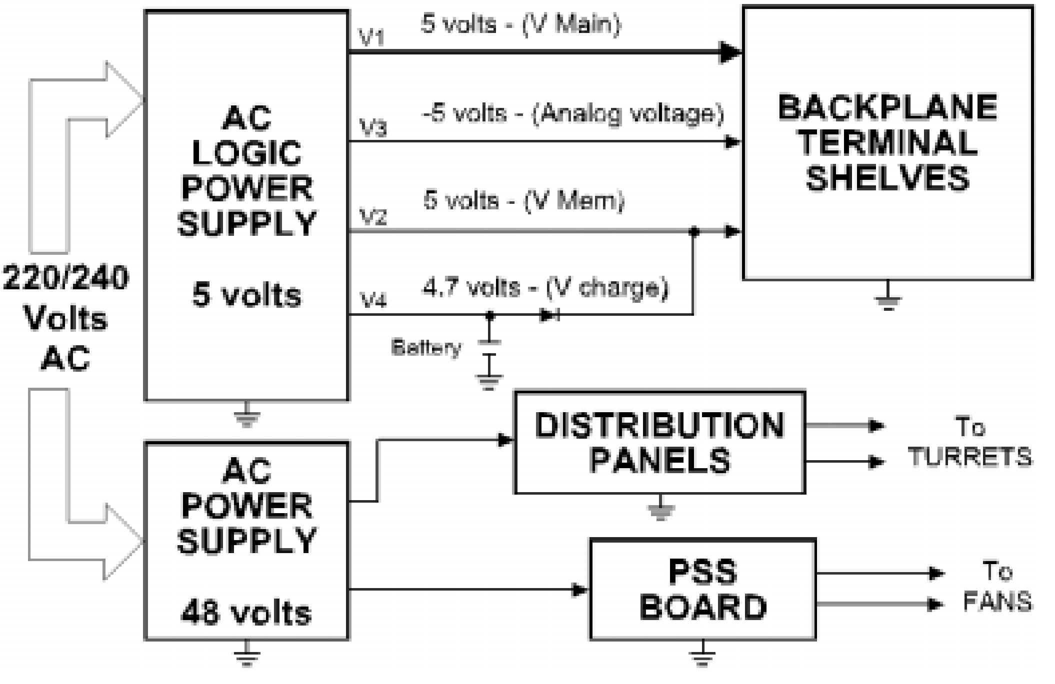
Item	Continuous Power	Surge Current in US at 120 volts AC	Surge Current in U.K. at 220 volts AC
Ultra 10	104 watts	4.7 amps	2.3 amps
SPARCstation	85 watts	2.4 amps	1.2 amps
17 Inch Monitor	103 watts	4.6 amps	2.3 amps
DAT Drive	2.2 watts	1.3 amps	0.7 amps
Modem	<60 watts	<1.0 amp	<0.5 amp
HP 1100 printer	4.3 watts–430 watts[a]	7.7 amps	3.6 amps
HP 6P printer	37 watts–495 watts[a]	3.7 amps	1.8 amps
HP 4000T printer	30 watts–724 watts[a]	3.4 amps	1.7 amps
Panasonic Printer	250 watts	< 1.0 amp	< 1.0 amp[b]
VME Tower[c]	250 watts	10.0 amps	5.0 amps

a. The two continuous power readings represent: at rest–while printing.
b. The panasonic printer is not available in 220 VAC. It must be powered from a line voltage reduction transformer when the system is powered from 220 VAC. It is able to accept 50Hz AC.
c. The System Center’s VME tower requires a 15 amp 110 VAC or 208/.240 VAC outlet. We recommend that you use a separate dedicated computer grade feed for the VME tower.

AC (Non-KEPCO) System Voltages

The following figure shows the system voltages in an AC (non-KEPCO) system.

FIGURE 3-7 AC (non-KEPCO) System Voltages



The following table describes V1–V4 in an AC (non-KEPCO) system.

TABLE 3-3 V1, V2, V3, and V4

	Voltage	AMPs	Description
V1	5 volts	190 amps	V Main, main voltage that provides power to the cards
V3	-5 volts	10 amps	analog voltage, powers audio
V2	5 volts	16 amps	V Mem, memory
V4	4.7 volts	5 amps	V charge, charges the battery

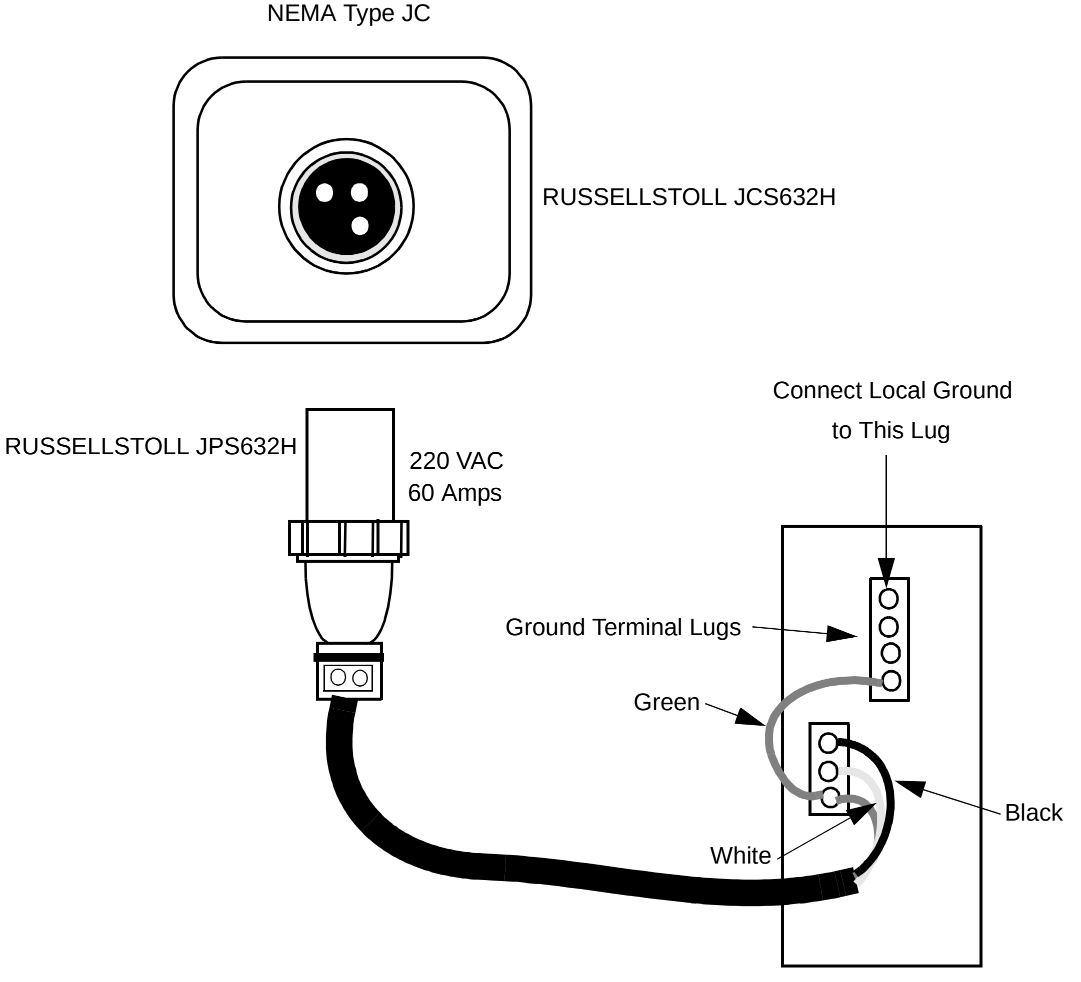
Turrets and fans are not power critical.

AC power requires a separate cabinet for the 48 V DC supplies that power the stations. The connections at the bottom of the 48 V DC bus bars are labeled as going to the 48 V cabinet. This cabinet is normally mounted to one side of the triplets, and is cabled under the floor to the triplet. This cabinet is not affected by split power, although the supplies within it can be split by adding an additional shelf to retain the redundancy required within each side of the split system. This might require a taller cabinet.

For AC-powered cabinets and triplets, IPC provides the 60 amp 600 volt 2-wire plus ground type J connector required as the receptacle. The part used is Russellstoll JCS623H or approved equivalent.

IPC also provides the 60 amp 600 volt 2-wire plus ground type J plug required to terminate the power cable from the cabinet in the receptacle, listed above. That panel is located on the left side of the Tradenet MX System cabinet looking at the back. The plug used is Russellstoll JPS623H or approved equivalent.

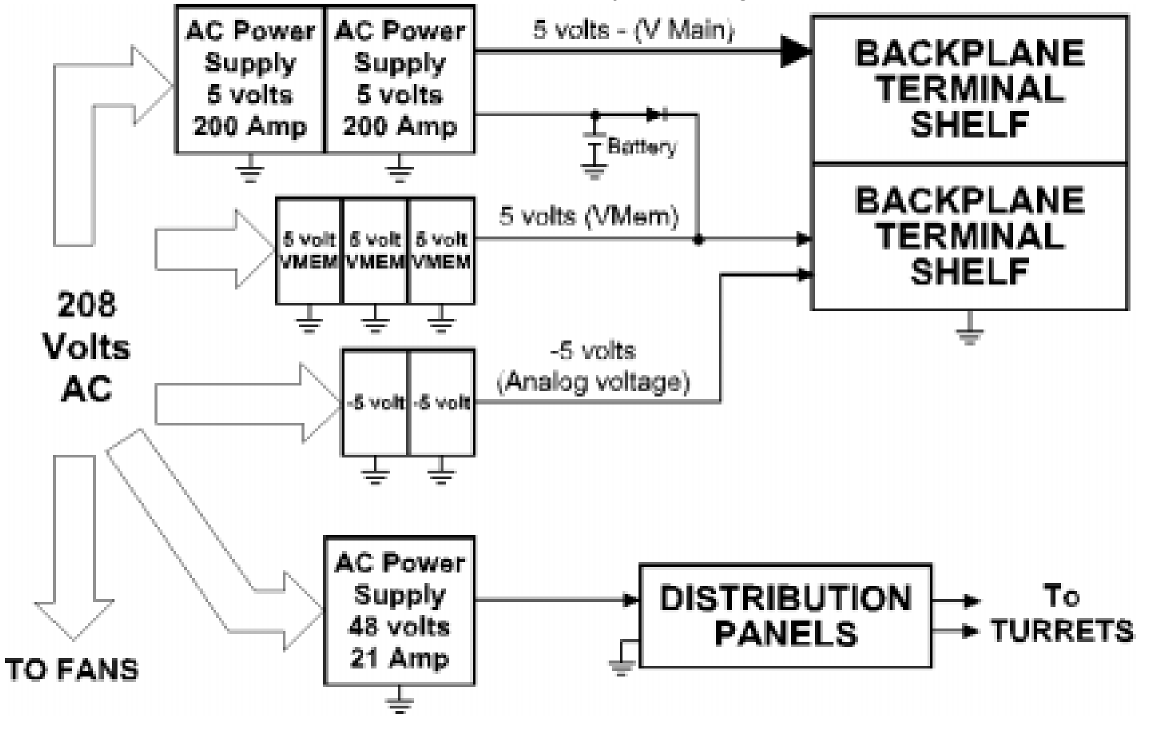
FIGURE 3-8 AC Input Connections



AC (KEPCO) System Voltages

Although a KEPCO MX System is AC-powered, the system voltages in a KEPCO system are different than those shown in *FIGURE 3-7 AC (non-KEPCO) System Voltages* on page 3-10. The following figure shows the system voltages in a KEPCO system.

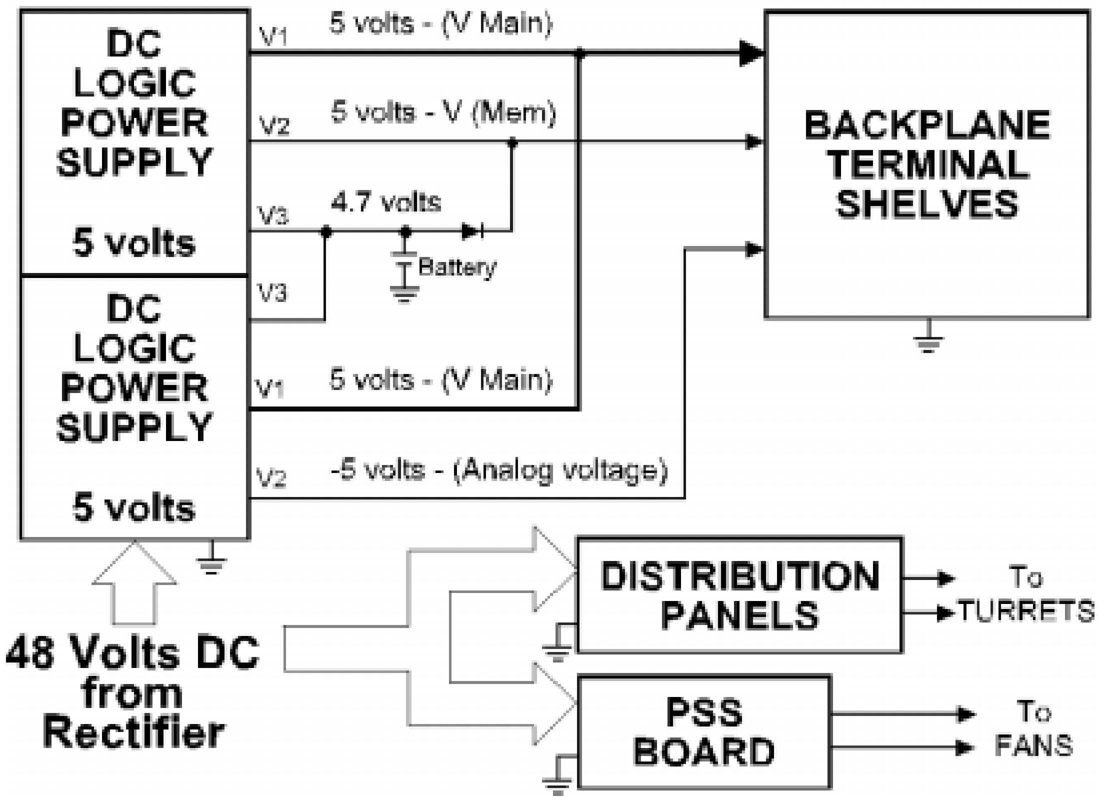
FIGURE 3-9 KEPCO System Voltages



DC System Voltages

The following figure shows the system voltages in a DC system.

FIGURE 3-10 DC System Voltages



With a DC system, you need a minimum of two power supplies. Each supply provides three voltages, as shown in the previous figure.

DC power input is at the 48 V DC required by the stations, so there is no requirement for a separate 48 V DC cabinet, unless split power is required. Because DC-powered +5 V DC PSMs have only two secondary outputs, one secondary voltage from all of the modules in each of the two shelves is connected with an opposite polarity at the terminal strip, so that one shelf provides -5 V DC, while the other shelf provides +5 V MEM, using the same secondary outputs from the PSMs.

REDUNDANCY

Extra Power Supply Modules

Your Tradenet MX System should be configured to have redundant power supplies: either N+1 or N+2. With N+1 redundancy, any one PSM in a triplet can fail without causing a power supply failure. With N+2 redundancy, any two PSMs can fail without causing a power supply failure. (N+2 redundancy is not available with the Compact or Mini systems due to restraints in the monitoring system used to detect supply failures.)

With N+1 redundancy, when a single PSM fails, you can replace it while the rest of the system is under load, but if you accidently remove a working PSM instead of the defective PSM, your system loses power. The individual PSMs are monitored by the system to ensure that a defective supply is accurately identified.

With N+2 redundancy, if you accidently remove a working PSM instead of the defective PSM, your system does not lose power.

Un-interruptible Power Supplies

When you want the System Center to function during building power failures, you need an un-interruptible power supply (UPS). If the MX System is powered from an AC UPS, then the System Center can be powered from the same UPS. If the MX System is powered from 48 V DC, then a 48 V DC input (120 V AC or 240 V AC (UK) output) inverter is required to power the System Center. Remember that the System Center is not required by the MX System, but it is needed for maintenance and administration, and is also required to reload cards should they need software or data, for example, when a trader logs on.

In *FIGURE 3-4 DC-powered (HC) and AC-powered (HC) MX System* on page 3-5, the DC system includes a UPS. This is almost always an integral part of 48 V systems, because the main addition required for this feature is the batteries themselves. Adjustments to the rectifiers can be required when they are set up for operation with or without batteries, but these are normally minor.

Split Power Supplies

How a triplet is configured for power is dependent upon two things: whether the triplet is AC- or DC-powered, and whether you are using split power or non-split power.You can use split power in non-KEPCO, AC-powered systems only.

In AC (non-KEPCO) systems, you can improve your redundancy by using split power to make your triplet a split rail system. Although redundant power supplies minimize the chances of a power supply failure, you can also split your power supplies in triplets to help limit the effects of a power supply failure, in the unlikely event one does occur. Split power supplies incorporate a separate set of power supply shelves, each incorporating N+1 redundant PSMs for each half of the triplet. Each cabinet, which holds up to five TUs, is separately powered from the other cabinet. For example, to ensure that there will be sufficient network capacity remaining in cabinet #3 after cabinet #1’s power supply fails, the network cards in cabinet #2 are also divided between the two power supplies.

If you use split power supplies with N+1 redundancy, you need two extra sets of redundant power supplies in a triplet. If you use split power supplies with N+2 redundancy, you need four extra sets of redundant power supplies in a triplet.

With split power, there are four power shelves, and only the top two and the bottom two are bussed together. The lower pair is cabled to the bus bars in the cabinet to the left (facing the rear of the triplet), while the upper pair is cabled to the bus bars in the opposite cabinet.

The power busses on the section and reflection shelves are split across their backplanes, with each side receiving power from the same set of power supplies as the closest cabinet. Thus, for example, the left side of the section shelf is cabled to the lower pair of power supply shelves, because they feed the triplet to the left. Note that both the section and reflection switch shelves are cabled directly to the power supplies, and not to a cabinet bus bar.

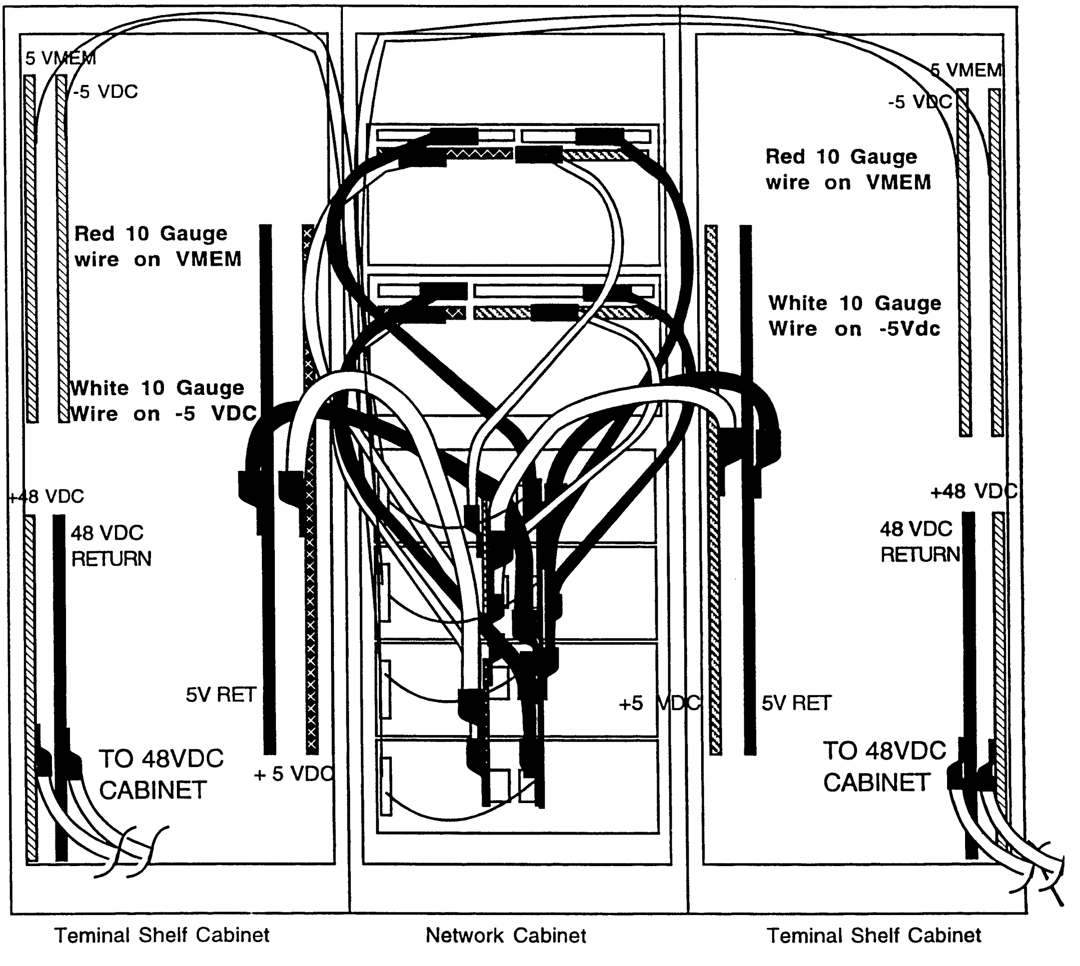
The VMEM and -5 V DC bus bars in each cabinet are connected by lighter cables to the same pair of power supplies as the +5 V DC supply to that cabinet.

The return connections for VMEM and -5 V DC are referenced to the +5 V DC supply return. The returns from both cabinets are commoned at a return bus bar that connects all four power supply shelves.

When split power is combined with DC power, the additional height of the DC power supply shelves makes it impossible to fit all four shelves required into a cabinet and still have room for a reflection shelf. Therefore, whenever there is a reflection shelf in a DC-powered split power system, a separate cabinet for power must be used. This shorter cabinet with two DC power shelves is placed to the right (viewing the triplet from the rear) of the right hand cabinet, and is connected to the bus bars in that cabinet. The left hand cabinet is then powered from the two power supply shelves in the center cabinet. The section and reflection shelves are cabled both to the supplies in the center cabinet and to those in the power cabinet.

The following figure shows a triplet with split AC power, a split rail system. This figure has N+1 redundancy across each half-triplet.

FIGURE 3-11 Triplet With Split AC Power

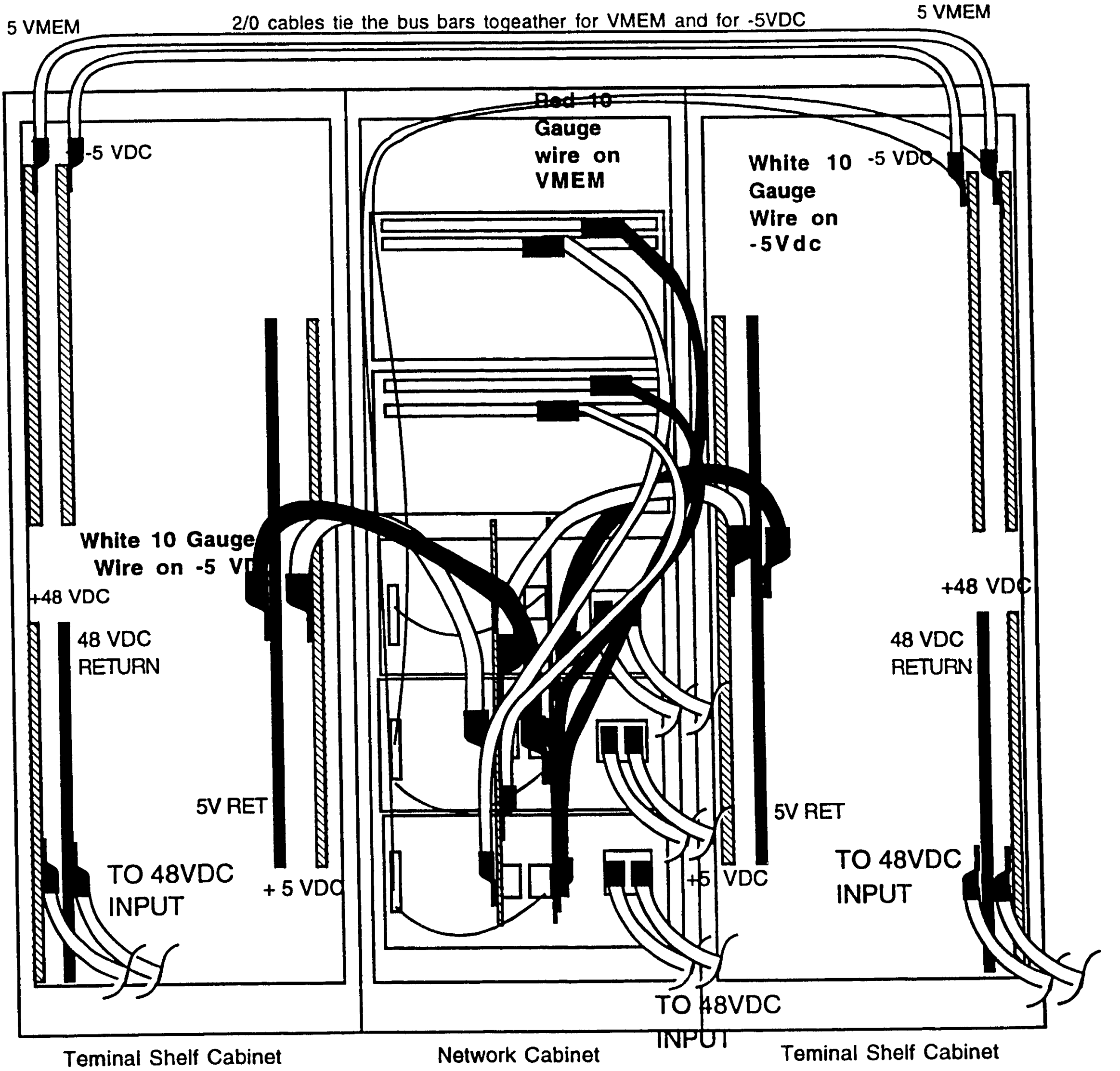


With non-split power, or single rail systems, there are three power shelves and their outputs are bussed across all three power shelves. The VMEM and -5 V DC bus bars are cabled across the three cabinets to tie both sets of bus bars together.

In a single rail system, the section shelf and optional reflection shelf are powered from the bus bars connecting the power supply shelves, but with only a single +5 V DC and +5 V DC return cable to each shelf rather than with two. One piece bus bars are used across the back of these shelves, to eliminate the requirement for the second set of cables.

The following figure shows a triplet with non-split AC power. This figure has N+1 redundancy across each triplet.

FIGURE 3-12 Triplet With Non-split AC Power



COMPACT SYSTEM POWER CONFIGURATION

Compact systems are single cabinet systems that contain one or two terminal units (TU), or terminal shelves. Compact systems use PSMs that are bolted into racks in the cabinet, and which have terminal lugs for connection to the power supply cabling, accessible from the rear of the cabinet. These supplies are used both to reduce space requirements, and to reduce system cost. After powering down your system, you can replace these supplies in the field.

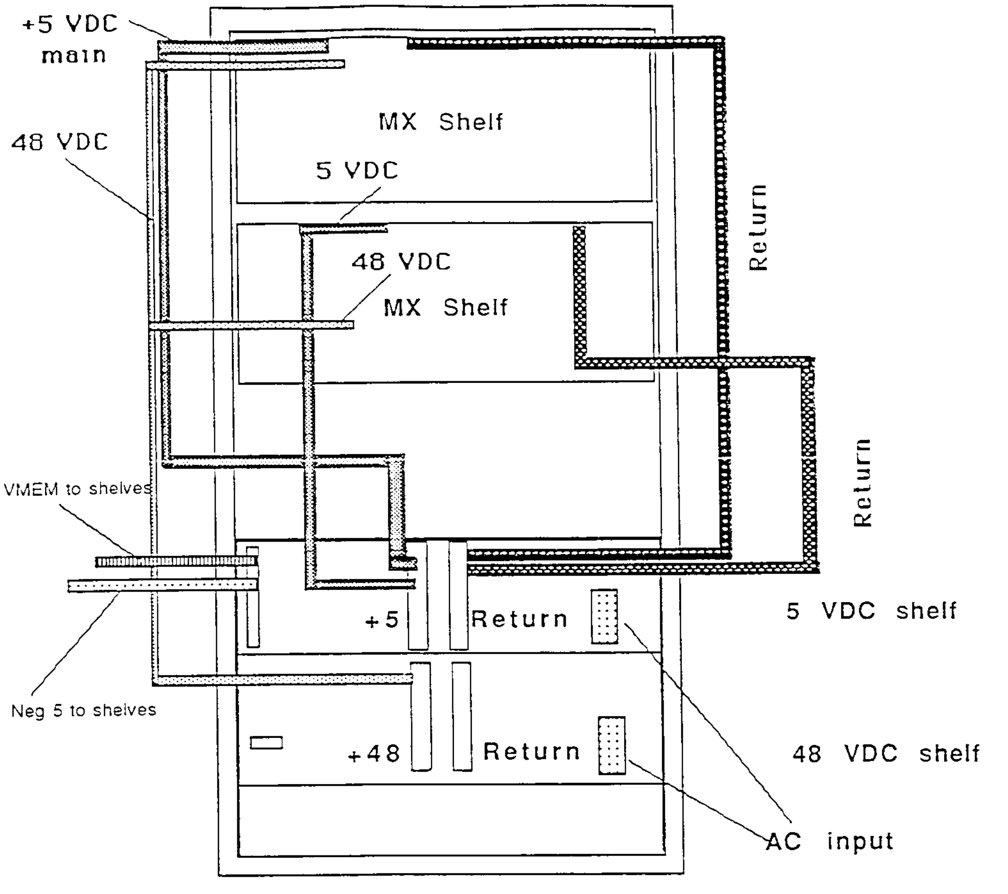
Warning! ***It is not possible to hot swap PSMs in a Compact system: the cabinet must be powered down first, to avoid both potential shock hazards to the technician, and the possibility of arcing across contacts or to ground while attaching cables to the lugs on the modules.***

The bolt-in PSMs used in Compact systems are dedicated +48 V DC (AC-powered systems only) or +5 V DC supplies. Compact systems are AC-powered only. In Compact systems, three +48 V DC PSMs and three +5 V DC PSMs are used, providing N+1 redundancy. (In a Compact system, you cannot achieve N+2 redundancy.) Isolation diodes, separately mounted on a support in the back of the cabinet, are used to prevent a failure in one supply from affecting other supplies.

Unlike the Mini system (also a single cabinet system), the Compact system does not have fan trays under each TU. Cooling is provided by a large single fan built into the top of the cabinet, and exhausting through a vent around the top of the cabinet. You cannot upgrade a Compact system to a triplet.

The following figure shows the power supply wiring in a single cabinet system.

FIGURE 3-13 Power Supply Wiring in a Single Cabinet System



For more information about the Compact system, see *Compact System* on page 5-4.

MINI SYSTEM POWER CONFIGURATION

Mini systems are single cabinet systems that contain one or two TUs. Mini systems use the same PSMs and shelves as triplets. The difference is in the number of PSMs required to provide the necessary power and the number of shelves required to hold them.

With the Mini system, you cannot split power (see *Split Power Supplies* on page 3-13) and you cannot achieve N+2 redundancy in a Mini system. AC-powered Mini systems use one shelf to supply the +5 V DC that powers the cabinet, and a second shelf to supply the +48 V DC that powers the turrets. Because AC-powered +5 V DC PSMs also have three secondary outputs, and because a single PSM can power the system alone, one shelf with two +5 V DC modules can provide N+1 redundancy for all of the DC system voltages except +48 V DC. A second shelf can hold two or three dedicated 48 V DC PSMs, each of which can power all of the stations in the system alone, thus providing N+1 redundancy for the station power.

Because DC-powered +5 V DC PSMs have only three outputs, two shelves are required, each with two supplies, to ensure N+1 redundancy for all three secondary voltages in a DC-powered system. One secondary voltage from each shelf is biased oppositely at the terminal strip, so that one shelf provides 5 V DC, while the other shelf provides +5 VMEM, using the same secondary outputs from the modules.

Warning! ***Each module must be calibrated for its system to properly share current in the system. If you are not sure that a replacement module is correctly calibrated for the system, then do not insert it if a potential calibration error could cause problems to your Tradenet MX users.***

FIGURE 3-13 Power Supply Wiring in a Single Cabinet System on page 3-18 shows the power supply wiring in a single cabinet system.

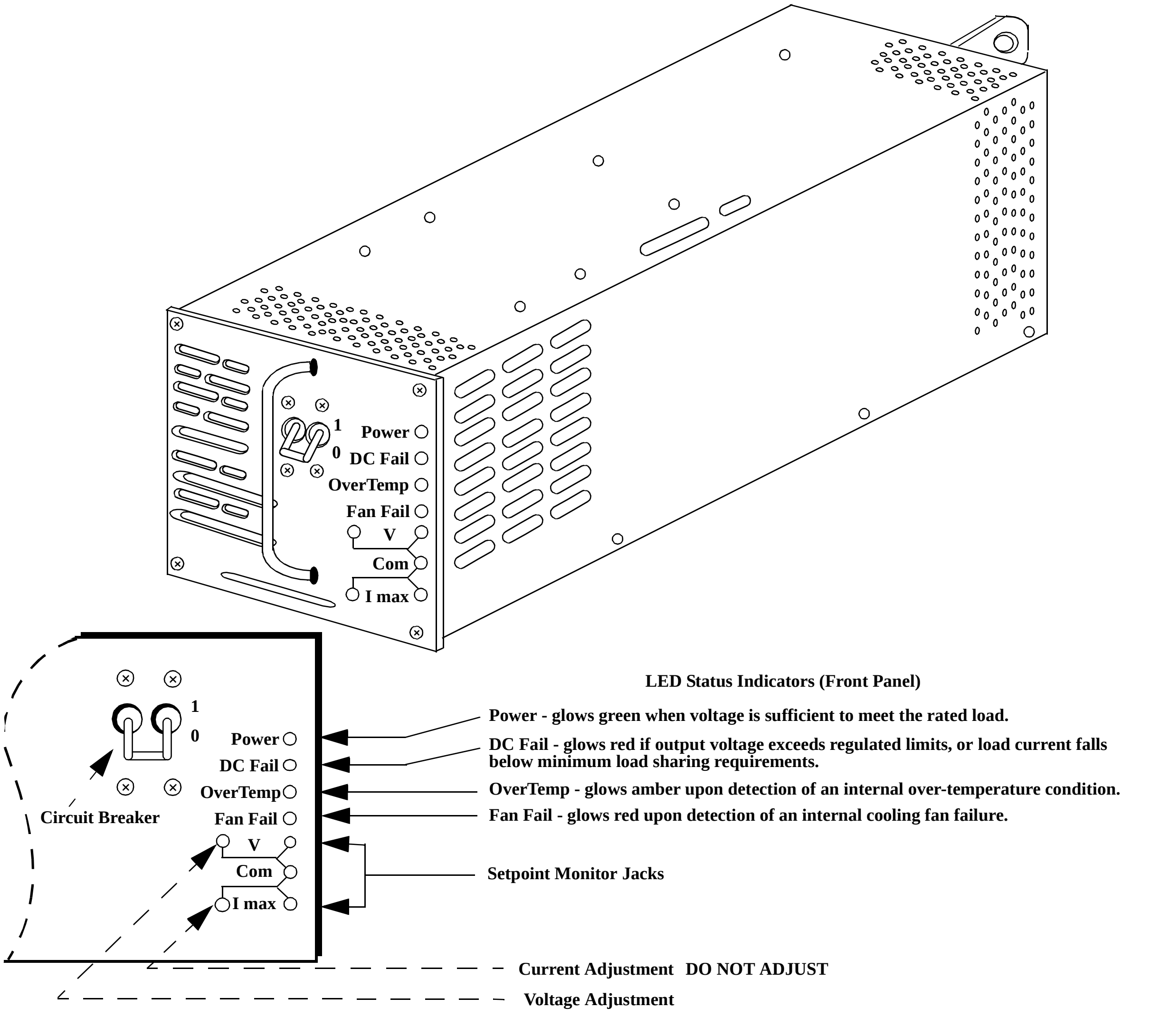
For more information about the Mini system, see *Mini System* on page 5-3.

KEPCO SYSTEM POWER CONFIGURATION

In a KEPCO system, each cabinet has two power supply racks. Each rack can contain two 5 volt supplies and one 48 volt supply. The 48 volt supplies in a triplet are all on the same bus. The 5 volt supplies are configured in groups of two per rack. One 5 volt supply in a rack powers a pair of TUs in the cabinet. The other supply is for redundancy. The 5 volt supplies are high-voltage sensitive, that is, the module with the highest voltage setting is the master. This contrasts with other AC systems that are low-voltage sensitive.

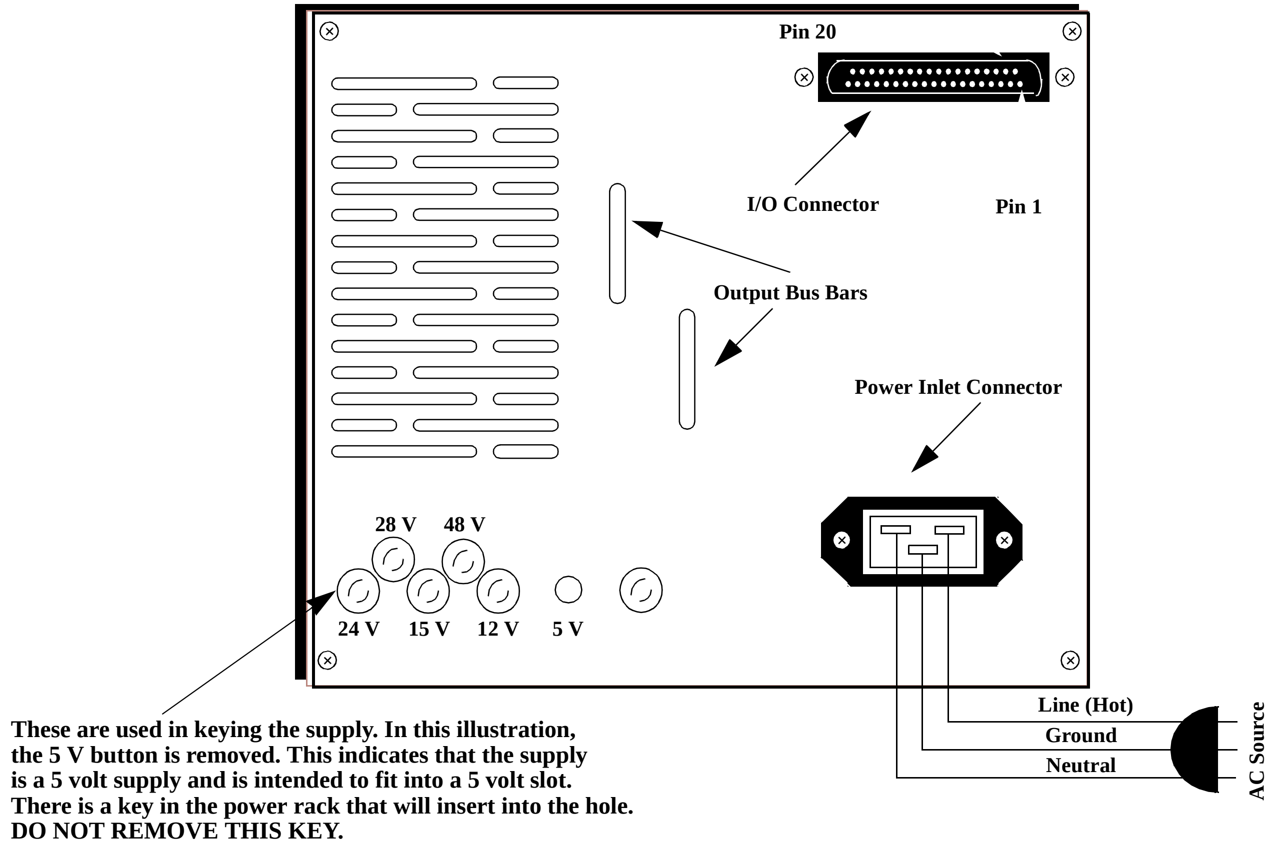
Cabinet #1 has an AUX power rack that houses VMEM and -5 volt supplies. (In non-KEPCO AC systems, these supplies are in one separate additional cabinet, the short power cabinet.) The following figure shows a KEPCO power supply.

FIGURE 3-14 The KEPCO Power Supply



The following figure shows the rear panel of the KEPCO power supply.

FIGURE 3-15 Rear Panel of the KEPCO Power Supply



SERIES II

Before the Tradenet MX System, IPC had Series II. With Series II interworking cards (S2IC), you need additional power supplies.

POWER SUPPLY RACKS

AC 5 V Power Supply Rack

The AC 5 V power supply rack is used to convert AC power to DC power. The AC power supply racks are mounted at the bottom of the cabinet. *FIGURE 3-8 AC Input Connections* on page 3-11 shows the connector used with this rack in the US.

When using the AC 5 V power supply rack:

- 5 V main is used to power all the cards in the system
- 5 V VMEM is used to supply the memory components on the cards
- -5 V is used to bias the analog circuits on analog line and turret interface cards
- 4.7 V DC charge is used to charge the backup battery for VMEM

DC 5 V Power Supply Rack

A DC-powered Tradenet MX System uses two or three DC power supply racks. The top one or two shelves supplies the voltages. The bottom shelf has one difference: the V3+ that normally supplies the 4.7 charge voltage supplies the -5 V DC and RTN (return). The bottom shelf must always contain two 5 V PSMs to supply redundancy for the -5 voltage. Compression fittings are recommended on the large 5 V output and 48 V input cables.

With the DC 5 V power supply rack:

- 5 V main is used to power all the cards in the system
- 5 V VMEM is used to supply the memory components on the cards
- -5 V is used to bias the analog circuits on analog line and turret interface cards
- 4.7 V DC charge is used to charge the backup battery for VMEM

Power Supply Shelf Port Descriptions

There are three types of DC 5 V power supply racks:

- PS2 C1155 power supply shelf
- PS3 C1158 power supply shelf
- PS3 C1029 power supply shelf

PS2 C1155 Power Supply Shelf

The following table describes the connections on the PS2 C1155 power supply shelf.

TABLE 3-4 PS2 C1155 Connections

Connection	Description
J1 STATUS	provides status of the PSMs in the rack; should be connected only to the PSSB
J2 SHARE	provides interconnection of PSMs to allow them to share current equally; must be connected to J2 of same type of power shelf.
V1	power supply output: 5 V DC at 190 amps; must be connected only to MX System 5 V input
TB3	sense and return for V1 output; connect across V1 at the farthest rack powered by VI for remote sensing, or across V1 for local sensing
TB2	power supply outputs: 5 V DC at 16 amps; 5 V DC at 10 amps; and 4.7 V DC at 5 amps, as well as sense and return; must be connected only to MX System power supply inputs

PS3 C1158 Power Supply Shelf

The following table describes the connections on the PS3 C1158 power supply shelf.

TABLE 3-5 PS3 C1158 Connections

Connection	Description
J1 STATUS	provides status of the PSMs in the rack; should only be connected to the PSSB
J2 SHARE	provides interconnection of PSMs to allow them to share current equally must be connected only to J2 of the same type of power shelf
V1	power supply output: 48 V DC at 44 amps; must be connected only to the MX turret 48 V input
TB2	sense and return for V1 output; connect across V1 at the farthest rack powered by VI for remote sensing, or across V1 for local sensing

PS3 C1029 Power Supply Shelf

The following table describes the connections on the PS3 C1029 power supply shelf.

TABLE 3-6 PS3 C1029 Connections

Connection	Description
48 VDC INPUT	DC Input; connect to 48 V DC PSM that has the locally required regulatory approval
J1 STATUS	provides status of the PSMs in the rack; should be connected only to the PSSB
J2 SHARE	provides interconnection of PSMs to allow them to share current equally; must be connected only to J2 of the same type of power shelf
V1	power supply output: 5 V DC at 144 amps; must be connected only to the MX System 5 V input
TB1	sense and return for V1 output; connect across V1 at the farthest rack powered by VI for remote sensing, or across V1 for local sensing
TB2	power supply outputs: 5 V DC at 16 amps and 4.7 V DC at 5 amps, as well as sense and return; must be connected only to the MX turret power supply inputs

Triplet Bus Bars

The bus bars are used to minimize the voltage drop between the PSMs and the shelves in the triplets. The bars are located in the back, right side of the cabinet that contains the TU shelves and the distribution panels. Bus bars are labeled with labels or colored tape to assist in identifying where power supply wiring is connected. When colored tape is used to label the bus bars, use the following table to identify the wire.

TABLE 3-7 Colored Tape Labels on Bus Bars

Bus Bar Tape Color	Wire Connected
White	#10 gauge black wire with white tape on it is the –5 V DC wire
Red	#10 gauge red VMEM wire

The following table lists the voltages and wires used with bus bars in split and non-split systems.

TABLE 3-8 Multiple Cabinet Bus Bar Voltages and Wires in Split and Non-split Systems

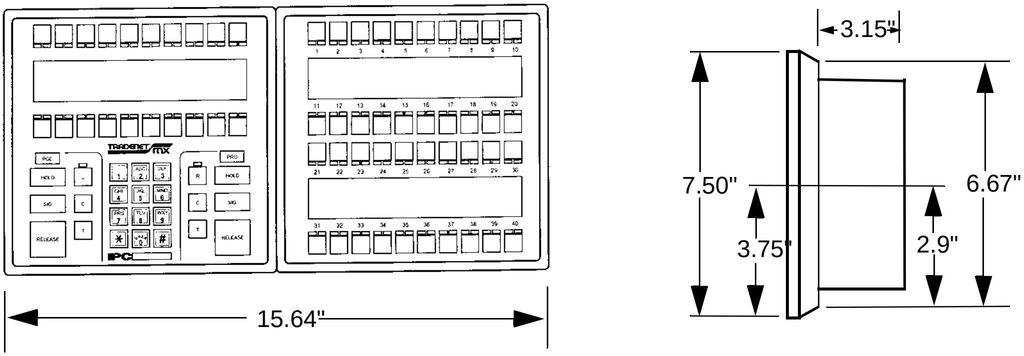
Voltages	Wires
+5 V DC Bus Bar Main Voltage	large red wires in the network cabinet
+5 RTN Bus Bar Main Voltage Return	large black wire in the network cabinet
–5 V DC	#10 gauge white wires on the bus bar to the power supply racks in the network cabinet
–5V RTN	return referenced at the power supply racks
+5 VMEM	#10 gauge red wires on the bus bar to the power supply racks in the network cabinet
+5 VMEM RTN	return referenced at power supply racks
+48 V DC +48 RTN	used with an AC system only, the black and red heavy gauge wires from the small power cabinet connect to the +48 V DC bus bars

The PSM’s heavy gauge wires are connected to the bus bars. Each shelf’s power connections are terminated on the bus bars.

FRONT ROOM POWER

The 99-CHEP-43 is a 100 watt 48 volt front room power supply unit. The 99-CHEP-43 provides local power to the turret and connectivity from the backroom to the desktop. For more information about the 99-CHEP-43, refer to *Chapter 7* in the *Tradenet MX Installation & Maintenance Manual 14.1* (part number B0108900003).

Chapter 4 Specifications



SYSTEM SPECIFICATIONS

This table describes some important specifications for the MX System.

TABLE 4-1 Tradenet MX Specifications

Item	Information
advanced technology	digital switching and folded hierarchal network architecture
BABT Registration No. (UK)	NS-2666-23-M-602603
blocking	Tradenet MX is non-blocking at rated capacity of two calls per handset per second.
cable length limit to a consolidated control/pagination module	U.K.: 10 pair—900 feet (274,32 m) on 22 SWG (0,711 mm) or 700 feet (213,36 m) on 24 SWG (0,559 mm) U.S.: 12 pair—900 feet on 22 AWG (22 AWG=0.643mm and 24 AWG=0.511mm)
cable length limit to a digital turret with a digital FTS (dFTS) speaker	U.K.: 10 pair—900 feet (274,32 m) on 22 SWG (0,711 mm) or 700 feet (213,36 m) on 24 SWG (0,559 mm) U.S.: 12 pair—900 feet on 22 AWG (22 AWG=0.643mm and 24 AWG=0.511mm)
cable length limit to a digital turret with two dFTS modules	U.K.: 10 pair—900 feet (274,32 m) on 22 SWG (0,711 mm) or 700 feet (213,36 m) on 24 SWG (0,559 mm) U.S.: 12 pair—900 feet on 22 AWG (22 AWG=0.643mm and 24 AWG=0.511mm)
Canadian registration information[a]	model number: Tradenet MX Telephone System type of equipment: 24 certification number: 632 4980 A interfaces: LS and CT connecting methods: CA21A load number: 11
capacity, system	3840 digital or 2,880 analog dual handset turrets 12,000 analog lines/23,040 digital channels
CCL certificate number	C86-0097
central exchange/PBX lines	To operate reliably on central exchange and PBX lines, Tradenet MX equipment requires: industry standard minimum of loop current of 20 mA, and a minimum loop voltage of 5.0 V DC. For more information, see *Central Exchange/PBX Lines* on page 4-26.
DataLink (analog turrets only)	connection at the turret RS232 signal format (DB9 interface) baud rate:19.2K asynchronous Hayes hand-shaking protocol fault tolerant interface (failure of unit will not cause turret malfunctions)
dialing	push-button Dual Tone Multi-Frequency (DTMF) and outpulse (loop disconnect) dialing
display update	within 300ms

Item	Information
environmental requirements for operating Tradenet MX System	humidity: minimum, 30% non-condensing; maximum, 90% non-condensing optimum[b]: 35-75% non-condensing temperature: minimum, 1° Celsius (34° Fahrenheit) maximum: 27° Celsius (80° Fahrenheit)[c] optimum:18° Celsius (65° Fahrenheit)
environmental requirements for Tradenet MX System in storage, including System Center	humidity: minimum, 5% non-condensing; maximum, 95% non-condensing optimum: 30-70% non-condensing temperature: minimum, 1° Celsius (34° Fahrenheit) maximum: 66° Celsius (150° Fahrenheit) optimum:18° Celsius (65° Fahrenheit)
environmental requirements for operating Tradenet MX System Center	humidity: minimum, 20% non-condensing @ 40° Celsius maximum: 80% non-condensing optimum: 30-65% non-condensing temperature: minimum, 0° Celsius (32° Fahrenheit) maximum: 40° Celsius (104° Fahrenheit) optimum:18° Celsius (65° Fahrenheit)
FCC part 15	meets Class A limits
FCC registration number (USA)	2GK-USA-73740-KF-E
Facility Interface Code (FIC)	02LS2 (2-wire local switched access, loop start) 02AC2 (2-wire private line manual ringdown) 04NO2 (4-Wire PL, no signalling)
growth capacity, system	maximum capacity of 120 terminal shelves in 12 triplets
hearing-aid compatible	the Tradenet MX System is hearing-aid compatible
interworking	all IPC systems, and some other vendor's products, including specified ISDN telephones
latch time	80ms for all calls regardless of system size or traffic volume
line compatibility	conventional two-wire dialtone analog lines with bridged ringing two-wire manual ringdown two-wire Central Office automatic ringdown four-wire U.K. Figure 6 lines: all implementations digital T1 and E1 lines with direct interface: no channel bank needed
line networking	see *Line Networking Specifications* on page 4-29
power factor correction	all AC input power supplies have built in Power Factor Correction (PFC) circuitry
power line regulations, system	AC input operable under brownout conditions of 95 VAC at inputs
ring acceptance	between 35–150 VAC and 16–68Hz
ring signaling	U.S.: 90 V AC, selectable 20 or 30 Hz (default 20Hz) U.K.: 100 V AC, 30 Hz.

Item	Information
Ringer Equivalency Number (REN)	1.0B
safety approvals	CCL–Communications Certification Laboratories[d]
SOC	9.0F (2 wire application) 9.0N (4 wire application)
speed dial/index dial	standard feature available to all turrets in the system, user programmable or programmable from the System Center, 35 digits per number, cascading, two-digit index or direct button dialing, use to activate PBX/Centrex features or other PSTN features

a. For more information, see the regulatory information at the beginning of the manual.

b. Low relative humidity encourages the discharge of static electricity, which can cause damage to station displays, hoot modules, and the turret. The grounding of equipment items and the installation of anti-static mats can provide a partial solution to static discharge problems. However, serious damage can occur if the working environment is not maintained as stated in this table.

c. The maximum operating temperature for KEPCO MX Systems is 72° Fahrenheit.

d. CCL operates as a Nationally Recognized Testing Lab and can satisfy all approvals. Those familiar with the UL logo and any other OSHA laboratory, please consider the CCL logo the same.

DIMENSIONS

This section provides the dimensions of cabinets, shelves, station equipment, turret housings (buckets), and System Centers in the Tradenet MX System.

Cabinets

The metal rack cabinets used with the Tradenet MX System are installed with a front door of smoked lexan that magnetically seals. The back door is metal with a key lock. There is no front door on the AC power supply cabinet and the back is vented with louvers.

The following table describes the dimensions of the rack cabinets in a Compact.

TABLE 4-2 Compact Rack Cabinet Dimensions

Width	Height	Depth
24 1/16 inches 61 centimeters	61 1/2 inches 157 centimeters	30 3/4 inches 79 centimeters

The following table describes the dimensions of the rack cabinets in a standard Tradenet MX System or Mini.

TABLE 4-3 Standard and Mini Rack Cabinet Dimensions

Width	Height	Depth
24 1/16 inches 61 centimeters	78 5/8 inches 200 centimeters	30 3/4 inches 79 centimeters

With KEPCO MX Systems, Plexiglass doors should not be used on the fronts of the cabinets; instead, only perforated doors should be used. The use of Plexiglass doors will cause your system to over-heat. Standard KEPCO MX Systems are shipped with perforated doors.

The operating environment for your KEPCO MX System should not exceed 72º F. KEPCO MX Systems do not include top cabinet fans.

The following table describes the dimensions of the HC power cabinets (AC-powered and DC-powered). Tradenet MX Systems using Unipower or KEPCO PSMs do not have separate power cabinets.

TABLE 4-4 HC Power Cabinet Dimensions and Cabinet Clearance Requirements

Width	Height	Depth	Front	Rear	Top	Sides (End Cabinets Only)
24 1/16 inches 61 centimeters	40 1/8 inches 102 cm	30 3/4 inches 79 cm	24 inches 61 cm	24 inches 61 cm	8 inches 20 cm	24 inches 61 cm

Shelves

All circuit cards and removable power supplies are installed in shelves. The power supply shelf sizes vary with application. The remaining shelf sizes are given in the following table.

TABLE 4-5 Shelf Sizes

Shelf	Width	Height	Depth
Terminal Shelf	19 inches 48.3 centimeters	10.5 inches 26.7 centimeters	20.5 inches 50.8 centimeters
Section Shelf	19 inches 48.3 centimeters	15.7 inches 39.9 centimeters	25.6 inches 65 centimeters
Reflection Shelf	19 inches 48.3 centimeters	15.5 inches 39.4 centimeters	20.5 inches 52.1 centimeters
Kepco Power Shelf	19 inches 48.3 centimeters	10.5 inches 26.7 centimeters	20.5 inches 50.8 centimeters

Station Equipment

Turrets must be installed in a customer-provided desk if they are not installed in the Tradenet MX free-standing cabinets or in the Tradenet MX module stands. The installation angle and the housing are different for the digital station equipment and analog station equipment.

TABLE 4-6 Station Equipment Dimensions in Inches

Item	Width	Height	Depth
Analog Module	7.83 inches	7.5 inches	0.90 inches to desk surface 4.9 inches below desk surface
Digital Control Module	7.83 inches	7.5 inches	0.90 to desk surface 3.65 below desk surface
ClearDeal Speaker Module	7.83 inches	7.5 inches	0.90 to desk surface 3.65 below desk surface
Slimline ClearDeal Speaker Module	7.83 inches	7.5 inches	1.232 to desk surface 1.521 below desk surface
Digital Speaker Module (dFTS)	7.83 inches	7.5 inches	0.90 to desk surface 3.65 below desk surface
Digital Consolidated Control/Pagination Module	15.64 inches	7.5 inches	0.90 to desk surface 3.156 below desk surface
Slimline Digital Consolidated Control/Pagination Module	15.64 inches	7.5 inches	1.232 to desk surface 1.521 below desk surface
Digital Add-on Intercom Speaker Module	4.5 inches	7.5 inches	0.90 to desk surface 3.156 below desk surface
TradePhone MX	10.45 inches	9.4 inches	4.0 inches (Rear) 0.9 inches (Front)

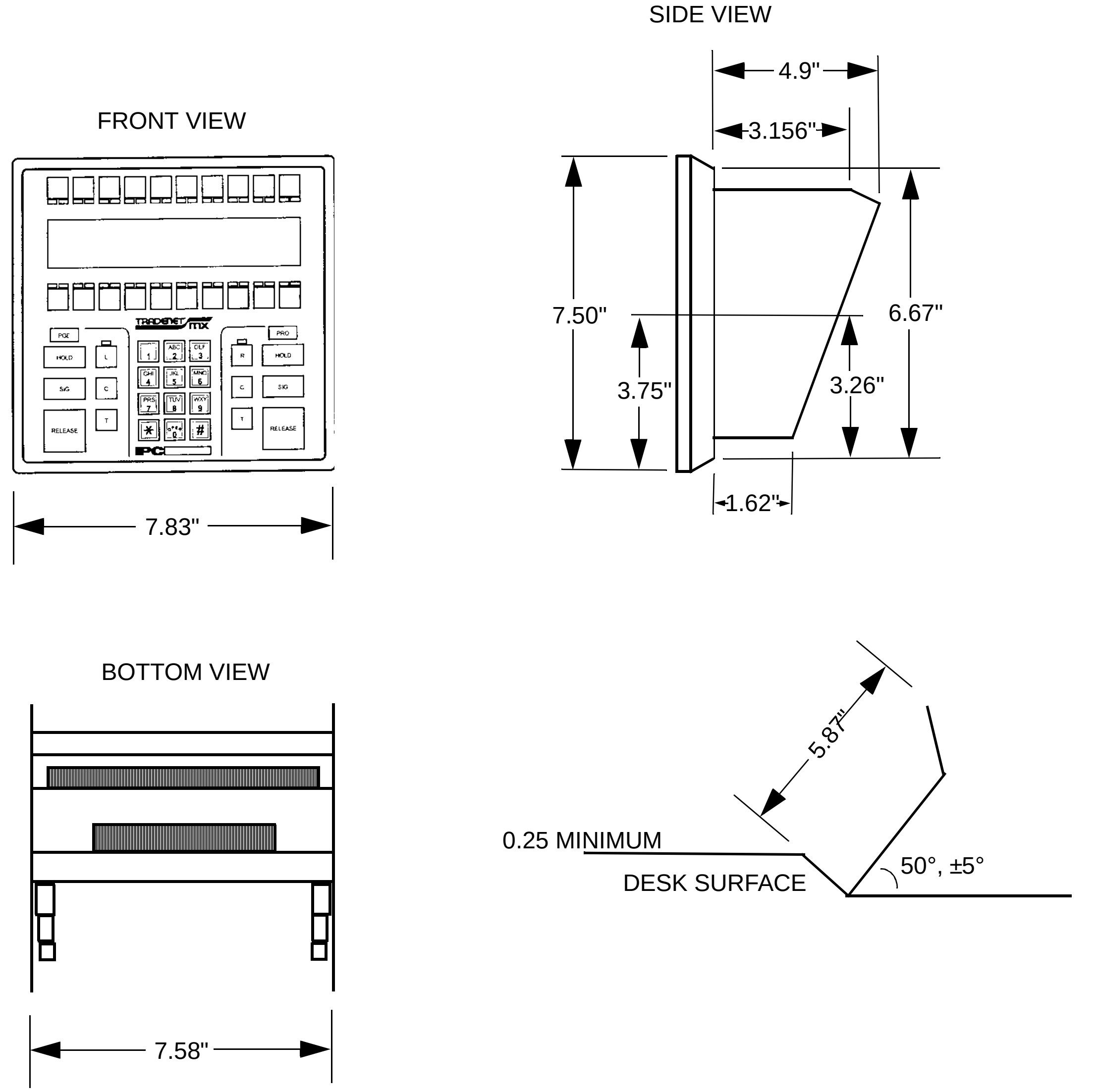
TABLE 4-7 Station Equipment Dimensions in Millimeters

Item	Width	Height	Depth
Analog Module	198,0 millimeters	190,0 millimeters	92,7 millimeters below desk surface
Digital Control Module	198,0 millimeters	190,0 millimeters	92,7 millimeters below desk surface
ClearDeal Speaker Module	198,0 millimeters	190,0 millimeters	92,7 millimeters below desk surface
Slimline ClearDeal Speaker Module	198,0 millimeters	190,0 millimeters	35,8 millimeters below desk surface

Item	Width	Height	Depth
Digital Speaker Module (dFTS)	198,0 millimeters	190,0 millimeters	92,7 millimeters below desk surface
Digital Consolidated Control/Pagination Module	397,8 millimeters	190,0 millimeters	80,0 millimeters below desk surface
Slimline Digital Consolidated Control/Pagination Module	397,8 millimeters	190,0 millimeters	35,8 millimeters below desk surface
Digital Add-on Intercom Speaker Module	114,3 millimeters	190,5 millimeters	80,0 millimeters below desk surface
TradePhone MX	264,0 millimeters	237,0 millimeters	102 millimeters (Rear) 22 millimeters (Front)

The rear buckets of the digital turret and digital speaker module (dFTS) do not have the same shape as that of the analog turret. Although the digital turret's width and height fit within a Series II cutout, the housing depth of the digital turret and dFTS is different than the analog turret.

FIGURE 4-1 Dimensions of the Analog Control Module in Inches

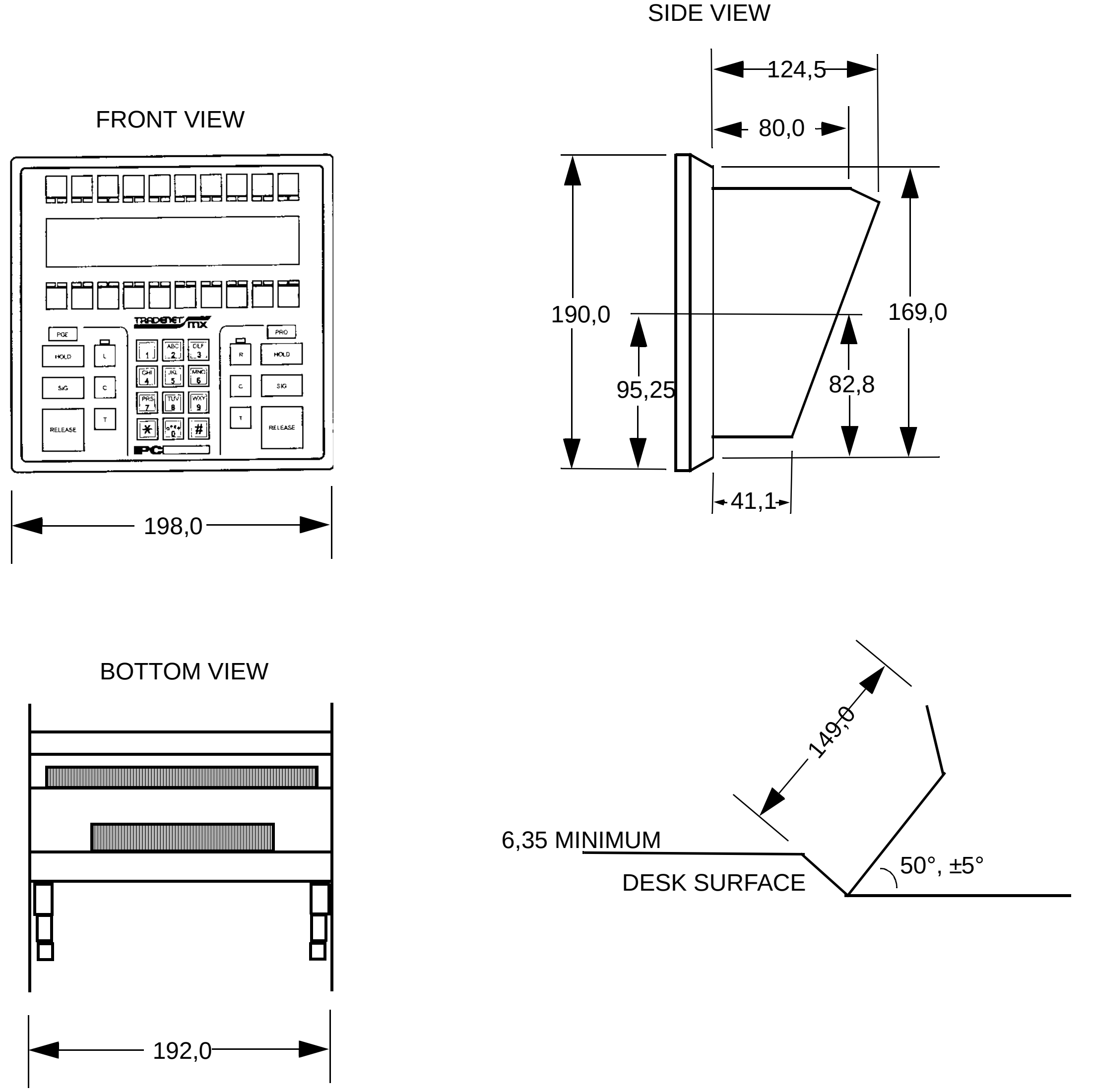


The following table lists what cutout width you need based on the number of analog control modules you have.

TABLE 4-8 Analog Control Module Cutouts in Inches

Number of Modules	Cutout Width
1	7.62 inches
2	15.43 inches
3	23.24 inches
4	31.05 inches
5	38.86 inches
6	46.67 inches

FIGURE 4-2 Dimensions of the Analog Control Module in Millimeters

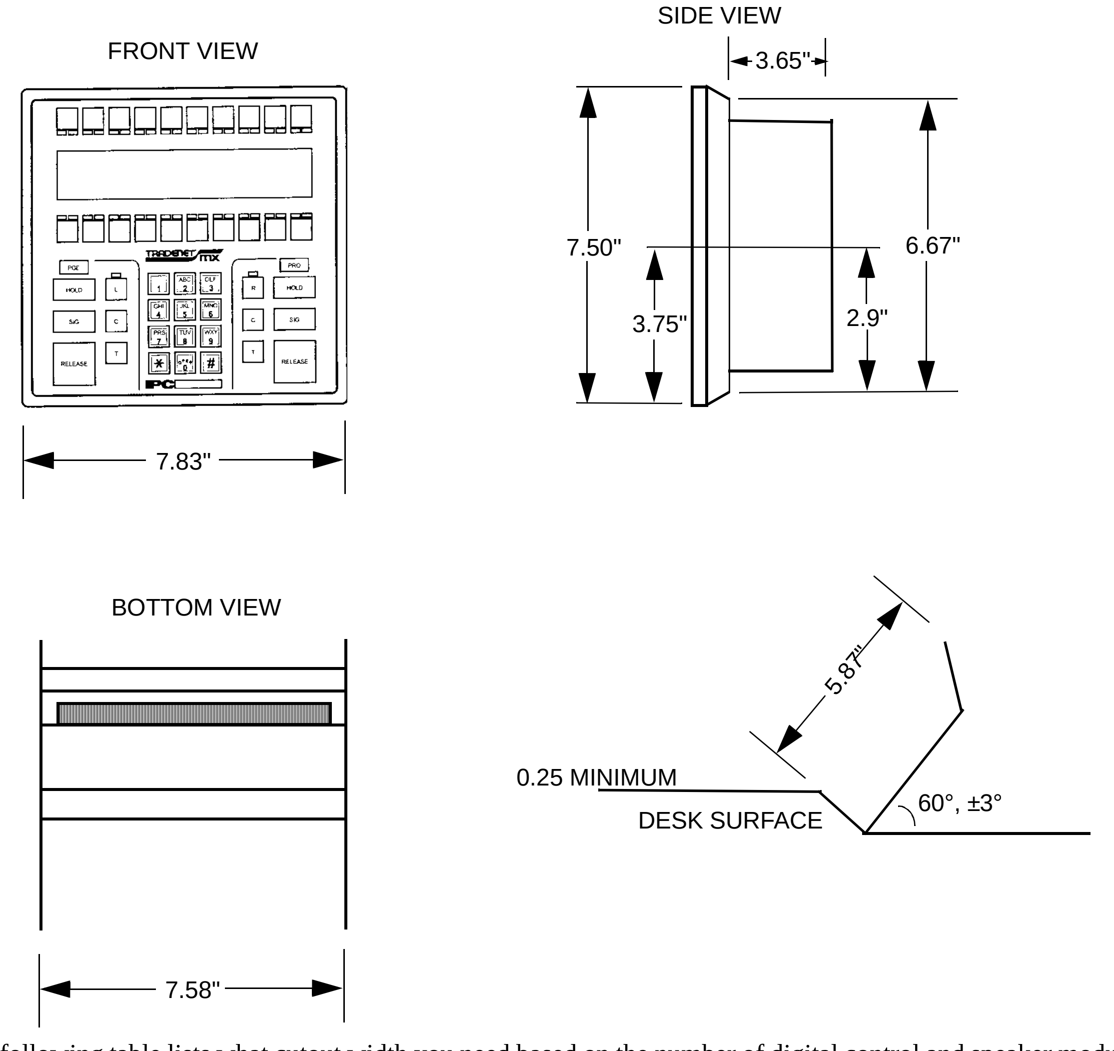


The following table lists what cutout width you need based on the number of analog control modules you have.

TABLE 4-9 Analog Control Module Cutouts in Millimeters

Number of Modules	Cutout Width
1	193,5
2	391,9
3	590,3
4	788,7
5	987,0
6	1185,4

FIGURE 4-3 Dimensions of the Digital Control Module and dFTS in Inches

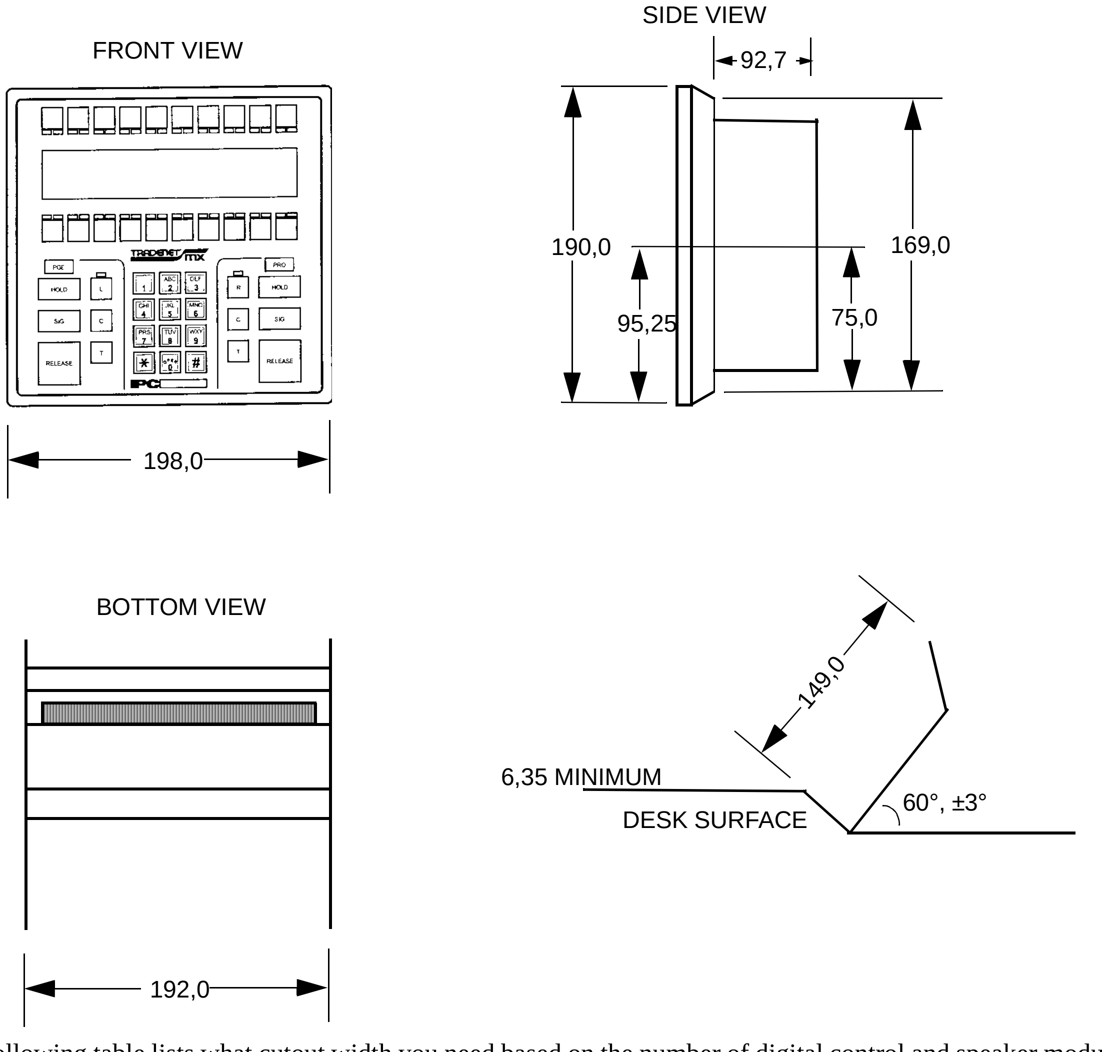


The following table lists what cutout width you need based on the number of digital control and speaker modules you have.

TABLE 4-10 Digital Control and Speaker Module Cutouts in Inches

Number of Modules	Cutout Width
1	7.59"
2	15.42"
3	23.25"
4	31.08"

FIGURE 4-4 Dimensions of the Digital Control Module and dFTS in Millimeters



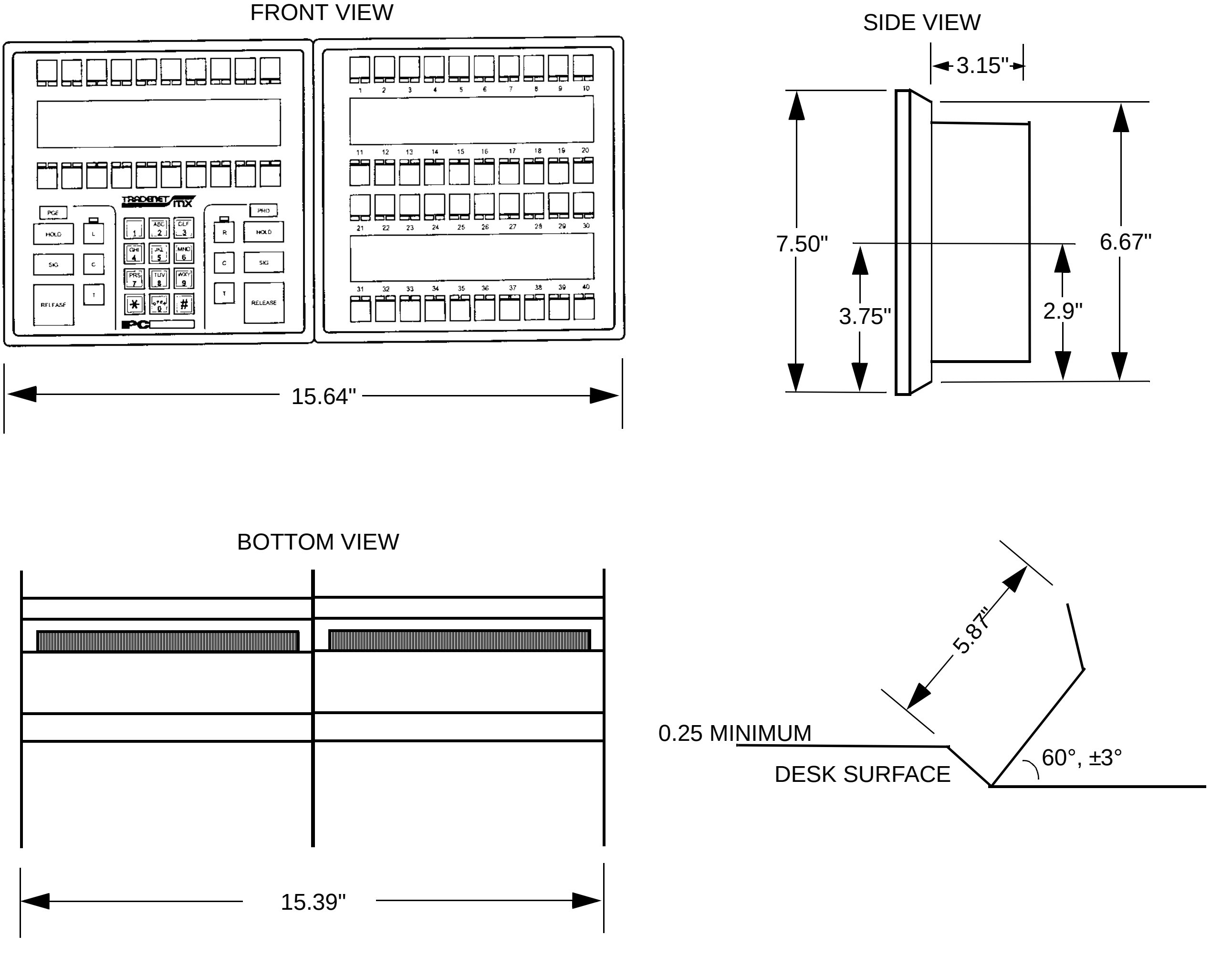
The following table lists what cutout width you need based on the number of digital control and speaker modules you have.

TABLE 4-11 Digital Control and Speaker Module Cutouts in Millimeters

Number of Modules	Cutout Width
1	192,8 millimeters
2	391,7 millimeters
3	590,6 millimeters
4	789,4 millimeters

The buckets of the consolidated control pagination modules are different from other modules’ buckets because the consolidated modules use a single, two-position bucket. The consolidated control pagination module is also available with the control and pagination modules above and below each other rather side by side. This configuration is called the Exchangephone. The Exchangephone uses two single buckets above and below each other.

FIGURE 4-5 Digital Consolidated Control/Pagination Module Dimensions in Inches

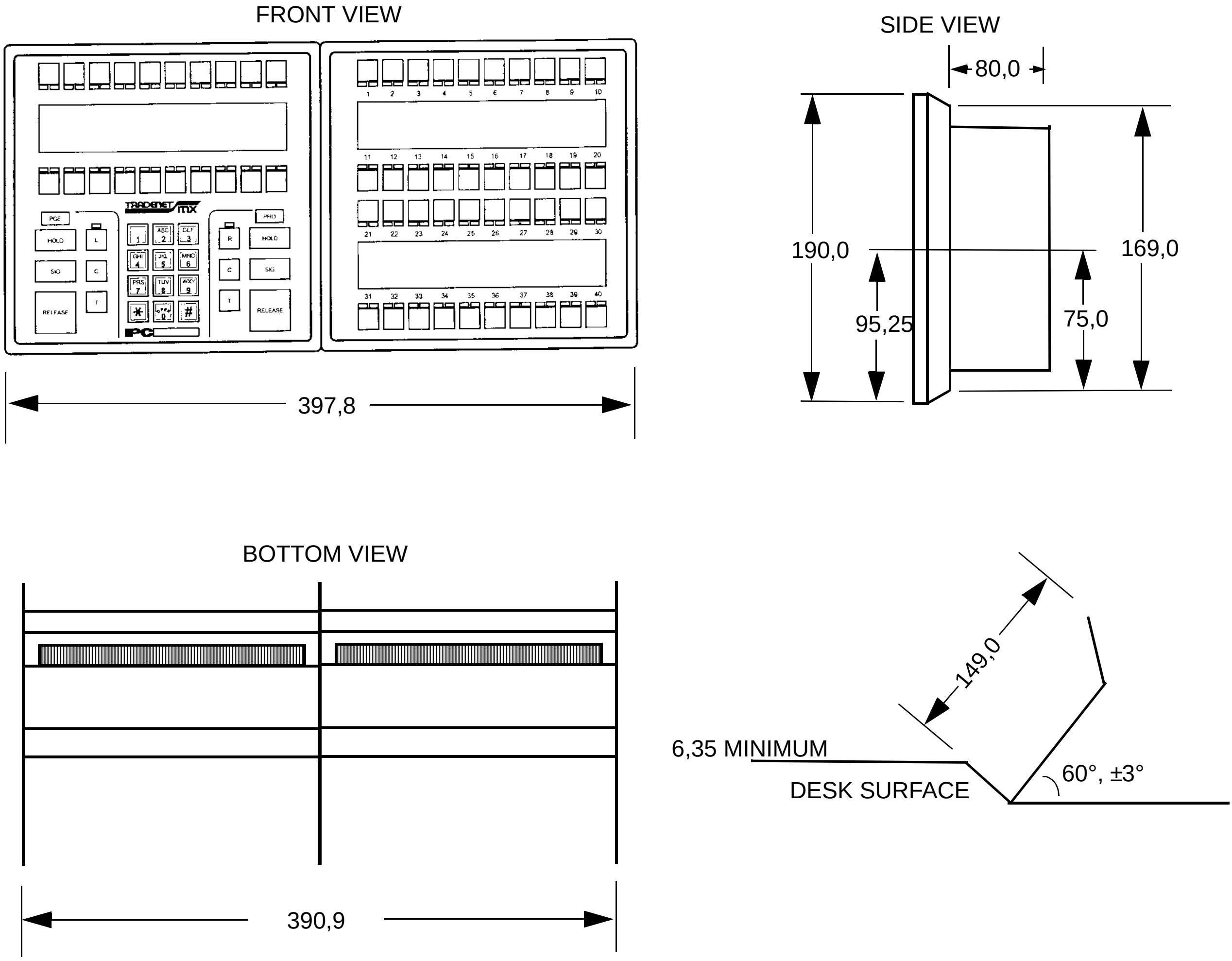


The following table lists what cutout width you need based on the number of digital consolidated control/pagination modules you have.

TABLE 4-12 Digital Consolidated Control/Pagination Module Cutouts in Inches

Number of Modules	Cutout Width
1 Consolidated Control/Pagination Module + 3 Modules	38.91 inches
2 Consolidated Control/Pagination Modules + 2 Modules	31.08 inches
3 Consolidated Control/Pagination Modules + 1 Module	23.25 inches
4 Consolidated Control/Pagination Modules	15.42 inches

FIGURE 4-6 Digital Consolidated Control/Pagination Module Dimensions in Millimeters



The following table lists what cutout width you need based on the number of digital consolidated control/pagination modules you have.

TABLE 4-13 Digital Consolidated Control/Pagination Module Cutouts in Millimeters

Number of Modules	Cutout Width
1 Consolidated Control/Pagination Module + 3 Modules	988,3 millimeters
2 Consolidated Control/Pagination Modules + 2 Modules	789,4 millimeters
3 Consolidated Control/Pagination Modules + 1 Module	590,6 millimeters
4 Consolidated Control/Pagination Modules	391,7 millimeters

Slimline digital consolidated control/pagination modules work the same way the original digital consolidated control/pagination module works. The Slimline control/pagination module uses a pivot foot to stand up and take advantage of the lower depth of its housing.

FIGURE 4-7 Slimline Digital Consolidated Control/Pagination Module Dimensions In Inches

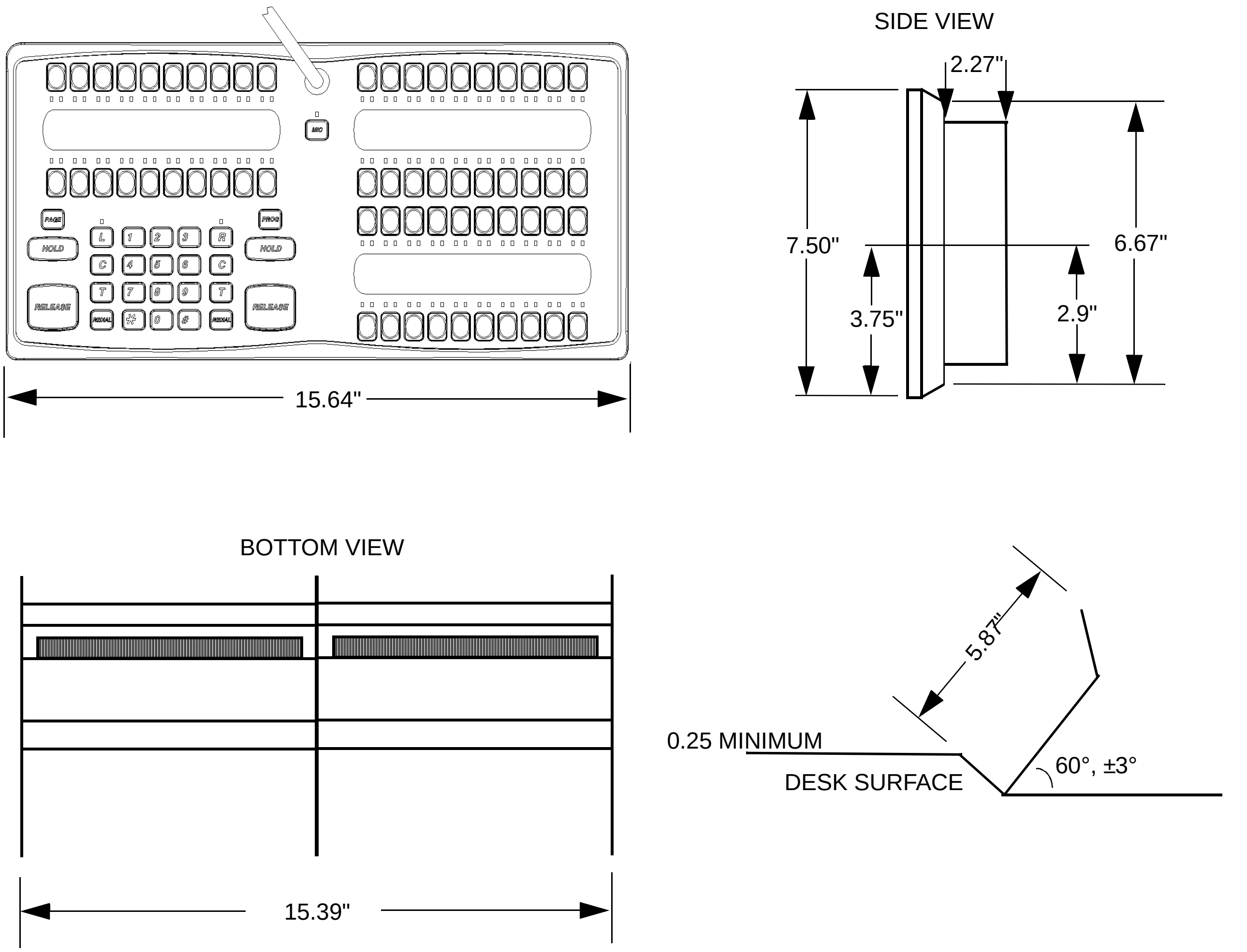
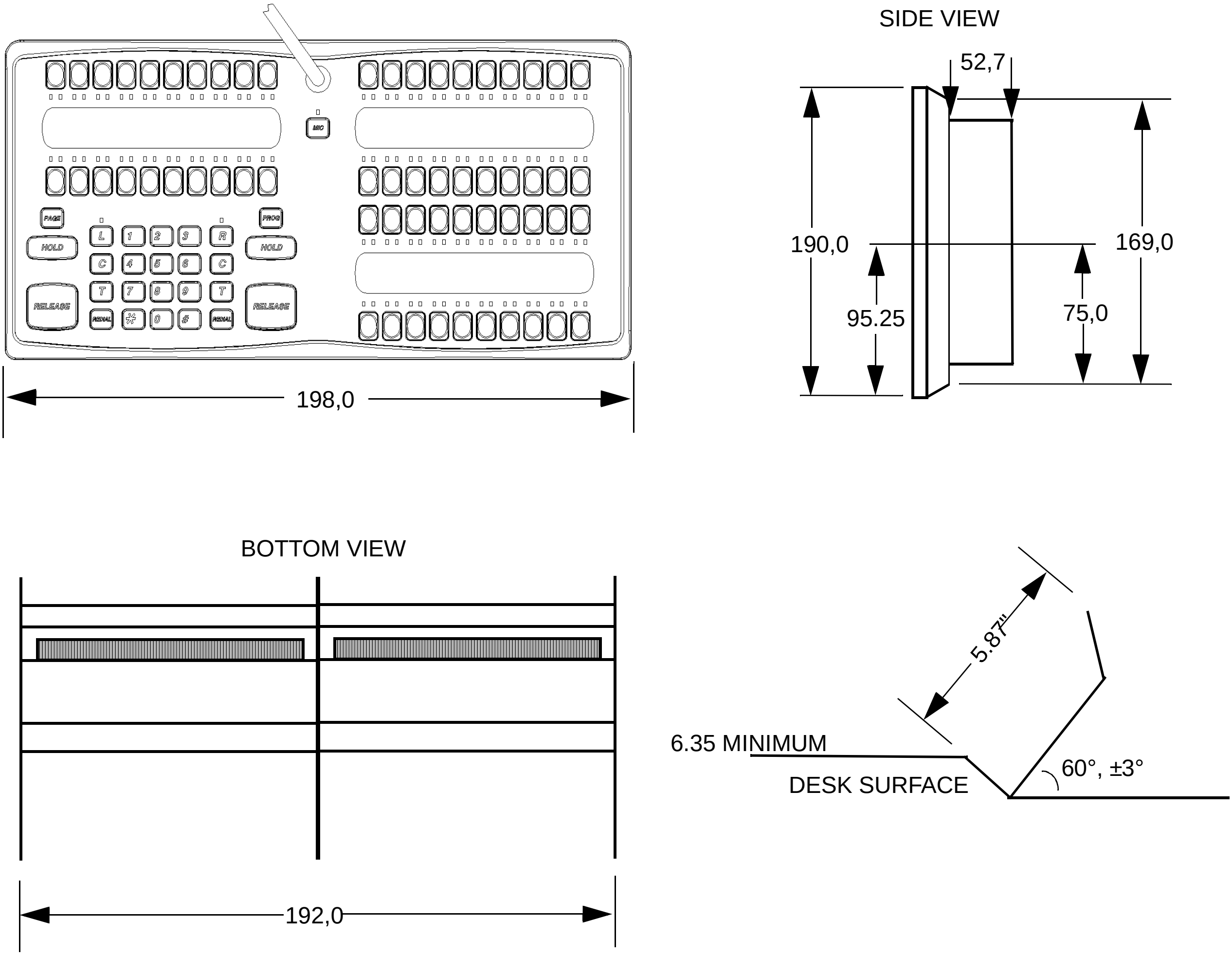
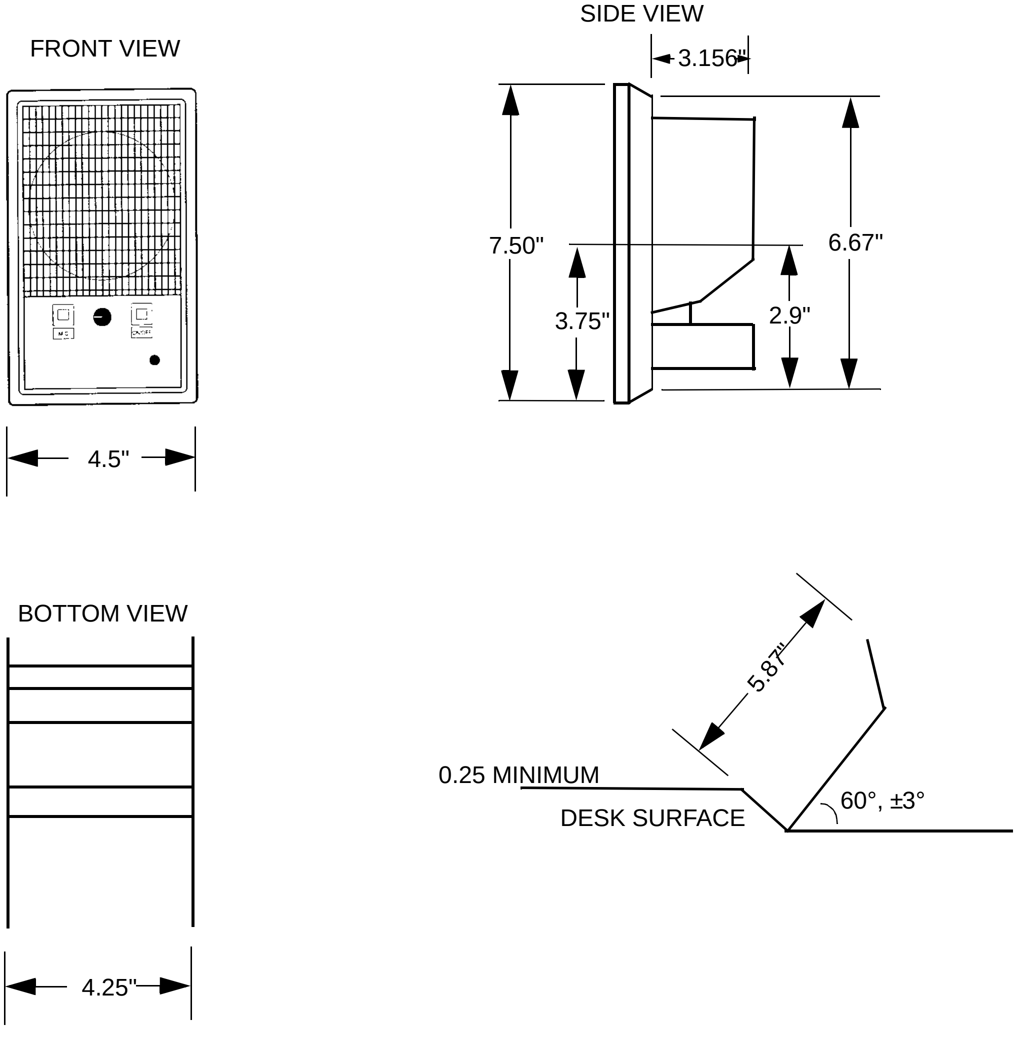


FIGURE 4-8 Slimline Digital Consolidated Con/Pag Module Dimensions In Millimeters



The add-on intercom module uses a unique bucket that has the same depth as the consolidated modules, but is slightly over half the width of a control or speaker module, or less than a third the width of a consolidated module.

FIGURE 4-9 Digital Add-on Intercom Speaker Module Dimensions in Inches

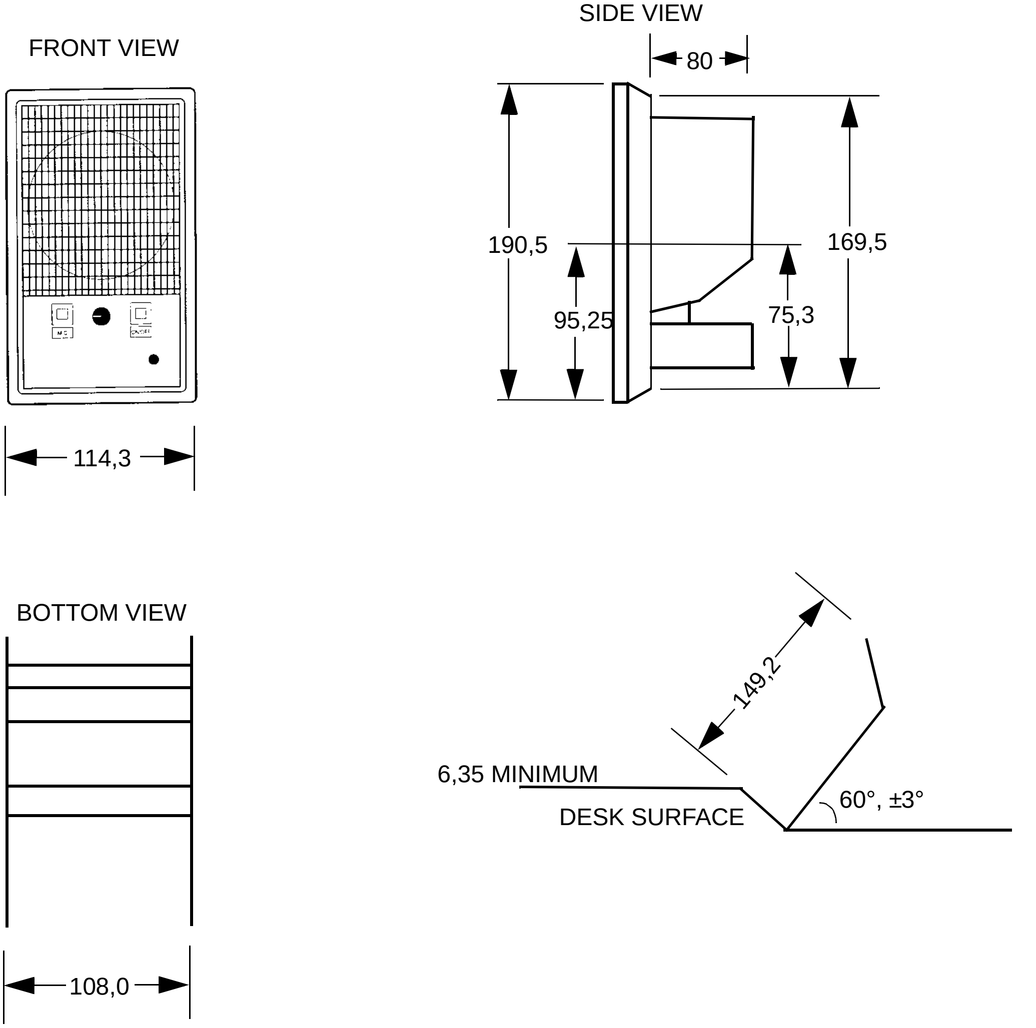


The following table lists what cutout width you need based on the number of digital add-on intercom speaker modules you have.

TABLE 4-14 Digital Add-on Intercom Speaker Module Cutouts in Inches

Number of Modules	Cutout Width
1	4.25 inches
2	8.75 inches

FIGURE 4-10 Digital Add-on Intercom Speaker Module Dimensions in Millimeters



The following table lists what cutout width you need based on the number of digital add-on intercom speaker modules you have.

TABLE 4-15 Digital Add-on Intercom Speaker Module Cutouts in Millimeters

Number of Modules	Cutout Width
1	108 millimeters
2	222,3 millimeters

The following figure shows the microphone.

FIGURE 4-11 Shure Microphone Dimensions in Inches

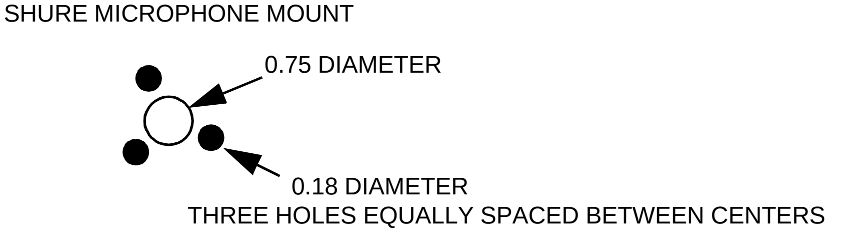
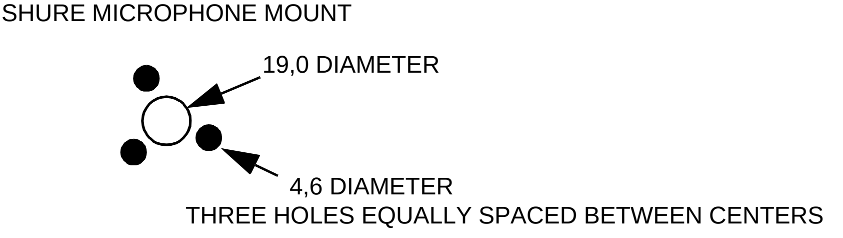


FIGURE 4-12 Shure Microphone Dimensions in Millimeters



Turret Housing (Buckets)

The rear buckets of the Tradenet MX digital turret and digital speaker module (dFTS) *do not* have the same shape as that of the Tradenet analog turret. The Tradenet MX turret rear housings are deeper and rectangular.

TABLE 4-16 Dimensions of the Buckets in Inches

Item	Width	Height	Depth
Digital Consolidated Control/Pagination Module	15.66 inches	7.5 inches	3.156 inches
Digital Control Module	7.83 inches	7.5 inches	3.65 inches
Digital Speaker Module	7.83 inches	7.5 inches	3.65 inches
Analog Control Module	7.83 inches	7.5 inches	4.9 inches
Add-on Intercom Speaker Module	4.25 inches	7.5 inches	3.156 inches

TABLE 4-17 Dimensions of the Buckets in Centimeters

Item	Width	Height	Depth
Digital Consolidated Control/Pagination Module	39,78 cm	19 cm	8 cm
Digital Control Module	19,89 cm	19 cm	9,27 cm
Digital Speaker Module	19,89 cm	19 cm	9,27 cm
Analog Control Module	19,89 cm	19 cm	12,5 cm
Add-on Intercom Speaker Module	107,8 cm	19 cm	8 cm

Power Supplies

TABLE 4-18 Hot, Insertable Power Supply Modules in Inches

Item	Width	Height	Depth
5V output, DC input	5.5 inches	10.5 inches	24–28 inches
5V output, AC input	5.5 inches	10.5 inches	24–28 inches
48V output, AC input	8.25 inches	7 inches	24–28 inches

TABLE 4-19 Hot, Insertable Power Supply Modules in Centimeters

Item	Width	Height	Depth
5V output, DC input	14 cm	27 cm	61–71 cm
5V output, AC input	14 cm	27 cm	61–71 cm
48V output, AC input	21 cm	18 cm	61–71 cm

TABLE 4-20 Bolt-in Power Supplies in Inches

Item	Width	Height	Depth
5V output, DC input	4.5 inches	8inches	8–12 inches
5V output, AC input	4.5 inches	8 inches	8–12 inches
48V output, AC input	4.5 inches	8 inches	8–12 inches

TABLE 4-21 Bolt-in Power Supplies in Centimeters

Item	Width	Height	Depth
5V output, DC input	11 cm	21 cm	21–31 cm
5V output, AC input	11 cm	21 cm	21–31 cm
48V output, AC input	11 cm	21 cm	21–31 cm

System Center

Position your System Center workstation so that you can see the front of the Tradenet MX cabinets while sitting at the workstation. This way you can see the status of cards in the MX System from the System Center workstation. Place the workstation so that there is free space to the rear of the unit for fan exhaust.

If you are using a Mini system, the System Center can be no more than 300 feet from the Mini system cabinet.

The Sun Ultra 10, and SPARCstation 5, are supported with the Tradenet MX System, Release 14.1. Earlier releases supported the SPARCstation 5, 20, IPC, Classic, and 10. For more information about the platforms available to run the Tradenet MX System, refer to the *Tradenet MX Platform Manual 14.1* (part number B0087686104).

Note *With all Sun workstations except the Ultra 10, the monitor is designed to be placed directly on top of the CPU, if the CPU is on a desk or countertop.*

TABLE 4-22 Sun Workstation Dimensions in Inches

Item	Width	Height	Depth
Ultra 10	6.9 inches	15.8 inches	17.1 inches
SPARCstation 5	16.4 inches	3.1 inches	16.1 inches
SPARCstation 20	16.4 inches	3.1 inches	16.1 inches
SPARCstation 10	16.4 inches	3.1 inches	16.1 inches
SPARCstation Classic	9.6 inches	4.6 inches	10.4 inches
SPARCstation IPC	9.6 inches maximum	4.6 inches maximum	10.4 inches maximum

TABLE 4-23 Sun Workstation Dimensions in Centimeters

Item	Width	Height	Depth
Ultra 10	17.6 cm	40.2 cm	43.5 cm
SPARCstation 5	41.7 cm	7.8 cm	40.9 cm
SPARCstation 20	41.7 cm	7.8 cm	40.9 cm
SPARCstation 10	41.7 cm	7.8 cm	40.9 cm
SPARCstation Classic	24.4 cm	11.7 cm	26.4 cm
SPARCstation IPC	24.4 cm maximum	11.7 cm maximum	26.4 cm maximum

TABLE 4-24 Other Equipment Dimensions in Inches

Item	Width	Height	Depth
Monitor	17.0 inches	16.5 inches	17.5 inches
VME Tower	11.0 inches	23.0 inches	20.0 inches
DAT Drive	7.5 inches	2.5 inches	12.5 inches

Item	Width	Height	Depth
HP 1100 Printer	14.5 inches	15.0 inches	13.0 inches
HP 6P Printer	17.5 inches	8.0 inches	16.0 inches
HP 4000T Printer	15.5 inches	15.5 inches	17.0 inches
Panasonic Printer	22.5 inches	10 inches	18 inches
Modem	8.5 inches maximum	1.5 inches maximum	13 inches maximum

TABLE 4-25 Other Equipment Dimensions in Centimeters

Item	Width	Height	Depth
Monitor	43.0 cm	42.0 cm	46.0 cm
VME Tower	27.9 cm	58.4 cm	51.0 cm
DAT Drive	19.0 cm	6.5 cm	31.5 cm
HP 1100 Printer	37.0 cm	38.5 cm	33.5 cm
HP 6P Printer	44.5 cm	20.5 cm	41.0 cm
HP 4000T Printer	39.5 cm	39.5 cm	43.5 cm
Panasonic Printer	57.2 cm	25.4 cm	45.8 cm
Modem	21.6 cm maximum	3.9 cm maximum	33.0 cm maximum

WEIGHT

This section lists the weights for the Tradenet MX System equipment in pounds and kilograms.

Cabinets

The following table lists the weights of the cabinets in the Tradenet MX System.

TABLE 4-26 Cabinet Weights (Fully Loaded)

Cabinet	Weight	
	Pounds	**Kilograms**
Terminal Shelf or Terminal Unit (TU) With Cards	505 pounds	229,3 kg
Triplet[a]	1400 pounds	635,6 kg
Short Power Cabinet	400 pounds	181,6 kg

a. The floor loading for a triplet is 96 pounds per square foot.

System Center

The following table lists the weights of the System Center.

TABLE 4-27 Sun Workstation Weights

Item	Pounds	Kilograms
Ultra 10	44 pounds	20.0 kilograms
SPARCstation 5	27 pounds	12.7 kilograms
SPARCstation 20	27 pounds	12.7 kilograms
SPARCstation 10	27 pounds	12.7 kilograms
SPARCstation IPC	17 pounds	7.8 kilograms
SPARCstation Classic	17 pounds	7.8 kilograms
17 inch color monitor	52 pounds	23.7 kilograms

Station Modules

The following table lists the weights of the station modules.

TABLE 4-28 Module Weights

Module	Weight	
	Pounds	Kilograms
Digital Consolidated Control/Pagination Module	8.5 pounds	3,9 kg
Digital Control Module	3.8 pounds	1,7 kg
Slimline Digital Consolidated Control/Pagination Module	5.4 pounds	2.4 kg
Analog Control Module	4.32 pounds	2,0 kg
Analog Pagination Module	4.19 pounds	2,0 kg
PCD module	2.83 pounds	1,4 kg
Touchscreen Module	8 pounds	3,6 kg
Digital Speaker Module (dFTS)	3.6 pounds maximum	1.6 kg maximum
Digital Add-on Intercom Speaker Module	2.2 pounds	1.0 kg
ClearDeal Speaker Module	4.8 pounds maximum	2.1 kg maximum
Slim Line ClearDeal Speaker Module	3.2 pounds	1.4 kg
TradePhone MX	3.1 pounds	1.4 kg

CENTRAL EXCHANGE/PBX LINES

To operate reliably on central exchange and PBX lines, Tradenet MX equipment requires:

- industry standard minimum of loop current of 20 mA
- a minimum loop voltage of 5.0 V DC

Failure to meet these minimum level requirements can cause operational problems for the telephone equipment and poor voice quality for the user. Specifically:

- Low voltage has been found to cause echo when a remote turret interface card (RTIC) is used.
- Line networking can be affected when remote ALICs are accessed.

Therefore it is essential that loop current and voltage be measured on every line from a service provider that terminates at an analog line interface card (ALIC). Measurements should be made at the time a line is installed; lines already in place should be tested as soon as possible.

If voltage or current is found to be below standard, contact the provider and make arrangements to have the condition corrected.

Measurement Procedure

To measure battery conditions at an ALIC line interface, take the following steps:

1. Open one leg of the circuit under test by disconnecting a bridge clip at the 66 block, or by removing a tip or ring wire from the battery feed circuit.
2. Connect an ammeter in series with the ALIC line under test in the tip or ring circuit.
3. Place the ALIC line under test in the off-hook condition and measure the direct current in the ammeter. The current must be greater than 20 mA.
4. Remove the ammeter from the circuit and restore the connection that was opened in step 1.
5. Ensure that the ALIC line under test is in the off-hook condition. Use a multimeter to measure the DC voltage across the tip and ring interface. The voltage must be at least 5.0 V DC.
6. If problems are found during the above test, perform the following test before contacting your provider:
   a. Disconnect the ALIC from the line under test at the 66 block of the distribution frame.
   b. Measure the open circuit DC voltage of the host system with a multimeter at the 66 block. The battery feed voltage should be at least 42.5 V DC on central exchange lines and PBX lines: the industry standard nominal value is about 48 V DC. Lower voltages can be measured on PBX or carrier system lines that use constant current feed circuits. Battery feed voltages below the levels noted can cause operational or transmission problems.
   c. Connect an ammeter across the open circuit tip and ring interface leads of the host system.
   d. Measure the short circuit direct current of the host system. The loop current varies depending on the type of exchange and PBX lines you have. The loop current should be at least 100 mA on conventional battery feed exchange and PBX lines, and at least 32 mA on constant current feed circuits. Short circuit currents below the levels noted may cause operational or transmission problems.
   e. Reconnect the ALIC to the host line under test at the 66 block of the distribution frame.

Explanation

This section provides background information about loop current and voltage.

The loop current and loop voltage at a telephone, key system, or PBX line interface are governed by three factors:

- the host equipment is battery feed circuit, including its source voltage and resistance

- the resistance of the serving exchange line
- the effective DC resistance of the telephone equipment

Loop current and voltage above the minimum levels help ensure functional and transmission performance.

In the US, the industry standard minimum loop current requirement for terminal equipment is 20 mA. The 20 mA current level is used in setting the maximum DTMF levels, and in establishing the voltage-versus-current DC characteristics of telephone equipment.

The minimum loop current requirement in other countries is also generally recognized as 20 mA. In the United Kingdom, the 20 mA level is used in setting the voltage-versus-current characteristics; however maximum DTMF level requirements are specified at 25 mA loop current.

In the US, telephone equipment must have a maximum effective DC resistance of 300 ohms. Technical standards published by the Electronics Industries Association, the Bell System, and other telephony organizations require the 300 ohm limit to be met at 20 mA loop current. Bell System standards also state that network steady-state DC voltage-versus-current characteristics should be within a defined network operating range. This range excludes levels below 20 mA and 6.6 V DC when normal power is available æ lower levels can be expected during commercial power outages.

Loop simulator circuits (LSC) are used to represent battery feed conditions on central exchange lines. In the US, the Federal Communications Commission and the Electronic Industries Association have adopted an LSC that provides a battery feed voltage with a range of
42.5-52.5 V DC, and a battery feed line resistance in the range 400-1740 ohms (maximum line resistance is 1340 ohms).

The minimum battery feed voltage available from the host equipment, together with the maximum line resistance and terminal equipment resistance, establish the minimum loop current on a line. Applying Ohm's law (E = IR, or I = E/R), a 42.5 V loop voltage, and a line and terminal resistance of 2040 ohms (1740 + 300), result in loop current of 20.8 mA (42.5V / 2040 Ohms). Applying Ohm's law further, the maximum theoretical voltage that can exist at a terminal equipment at minimum loop current is 6.24 V (20.8 mA 300 Ohms).

In some countries, telephone equipment DC resistance is permitted to be higher than 300 ohms. In the UK, for example, a DC resistance of 450 ohms at 20 mA and 360 ohms at 25 mA is permitted. Therefore, the maximum theoretical voltage that can exist at a terminal at minimum current is 9 V DC.

The DC resistance of analog line interface cards (ALICs) used in the Tradenet MX System is about 250 ohms at 20 mA. The loop voltage at 20 mA, when measured across the tip and ring interface of the ALIC, is approximately 5.0 V DC (20 mA x 250 Ohms).

The DC resistance of the ALIC decreases as the loop current increases such that the resistance is about 175 ohms at 40 mA current. The resulting loop voltage will therefore be about 7.0 V DC. Higher loop currents will result in higher loop voltages at the line interface card.

Because loop currents above the minimum required level help ensure better transmission performance, the voltage measured across an ALIC tip and ring interface should not be less than 5.0 V DC. Loop voltages below 5.0 V DC can result in poor voice transmission quality for the user

Protocol Converters

If you are connecting the Tradenet MX to a line from the central office (CO) that uses the North American Primary Rate Interface (NA PRI) T1 protocol, you will need a protocol converter. The protocol converter will be configured to convert a NA PRI T1 to a DASS2 E1. For more information about protocol converters, see *Protocol Converters* on page 7-38.

T1 to E1 Converter

If you are connecting the Tradenet MX to a line from a private branch exchange (PBX) that uses the QSIG T1 protocol, you will need a T1 to E1 converter. The T1 from the PBX will be converted to the E1 input required by the Tradenet MX QSIC (CPIC) card. For more information about the T1 to E1 converter, see *Aydin T1/E1 Converter* on page 7-42.

Echo Cancellers

If you are accessing a two wire Tradenet MX line from a remote site located more than 500 miles away (resulting in a total round trip delay of 50 milliseconds or more) where two or more networked Tradenet MX Systems are networked, you can notice echo on the turrets. This problem can occur when you are using remote turrets (RTICs) or line networking.

To solve this problem, you need to install an echo canceller, purchased from an outside vendor. For more information about echo cancellers, see *Echo Cancellers* on page 7-43.

Voxing (Echo Suppression)

Using an echo canceller is the optimal way to cancel echo. However, if you do not use an echo canceller, you can use voxing (echo suppression) to decrease echo. Voxing permits only half-duplex conversations, where only one person can talk at a time. This can result in the first few words someone speaks being cut off.

Voxing requires you to tune some of the software parameters at the System Center. For more information about this, contact IPC Systems Support Engineering.

LINE NETWORKING SPECIFICATIONS

For successful line networking, the Tradenet MX equipment requires:

T1 Specifications

- Line Code– B8ZS
- Framing Mode– Extended Super Frame (ESF)
- Clear Channel Signaling (CCS) with Robbed Signaling Bits off
- No Facility Data Link (FDL)
- No echo cancellation or compression of the “P” channel
- Line Build–Long
- Voltage on each side of the T1 measures 4.8 to 7.0 volts Peak-to-Peak (2.4 to 3.57 volts Peak)

Note *The Peak-to-Peak voltage is critical. If the Peak-to-Peak voltage is out of spec, the “P” channel will be affected.*

The “P” channel performs the following functions:

- inter-MX proprietary signaling
- handles initialization
- exchange line status
- network call management
- exchange list of lines

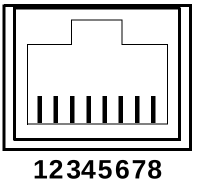
There are two choices for T1 clocking.

1. When networking is on the customer’s private network, both MX sites can use slave cards (NTSC or NESC). Clocking will be delivered from the customer’s network. This is the preferred method when using a private network.
2. A master card (NTMC or NEMC) can be used at one MX site with the other networked site set up as slave. The clocking is then derived from the master site.

The 23 DSO channels must be channelized DSOs. Echo cancellation is required on both ends of the span if there are more than 500 miles between sites. A standard DSO channel is 64K, but it can be compressed down to 16K. All DSO channels must be configured as clear channels with no robbed signaling bits. If New Bridge equipment is used, then each DSO must be configured with no robbed signalling bits.

FIGURE 4-13 T1 Category 5 Cable Pinouts

RJ45



Pin 1 = TX Ring
Pin 2 = TX Tip
Pin 4 = TX Data Ring
Pin 5 = RX Data Tip

To enable monitoring of the T1 span and channel information, IPC highly recommends DSX panels (DSX panel type ADC, model number DSX-1/WM, 8 port unit). One for the networked side of the span and one for the local MX side of the span.

The T1 card alarms are:

- LED #1 Loss of Sync (LOS)
- LED #2 Alarm Indicating Signal (AIS)
- LED #3 Red Alarm
- LED #4 Yellow Alarm
- LED #5 Loop Up

E1 Specifications

- Line Code– HDB3-E1
- International Signaling Bit enabled
- Clear Channel Signaling (CCS) with Robbed Signaling Bits off
- No echo cancellation or compression of the “P” channel

The “P” channel performs the following functions:

- inter-MX proprietary signaling
- handles initialization
- exchange line status
- network call management
- exchange list of lines

There are two choices for E1 clocking:

1. When networking is on the customer’s private network, both MX sites can use slave cards (NTSC or NESC). Clocking will be delivered from the customer’s network. This is the preferred method when using a private network.
2. A master card (NTMC or NEMC) can be used at one MX site with the other networked site set up as slave. The clocking is then derived from the master site.

The 30 DSO channels must be channelized DSOs. Echo cancellation is required on both ends of the span if there are more than 500 miles between sites. A standard DSO channel is 64K, but it can be compressed down to 16K. All DSO channels must be configured as clear channels with no robbed signaling bits. If New Bridge equipment is used, then each DSO must be configured with no robbed signalling bits.

The E1 cabling consists of two 75 ohm coax cables. One for transmit and one for receive.

The E1 card alarms are:

- LED #1 Red Alarm
- LED #2 Loss of Frame
- LED #3 Alarm Indicating Signal (AIS)
- LED #4 Yellow Alarm
- LED #5 Bit Error Rate (BER)

POWER CONSUMPTION

To determine power consumption calculations for your site, use DataMan's AutoQuote tool. (For information about using this tool, refer to the *Tradenet MX DataMan Manual 11.1*, part number B-01087-0-00-01.) Because the Tradenet MX System is a digital system, your power needs will not change significantly with usage. However, the trading floor power varies up to 30% depending on whether the turret displays are active or in sleep mode.

System Center Power Requirements

The System Center is available in two voltages:

- 110 V AC
- 220 V AC (UK)

Note *A 110 VAC six receptacle surge protection power strip is supplied in the US to power the System Center, including the Sun workstation, monitor, DAT drive, modem, printer, CD drive, etc.*

The following table describes the power requirements of the System Center.

TABLE 4-29 System Center Power Requirements

Item	Continuous Power	Surge Current in US at 120 volts AC	Surge Current in U.K. at 220 volts AC
Ultra 10	104 watts	4.7 amps	2.3 amps
SPARCstation	85 watts	2.4 amps	1.2 amps
17 Inch Monitor	103 watts	4.6 amps	2.3 amps
DAT Drive	2.2 watts	1.3 amps	0.7 amps
Modem	<60 watts	<1.0 amp	<0.5 amp
HP 1100 printer	4.3 watts–430 watts[a]	7.7 amps	3.6 amps
HP 6P printer	37 watts–495 watts[a]	3.7 amps	1.8 amps
HP 4000T printer	30 watts–724 watts[a]	3.4 amps	1.7 amps
Panasonic Printer	250 watts	< 1.0 amp	< 1.0 amp[b]
VME Tower[c]	250 watts	10.0 amps	5.0 amps

a. The two continuous power readings represent: at rest–while printing.
b. The panasonic printer is not available in 220 VAC. It must be powered from a line voltage reduction transformer when the system is powered from 220 VAC. It is able to accept 50Hz AC.
c. The System Center's VME tower requires a 15 amp 110 VAC or 208/.240 VAC outlet. We recommend that you use a separate dedicated computer grade feed for the VME tower.

If you want your Tradenet MX System to operate during building power failures, you need an un-interruptible power supply (UPS). If the MX System is powered from an AC UPS, then the System Center can be powered from the same UPS. If the MX System is powered from 48 VDC, then an inverter that converts the DC to the local AC voltage is required to power the System Center. The System Center is not required in a Tradenet MX System, but you need the System Center for maintenance, administration, and reloading cards.

Specific Power Requirements in the US and Canada

AC Input Power Requirements

The AC input power requirements for an AC shelf for a +5 V DC power supply module is 14.5 amps @ 220 volts (at rated load). The AC input power requirements for an AC shelf for +48 V DC module is 18 amps @ 220 volts (at rated load).

AC Input Voltage Ranges

The AC input voltage must be between 90 volts and 264 volts.

DC Input Voltage Range

The DC input voltage must be 48.00 +/–1.00 volt.

Input Power Requirements for DC Systems

The input power requirements for the DC shelf for +5V DC module is 80 amps DC (at rated load).

Specific Power Requirements in the U.K.

Input Voltage Range

The input voltage range must be 220/240 volts at 50 Hz.

AC Input Power Requirements

The input power to the system originates from the Power Distribution Unit (PDU). Each output to the system runs from a circuit breaker rated at 30 amps.

Types of Outlets, Receptacles, and Plugs

The plugs from the 5 volt and 48 volt shelves are cabled in the U.K. A 2.5mm, 3-core flex cable connects to the back of the terminal shelves and runs into industrial-type sockets mounted below the floor.

For AC powered cabinets and triplets, IPC provides the 60 amp 600 volt 2-wire plus ground type J connector required as the receptacle. The part used is Russellstoll JCS623H or approved equivalent.

IPC also provides the 60 amp 600 volt 2-wire plus ground type J plug required to terminate the power cable from the cabinet in the receptacle, listed above. The part used is Russellstoll JPS623H or approved equivalent. *FIGURE 3-8 AC Input Connections* on page 3-11 shows the type J connector now being used.

Miscellaneous Requirements

The MX System requires a functional earth (ground) originating from the electrical intake of the building. There should be a minimal cross sectional area of 1.5mm^2. The cable sheath should be cream in color in accordance with BS6746C and continuously embossed with the words, *Telecomms Functional Earth*.

UPS SYSTEM CONFIGURATION GUIDELINES

You can use an un-interruptible power supply (UPS) to supply 48 V DC that will support a given DC-powered Tradenet MX System.

Some of the factors used for configuring the 48 V DC power system for a DC-powered Tradenet MX application are provided. The task of determining the correct DC power system and equipment is normally *not* the responsibility of the IPC technician, but background information in this area can be helpful.

A standard configuration for the UPS for an MX includes:

- +48 V DC output; positive bus and ground bar
- low-voltage disconnect
- system meter and alarm panel
- 500 V (AC) inverter for System Center and VME tower
- battery service disconnect

Voltage Drop

Power cables from the UPS to the DC-powered MX System should be sized to minimize voltage drop, using the following guidelines:

- *system power supply*—There cannot be more that a 0.5 V DC drop in either leg between the batteries and the power supply shelves in the MX System. The following table indicates the appropriate cable size for a given length of cable.

TABLE 4-30 Appropriate Cable Length to Minimize Voltage Drop

Cable Length (feet)	Cable Size (AWG)
10 feet	5 AWG
15 feet	3 AWG
20 feet	1 AWG
25 feet	1 AWG
30 feet	1/0 AWG
35 feet	2/0 AWG
40 feet	2/0 AWG

Each power supply shelf must have its own branch circuit from the UPS system. The power supply shelf branch circuits must be protected with 100 Amp circuit breakers.

- *turret power supply*—There cannot be more than a 1.5 V DC voltage drop from the batteries to the 48V bus bars which feed the turret distribution panels in the TU cabinets. The following table indicates the appropriate cable size for a given length of cable.

TABLE 4-31 Appropriate Cable Length to Minimize Voltage Drop

Cable Length (feet)	Cable Size (AWG)
20 feet	6 AWG
25 feet	5 AWG
30 feet	4 AWG
35 feet	3 AWG
40 feet	2 AWG

Each TU cabinet must have its own branch circuit from the UPS system. The TU cabinet branch circuits must be protected with 100 amp breakers.

Final Cell Voltage

When specifying a UPS system, the final cell voltage should be 1.77 volts per cell (vpc) for a 24-cell system, or 42.5 volts for the system. The low voltage disconnect should be factory-set to the 42.5 volt setting.

Note *When you consider the 0.5 V DC drop from the batteries to the shelves, the MX power supply shelves will actually get 42.0 V DC. Operating the MX System at less than 42.0 V DC will cause overheating and possible damage to the equipment.*

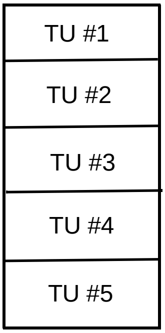
Counter-EMF Panel

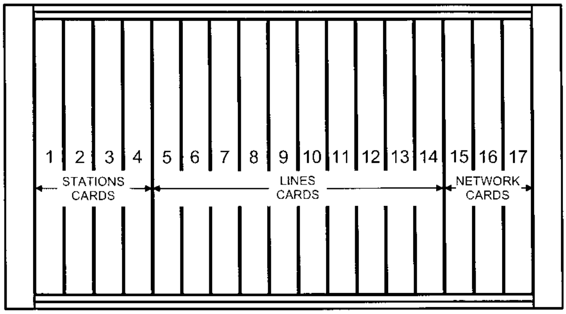
A counter-EMF (CEMF) panel might be required, depending on the equipment used. For example, analog turrets made before 1993 can be damaged by voltages exceeding 50.0 V DC, but the newer analog turrets (part numbers 21112740 and 21112741), do *not* require the CEMF panel.

If a CEMF panel *is* required, configuration of the CEMF panel must be sized, and the cut-in/cut-out levels adjusted so the UPS system, under 25% load *and* with the rectifiers set to the *equalize* setting (typically 54–58 V DC), the MX System will never receive more that 50.0 V DC. It might be necessary to connect multiple CEMF panels in series to accomplish this.

Note *Systems such as the analog FTS are normally powered from commercial AC power. If these systems are to be protected during power failure, you should supply the required DC power directly from the UPS rather than use an inverter for DC-to-AC and another power supply device for the necessary AC-to-DC power requirements.*

Chapter 5 Cabinets and Shelves





CABINETS

Cabinets contain shelves that hold cards, power supplies, and other equipment, such as fan filters and cables. This equipment is called the *back room equipment*. The cabinets have a smoked lexan front door that magnetically seals. The back door is metal with a key lock. There is no front door on the AC power supply cabinet and the back door is vented with louvers. Each terminal unit (TU), or terminal shelf (see *Terminal Shelves* on page 5-15), has a black, mesh door that provides EMI (electromagnetic interference) and RFI (radio-frequency interference) shielding for the cards. You can have either a raised floor or a ladder rack installation.

Specific cabinet configurations are determined on an individual customer basis by the DataMan tools (AutoQuote, SiteMan, and CustMan) and by the Database Reconfigurator. (For more information about these tools, see *Database Production* on page 2-51.) A Tradenet MX System can be one of the following configurations:

- *Single Cabinet*–One cabinet that contains one, two, or three TUs, as well as power supply modules (PSM). A single cabinet system does not use a section or reflection shelf.
- *Triplet*–Two or three cabinets containing 4–10 TUs and a section shelf. A triplet has one network cabinet (cabinet #2), one or two terminal cabinets (cabinet #1 and cabinet #3), and might include a power cabinet (short cabinet).
- *Multi-Triplet*–Two or more triplets, that is, five or more cabinets, connected with fiber optic cable. Each triplet has a section shelf, and might also have a reflection shelf.

The number of TUs you need determines the number of cabinets you need in your system. Using the DataMan and Database Reconfigurator tools, the number of lines in your system and how many trader stations you have determines the number of TUs you need.

Single Cabinet System

There are three single cabinet systems available: the Mini system, the Compact system, and the single-cabinet KEPCO MX System. A typical single cabinet system contains the following equipment:

- one, two, or three TUs with each TU containing a backplane, distribution panel, cards, and a shelf door
- a power supply status board (PSSA)
- connection cables
- power modules (+5 V DC and +48 V DC[1])
- fans
- cable connections to the System Center
- 12-pair station cables and incoming line cables installed at the customer site

Single Cabinet Network Interconnection

In a system with a single TU, no interconnection is required beyond that provided by the backplane itself. In a system with two TUs, two special cables provide interconnection between the access switch cards in the two TUs. There are two sets of these cables.

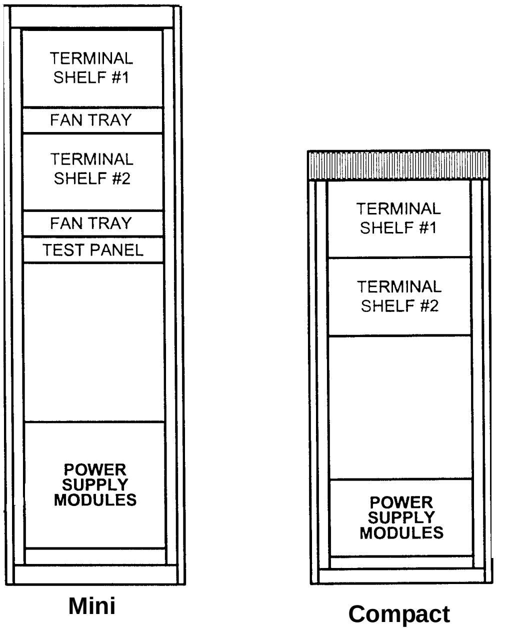
To allow customers with limited speaker requirements to reduce the cost of their systems, IPC has designed the MX System to be functional with two switch element cards (SELC) acting as access switch cards in a TU, as well as with the hardware defined maximum of three. (For information about SELCs, see *SELC* on page 6-85.) During the design phase, the DataMan tools look at the number of speakers and turrets or TradePhone MXs required, and determines if the system can function efficiently with two SELCs acting as access switch cards in each TU. Because this option

1. If the 48 V DC rectifier system is used, the +48 V DC supplies are not required.

uses no special hardware other than the cables between the two TUs, you can elect to save the cost of the unneeded cards at initial installation, while reserving the option to upgrade to three whenever the traffic requires it, by simply adding the third SELC in each TU and changing the two cables interconnecting the TUs.

The following figure shows cabinet configurations for the Mini and Compact systems.

FIGURE 5-1 Mini System and Compact System Cabinets



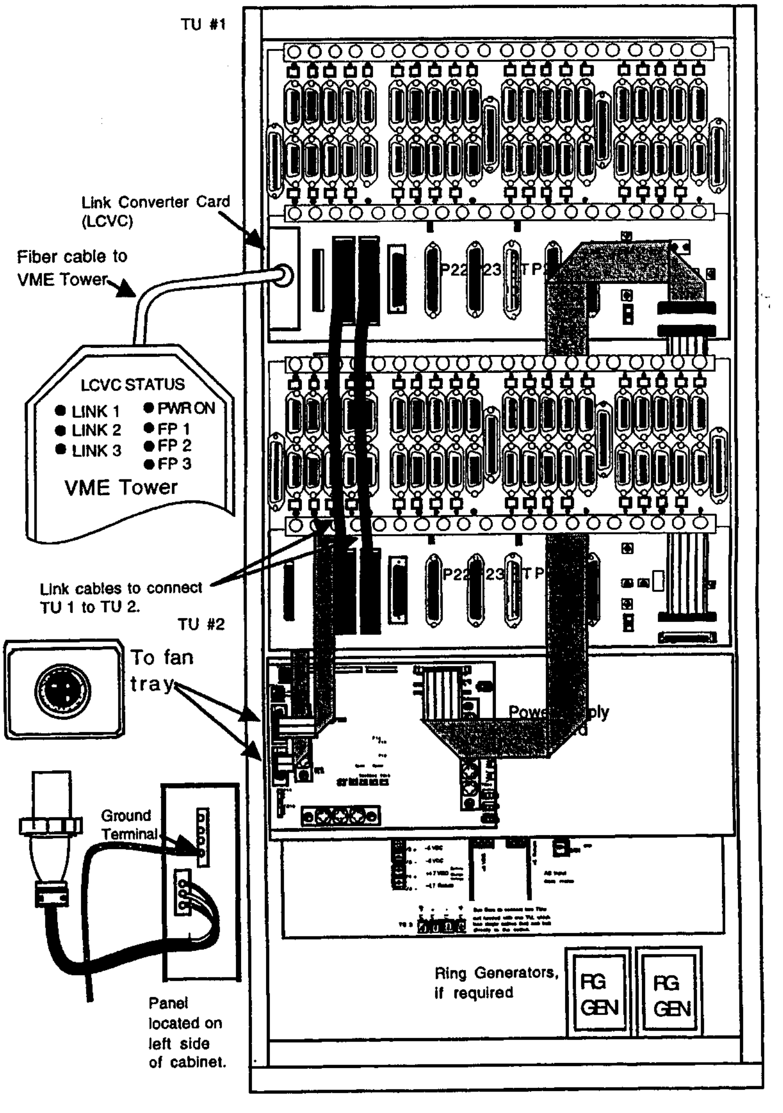
Mini System

The Mini system is made up of a single cabinet with one or two TUs. The Mini system uses HC power; it can be powered with AC or DC power supply modules. You can *hot swap* or *hot insert* PSMs in a Mini system; that is, you can remove and replace power supplies in a Mini system while the system is running. (For more information about power in the Tradenet MX System, see *Chapter 3 System Power* on page 3-1.)

The Mini system has a fan tray under each TU. A System Center gateway card (SCGC) is installed in the cabinet and is connected on site to an external VME tower using a fiber optic cable. The VME tower is connected to the System Center.

There is no setup required with the Mini system. The following figure shows the back view of the Mini system.

FIGURE 5-2 Back View of the Mini System



The Mini system provides $N + 1$ redundancy. Because the Mini system uses the same VME tower and fiber optic connection as the triplet, it is possible to expand a Mini system to a triplet configuration.

Compact System

The Compact system is made up of a single cabinet with one or two TUs. Because the Compact system's PSMs are not hot swappable, or hot insertable, you must first shut down the system before replacing PSMs. (For more information about power in the Tradenet MX System, see *Chapter 3 System Power* on page 3-1.)

Newer Compact systems have a perforated top on the cabinet; older Compact systems use a large, top-mounted cooling fan.

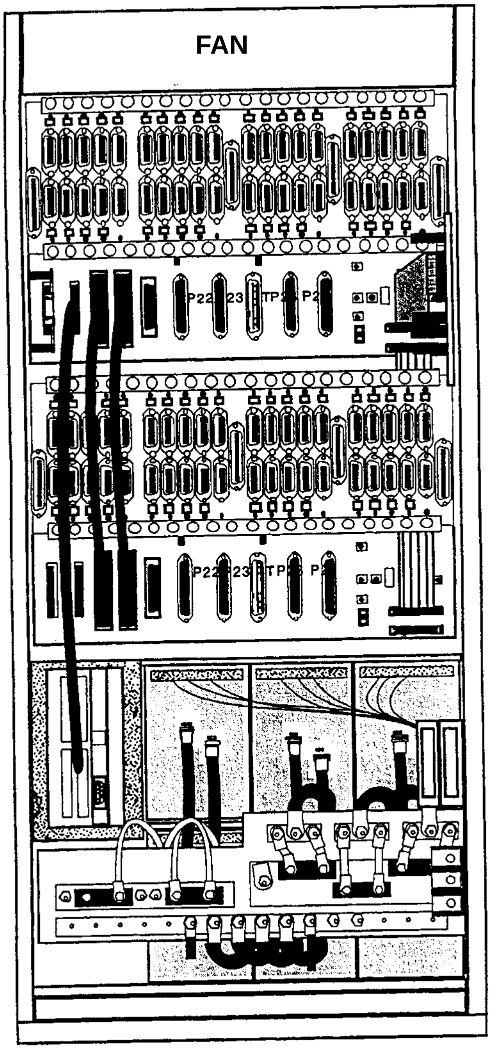
It is essential that no objects of any kind be placed on top of the Compact cabinet for two reasons:

- If the flow of air is restricted to any degree, the cabinet will overheat.
- The perforated top does not have sufficient structural strength to support objects.

A System Center link converter card is installed in the cabinet and is connected on site to the System Center, using a copper cable.

There is no setup required with the Compact system. The following figure shows the back view of the Compact system.

FIGURE 5-3 Back View of the Compact System

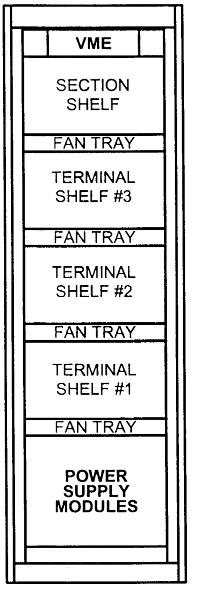


The Compact system provides $N + 1$ redundancy for power supplies. The Compact system is not easily expandable due to its built-in non-fiber optic connection between the cabinet and the System Center.

Single-cabinet KEPCO MX System

The single cabinet KEPCO MX System contains a VME module, a section shelf, up to three TUs, and KEPCO PSMs. The KEPCO MX System gives you three TUs in one cabinet, while the Mini system and Compact system give you only two TUs in one cabinet.

FIGURE 5-2 Single Cabinet KEPCO MX System Cabinets



Single Cabinet KEPCO MX System

You can *hot swap* or *hot insert* PSMs in a KEPCO MX System; that is, you can remove and replace power supplies in a KEPCO MX System while the system is running. (For more information about power in the Tradenet MX System, see *Chapter 3 System Power* on page 3-1.)

Note *Although it is possible to have a single cabinet KEPCO System with only one or two TUs, this is not a standard system. For more information about a one- or two-TU KEPCO system, contact IPC Systems Support Engineering.*

Half-triplet System

A half-triplet system is used for systems that need four–seven TUs. If you are using HC or Unipower, you can have up to five TUs in a half-triplet, or two cabinet, system; cabinet #1 has up to five TUs. If you are using KEPCO, you can have up to seven TUs in a half-triplet system; cabinet #1 has up to three TUS and cabinet #2 has up to four TUs.

Triplet System

The triplet is used for systems that require 4–10 TUs. (If you need three TUs, you can use the single-cabinet KEPCO MX System. If you are using Unipower or HC power, you need a triplet to support three TUs.) A triplet uses a section shelf. The triplet configuration contains the following equipment:

- two terminal cabinets (cabinets #1 and #3), each containing up to five TUs, a backplane, a distribution panel, cards, and a shelf door

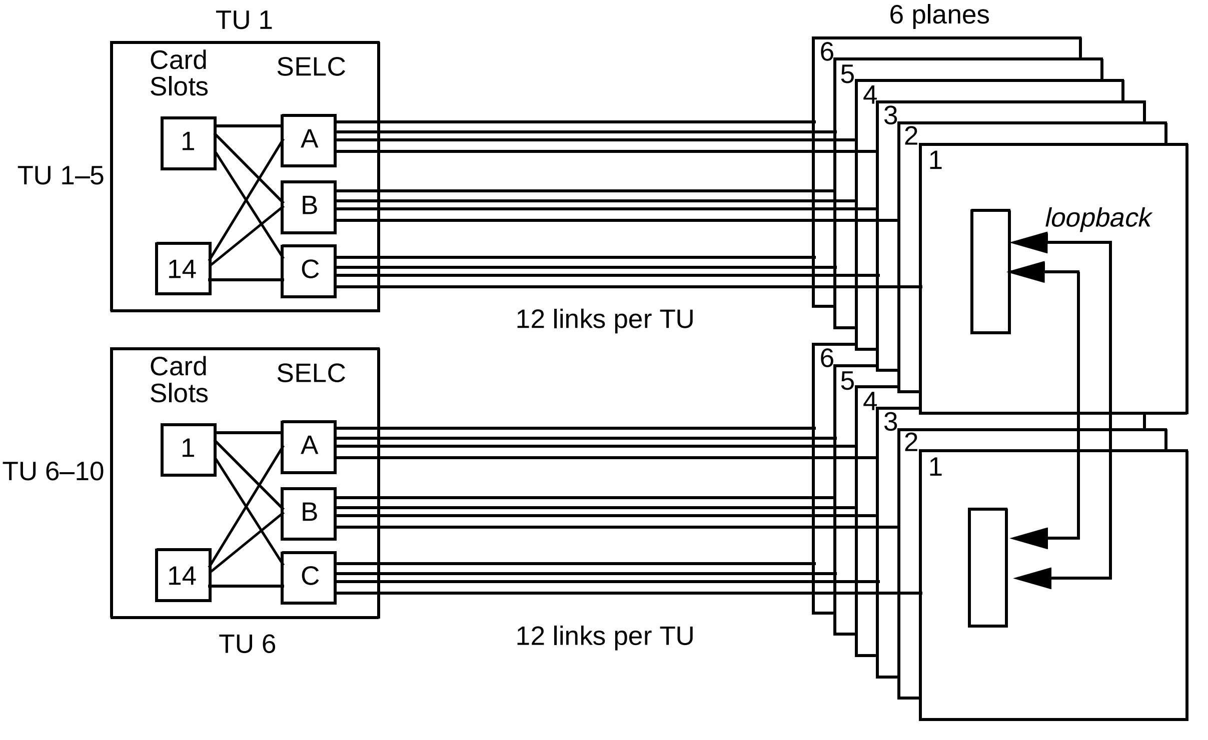
- network cabinet (cabinet #2), containing a section shelf, reflection shelf (if necessary), power supply status board (PSSB), connection cables, power modules (+5 V DC), and fans
- power cabinet[2] (short cabinet), containing the 48 V DC PSMs for AC systems with split or non-split power and two 5 V DC shelves for DC systems with split power

A triplet system can be either AC-powered (HC or KEPCO) or DC-powered (Unipower).

A triplet can have either four planes or six planes. (For a description of planes, see *Planes* on page 2-21.) In a six plane system, there are three switch element cards (SELC) acting as access switches in each TU, each of which has links to a different, overlapping sub-group of four planes. A four plane system has only two access switches in each TU, each of which has links to all four planes.

The following figure shows the functional layout of a triplet system (10 TUs).

FIGURE 5-3 Triplet Function Layout



On the left side of the previous figure, TUs are represented by a square containing 3 SELCs and 2 of the 14 turret/TradePhone MX or line interface cards. For simplicity in the drawing only TU #1 and TU #6 are shown.

In triplet systems, the SELCs acting as access switch cards in each TU are linked to the section shelf by 2 cables containing 12 digital links. The links are evenly distributed to SELCs acting as section switch cards 1–6 to maintain the folded hierarchal architecture, thereby safeguarding the system against the failure of one or two links or cards. TUs 1–5 are connected to cards 1–6 of the first 6 section switch cards. TUs 6–10 are connected to cards 1–6 of the remaining 6 section switch cards. (In a four plane system, you have only four SELCs acting as section switch cards.)

In a single triplet system, the two section switch cards in the set making up each plane are interconnected by section switch loopback cards. These provide the required interconnection within the triplet. There are only these two section switch cards in each plane, and no reflection switch cards.

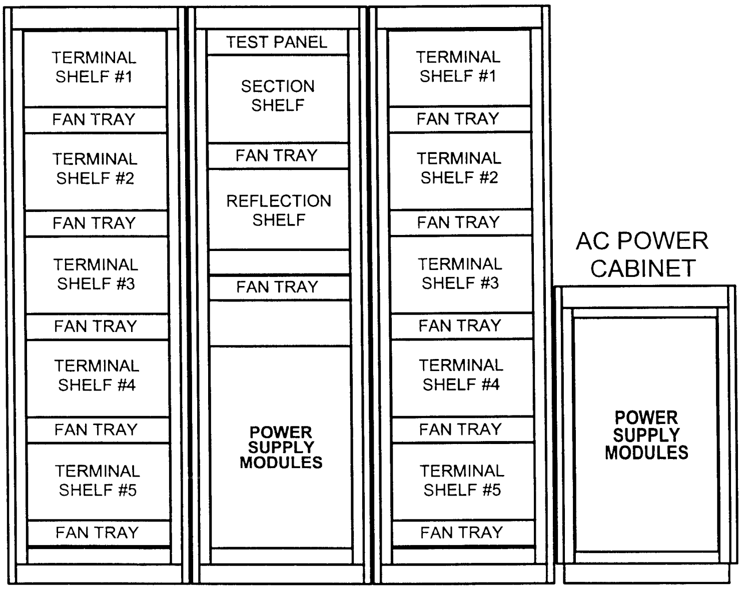
2. KEPCO-powered triplet MX Systems do not use a power cabinet, just the three cabinets.

When you have 1–5 TUs in a triplet, you use six section switch cards in the section shelf in cabinet #2. When you have 6–10 TUs in a triplet, you use 12 section switch cards in the section shelf in cabinet #2. In triplet systems with more than five TUs, you use four or six section switch loop back cards in the section switch shelf in cabinet #2. One section switch loop back card is used for each plane in your system.

HC-powered Triplets

The following figure shows the triplet cabinet configuration for HC power.

FIGURE 5-4 Triplet HC Cabinet Configuration



Newer HC systems have a perforated top on cabinets #1 and #3; older HC systems use a large, top-mounted cooling fan in cabinets #1 and #3.

It is essential that no objects of any kind be placed on top of a cabinet for two reasons:

- If the flow of air is restricted to any degree, the cabinet will overheat.
- The perforated top does not have sufficient structural strength to support objects.

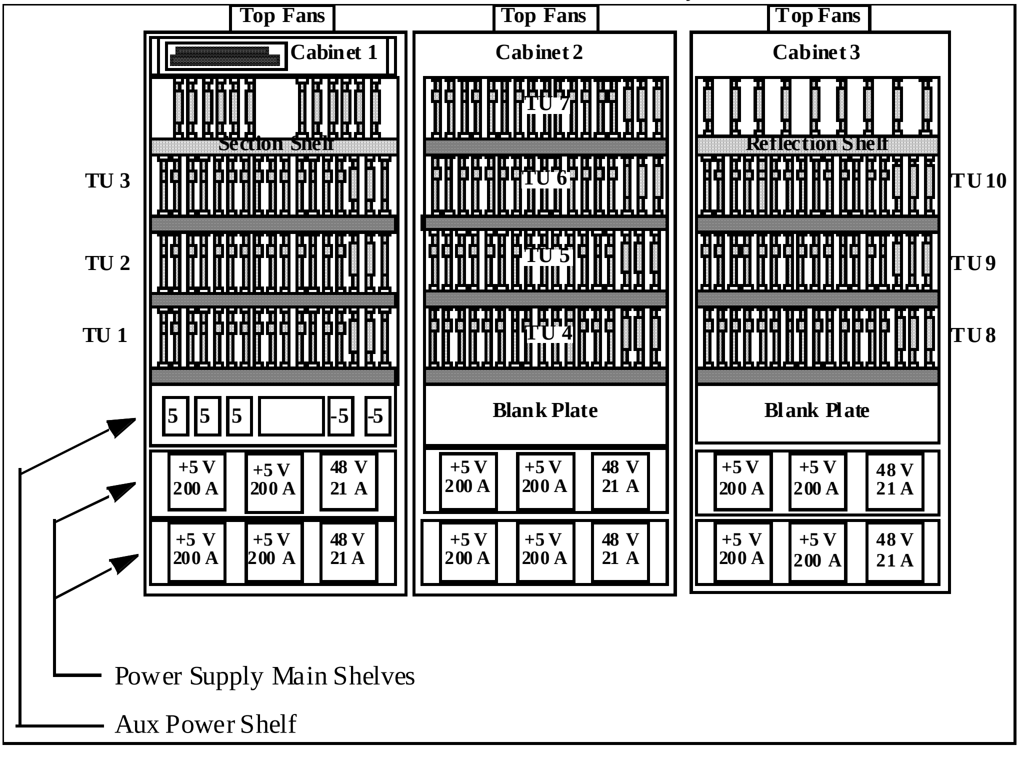
KEPCO-powered Triplets

Differences between TU configurations in the HC and KEPCO MX Systems are as follows:

- TUs are numbered in descending fashion in the KEPCO System (top-down) and in ascending fashion (top-down) in the HC system.
- The section shelf and reflection shelf are in different cabinets, cabinets #1 and #3, respectively.
- The KEPCO System supports a three TU system or larger, that is, it does not support a one- or two-TU system.
- You can expand a single-cabinet KEPCO System to a six or seven TU system with the addition of only one cabinet. To expand a single-cabinet HC system to a six or seven TU system, you must add two cabinets.

The following figure shows the front view of a KEPCO System TU layout (single triplet).

FIGURE 5-5 Front View of a KEPCO System



The database has not changed with respect to the numbering of TUs. In the previous figure, the TUs are numbered TU #1, TU #2…TU #10. The numbering in the database that corresponds to this is defined in the following table.

TABLE 5-1 System TU Numbering

Designation	Database Designation
Terminal Unit 1	1-1
Terminal Unit 2	1-2
Terminal Unit 3	1-3
Terminal Unit 4	1-4
Terminal Unit 5	1-5
Terminal Unit 6	3-1
Terminal Unit 7	3-2
Terminal Unit 8	3-3
Terminal Unit 9	3-4
Terminal Unit 10	3-5
Section Shelf	2-1
Reflection Shelf	2-2

Cabinets

The HC system has a 5/0/5 TU configuration. The terminal cabinets (cabinets #1 and #3) can house up to five TUs each, and the network shelf cabinet (cabinet #2) houses the section and reflection shelves along with the power supplies.

The KEPCO System has a 3/4/3 TU configuration. A KEPCO cabinet can contain three or four TUs, with each cabinet containing its own power supplies. The section and reflection shelves are housed in cabinets #1 and #3, respectively.

The KEPCO single cabinet is a three TU, AC-standalone cabinet that accommodates a section shelf and up to three TUs. The standard single cabinet KEPCO System contains three TUs. This cabinet contains all the subassemblies housed in the original network cabinet, for example, the power supply status boards, batteries, ring generators, and so on. It also houses the Gateway on a bracket above the section shelf.

Systems of four or more TUs require an expansion cabinet or cabinets (cabinets #2 and #3 in *FIGURE 5-5 Front View of a KEPCO System* on page 5-9). Cabinet #2 provides space for up to four TUs. Cabinet #3 provides space for up to three TUs and a reflection shelf. Each also provides space for 5 and 48 volt power shelves.

When ordering KEPCO cabinets, keep the following points in mind:

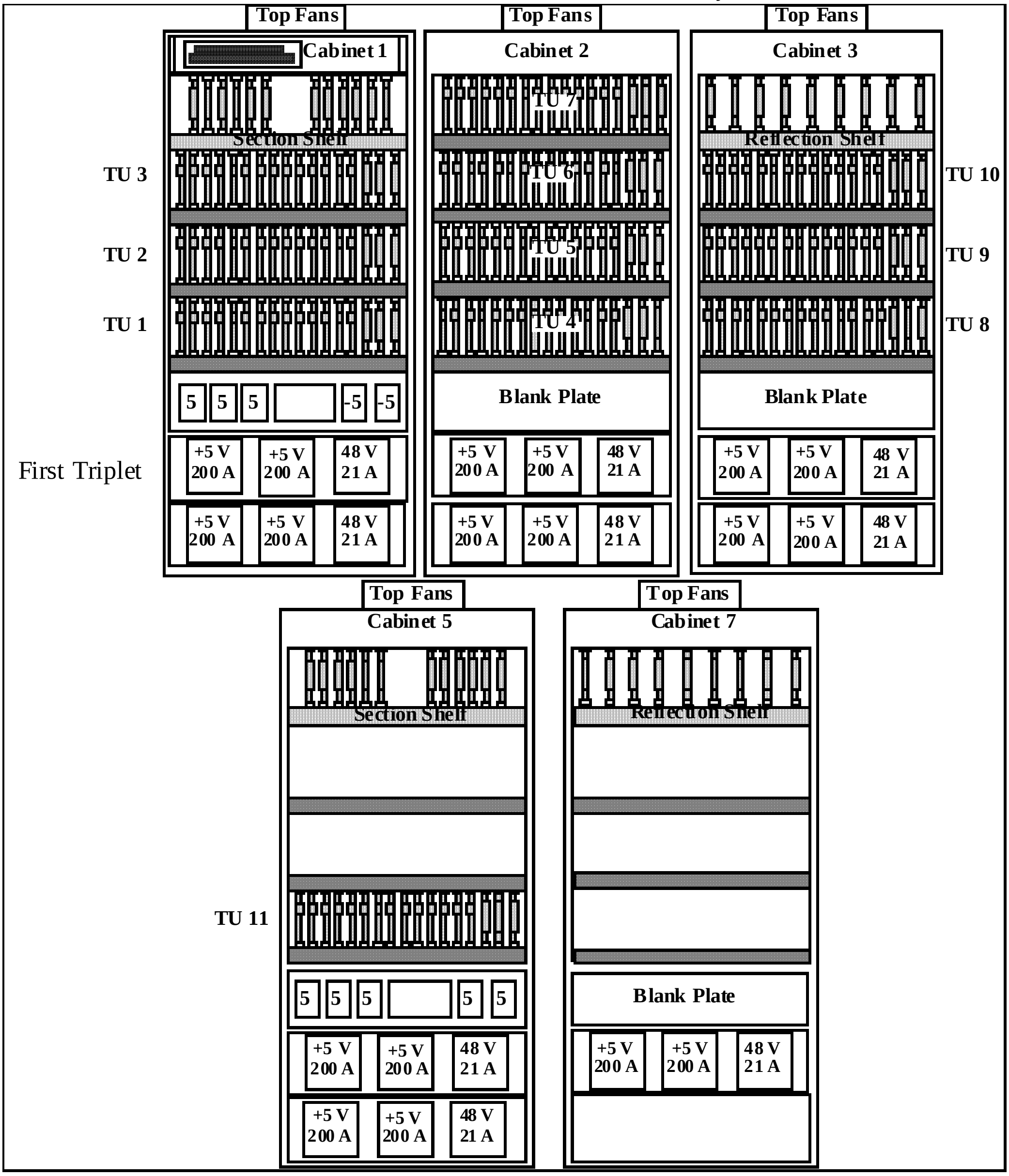
- The smallest standard KEPCO System is a three-TU system.

Note *Although it is possible to have a single cabinet KEPCO System with only one or two TUs, this is not a standard system. For more information about a one- or two-TU KEPCO system, contact IPC Systems Support Engineering.*

- If you add an additional triplet, even a triplet with just one TU, you must add two cabinets: a cabinet that will house the added TU along with a selection shelf and a cabinet that will house the reflection shelf. This is intended to maintain standardization.
- KEPCO equipment is included in AutoQuote.

The following figure shows an example of the front view of an 11 TU system.

FIGURE 5-6 Front View of an 11 TU KEPCO System



Note that the cabinet numbering is the same as in the HC system. As a result, cabinet #5 follows cabinet #3.

KEPCO System Configurations

Use the following table when ordering your KEPCO MX System.

TABLE 5-2 KEPCO MX Systems Configurations

Triplet	Total # of TUs	Power Supply Main Shelves	Number of Cabinets	48 Volt DC Current Draw Limit per Triplet
First	3	2	1	19 Amps
First	4	4	2	57 Amps
First	5	4	2	57 Amps
First	6	4	2	57 Amps
First	7	4	2	57 Amps
First	8	6	3	94 Amps
First	9	6	3	94 Amps
First	10	6	3	94 Amps
Second	11	10	5	57 Amps
Second	12	10	5	57 Amps
Second	13	10	5	57 Amps
Second	14	12	6	94 Amps
Second	15	12	6	94 Amps
Second	16	12	6	94 Amps
Second	17	12	6	94 Amps
Second	18	12	6	94 Amps
Second	19	12	6	94 Amps
Second	20	12	6	94 Amps

If the current draw of your 48 volt DC supplies exceeds the current draw limit specified in this table, you need to install a third KEPCO power rack in cabinet #2 of your KEPCO MX System. For information about how to install the third KEPCO power rack in cabinet #2, refer to the *Tradenet MX Installation & Maintenance Manual 14.1* (part number B0108900004).

Multi-triplet Systems

Systems requiring more than 10 TUs use 1 or more sets of 3 attached cabinets, or triplets. Systems using more than one group of three cabinets are called *multi-triplet* systems.

A triplet supports 4–10 TUs and has a section shelf. A triplet used in a multi-triplet system normally has up to 10 TUs, a section shelf, and a reflection shelf, although some large system configurations do not require a reflection shelf in every triplet. Multi-triplet systems are needed when the system line or station count requires 11 or more TUs. The population of all of the shelves varies based on the number of planes in the system.

A multi-triplet system can have either four planes or six planes. (For a description of planes, see *Planes* on page 2-21.) In a six plane system, there are three switch element cards (SELC) acting as access switches in each TU, each of which has links to a different, overlapping subgroup of four planes. A four plane system has only two access switches in each TU, each of which has links to all four planes.

A special type of multi-triplet MX System is the *double-sided* system. Double-sided systems consist of two under-populated multi-triplet systems, or *sides*, interconnected by links between the reflection switches. (Under-populated systems contain fewer than the maximum number of TUs and section shelves.) The sides are under-populated to free up the links used to interconnect the reflection switch shelves in each side. For this reason, the largest single-sided systems can have 90 TUs, while each side of the largest double-sided system is limited to 60 TUs. These systems can be used to expand the capacity of an MX System to 120 TUs, or they can be used to divide a system into two sections that can be located in separate floors or rooms, to provide security against physical damage to the entire system. There is no limitation in the interworking between sides: a double-sided system is functionally equivalent to the same sized single-sided system.

In multi-triplet systems, the SELCs acting as access switch cards in each TU are linked to the section shelf by two cables containing 12 digital links. The links are evenly distributed to section switch cards 1–6 to maintain the folded hierarchal architecture, thereby safeguarding the system against the failure of one or two links or cards. TUs 1–5 are connected to cards 1–6 of the first 6 section switch cards. TUs 6–10 are connected to cards 1–6 of the remaining 6 section switch cards.

Unlike single triplet systems, multi-triplet systems do not use loopback cards. In their place are two types of cables that link each SELC acting as a section switch card in a plane to the SELC acting as reflection switch card in the same plane. The number of these interconnections varies with system size, likewise the number of reflection switch cards in a plane. To ensure fault isolation within planes, there is no connection between planes except that provided by the access switch card connections. Reflection or section switch cards in different planes are never linked.

Each triplet in a multi-triplet system has two section switch cards associated with each of the six planes. However, for convenience, all of the reflection switch cards in a plane are located in a single triplet. Therefore, in any given plane, two of the section switch cards in the plane can be in the same triplet as the reflection switch cards in the plane, while the others will be with their TUs in the other triplets in the system. Note that there are configurations where one or more triplets have no reflection switches. The type of interconnection between the section and the reflection switch cards in a plane depends on whether the cards are physically in the same triplet.

Section switch cards in the same triplet as the reflection switch cards are linked to the reflection switch cards with a network loop back cable. These are not fiber optic cables because you do not have the same electrical concerns within a triplet you have between triplets. Section switch cards *not* in the same triplet as the reflection switch cards are linked to the reflection switch cards with fiber optic cables to provide the ultimate in immunity to electrical noise, as well as to eliminate noise radiation to other equipment. The fiber cable also prevents current loops between cabinets.

The following scenarios apply to single-sided systems: In two- or three-triplet systems (up to 30 TUs), three SELCs acting as reflection switch cards are used in the reflection shelves for each plane; either 12 or 18 reflection switch cards total. In four- or five-triplet systems (31–45 TUs), four reflection switch cards are used in the reflection shelves for each plane. In five- or ten-triplet systems (46–95 TUs), nine reflection switch cards are used in the reflection shelves for each plane.

Unlike section switch cards, which are physically located in the same triplet as the TUs in which they are located, reflection switch cards are physically grouped by plane. Remember that the section switch backplane connectors are already configured by plane: thus, it is convenient to route the cables from these connectors to different reflection switch backplanes in different triplets, even though they start from the same section switch backplane. To help balance power and space requirements, only one reflection switch backplane is installed in any one triplet; however some triplets can have none. For example, two reflection switch backplanes, each with three planes of three cards, are enough for all of the TUs in three triplets. One reflection switch backplane each will be installed in two triplets, with none in the third.

There are different cables used to interconnect section switches and reflection switches: fiber optic cables are used when the shelves are not in the same triplet, and copper cables are used when they are.

SHELVES OF THE CABINETS

The cabinets in the Tradenet MX System can contain the following shelves:

- terminal shelves, or terminal units (TU)
- section shelves
- reflection shelves
- power supply shelves

Terminal Shelves

The terminal shelf, or terminal unit (TU), has line and station cards that interface to the trader station equipment and switch element cards (SELC) that do not terminate lines or turrets, but rather route calls between cards that do. SELCs can be used as access switch cards, section switch cards, and reflection switch cards. SELCs in TUs are access switch cards, SELCs in section shelves are section switch cards, and SELCs in reflection shelves are reflection switch cards. (For more information about SELCs, see *SELC* on page 6-85.)

SELCs are used in every TU, along with the line and station interface cards. Traffic within the TU is handled entirely by the access switch cards, each of which has links to every line and turret card in the TU; thus, within a TU, every card can communicate with every other card using any one of the access switch cards.

Depending on your speaker requirements, each TU has either two or three access switch cards. When setting up a Tradenet MX System, the DataMan tools determine whether your system can fully function with only two access switch cards. (The number of access switch cards in a TU is dependent upon the number of lines, speakers, turrets, and TradePhone MXs required.) If you set up your MX System with only two access switch cards in a TU, you can add a third access switch card later, if needed due to increased traffic. In a three access switch system, each line or turret card can use any of the three links, while in the two access switch implementation, each line or turret card can use one of two links.

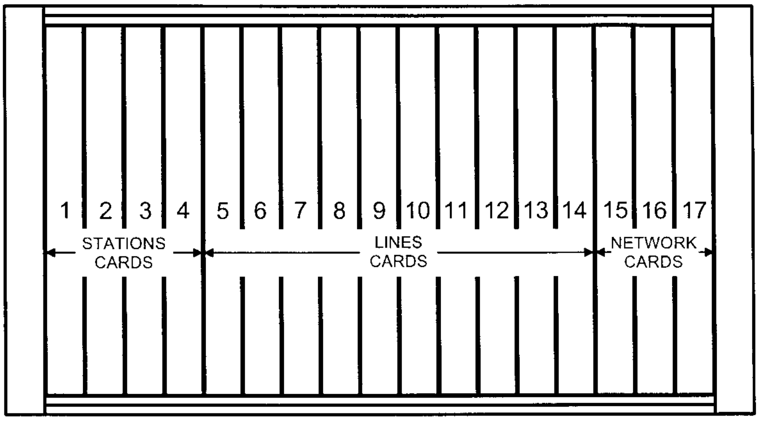
TUs contain station cards, line cards, network cards, a backplane, and an analog or digital distribution panel. TUs contain either analog or digital station cards. The following types of station cards are used in the Tradenet MX:

- analog turret interface cards (ATIC), used for analog turrets and speakers
- basic rate interface cards (BRIC), basic speaker interface cards (BSIC), station interface cards (STIC or SNIC), and multiple speaker interface cards (MSIC) used for digital turrets, speakers, and intercoms

If you have both analog and digital turrets, you need at least two TUs: one for ATICs and one for BRICs.

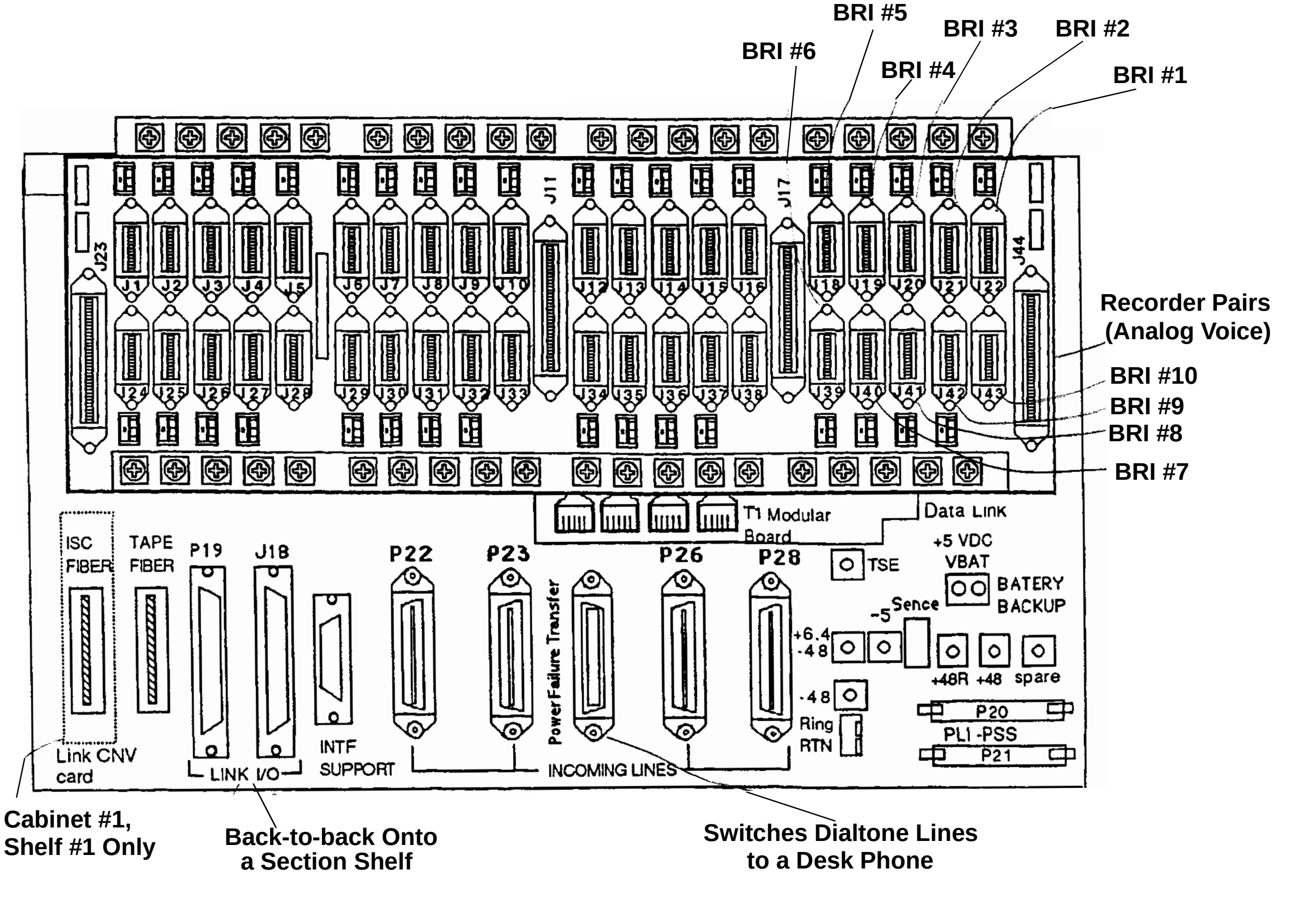
FIGURE 5-7 TU (Front View) on page 5-16 and *FIGURE 5-8 TU (Rear View) With a Digital Distribution Panel* on page 5-16 show the layout of a TU.

FIGURE 5-7 TU (Front View)



Front View

FIGURE 5-8 TU (Rear View) With a Digital Distribution Panel



A single TU cannot contain both analog and digital station cards because there is a unique distribution panel for TUs with analog station cards and TUs with digital station cards. Therefore, if you have both analog and digital turrets/TradePhone MXs in your system, you must have at least two TUs; one for the analog turrets and one for the digital turrets.

Note A maximum of five TUs can be installed in a cabinet.

The TU has 17 card slots with a distribution panel mounted on the rear. The first four card slots from the left, facing the front of the rack, contain station cards. Slots 5–14 contain line interface cards with one exception: slot #14 of TU #1 of cabinet #1 in any system always contains the System Center access card (SCAC). The last three card slots in a TU are always used for network cards. The following table describes what cards can be installed in what slots of a TU.

TABLE 5-3 TU Slots

TU Slot	Type of Card	Specific Cards
1–4	station (turret) cards	BRIC, BSIC, ISIC, IPIC, STIC, MSIC or ATIC
5–14[a]	line interface cards, analog 2-wire or Series II interworking cards (S2IC)	ALIC, PLIC, or S2IC
5–11	T1 digital line cards	DLIC
5–11	E1 digital line cards	CPIC
5–9	5 four-wire line cards	FLIC
15–17	switch element card (SELC)	SELC

a. Slot #14 of TU #1 in cabinet #1 in any system always contains the SCAC.

Warning! The ground strap attached to every MX cabinet assembly must be worn when cards are handled. If the strap is missing or damaged it must be replaced: all cards are static sensitive.

Cards are inserted from the front of the cabinet into the TU slots. Each TU has a number of dedicated slots for each type of card. The maximum number of these cards per TU are as follows.

TABLE 5-4 Maximum Number of Cards in a TU

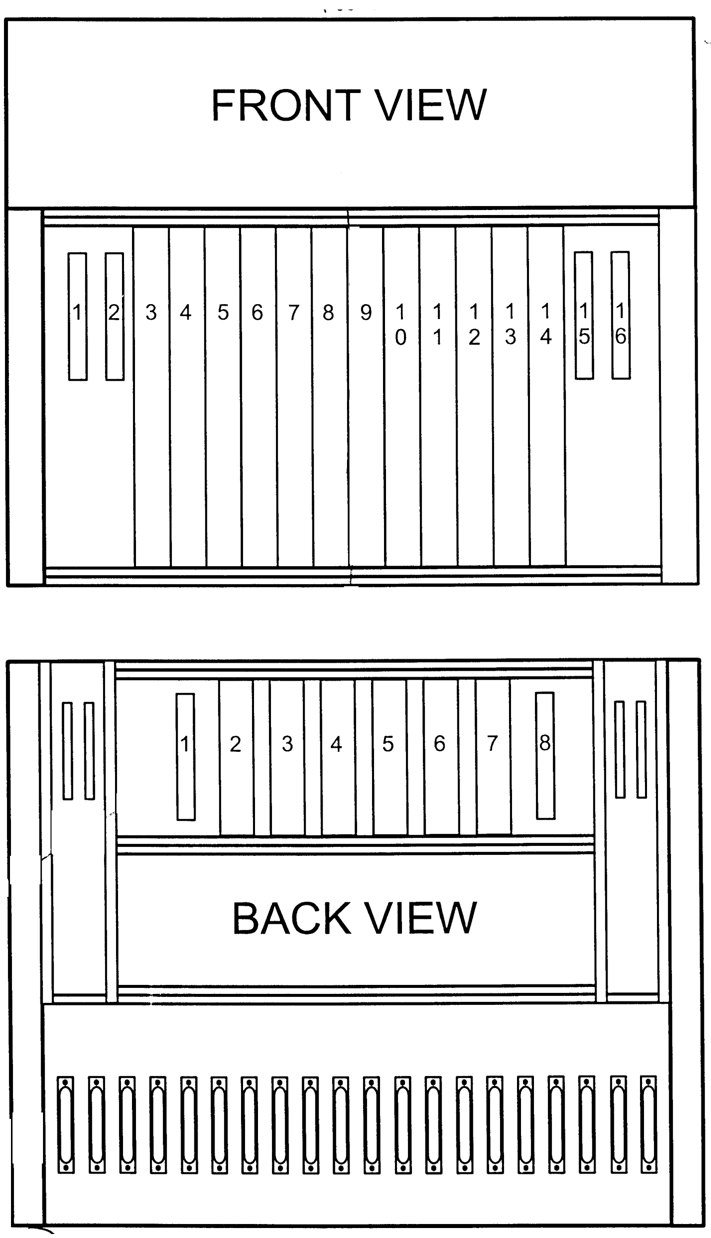
Type of Cards	Maximum Cards per TU	Card Name
analog line interface card	10	ALIC
private line interface card	10	PLIC
Series II interworking card	10	S2IC
four-wire line interface card	5	FLIC
T1 digital line interface card	approximately 8	DLIC[a]
E1 digital line interface card	approximately 6	CPIC[b]
System Center access card	1 (per system)	SCAC
switch element card	2 or 3	SELC
digital turret interface cards	4	BRIC
digital speaker interface card	4	BSIC
Station interface card	4	STIC or SNIC
analog turret interface card	4	ATIC
TradePhone MX Interface card	4	IPIC
ISDN keyset interface card	4	ISIC
multiple speaker interface card	4	MSIC

a. DLICs require a special daughter board with modular jacks attached to the TU backplane.
b. CPICs require a special daughter board with BNC connectors attached to the TU backplane. (In the U.S., the CPIC will require a special daughter board with modular jacks, and a balun.)

Section Shelves

Section shelves are used in triplet systems as well as the single-cabinet KEPCO MX System to connect TUs and reflection shelves. A section shelf contains a backplane and fan tray. KEPCO MX Systems always contain a section shelf in cabinet #1. Non-KEPCO systems contain a section shelf in the network cabinet (cabinet #2) if the system has more than two TUs. The following figure shows the layout of a section shelf.

FIGURE 5-9 Section Shelf



The section shelf contains 6 or 12 switch element cards (SELC) in 6 plane systems, and 4 or 8 SELCs in 4 plane systems. (See *SELC* on page 6-85.) The SELCs provide the link between the TUs in each cabinet. On the back of the section shelf is the network loop back shelf.

In a non-KEPCO system, the SELCs in slots 3–8 of the section shelf connect the left half of the triplet (TUs 1–5) and the SELCs in slots 9–14 connect the right half (TUs 6–10). In a single-cabinet KEPCO MX System, you have SELCs in slots 3–8 only. In a triplet KEPCO MX System, the section shelf is in cabinet #1, but the cards interconnect the same way they do in non-KEPCO MX Systems: the SELCs in slots 3–8 connect the left half of the triplet (TUs 1–5) and the SELCs in slots 9–14 connect the right half (TUs 6–10). (In all systems, slots 1, 2, 15, and 16 of the section shelf are always empty.)

The section shelf has either six planes or four planes. (For information about planes, see *Planes* on page 2-21.) Most Tradenet MX Systems use six plane section shelves. The following tables describe which slots in a section shelf indicate which plane in both six plane and four plane systems.

TABLE 5-5 Six Plane Section Shelf

Section Shelf Slots	Indicate
3 and 9	plane 1
4 and 10	plane 2
5 and 11	plane 3
6 and 12	plane 4
7 and 13	plane 5
8 and 14	plane 6

TABLE 5-6 Four Plane Section Shelf

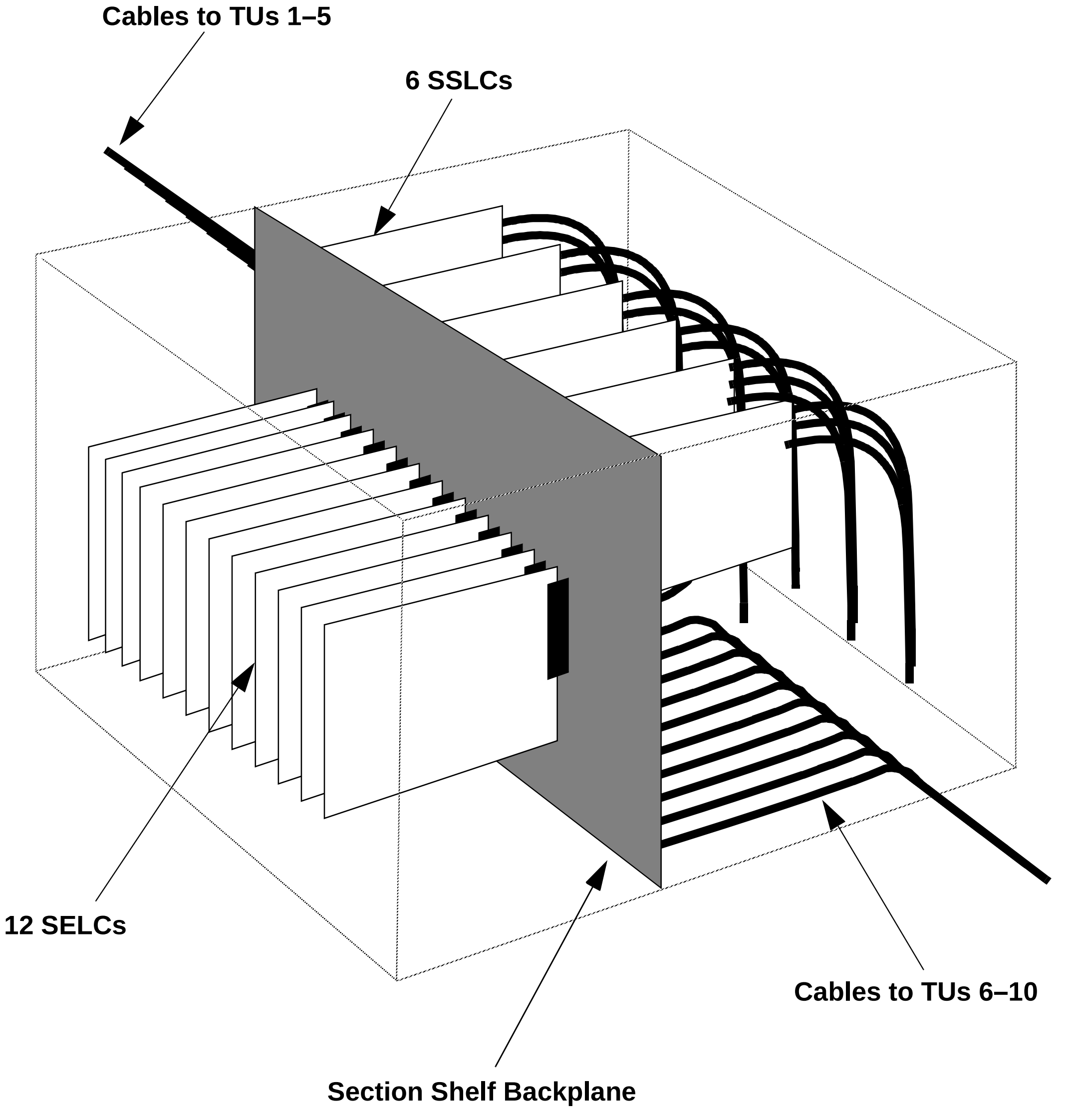
Section Shelf Slots	Indicate
4 and 10	plane 1
5 and 11	plane 2
7 and 13	plane 3
8 and 14	plane 4

There are two sets of 37-conductor cables used to connect the backplane of the section shelf and each of the TUs in the two outer cabinets. One set of these cables is grey and is labeled to show which end must be connected to the section shelf. This set is used in four plane systems using eight SELCs in the section shelf (four in each half). The other set of these cables is made up of two standard cables. This set is used in 6 plane systems using 12 SELCs in the section shelf (6 in each half). These two sets of cables provide the links between the SELCs acting as access switch cards in the TUs and the SELCs in the section shelf acting as section switch cards.

In systems of more than five TUs, you need to use section switch loop back cards (SSLB). In four plane systems of more than five TUs, you need four SSLBs. In six plane systems of more than five TUs, you need six SSLBs. The SSLBs bridge the *left* half of the section shelf (slots 3–8) with the *right* half of the section shelf (slots 9–14). For more information about SSLBs, see *SSLB* on page 6-92.

The following figure shows the SSLBs in a section shelf.

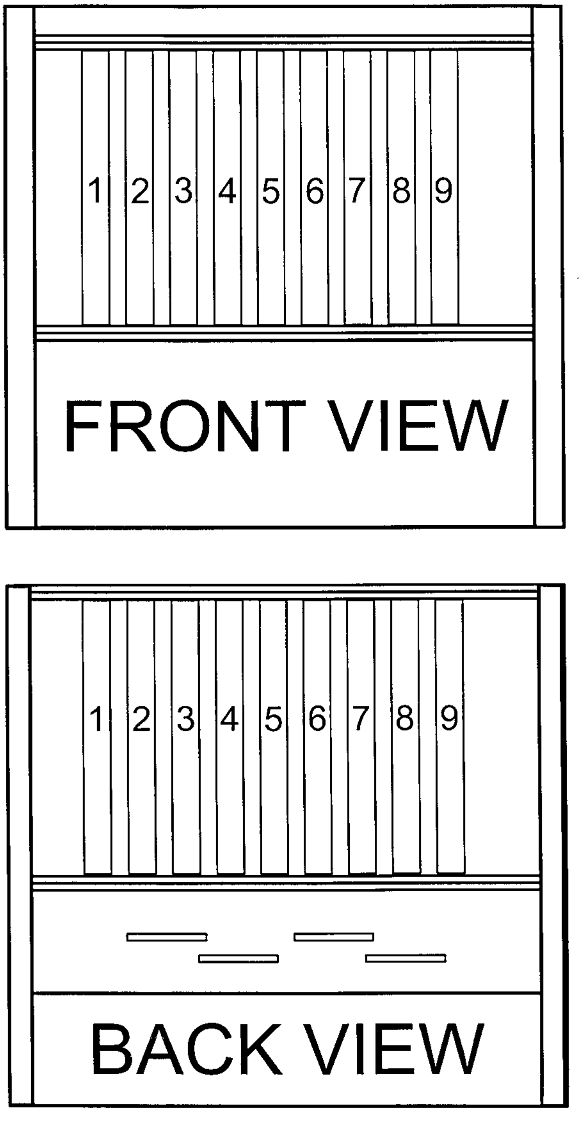
FIGURE 5-10 SSLBs in a Section Shelf



Reflection Shelves

Reflection shelves are used in all multi-triplet MX Systems: in cabinet #3 of KEPCO triplet systems and in the network cabinet (cabinet #2) of HC and Unipower triplet systems. The following figure shows the layout of a reflection shelf.

FIGURE 5-11 Reflection Shelf



The reflection shelf contains nine SELCs. (See *SELC* on page 6-85.) There are three types of reflection shelves.

There are three types of reflection shelves: triple-linked, double-linked, and single-linked. Triple-linked reflection shelves are the most common. The following table describes Tradenet MX Systems with the different types of reflection shelves.

TABLE 5-7 Types of Reflection Shelves

Type of Reflection Shelf	Number of Triplets in Tradenet MX System	Number of Planes in Each Reflection Shelf
triple-linked	2–4 triplets	3 planes
double-linked	5–6 triplets	2 planes
single-linked	7–12 triplets	1 plane

Triple-linked reflection shelves use three groups of three SELCs and have one set of card cable slots in the rear of the reflection shelf for each of the three groups. Single-sided systems of 11–30 TUs use two reflection shelves: one in triplet #1 and one in triplet #2. Double-sided systems of up to 40 TUs use four reflection shelves: one in each triplet.

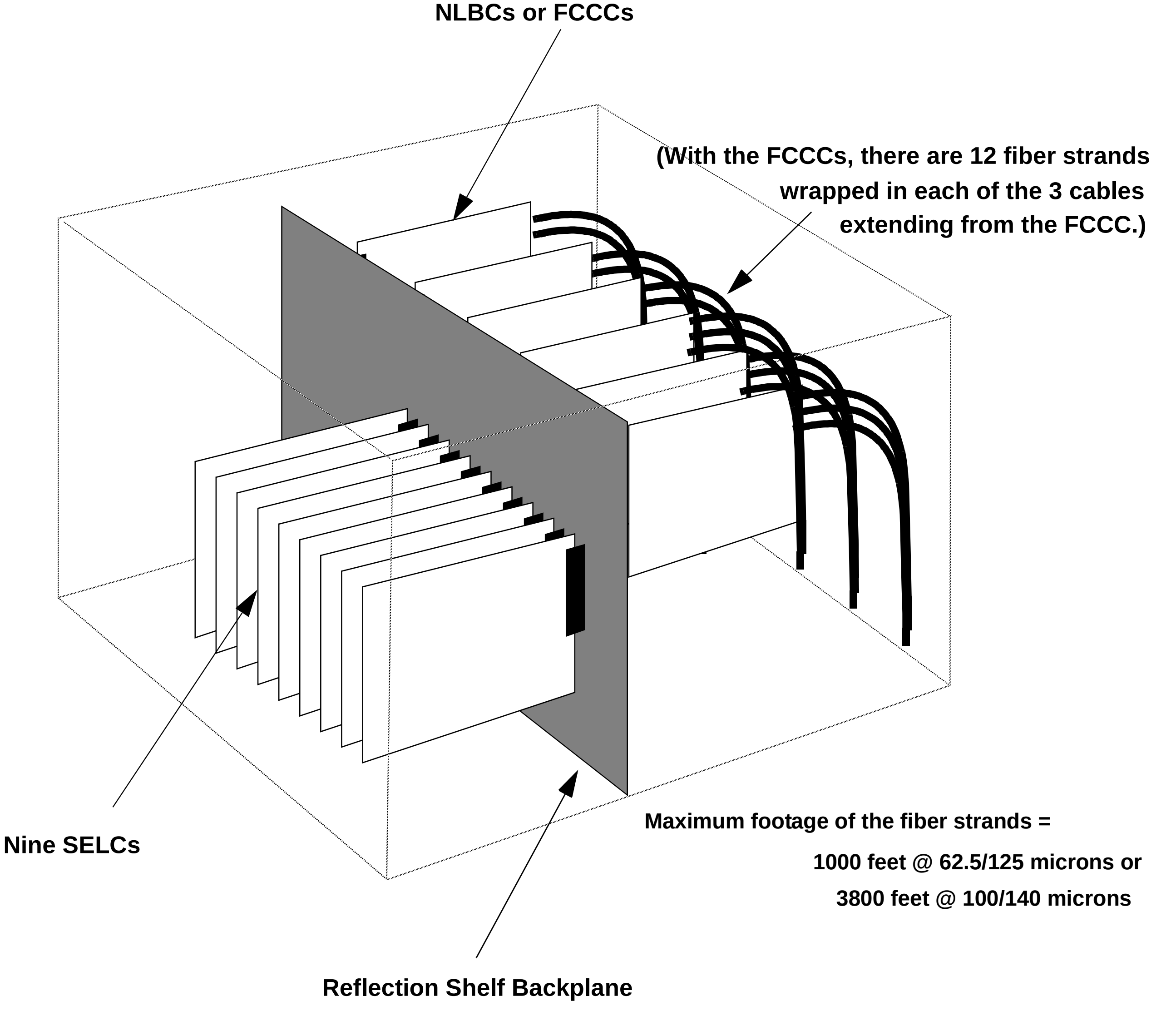
Double-linked reflection shelves use two groups of four SELCs and have two sets of card cable slots in the rear of the reflection shelf for each of the two groups. Single-sided systems of up to 45 TUs use three reflection shelves: three triplets have reflections shelves and two triplets do not. Double-sided systems of up to 60 TUs use six reflection shelves: one in each triplet.

Single-linked reflection shelves use one group of nine SELCs and have one set of ten card cable slots in the rear of the reflection shelf for the group.

There are two types of cables used at the rear of the reflection shelf: the network loop back card (NLBC) and the fiber cable connection card (FCCC). The NLBC (using copper cable) is used for interconnection between the SELCs in section shelves and the SELCs in reflection shelves in the same plane when both types of SELCs are in the *same* cabinet. The FCCC is used for interconnection between the SELCs in section shelves and the SELCs in reflection shelves in the same plane when the two types of SELCs are in different cabinets. FCCCs are installed using screws and a metal face plate for each card. In double-sided systems, FCCCs are also used to interconnect the SELCs in the reflection shelves in the two sides of the system.

The following figure shows a reflection shelf with NLBCs or FCCCs.

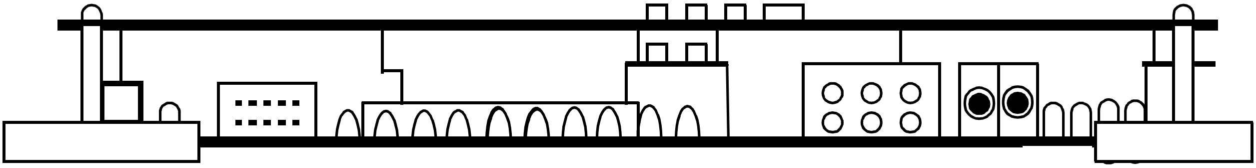
FIGURE 5-12 Reflection Shelf with FCCCs



Power Supply Shelves

The power supply shelves hold the power supply modules (PSM). In triplet HC systems (both AC- and DC-powered), the PSMs are located in power supply shelves in an additional small power cabinet. In triplet KEPCO and Unipower systems, the PSMS are in power supply shelves in the bottom of the three cabinets. In single cabinet systems (Mini, Compact, and KEPCO MX Systems), the PSMS are in a power supply shelf in the bottom of the cabinet.

Chapter 6 Cards



INTRODUCTION

This chapter describes the cards in the shelves in the cabinets of the *back room equipment*.

The terminal, section, and reflection shelves can contain the following cards:

- line interface cards
- station interface cards
- switching and network cards
- System Center cards

The ejectors at the top and bottom of cards are color coded so that you can easily recognize the different cards. The bottom ejector indicates the type of card and the top ejector indicates the specific card.

- Line interface cards always have a yellow bottom ejector.
- Station interface cards always have a blue bottom ejector.
- Switching and network cards always have a red bottom ejector.
- System Center cards always have a black bottom ejector.

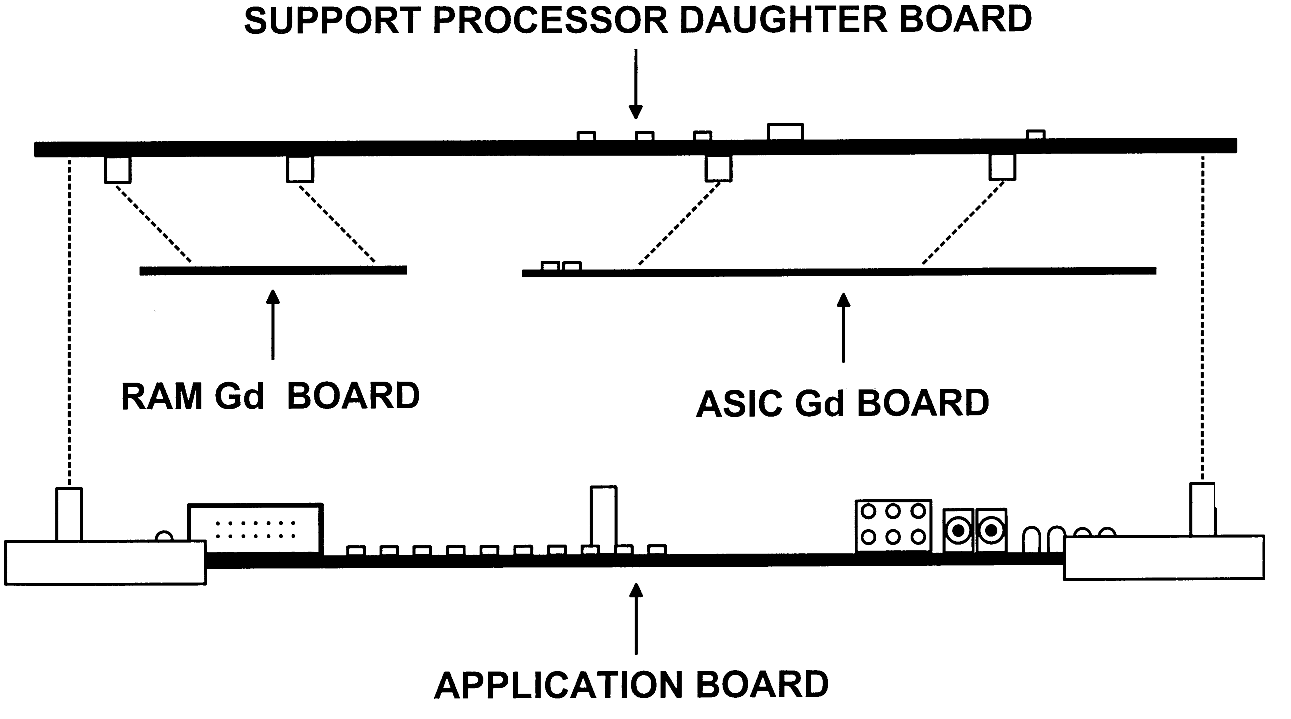
All cards have four boards:

- support processor daughter board
- RAM granddaughter (Gd) board
- application specific integrated circuit (ASIC) granddaughter (Gd) board[1]
- application board

1. All cards used with Release 8.0.2 and later have the ASIC.

The following figure shows the basic parts of all cards.

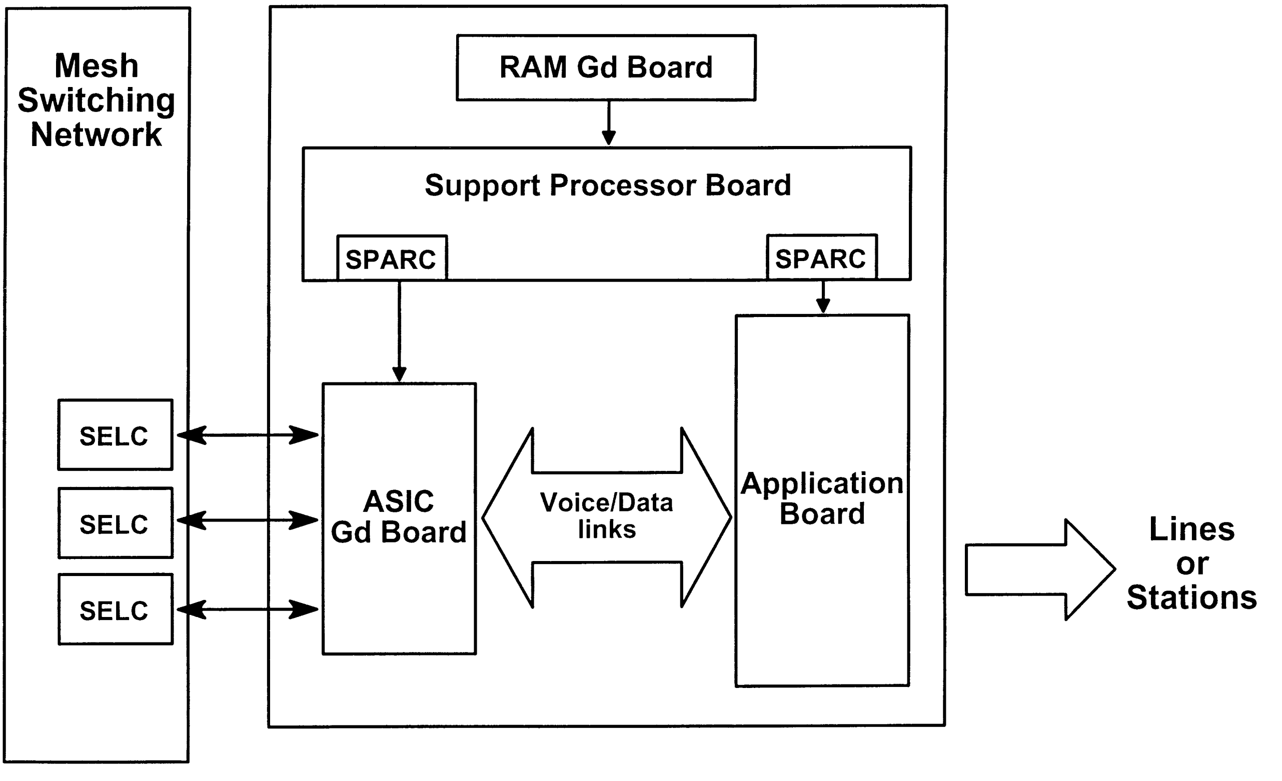
FIGURE 6-1 Basic Parts of a Card



Each of the boards are surface mounted. Smaller boards can take more power than larger boards because with new technology components are getting smaller.

The following figure shows how a card interfaces within your system.

FIGURE 6-2 Card Functional Diagram



The following table briefly describes how each card in the Tradenet MX Systems is used.

TABLE 6-1 Card Descriptions

Card Name	Used for	Comments	Position	Number of Ports (Offsets)
ALIC (analog line interface card)	10 dialtone lines or 10 central office (CO) auto ringdown lines	wet circuits only (loop current, normally from CO or PBX); multi-colored LEDs	slots # 5–13 (in TU #1 in cabinet #1) or slots #5–14 (in all other TUs)	10
ATIC (analog turret interface card)	6 non-dual talkpath (DTP) or 6 DTP turrets, 24 turrets per TU	also used with analog speakers (FTS-4 or FST-8); 12 talkpaths or tip and ring	slots #1–4	6
BRIC (basic rate interface card)	up to 8 digital Tradenet MX turrets, or 10 TradePhone MXs	can be upgraded to a BSIC by installing a digital speaker daughter board (DSDB)	slots #1–4	10 (maximum you can use is 8)
BSIC (basic speaker interface card)	digital Tradenet MX turrets with speakers	BRIC with digital speaker daughter board (DSDB); each speaker uses one of the BSIC ports	slots #1–4	2–5
CPIC (CEPT/primary ISDN interface card)	30 digital channels per card	dependent on the number of cards in the TU; European standard digital spans for 30 voice or data channels; can be configured for dialtone, automatic ringdown, or manual ringdown lines	slots #5–12 and slot #14	up to 30
DLIC (digital line interface card)	24 digital channels per card	dependent on the number of cards in the TU; North American standard digital spans for 24 voice or data channels; can be configured for dialtone, automatic ringdown, or manual ringdown lines	slots #5–12 and slot #14	up to 24
DXIC (digital cross-connect card)	30 digital channels per port; up to 5 ports per card	concentrates voice outputs from STICs so that each E1 link to a digital recorder is used to maximum capacity – up to 30 channels	slots #5–12 and slot #14	5 input 5 output
ENIC	System Center card in place of the SCGC	Ethernet Interface kit is made up of the ENIC and the PIC and replaces the VME tower	TU #1, slot #14	N/A

Card Name	Used for	Comments	Position	Number of Ports (Offsets)
FCCC (fiber cable connection card)	multiple triplets (11 TUs or more)	up to 6 cards used	P28–P33 and P2–P18 (reflection shelf)	N/A
FLIC (four-wire line interface card)	5 four-wire lines	Tradenet MX System is inherently four-wire	slots #5–13 (in TU #1 in cabinet #1) or slots #5–14 (in all other TUs)	5
IPIC (TradePhone MX interface card)	10 TradePhone MXs	Tradenet MX software configures a BRIC to an IPIC	slots #1–4	10
ISIC (ISDN interface card)	10 ISDN telephone sets	Tradenet MX software configures a BRIC to an ISIC	slots #1–4	10
MSIC	remote speakers	Release 9.0.1 and later	slots #5–9	5
NLBC (network loop back card)	multiple triplets (11 TUs or more)	up to 6 cards used	P28–P33 (section shelf) and P2–P18 (reflection shelf)	N/A
NEMC (networking E1 master card)	line networking feature using master E1 lines	master cards provide clock; 29 voice channels and 1 data channel	slots #5–12 and slot #14	1
NESC (networking E1 slave card)	line networking feature using slave E1 lines	slave cards derive clock from the link; 29 voice channels and 1 data channel	slots #5–12 and slot #14	1
NTMC (networking T1 master card)	line networking feature using master T1 lines	master cards provide clock; 23 voice channels and 1 data channel	slots #5–12 and slot #14	1
NTSC (networking T1 slave card)	line networking feature using slave T1 lines	slave cards derive clock from the link; 23 voice channels and 1 data channel	slots #5–12 and slot #14	1
PLIC (private line interface card)	10 private (manual) lines	dry, manual, two-wire type lines only (no loop current; direct line without CO or PBX involved); multi-colored LEDs	slots # 5–13 (in TU #1 in cabinet #1) or slots #5–14 (in all other TUs)	10
PSSA (power supply status board)	single cabinets (1 or 2 TUs)	1 card per system	N/A	N/A
PSSB (power supply status board)	multiple cabinets (3 TUs or more)	1 card per network cabinet	N/A	N/A

Card Name	Used for	Comments	Position	Number of Ports (Offsets)
QSIC (QSIG Interface Card)	30 digital channels per card	Tradenet MX software configures a CPIC to a QSIC	slots #5–12 and slot #14	up to 30
SCAC (System Center access card)		only 1 per System Center	TU #1, cabinet #1, slot #14	N/A
SCGC (System Center Gateway card)	used with the link converter card	data transport only, not voice *or* data	VME tower	N/A
SELC (switch element card)	19 bi-directional switch ports	2 or 3 SELCs per TU; 1 or 2 sets of 4 or 6 planes per section shelf; 8 or 9 per reflection shelf	slots #15–17	N/A
SSLC (section switch loop back card)	single triplets (3 TUs or more)	4 or 6 cards used	P28–P33 (section shelf)	N/A
STIC (station interface card)	digital Tradenet MX turrets with speakers	increased speaker capacity and enhanced digital recording providing expanded speaker-to-line connections for up to 64 speaker channels, in addition to 20 handset channels, for a total of 84 channels	slots #1–4	10
S2DC (Series II dialtone card)	interworks with 10 dialtone Series II lines	Tradenet MX System’s window to dialtone lines on Tradenet, Series II, Series I, Centremax and other systems.	slots #5–13 (in TU #1 in cabinet #1) or slots #5–14 (in all other TUs)	10
S2PC (Series II private card)	interworks with 10 private Series II lines	Tradenet MX System’s window to private lines on Tradenet, Series II, Series I, Centremax and other systems	slots #5–13 (in TU #1 in cabinet #1) or slots #5–14 (in all other TUs)	10

Warning! ***The cards are static sensitive. Proper handling and grounding precautions are required.***

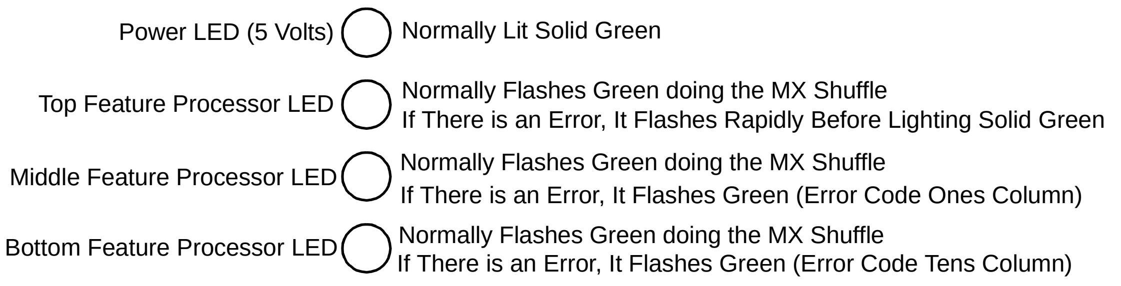
POWERING UP CARDS

When you power up the Tradenet MX System, the cards go through the following procedures:

1. self-test
2. download of system specific information
3. download of card specific information
4. running

The feature processor LEDs on a card indicate which procedure the card is going through. The top LED on a card is the power LED and the three feature processor LEDs are just below the power LED.

FIGURE 6-3 Feature Processor LEDs on a Card



Note *Some cards might have green LEDs for the power LED and three feature processor LEDs. Treat these yellow LEDs as if they were green LEDs.*

Self-test

The card self-test procedure tests the basic integrity of the card, including:

- read-only memory (ROM)
- card type
- card location
- power supply status
- processor board RAM
- RAM board (see *FIGURE 6-2 Card Functional Diagram* on page 6-5)
- timers
- FIFOs
- basic ASIC communication

The following table describes what happens during a card's self-test procedure.

TABLE 6-2 Self-test Procedure

Time to Complete Procedure	Normal Condition	Failure Condition
12 seconds	Normally, the center feature processor LED flashes green at a variable rate. At the end of the self-test procedure, the center and bottom feature processor LEDs flash green once together.	If there is an error, the top feature processor LED flashes green rapidly, then turns solid green. The center and bottom feature processor LEDs flash an error code. First, the bottom LED flashes the error code's tens position, then the center LED flashes the error code's ones position. For example, if the bottom LED flashes twice and the center LED flashes six times, the error code is 26.

Download of System Specific Information

If the card successfully completes the self-test procedure, the card downloads system specific information. During this procedure, the card requests the System Center to download the portion of software common to every card in the system. This system software, called RTOOS, enables every processor board to manage and run the different pieces of the application program it downloads during the next procedure (see *Download of Card Specific Information* on page 6-10).

The following table describes what happens during a card's download of system specific information.

TABLE 6-3 Download of System Specific Information

Time to Complete Procedure	Normal Condition	Failure Condition
35 seconds	Normally, the bottom feature processor LED flashes green twice per second and the center feature processor LED flashes green four times per second. At the end of the download, the three feature processor LEDs go out, then momentarily flash on again, then go out.	If there is an error, the card resets and returns to the self-test procedure. See *Self-test* on page 6-9.

Download of Card Specific Information

If the card successfully downloads system specific information, the card downloads card specific information. During this procedure, the card requests the System Center to download the following information:

- portion of software unique to that card type
- data unique to that card type
- date unique to that particular slot in the system

The following table describes what happens during a card's download of card specific information.

TABLE 6-4 Download of Card Specific Information

Time to Complete Procedure	Normal Condition	Failure Condition
30 seconds	Normally, the top and bottom feature processor LEDs alternately flash green, one-and-a-half times per second.	If there is an error, the card resets and returns to the self-test procedure. See *Self-test* on page 6-9.

Running

If the card successfully downloads card specific information, the card runs. The following table describes what happens during a card's download of card specific information.

TABLE 6-5 Card Running

Time to Complete Procedure	Normal Condition	Failure Condition
N/A	Normally, the three feature processor LEDs flash green in the MX shuffle.	If there is an error, the card resets and returns to the self-test procedure. See *Self-test* on page 6-9.

LINE INTERFACE CARDS

Line interface cards include:

- analog line interface card (ALIC)
- CEPT/primary ISDN interface card (CPIC)
- digital line interface card (DLIC)
- digital cross-connect card (DXIC)
- four-wire line interface card (FLIC)
- multiple speaker interface card (MSIC)
- E1 networking master card (NEMC)
- E1 networking slave card (NESC)
- T1 networking master card (NTMC)
- T1 networking slave card (NTSC)
- private line interface card (PLIC)
- QSIG interface card (QSIC)
- Series II interworking card (S2IC or S2IW)
- universal line cards

Line interface cards perform the following functions:

- determine line status and broadcasting this by way of the switch ports to the network and onwards to the turrets
- handle calls for each of the voice channels
- download line configurations from the System Center
- run diagnostics at boot-up, on reset, and on a continuing basis

The ejectors at the top and bottom of line interface cards are color coded so that you can easily recognize the different cards. The following table shows the ejector colors of these cards.

TABLE 6-6 Ejector Color of Line Interface Cards

Card	Top Ejector Color	Bottom Ejector Color	Label
ALIC	Black	Yellow	
CPIC	Purple	Yellow	
DLIC	Blue	Yellow	
FLIC	Green	Yellow	
MSIC	Black	Yellow	
NEMC	White	Gray	E1M
NESC	White	Gray	E1S
NTMC	Red	Gray	T1M
NTSC	Red	Gray	T1S
PLIC	Yellow	Yellow	
QSIC	Purple	Yellow	
S2IC	Red	Yellow	

ALIC

There are two basic analog line interface cards, the analog line interface card (ALIC) for common battery (dialtone) lines, and the private line interface card (PLIC) for dry private lines. (See *PLIC* on page 6-52.) ALICs do not initiate voice paths, but voice paths are their destination. The 7.68 mbits from the access switch cards are converted by a dedicated link interface integrated circuit to a 6.144 MHz data stream that is fed through the switch port of the card. There, channels containing data packets are switched to the feature processors for control purposes, and the voice channels are switched on to the DSP. If a multi-party conference is involved on any channel, the DSP compresses the resulting greater-than-13-bit-word back to 13 bits nominal magnitude. Any other digital processing is also handled by the DSP. Because of this, IPC Engineering can alter levels by changing simple algorithms. After the DSP processes the 6.144 MHz data stream (which contains some empty channels), it provides a 2.048 MHz mu-law data stream as its output.

Dual subscriber line access circuits (DSLACs) terminate the 2.048 MHz data stream from the DSP. Each DSLAC codes and decodes each of two channels to a two-wire analog voice circuit. The two-wire analog voice circuit is provided to the public network using a transformer and a complex impedance circuit. The complex impedance circuit is formed in part by discrete terminating components and in part by digital manipulation performed by the DSLAC. Four-wire lines are terminated on the ALIC on both channels of a DSLAC, with one channel acting as receive and the other acting as transmit. The complex impedance in each channel is effectively cancelled in the DSLAC, allowing a true four-wire connection to the network. Using 2 channels for 1 line cuts the number of lines served by the ALIC from 10 to 5.

ALICs have gyrators to absorb network loop current, along with relays to make and break the network connection. You can dial on the network in one of two ways: *dual tone multi-frequency* (DTMF), used throughout North America; and *dial pulse* (also called *out pulse* in the USA and *loop disconnect* in the UK).

DTMF signaling is initiated by the user at the turret dial pad. Digital information associated with each key is passed through the switch to the ALIC. The DSP on the ALIC generates the appropriate digital representations of the DTMF tones (which are converted to analog by the DSLAC), and then sent out to the network. While DTMF is being sent to the network, transmit and receive is broken between the turret and the line interface. To provide user feedback, the DSP on the BRIC produces a digital representation of tones similar to those associated with DTMF signalling. These are converted to analog by the CODEC in the turret.

Note The two tones occur within a defined time frame, but might not occur synchronously.

Dial pulse (or out pulse or loop disconnect) signaling in the MX System is similar to DTMF signaling in that the information about each button press is sent as data through the MX System to the line card. Dial pulse is initiated when you select a pulse dial line (most common are British Public Switched Telephone Network, PSTN, and lines) and press the dial pad buttons. As you press the dial pad, a command word relating to the number pressed is forwarded to the BRIC or ATIC. That card passes the command word to the ALIC using the preset path established when the turret first requests a talkpath to the line. The command processor then causes the line relays to open and close accordingly in a pulsed pattern to represent the dialed number.

Dial pulse signalling on any analog line can be initiated by pressing # on the dial pad, followed by the numbers to be dialed. Associated digital information is passed through the switch to the ALIC, which takes action by opening and closing the line relays.

ALICs have 10 circuits per battery. An ALIC is a RAM card; that is, when you pull the card out, you lose any memory on that card. The ALIC and the PLIC are physically identical (except for the color of the top ejector).

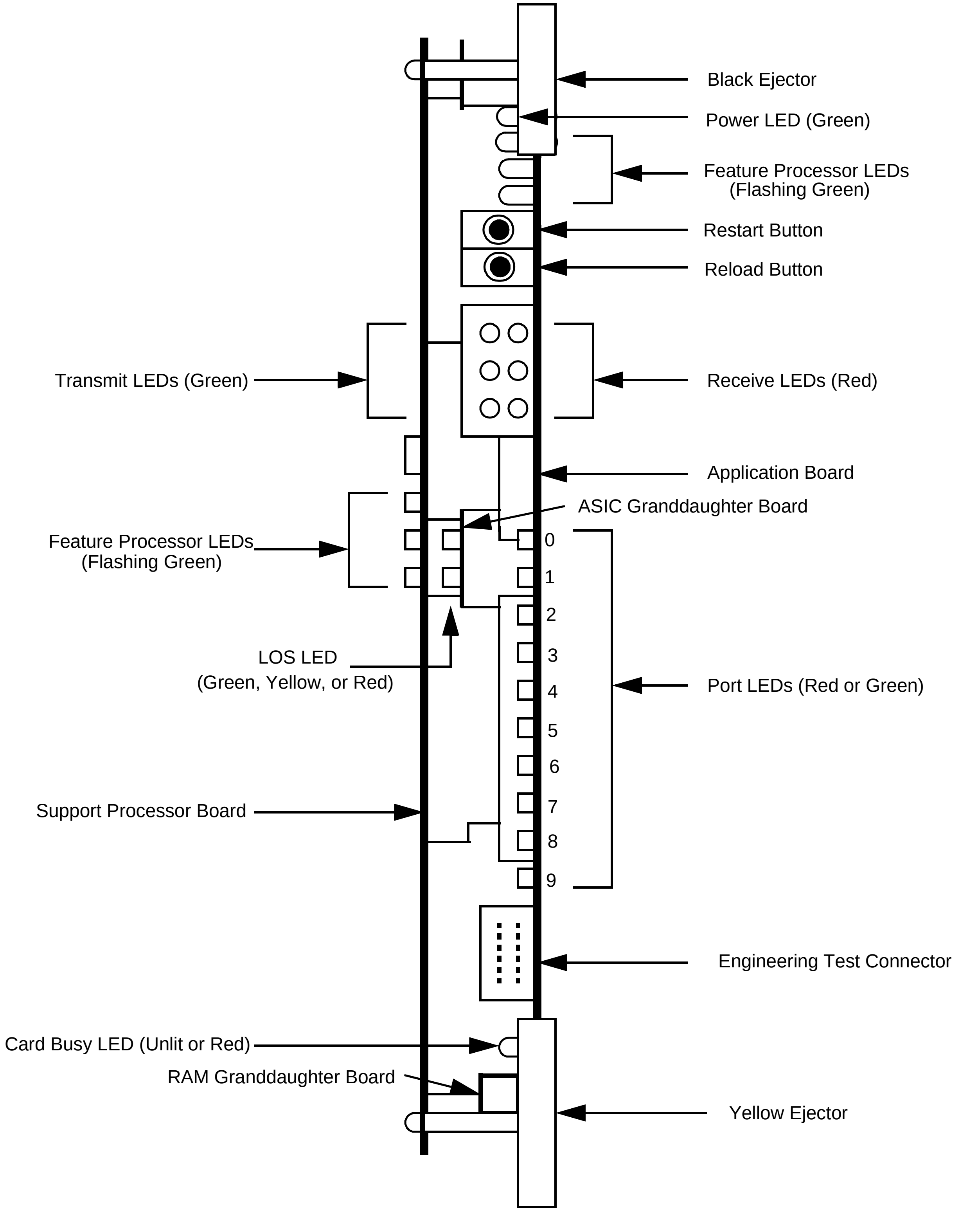
The ALIC interfaces between the digital switching center and 10 analog PSTN lines. ALIC is also used with dialtone lines or Central Office (CO) auto ringdown lines. The ALIC works with wet circuits only (those with loop current, and, normally, dialtone). Each card has 10 ports (lines) numbered as offsets 0–9. The ALIC performs the following functions:

- interfaces to common battery lines (known as Figure #1 in the UK)
- A/D and D/A conversion
- ring detection
- hold
- DTMF signalling
- dial pulse (loop disconnect) signalling
- on/off hook
- loop detection
- power fail transfer of first two lines on a card

Except for power fail transfer, each of these signals are passed to and from the SELC and onwards to the applicable turret/turrets. Power fail transfer occurs automatically whenever the 5 V logic power fails. In compliance with regulations in the U.K., 2 of the 10 lines on each card are transferred in copper circuits to the power fail transfer outputs on the TU backplane. Because this only happens in the event of power failure to the card itself, in which case the card will be inoperative, there is no signal outside the card when transfer occurs, except for the physical transfer of the affected lines.

The following figure shows the parts of the ALIC.

FIGURE 6-4 ALIC



The card LEDs help you to diagnose problems in your system. The following table describes the LEDs on the ALIC.

TABLE 6-6 ALIC LEDs and Buttons

LEDs and Buttons	Description
Power LED	The power LED is green. This LED is always on to indicate there is power to the ALIC.
Top Three Feature Processor LEDs	The three feature processor LEDs just below the white ejector should normally be flashing green. (This pattern is called the *MX shuffle*.)
Restart Button	When you press the restart button, the card restarts after 10–20 seconds, using information stored on the card. This generates a hardware reset. Use this button when the data on the card is correct. This button does not affect system operation. Pushing this button is equivalent to using the **Restart Card** option from the System Center Application (SycAp) menu. (Select **Maintenance**, **Card**, and **Restart Card**. For more information about the SycAp menu, refer to the *Tradenet MX System Center Manual 14.1*, part number B0086185104.)
Reload Button	When you press the reload button, the card reloads after two–three minutes, using new data and information from the System Center. This generates a non-maskable interrupt. Use this button when there is a problem with the data loaded on the card. This button does not affect system operation. Pushing this button is equivalent to using the **Load Card Processor** option from the System Center Application (SycAp) menu. (Select **Maintenance**, **Card**, and **Load Card Processor**. For more information about the SycAp menu, refer to the *Tradenet MX System Center Manual 14.1*, part number B0086185104.)
3 Pairs of Receive/Transmit LEDs	The green LEDs are the transmit LEDs and the red LEDs are the receive LEDs. These LEDs represent links to the SELCs. There is one receive/transmit pair of LEDs for each SELC to which the ALIC is connected. When the top receive/transmit pair is lit, it indicates the SELC in slot #15 is communicating properly. When the middle pair is lit, it indicates the SELC in slot #16 is communicating properly. When the bottom pair is lit, it indicates the SELC in slot #17 is communicating properly.
Middle Three Feature Processor LEDs	The three feature processor LEDs in the middle of the card should normally be flashing green in the MX shuffle pattern.
ASIC LED	On the ASIC granddaughter card in the center of the card, there is an ASIC LED just above the LOS LED. This LED is normally lit light green and it indicates proper communication between the ASIC and application board.

LEDs and Buttons	Description
LOS LED	This LED is normally lit green to indicate the card is loaded. If it is lit yellow, the ALIC is in the process of receiving data from the System Center. If it is lit red, the ALIC is not loaded.
10 Port LEDs	The port LEDs are for the 10 ports, or lines, on the ALIC. The top port LED is associated with port #1 (offset 0), the second port LED is associated with port #2 (offset 1), and so on. When a port LED flashes red, it indicates the port is active or busy. When a port LED flashes green, it indicates a call is ringing in on that port (line). When a port LED is lit steady red, it indicates a call on that line is on hold.
Card Busy LED	Normally, the card busy LED is unlit. If any of the 10 port LEDs are active or busy, the card busy LED is lit red.

Swiss Installations

In a Swiss installation, the only special consideration required is a special 12 kHz metering signal filter assembly that filters metering pulses. (The part number for this kit is 24413115.) All other equipment in a Swiss installation is standard. The 12 kHz metering signal filter is used only with ALICs (not PLICs). The filter assembly accommodates 50 analog lines (5 ALICs) and is wired between the CO and the line card connection. Each filter passes normal audio with no loss, but reduces the 12 kHz pulses by at least 30 dB. The Swiss telephone network can handle 12 kHz metering signals without interfering with other equipment. The semiconductor line hold circuits in modems can be impacted by these large signals because the voltage swing can exceed the standing DC level. The Swiss filter suppresses metering signals so that the DC level is reduced to less than 0.25 Vrms across the line hold.

The following table lists the limitations of the 12kHz Meter Pulse Filter Card.

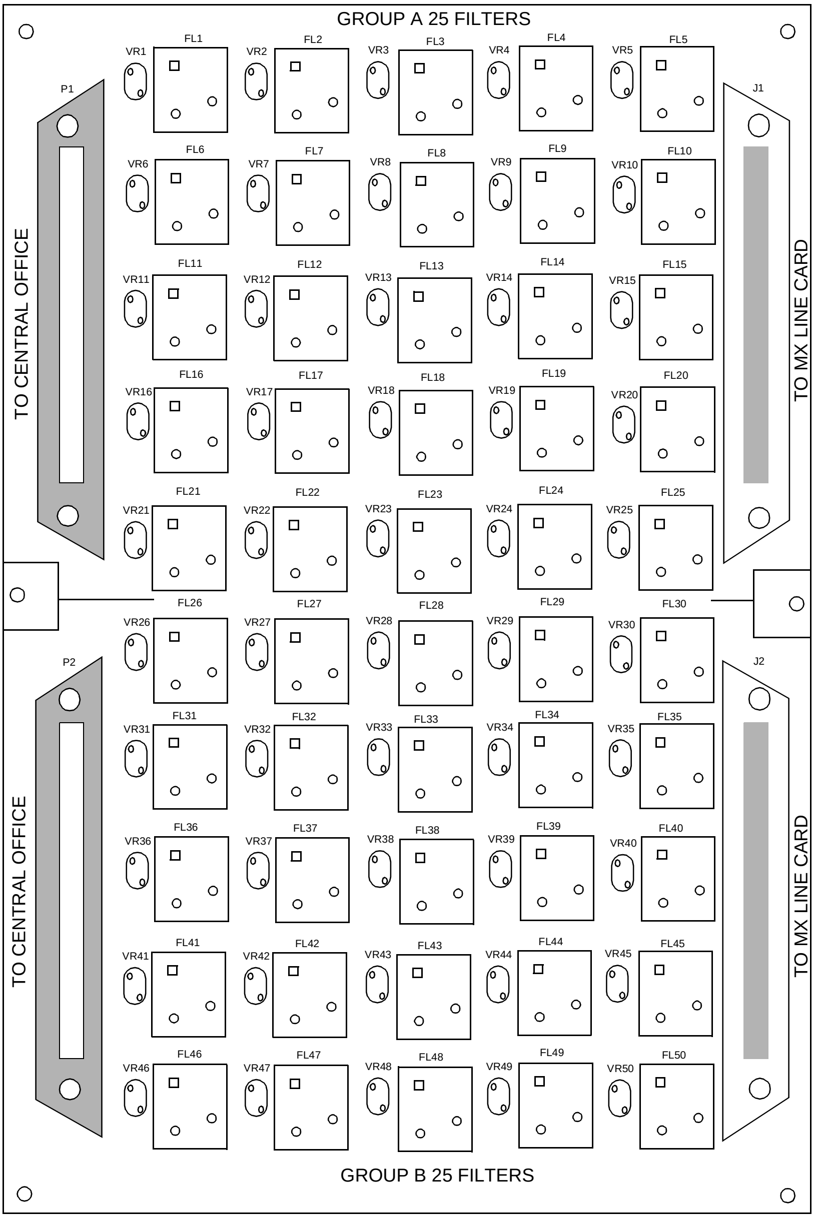
TABLE 6-7 Limitations of the 12kHz Meter Pulse Filter Card

Frequency	12 kHz +/-150Hz
Input Voltage	up to 10 Vrms
DC	up to 100 mA
Temperature	-10° C to +70° C

There are no LEDs on this card.

The following figure shows the front of the 12 kHz meter pulse filter card. The connectors to the CO are male and the connectors to the MX line card are female.

FIGURE 6-5 Front of 12kHz Meter Pulse Filter Card



Music on Hold

If you are using the Music on Hold feature, music on hold terminates in the backroom to an ALIC or PLIC (analog) port. That line port and its associated LAC are known as the music source line or LAC. For information about installing equipment necessary for music on hold, refer to the *Tradenet MX Installation & Maintenance Manual 14.1* (part number B0108900003).

CPIC

Turrets (if programmed) have access to the digital network. The digital network connection is supported by the digital line interface card (DLIC) for T1, and by the CEPT primary rate interface card (CPIC) for E1.

The CPIC performs the following functions for E1 spans:

- 30 voice channels—Access from a Tradenet MX turret to one of the voice channels of a 2.048 MHz digital link can be achieved in the same manner as a call placed to the PSTN line. D/A and A/D conversion, however, is not made, and an algorithm is set to both the incoming and outgoing speech to achieve a linear to algorithmic code (A-law) conversion.
- Signaling—Signaling is achieved in the same manner as for a PSTN line card when controlled from a Tradenet MX turret but, instead of activating relays, the ABCD signalling bits are set in the correct manner by the CEPT interface controller.
- Alarms—If dialing signal is lost from the 2.048 MHz incoming, all Tradenet turrets that have voice channel access capability are informed by their applicable line keys, showing a line on hold, that is, facility not available. The alarm comes up on the System Center.

There are various locations (either during the digital stage or analog stage) within the Tradenet MX System at which voice levels and frequency responses can be changed. All of these parameters are set during initialization of the DSPs, DSLACs, CODECs, and of the Tradenet MX turret. These values, apart from receive volume, are not changeable by the users of the system nor by the administrator, but are only changeable by database changes to the installation data. This ensures that parameters with regulatory significance, such as transmit level, are not inadvertently altered after the system leaves the factory.

If a fault occurs in the system handling of data or analog voice, no safety infringement occurs. Incoming voice to the turret is limited to a maximum of 18 deciBels Pascal (a sound pressure measurement roughly equivalent to loud speech close to the mouth) by means of discrete components just prior to the handset, and the outgoing voice levels to the lines are limited by the DSLACs inability to generate more than 6.6 deciBels relative to one volt (a voltage measurement roughly equivalent to loud speech over the network).

The CPIC is used to terminate European standard digital line facilities. An E1 span consists of 30 digital voice channels on a single transmission path. (Use of the channel for data transmission is not supported.) The path is normally a shielded dual coaxial pair cable with digital repeaters. In the U.S., a balun is used to convert the impedance of a coaxial output to that of a twisted pair modular cable. Each of the 30 channels in an E1 span is of a certain type. They can be the same type, or they can be different within a single span.

The CPIC is compatible with standard framing types and channel signalling. Among the channel signaling types supported are:

- dialtone (loop and ground start with DTMF or pulse dialing)
- manual ringdown and manual ringdown with auto signalling
- PLAR and PLAR with ringback tone
- 4-wire

Software is used to configure the CPIC for the different framing types and channel signalling. CPIC software keeps track of which channel is for which line assignment by LAC number. The CPIC is essentially the European digital equivalent of the common battery, 4-wire, and private line cards.

The Tradenet MX System does *not* require a channel bank for the E1 lines because it allows direct connection of the E1 line to its CPIC. One card is required for every E1 line. IPC Engineering recommends that a drop and insert panel designed for E1 applications be used for troubleshooting access. The framing types that are supported are:

- 16-frame
- CRC-4 multi-frame

Theoretically, up to eight E1 cards can be installed on a TU. There are physically enough slots for eight cards and there are BNC connectors on the BNC daughterboard used for the E1 lines. However, the number installed is based on various factors, such as traffic, ratio of turrets to lines, analog and digital mix, and the use of speakers.

The CPIC is the European equivalent of the T1 card, in that one card is required for every E1 line. The cost savings and equipment floor space reduction associated with T1 also apply to E1. Typically, a system is installed with either T1 or E1, but the system can accommodate both types of digital facilities simultaneously. The CPIC can also be used for DASS2, and QSIG.

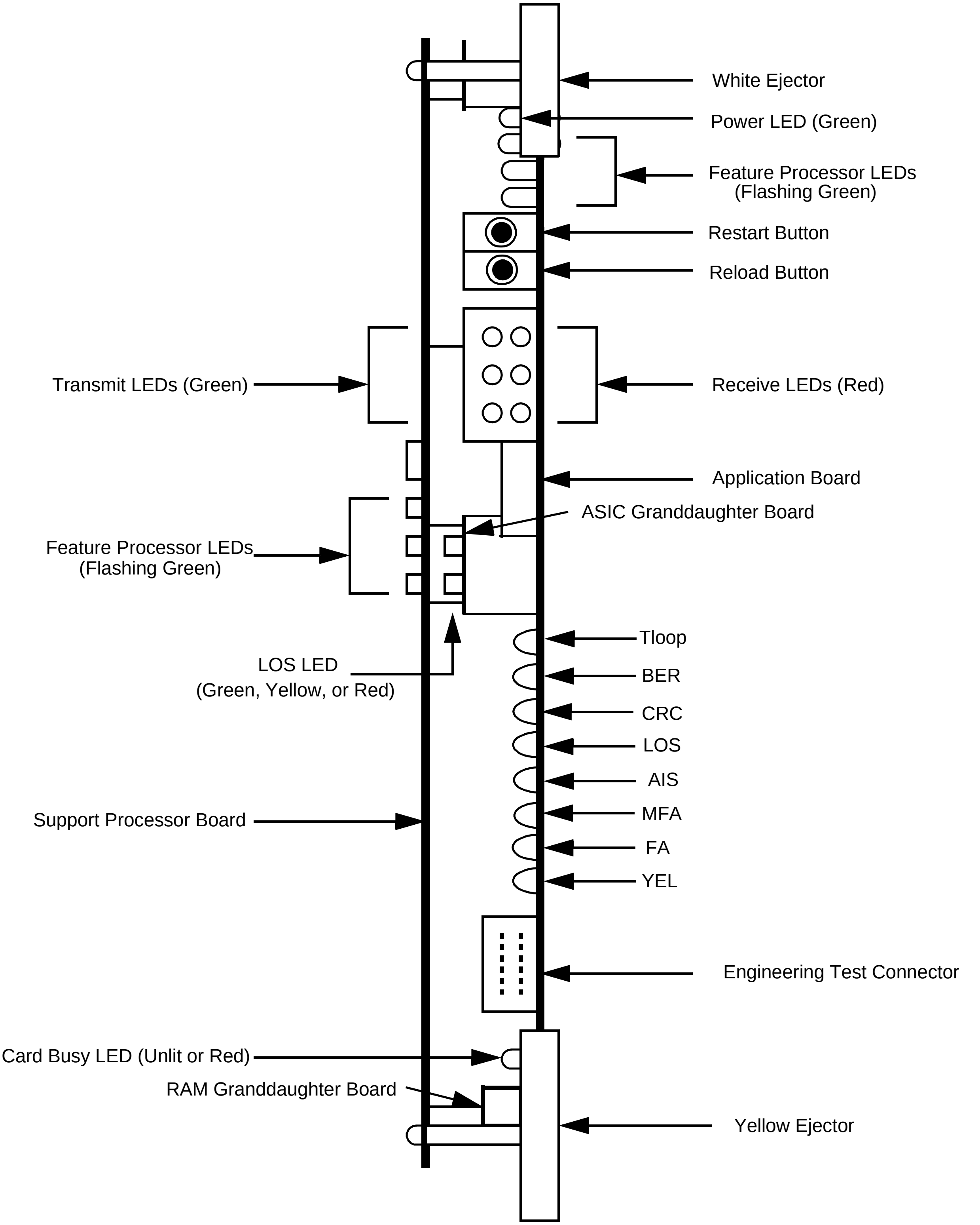
The E1 circuit must use high density bipolar 3-zero maximum (HDB3) zero suppression methods to be compatible with the CPIC interface. This must be specified when ordering E1 lines.

The CPIC has on-board alarms to detect span problems. Each alarm has an LED indication on the E1 card. Alarms are also automatically transmitted to the System Center. Card level alarms include:

- Tloop indicates that the E1 line is being looped back during diagnostic conditions
- bit error rate (BER) indicates excessive bit errors or bipolar violations
- cyclic redundancy check (CRC) indicates end-to-end data transmission error and that information in the frames is corrupted
- loss of signal (LOS)
- alarm indication signal (AIS) is a yellow alarm indicating an incoming signal is all 1’s
- multi-frame alignment (MFA) indicates loss of multi-frame alignment
- frame alignment (FA) alarm indicates it has lost frame alignment
- remote alarm indication signal (labeled YEL alarm on the CPIC) lights a yellow LED near the bottom of the card indicating the other end (line or card) is having a problem, and returns to the transmitting terminal to report a loss of multi-frame alignment at the receiving end

The following figure shows the parts of the CPIC.

FIGURE 6-6 CPIC



The card LEDs help you to diagnose problems in your system. The following table describes the LEDs on the CPIC.

TABLE 6-8 CPIC LEDs and Buttons

LEDs and Buttons	Description
Power LED	The power LED is green. This LED is always on to indicate there is power to the ASIC.
Top Three Feature Processor LEDs	The three feature processor LEDs just below the white ejector should normally be flashing green. (This pattern is called the *MX shuffle*.)
Restart Button	When you press the restart button, the card restarts after 10–20 seconds, using information stored on the card. This generates a hardware reset. Use this button when the data on the card is correct. This button does not affect system operation. Pushing this button is equivalent to using the **Restart Card** option from the System Center Application (SycAp) menu. (Select **Maintenance**, **Card**, and **Restart Card**. For more information about the SycAp menu, refer to the *Tradenet MX System Center Manual 14.1*, part number B0086185104.)
Reload Button	When you press the reload button, the card reloads after two–three minutes, using new data and information from the System Center. This generates a non-maskable interrupt. Use this button when there is a problem with the data loaded on the card. This button does not affect system operation. Pushing this button is equivalent to using the **Load Card Processor** option from the System Center Application (SycAp) menu. (Select **Maintenance**, **Card**, and **Load Card Processor**. For more information about the SycAp menu, refer to the *Tradenet MX System Center Manual 14.1*, part number B0086185104.)
3 Pairs of Receive/Transmit LEDs	The green LEDs are the transmit LEDs and the red LEDs are the receive LEDs. These LEDs represent links to the SELCs. There is one receive/transmit pair of LEDs for each SELC to which the ASIC is connected. When the top receive/transmit pair is lit, it indicates the SELC in slot #15 is communicating properly. When the middle pair is lit, it indicates the SELC in slot #16 is communicating properly. When the bottom pair is lit, it indicates the SELC in slot #17 is communicating properly.
Middle Three Feature Processor LEDs	The three feature processor LEDs in the middle of the card should normally be flashing green in the MX shuffle pattern.
Tloop	This green LED lights when in network or system loopback mode.
BER	The bit error rate (BER) LED is red and it is normally off. If it is lit red, it indicates excessive BER or bipolar rate violations.
CRC	The cyclic redundancy check (CRC) LED is red and it is normally off. If it is lit red, it indicates an end-to-end data transmission error where information in the frames was corrupted.
LOS	The loss of signal (LOS) LED is red and it is normally off. If it is lit red, it indicates the E1 line is lost.
AIS	The alarm indication signal (AIS) LED is red and it is normally off. If it is lit red, it indicates all the 1’s are received.

LEDs and Buttons	Description
MFA	The multi-frame alignment LED is red and it is normally off. If it is lit red, it indicates the CPIC is unable to receive signalling information.
FA	The frame alignment (FA) LED is red and it is normally off. If it is lit red, it indicates the CPIC was unable to recover a frame from an incoming signal.
YEL	This yellow LED is normally off. If it is lit yellow, it indicates the other end of the card (or line) cannot recover the frame or multi-frame from the CPIC.
Card Busy LED	Normally, the card busy LED is unlit. If any of the 10 port LEDs are active or busy, the card busy LED is lit red.

DLIC

Turrets (if programmed) have access to the digital network. The digital network connection is supported by the digital line interface card (DLIC) for T1, and by the CEPT Primary rate Interface Card (CPIC) for E1.

On the DLIC, the 7.68 Mbits from the access switch cards are converted by a dedicated link interface integrated circuit to a 6.144 MHz data stream that is fed through the switch port of the card. There, channels containing data packets are switched to the feature processors for control purposes, and the voice channels are switched on to the DSP. If a multi-party conference is involved on any channel, the DSP compresses the resulting greater-than-13-bit-word back to 13 bits nominal magnitude. Any other digital processing is also handled by the DSP. After the DSP processes the 6.144 MHz data stream, it provides a T1 or E1 drop as its output. The E1 interface card incorporates additional processors to handle the more complex E1 protocol, but otherwise the operation of the cards is essentially similar.

The DLIC performs the following functions for T1 spans:

- 24 voice channels—Access from a Tradenet MX turret to one of the voice channels of a T1 digital link can be achieved in the same manner as a call placed to a PSTN line. However, D/A and A/D conversion is not made and an algorithm is set to both the incoming and outgoing speech to achieve a linear to algorithmic (m-law) code conversion.
- Signaling—Signaling is achieved in the same manner as for a PSTN line card when controlled from a Tradenet MX turret. The T1 facilities card is compatible with standard framing types and channel signaling.
- Alarms—If dialing signal is lost, all Tradenet MX turrets that have voice channel access capability are informed by their applicable line keys. Each card has on-board alarms to detect span problems. The alarm comes up on the System Center.

There are various locations (either during the digital stage or analog stage) within the Tradenet MX System at which voice levels and frequency responses can be changed. All of these parameters are set during initialization of the DSPs, DSLACs, CODECs, and of the Tradenet MX turret. These values, apart from receive volume, are not changeable by the users of the system nor by the administrator, but are only changeable by database changes to the installation data. This ensures that parameters with regulatory significance, such as transmit level, are not inadvertently altered after the system leaves the factory.

If a fault occurs in the system handling of data or analog voice, no safety infringement occurs. Incoming voice to the turret is limited to a maximum of 18 deciBels Pascal (a sound pressure measurement roughly equivalent to loud speech close to the mouth) by means of discrete components just prior to the handset, and the outgoing voice levels to the lines are limited by the DSLACs inability to generate more than 6.6 deciBels relative to one volt (a voltage measurement roughly equivalent to loud speech over the network).

The DLIC has 24 channels.

The DLIC is used to terminate North American standard digital T1 spans. A T1 span has 24 digital channels (multiplexed over four conductors). Each of the 24 channels in a T1 span is of a certain channel signaling type. The channels can be the same, or they can be different within a single span, and they can be used for either voice or data.

The DLIC is compatible with standard framing modes and channel signalling types. The D3 and D4 framing modes are supported by the DLIC. The channel signaling types supported are:

- dialtone (loop and ground start)
- private line automatic ringdown (PLAR)
- manual ringdown

Software is used to configure the DLIC for the different framing types and channel signalling. DLIC software keeps track of which channel is for which line assignment by LAC number. The CPIC is essentially the European digital equivalent of the common battery, 4-wire, and private line cards.

The Tradenet MX System does *not* require a channel bank for the E1 lines because it allows direct connection of the E1 line to its CPIC. One card is required for every E1 line. IPC Engineering recommends that a drop and insert panel designed for E1 applications be used for troubleshooting access. The framing types that are supported are:

- 16-frame
- CRC-4 multi-frame

Theoretically, up to nine T1 cards can be installed on a TU. There are physically enough slots for eight DLICs and there are BNC connectors on the BNC daughterboard used for the T1 lines. However, the number installed is based on various factors, such as traffic, ratio of turrets to lines, analog and digital mix, and the use of speakers.

The DLIC is the American equivalent of the PLIC, in that one card is required for every T1 line. The cost savings and equipment floor space reduction associated with E1 also apply to T1. Typically, a system is installed with either T1 or E1, but the system can accommodate both types of digital facilities simultaneously.

There are three types of T1 line services, or framing modes: D3, D4, and extended superframe (ESF). The Tradenet MX System supports D3 and D4. ESF is AT&T's newest T1 standard and is not supported by the Tradenet MX System.

Foreign exchange (FX) channels are the regular dialtone lines provided in the T1 span. The T1's FX types are for one end of the FX connection or the other:

- FX subscriber (FXS)—the end that terminates to the Tradenet MX System
- FX originating/office (FXO)—the Central Office (CO) end of each FX line (if no CO is involved, such as in a point-to-point connection of T1's, one end acts as a CO and supplies the dialtone for the line—*the Tradenet MX System cannot supply dialtone to the T1 and cannot be used for an FXO channel*)

There are many types of private lines. The most common type in MX Systems are manual ringdown (MRD) or automatic ringdown (PLAR). There are two variations of PLAR, depending on the T1 line service. Another form of private line is a clear channel circuit for hoot 'n' holler applications that require no signalling. The Tradenet MX System supports private line, MRD, PLAR, and PLAR with ringback. (PLAR with ringback is used in those cases where ringback signal is required by the distant end, and must be supplied by the Tradenet MX System. PLAR with ringback is accomplished by adding a special type of private line service labeled *PLAR with Ringback*.)

The channels within a T1 span can be mixed from the above types (FX, PLAR, and MRD) in any order without limitations (unless specified by the T1 vendor).

The T1 circuit must use one of the following types of *zero suppression* methods to be compatible with the Tradenet MX System:

- AMI with 7 bit stuffing
- binary 8 zero substitution (B8ZS)

When ordering T1 circuits, make sure you specify one of the previous types of zero suppression.

The T1 transmits a reference clock along with the digitized voice, and uses a method of zero suppression, so it will not send a stream of all zeroes. This prevents a garbage signal from being interpreted as a good signal.

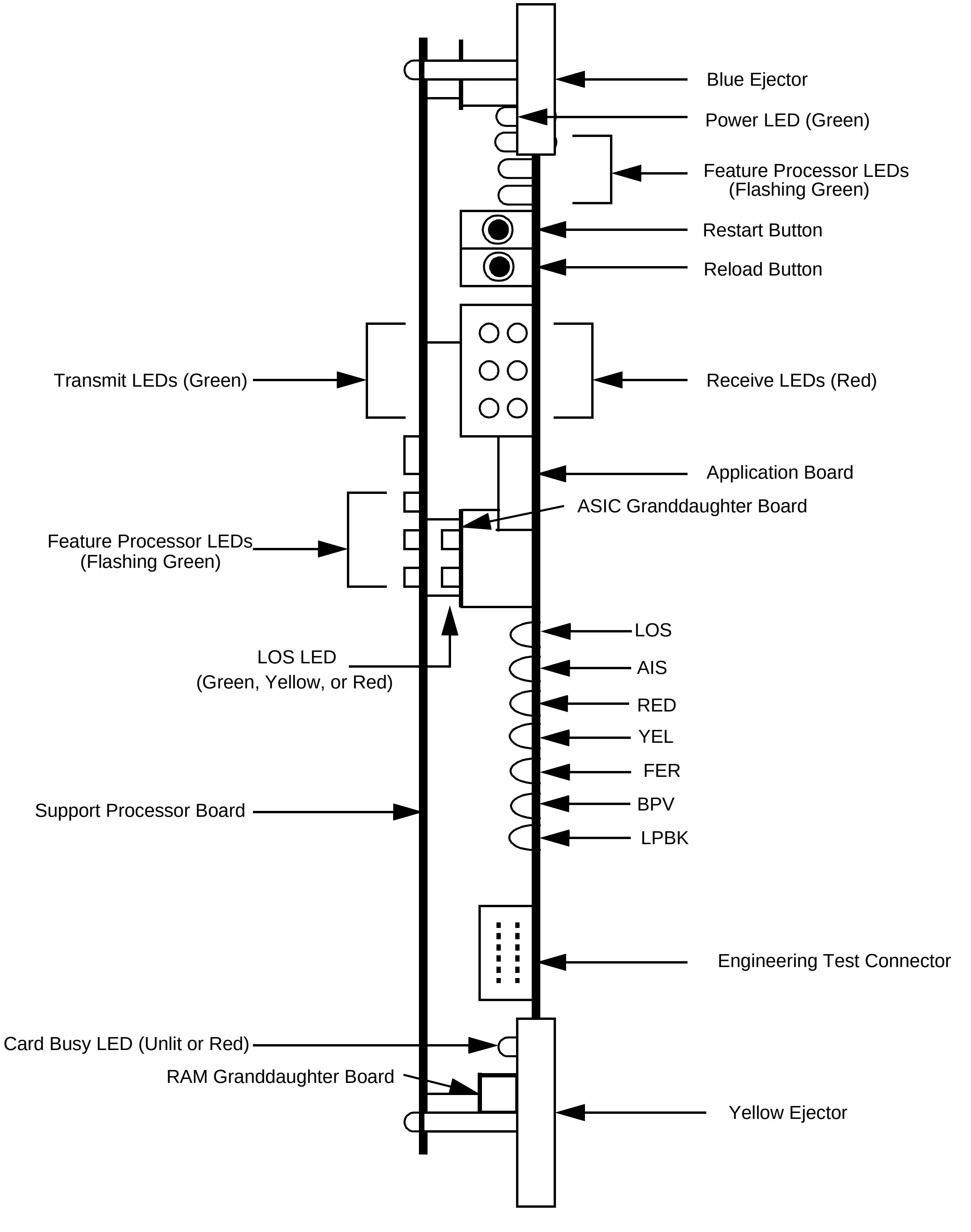
The DLIC has on-board alarms to detect span problems. Each alarm has a LED indication on the T1 card. Alarms are also automatically transmitted to the System Center. Card level alarms include:

- red alarms—distant end cannot receive valid T1
- yellow alarms—distant end reports loss of incoming signal
- loss of signal (LOS)—T1 line is lost
- AIS (Alarm Indication Signal), blue alarms—all 1’s received
- bipolar violation (BPV)—excessive bipolar violations
- loopback indication (LBK)—used for remote diagnostics

The DLIC includes a built-in channel service unit (CSU). CSUs provide the interface between the carrier and the switch to normalize the signal to the carrier, and to generate all 1’s in the event of a loss of signal from the switch. However, the primary function of the CSU is to provide the carrier with a facility to perform loopback testing. Loopback testing is used by the carriers to test the span remotely and to verify the link between the CO and the switch. To test individual channels of a T1 span, field technicians use *drop and insert* test sets. These sets allow monitoring and testing of any one of the 24 voice channels present in a T1 signal. In drop mode, the technician selects any channel and decodes the DS-0 (digital signal level 0: one 64kbps voice or data channel) information without interrupting operations. In insert mode, The technician inserts new data into any channel. The test set can be configured to operate as the CO to test the switch, or as customer premise equipment (CPE) to test the span. Insert mode can generate signaling, and insert voice, tones, or data. IPC typically uses the Telecommunication Techniques Corporation’s T1 drop and insert instrument. IPC field service personnel are trained with this equipment.

The following figure shows the parts of the DLIC.

FIGURE 6-7 DLIC



The card LEDs help you to diagnose problems in your system. The following table describes the LEDs on the DLIC.

TABLE 6-9 DLIC LEDs and Buttons

LEDs and Buttons	Description
Power LED	The power LED is green. This LED is always on to indicate there is power to the ASIC.
Top Three Feature Processor LEDs	The three feature processor LEDs just below the white ejector should normally be flashing green. (This pattern is called the *MX shuffle*.)
Restart Button	When you press the restart button, the card restarts after 10–20 seconds, using information stored on the card. This generates a hardware reset. Use this button when the data on the card is correct. This button does not affect system operation. Pushing this button is equivalent to using the **Restart Card** option from the System Center Application (SycAp) menu. (Select **Maintenance**, **Card**, and **Restart Card**. For more information about the SycAp menu, refer to the *Tradenet MX System Center Manual 14.1*, part number B0086185104.)
Reload Button	When you press the reload button, the card reloads after two–three minutes, using new data and information from the System Center. This generates a non-maskable interrupt. Use this button when there is a problem with the data loaded on the card. This button does not affect system operation. Pushing this button is equivalent to using the **Load Card Processor** option from the System Center Application (SycAp) menu. (Select **Maintenance**, **Card**, and **Load Card Processor**. For more information about the SycAp menu, refer to the *Tradenet MX System Center Manual 14.1*, part number B0086185104.)
3 Pairs of Receive/Transmit LEDs	The green LEDs are the transmit LEDs and the red LEDs are the receive LEDs. These LEDs represent links to the SELCs. There is one receive/transmit pair of LEDs for each SELC to which the ASIC is connected. When the top receive/transmit pair is lit, it indicates the SELC in slot #15 is communicating properly. When the middle pair is lit, it indicates the SELC in slot #16 is communicating properly. When the bottom pair is lit, it indicates the SELC in slot #17 is communicating properly.
Middle Three Feature Processor LEDs	The three feature processor LEDs in the middle of the card should normally be flashing green in the MX shuffle pattern.
LOS	The loss of signal (LOS) LED is red and it is normally off. If it is lit red, it indicates the T1 line is lost.
AIS	The alarm indication signal (AIS) LED is red and it is normally off. If it is lit red, it indicates all 1’s are received.
RED	The RED LED is normally off. If it is lit red, it indicates the other end cannot receive a valid T1 signal.
YEL	The YEL LED is normally off. If it is lit red, it indicates the other end reports a loss of incoming signal.
FER	The red frame error (FER) LED indicates excessive frame errors.

LEDs and Buttons	Description
BPV	The bipolar violations (BPV) LED is red and it is normally off. If it is lit red, it indicates excessive bipolar violations, or voltage spikes (noise).
LPBK	The loopback (LPB) LED is red and it is normally off. It is used for remote diagnostics by IPC Engineering.
Card Busy LED	Normally, the card busy LED is unlit. If any of the 10 port LEDs are active or busy, the card busy LED is lit red.

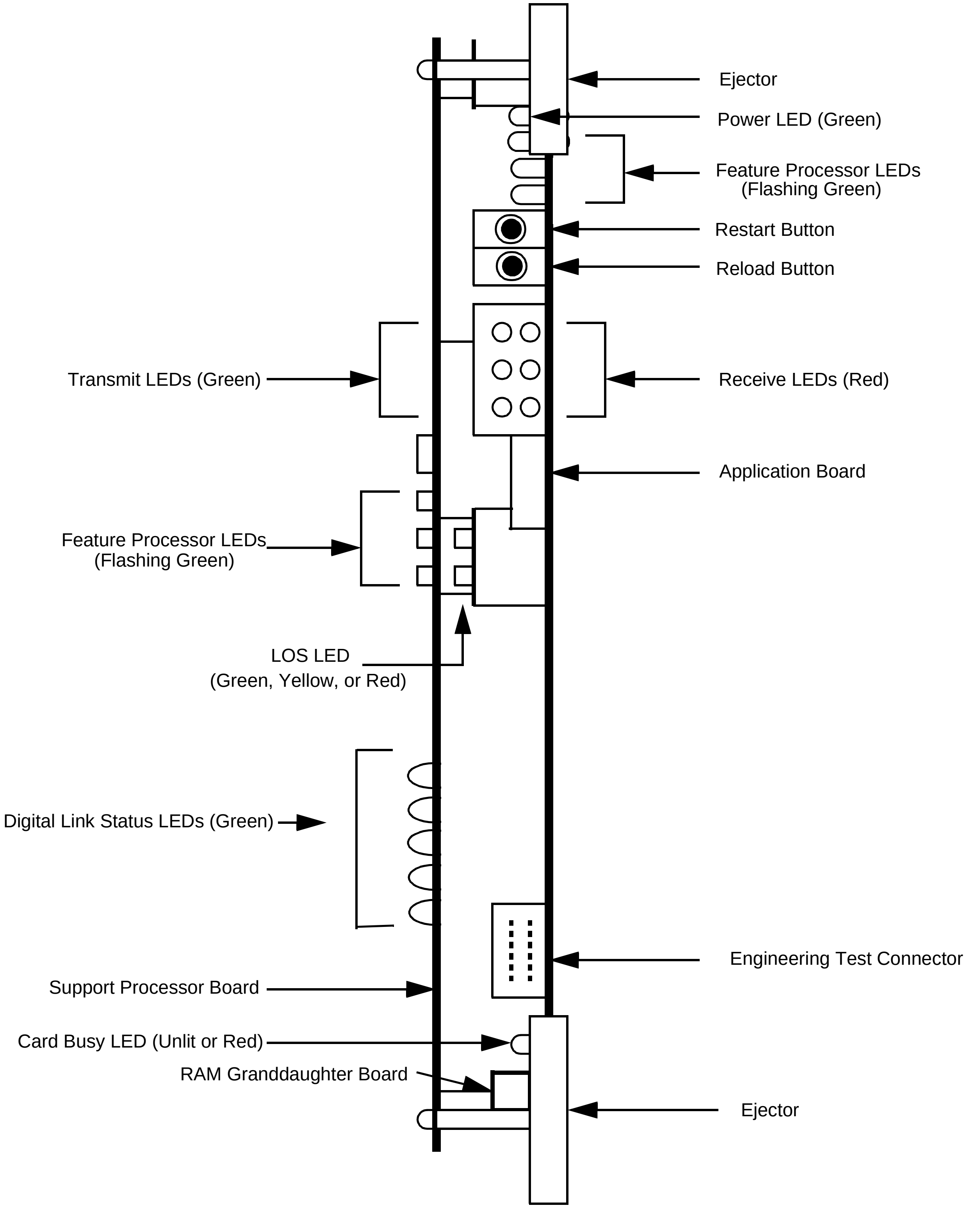
DXIC

The Digital Voice Recording (Record Groomer) feature uses the digital crossconnect card (DXIC) to optimize the configuration of the E1 links that connect station interface cards (STICs) and digital voice recording devices. It works to assure that each E1 link to a digital recording device is used to maximum capacity; that is, up to 31 voice channels plus one signalling channel.

There are no traffic or system loading implications. The DXICs occupy available TU line card slots. From the hardware standpoint, the DXIC is functionally identical with the E1 master version of the multiple speaker interface card (MSIC).

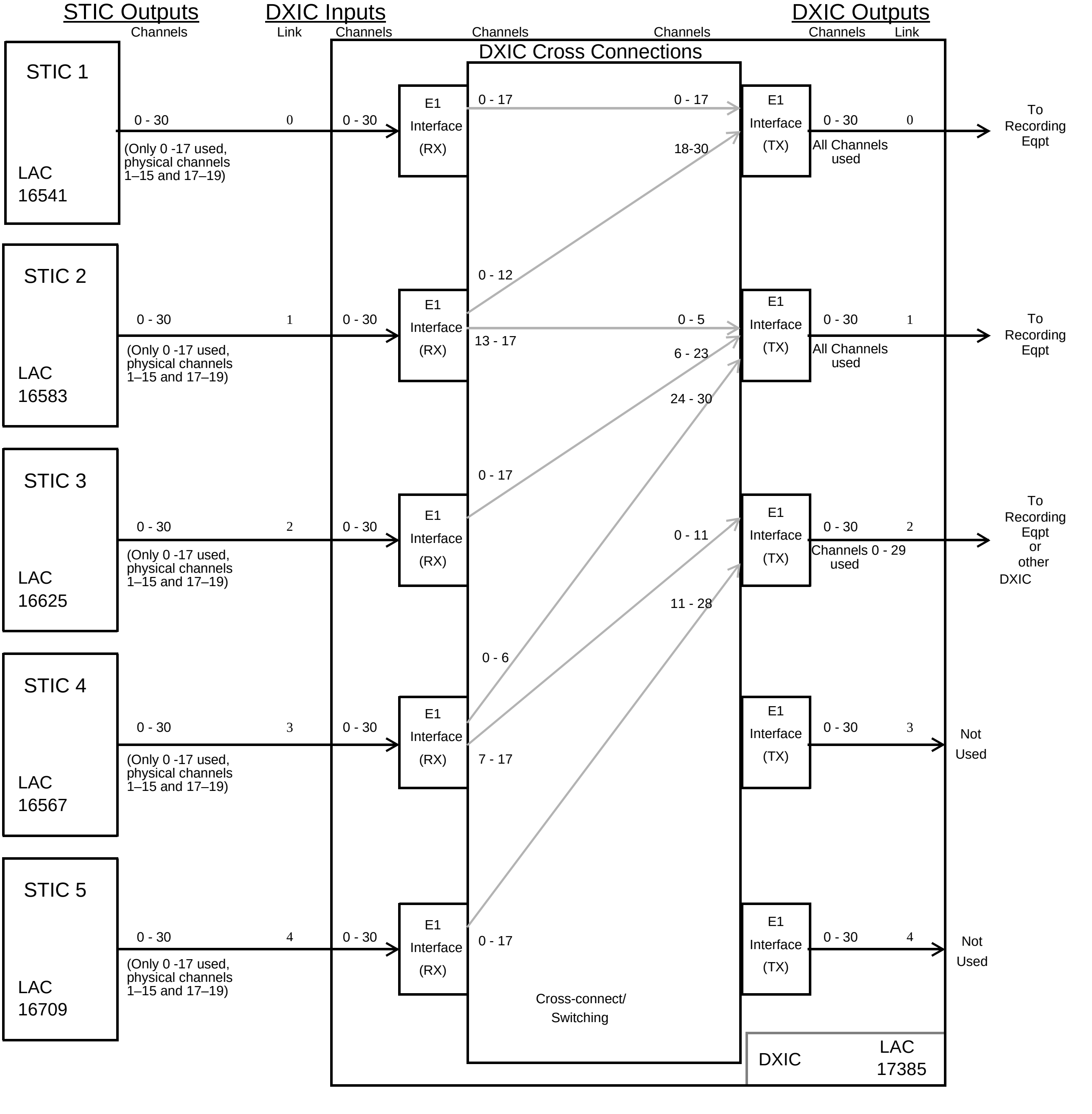
The following figure shows the parts of the DXIC.

FIGURE 6-8 DXIC



There are up to a maximum of five E1 links incoming into each DXIC, and up to four STICs per TU (terminal unit). Input from any STIC can be allocated to any DXIC. The STIC uses logical channels 0–17. It does not transmit audio on physical channel 16; it uses physical channels 1–15 and 17–19. (The NICE call logger device also skips physical channel 16.) The DXIC contains five, four-wire E1 interfaces. The input and output portions of the E1 are split. The five input E1 links interface to up to five STIC recording outputs—a maximum of 155 voice channels. However, these E1 links are rarely used to full capacity.

FIGURE 6-9 E1 Facilities on a DXIC



Typically, the five E1 input links have up to 18 channels in use, for a maximum of 90 channels. These 90 channels can be concentrated onto three E1output links for connection to digital recording devices. Thus five under-utilized links can be concentrated onto three fully utilized links.

Each E1 output link to a digital recording device is programmed to record voice channels from a STIC. The STIC recorder output is hard-wired and therefore fixed. The allocation of voice channels to output links is performed by the time slot interchange (TSI) chip on the DXIC. You allocate output links by making entries in the **i_groomer_card** table in the System Center. For information about the System Center, refer to the *Tradenet MX System Center Manual 14.1* (part number B0086185104).

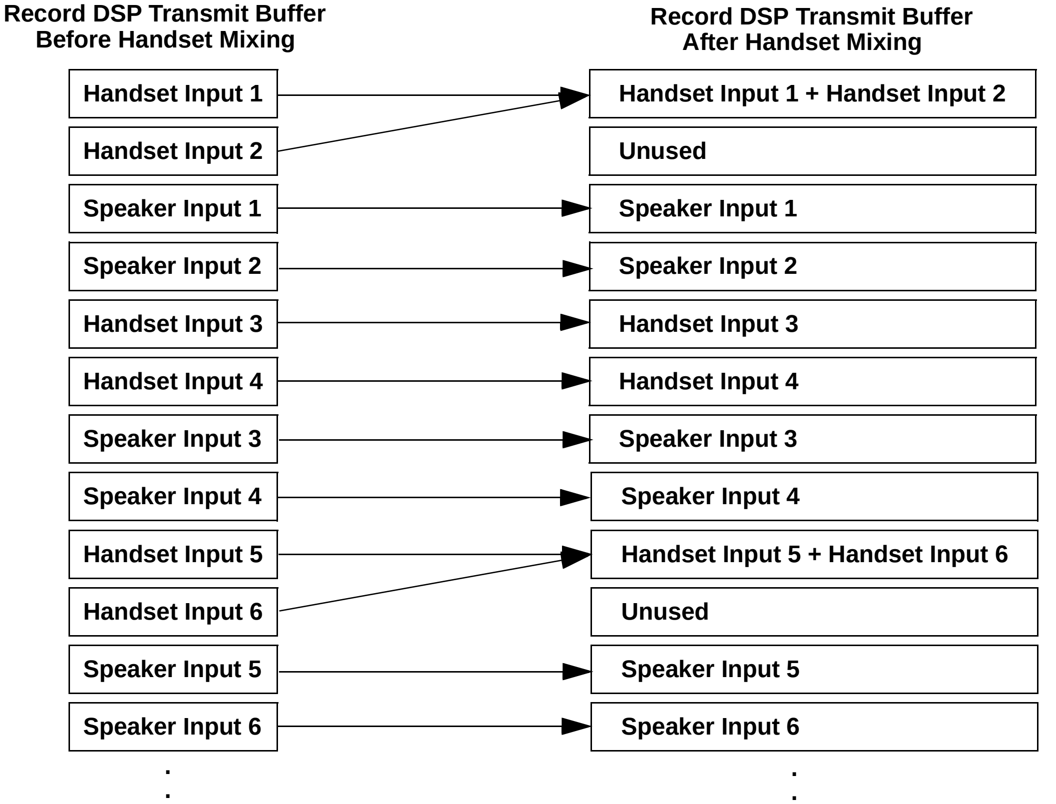
When the DXIC is on a station with multiple ClearDeal speaker modules connected to a STIC with the recording output using the DXIC, you can record audio at the voice recorder for every speaker module (BRI) on that station, regardless of which talkback is pressed.

With the DXIC, you can mix traffic from the left and right handsets. Voice inputs to a recording device can be handled in either of two ways:

- One voice channel is devoted to the voice input from each handset.
- Optionally, the voice inputs from both handsets can be *mixed*, and carried on one voice channel. Handset inputs are mixed before mapping. (For more information, refer to the *Tradenet MX Technical Reference Manual 14.1*, part number B0108800003.)

  This mixing is as follows.

FIGURE 6-10 Handset Mixing with the STIC



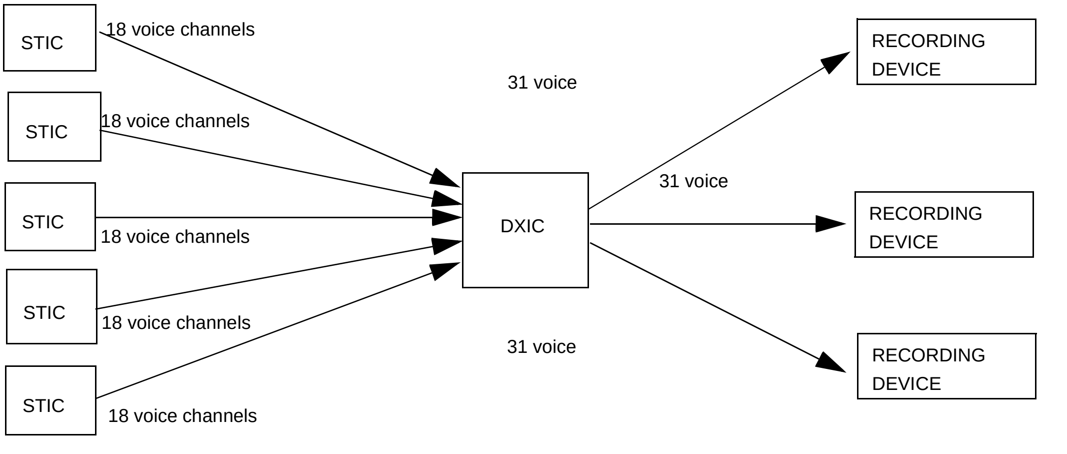
The mixing option is not provided for speakers, because their voice inputs are already mixed. You determine which method is to be adopted, and enable or disable mixing at each station that is equipped with two handsets. To enable or disable mixing for a given station LAC, you update the station digital recording parameter **Local Record** for that station LAC in the ***p_Station_Edit_Group*** table. (For more information about the Iview tables, refer to the *Tradenet MX System Center Manual 14.1*, part number B0086185104.)

Two tables are used in connection with the Digital Voice Recording (Record Groomer) feature:

- The **i_groomer_card** table is used to add information or edit information about a single DXIC.
- The **i_groomer_view** table is used to view information about all the DXICs in a Tradenet MX System. You cannot edit the information in this table.

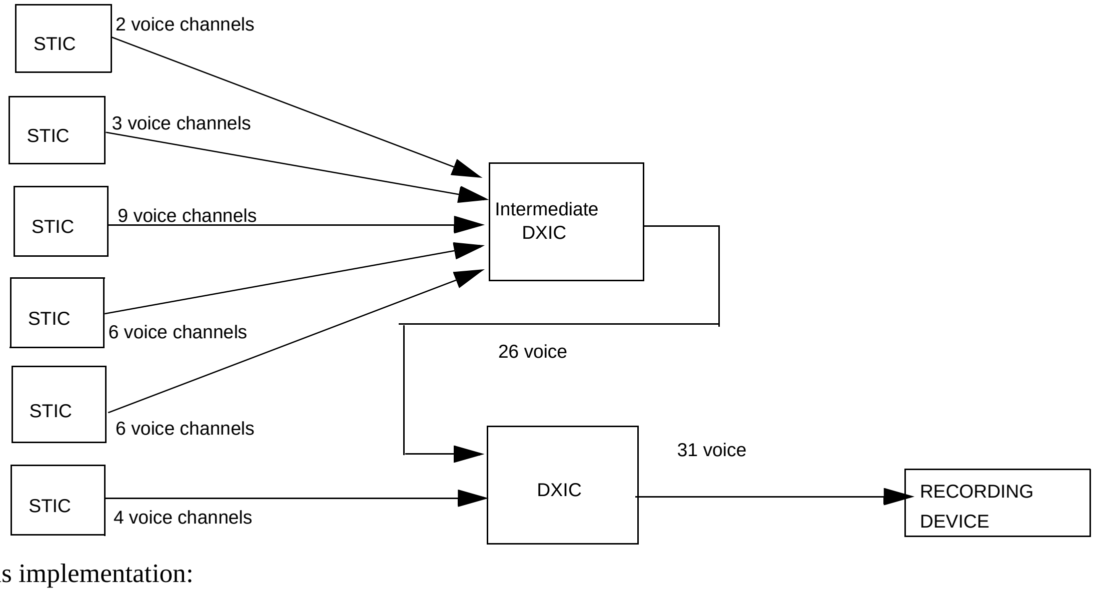
There are two typical implementations of the DXIC. In the figure below, E1 links run from each of five STICs to the DXIC, and from the DXIC to three recording devices. In each link, you use the System Center software to map inputs from STICs to outputs to recording devices until all 31 channels are filled.

FIGURE 6-11 Typical Implementation of the DXIC



The figure below shows the cascading of voice channels from one DXIC to another. If the final E1link to a recording device is not filled, traffic from an intermediate DXIC can be cascaded to the DXIC that is connected to the recording device.

FIGURE 6-12 Implementation Using an Intermediate DXIC



In this implementation:

- The intermediate DXIC receives input from the maximum of five STICs – 26 voice channels.
- The output of the intermediate DXIC is cascaded to the DXIC that is connected to the recording device.

- The DXIC that is connected to the recording device also receives input from another STIC – four voice channels.
- The E1 link to the recording device contains 31 voice channels.

FLIC

The four-wire line interface card (FLIC) is a line card that interfaces between the digital switching center and five four-wire lines. The FLIC is recommended for use with the digital turret only, although it can be used with the analog turret when there are limited drops with four-to-two conversion on a given four-wire circuit. When the analog turrets are used they do not have separate receive and transmit talkpaths to the turret, as the digital turrets do: therefore, there will be some undesired sidetone added from the digital turret. This will not normally be a problem at a single site on a multi-drop four-wire circuit, but can become a problem when there are multiple such drops on the same four-wire line. The digital turrets have completely separate digital transmit and receive talkpaths to the turret, so there is no potential for additional unwanted sidetone being added to the line.

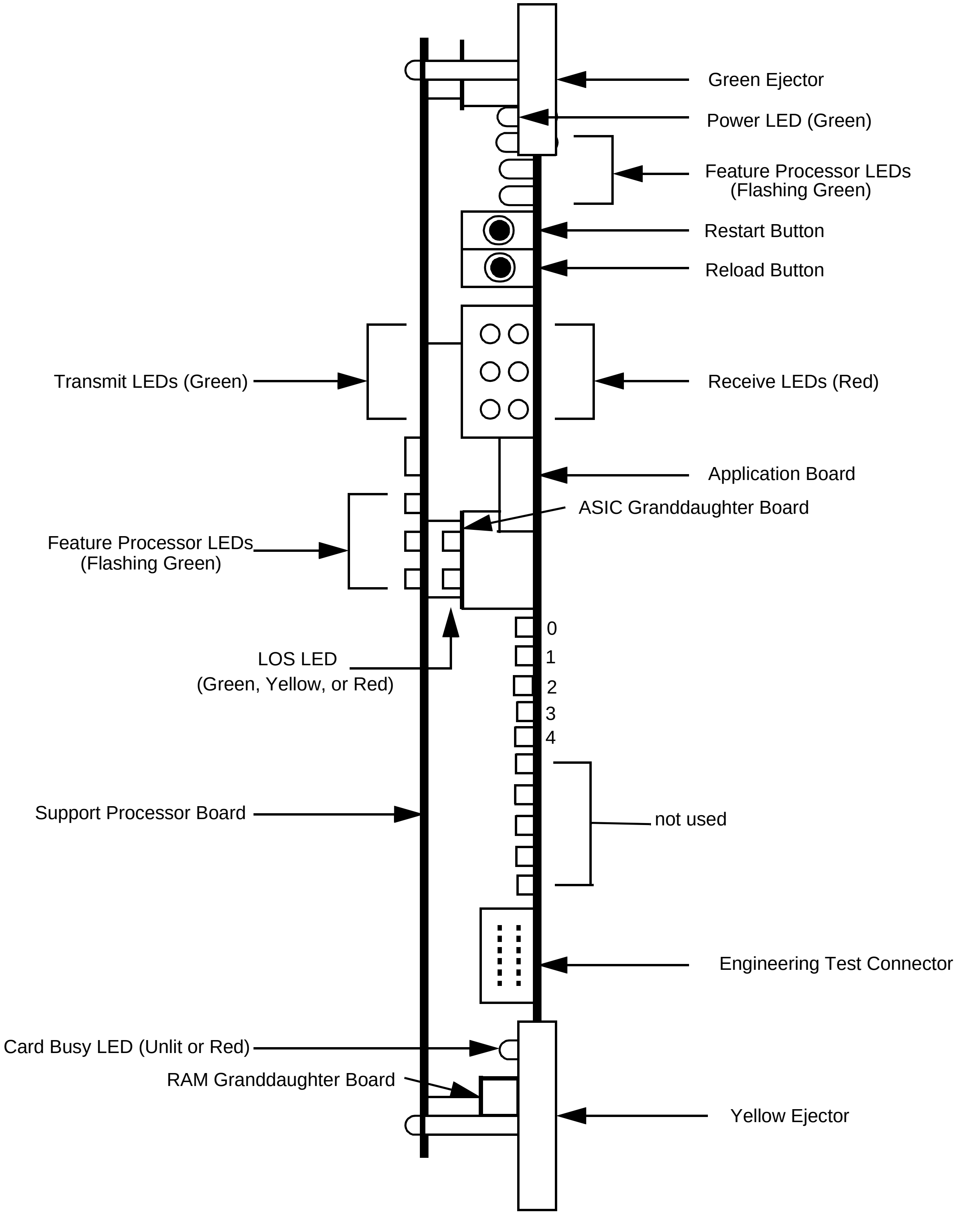
Each FLIC has five ports (lines) numbered 0 to 4. The FLIC performs the following functions:

- interfaces to four-wire (analog) lines
- A/D and D/A conversion of voice
- on/off hook
- lamping

The cards also allow line level adjustments and provide sidetone to the MX handsets. All signals are passed to or from the SELC acting as an access switch in the TU and onwards to the applicable turrets.

The following figure shows the parts of the FLIC.

FIGURE 6-13 FLIC



The card LEDs help you to diagnose problems in your system. The following table describes the LEDs on the FLIC.

TABLE 6-10 FLIC LEDs and Buttons

LEDs and Buttons	Description
Power LED	The power LED is green. This LED is always on to indicate there is power to the ASIC.
Top Three Feature Processor LEDs	The three feature processor LEDs just below the white ejector should normally be flashing green. (This pattern is called the *MX shuffle*.)
Restart Button	When you press the restart button, the card restarts after 10–20 seconds, using information stored on the card. This generates a hardware reset. Use this button when the data on the card is correct. This button does not affect system operation. Pushing this button is equivalent to using the **Restart Card** option from the System Center Application (SycAp) menu. (Select **Maintenance**, **Card**, and **Restart Card**. For more information about the SycAp menu, refer to the *Tradenet MX System Center Manual 14.1*, part number B0086185104.)
Reload Button	When you press the reload button, the card reloads after two–three minutes, using new data and information from the System Center. This generates a non-maskable interrupt. Use this button when there is a problem with the data loaded on the card. This button does not affect system operation. Pushing this button is equivalent to using the **Load Card Processor** option from the System Center Application (SycAp) menu. (Select **Maintenance**, **Card**, and **Load Card Processor**. For more information about the SycAp menu, refer to the *Tradenet MX System Center Manual 14.1*, part number B0086185104.)
3 Pairs of Receive/Transmit LEDs	The green LEDs are the transmit LEDs and the red LEDs are the receive LEDs. These LEDs represent links to the SELCs. There is one receive/transmit pair of LEDs for each SELC to which the ASIC is connected. When the top receive/transmit pair is lit, it indicates the SELC in slot #15 is communicating properly. When the middle pair is lit, it indicates the SELC in slot #16 is communicating properly. When the bottom pair is lit, it indicates the SELC in slot #17 is communicating properly.
Middle Three Feature Processor LEDs	The three feature processor LEDs in the middle of the card should normally be flashing green in the MX shuffle pattern.
ASIC LED	On the ASIC granddaughter card in the center of the card, there is an ASIC LED just above the LOS LED. This LED is normally lit light green and it indicates proper communication between the ASIC and application board.

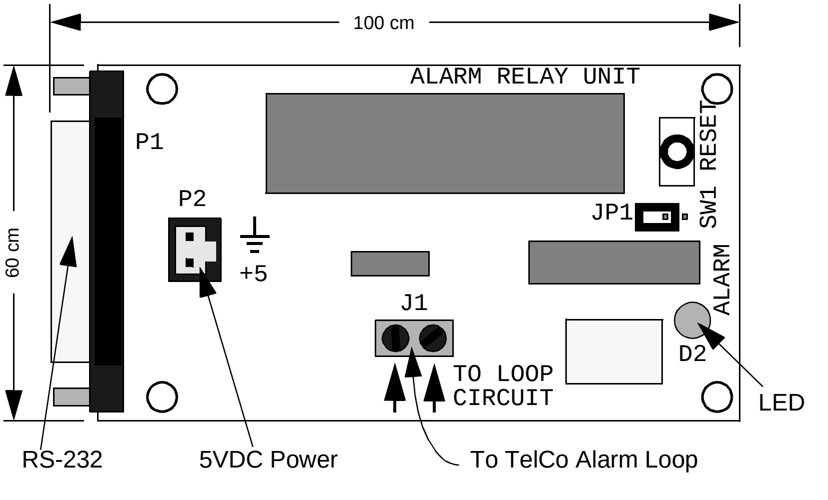
LEDs and Buttons	Description
LOS LED	This LED is normally lit green to indicate the card is loaded. If it is lit yellow, the ASIC is in the process of receiving data from the System Center. If it is lit red, the ASIC is not loaded.
5 Port LEDs	The port LEDs are for the five ports, or lines, on the ASIC. The top port LED is associated with port #1 (offset 0), the second port LED is associated with port #2 (offset 1), and so on. When a port LED is lit red, it indicates the port is active or busy. When a port LED is lit green, it indicates a call is ringing in on that port (line). When a port LED is lit orange, it indicates a single key on a turret or TradePhone MX is selected.
Card Busy LED	Normally, the card busy LED is unlit. If any of the 10 port LEDs are active or busy, the card busy LED is lit red.

French Alarm Board

French-approved MX Systems require that an alarm signal (the opening of a low-voltage loop circuit in the event of an established alarm criteria) be forwarded to the local operating telephone company on a facility provided for this purpose. The conventional Tradenet MX hardware does not support this, so an additional alarm board must be added to each MX System installed in France.

The following figure shows the front view of the French alarm board.

FIGURE 6-14 Front View of the French Alarm Board



The alarm board measures approximately 60 cm by 100 cm (2-3/8 inches by 4 inches).

The alarm circuit is normally a closed circuit. In the event the alarm circuit is open, the operating telephone company will recognize this as a failure or alarm mode. An established criteria of a failure of 25% or more of critical components of the system will cause the alarm board to open this closed loop circuit.

The facility is delivered to the site over the demarcation wiring, using a single pair of wires. This pair of wires connects directly to two screw terminals on the alarm board. A local indication of alarm is a red LED on the board. There is no audible alarm on the alarm board. Normal System Center alarm reporting continues to occur, with the familiar red window for alarms.

The alarm board receives power from a power connection to the backplane, using the sense connector on a backplane to provide the 5 V DC source.

MSIC

The multiple speaker interface card (MSIC) connects remote speakers with the IPC Bridge D/A box. The MSIC provides a digital output link that is used for remote speaker applications. The MSIC provides up to five digital links, each having 24 digital audio channels, that can effectively provide 84 individual speaker channels per MSIC installation. The digital link provided by the MSIC is not a true T1 line and has no bearing on countrybase or installation location, because the digital links provided are internal to the application and are not connected to the telephone network. There is no E1 equivalent required for European installations.

Because the MSIC imposes a heavy traffic load on the system, it requires its own TU, except in the Compact system, where MSICs can be in a TU with other cards. You can have up to four MSICs in a TU, giving you a maximum of 336 speaker channels. The MSIC provides digital link connections from the 25-pair backplane line connectors of the TU. Each digital link requires four copper conductors, so multiple digital links can be routed through a single 25 pair cable.

MSICs can be used in 6-plane systems with three SELCs or in 4-plane systems with two SELCs. A single MSIC can support 84 maximum speaker calls, depending on planes and unique channel requirements.

The MSIC provides up to 5 digital links, each having 24 digital full-duplex audio channels, that are connected to a digital-to-analog converter box (the IPC/Bridge D/A box) to convert the 24 digital channels into 24 full-duplex analog channels. The lines can be used for audio transmission either in one direction or both directions. The analog channels are four conductors providing two discrete paths, one pair for transmitting and one pair for receiving audio, with 600 ohm termination requirements. A variety of analog speaker and microphone applications can then be employed from the output of the MSIC.

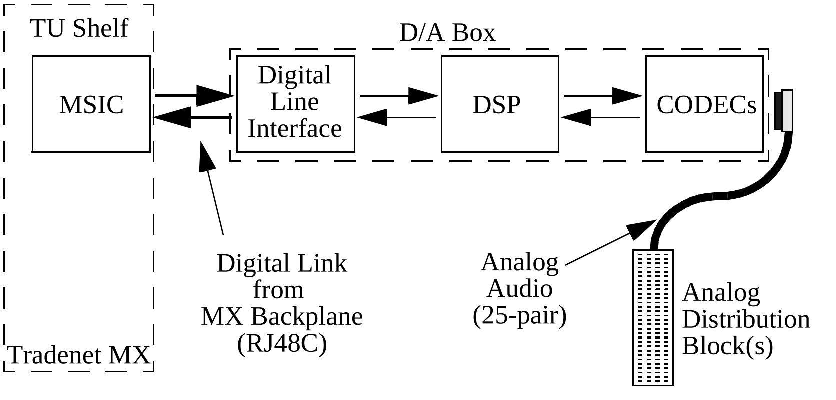
Note *Do not confuse the analog audio channels with a four-wire line. The four conductors for each analog channel includes one discrete pair for transmit and one discrete pair for receive.*

The MSIC’s TU shelf is equipped with the same switch element hardware as other TU shelves. However, because of the traffic requirements for the number of individual speaker calls, and the concentrated number of individual lines being delivered using the MSIC, a special TU shelf is set aside for MSICs. Because of the concentration of speaker channels, this shelf is nearly empty.

Because of the concentration of speakers provided from one MSIC card, it is important to realize the potential for problems in the unlikely event of a failure of the MSIC or its D/A box. There is no MSIC redundancy.

The following figure describes the flow of information in a system with MSICs.

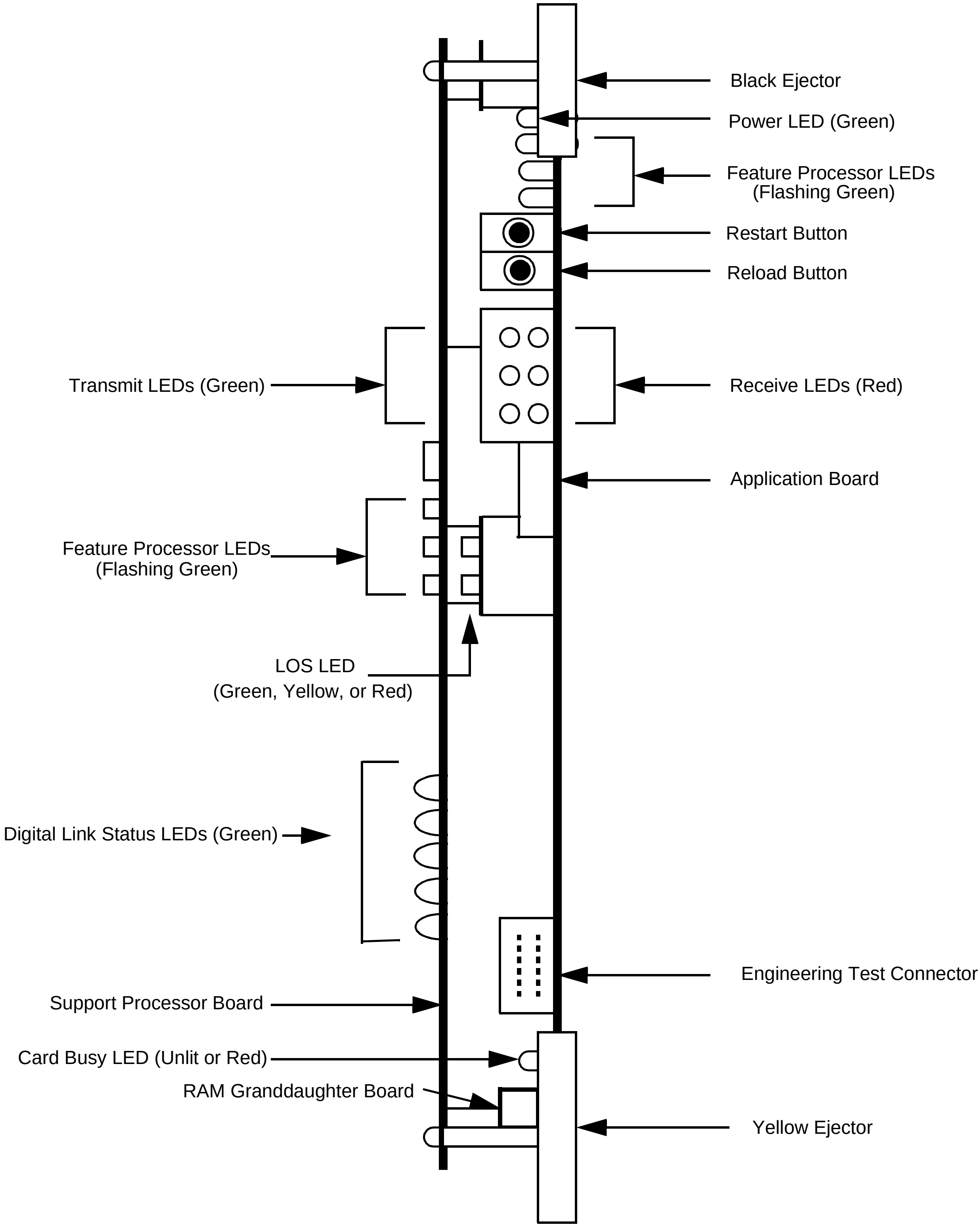
FIGURE 6-15 MSIC and D/A Box Signal Flow



On an MSIC TU, network redundancy is provided in an 6-plane configuration for 84 individual speaker calls. Assuming a single MSIC, in the event of failure of one SELC, 56 ports are fully supported. In 4-plane configurations, network redundancy is provided for 56 individual speaker calls. In this case, if one SELC on that shelf fails, 28 ports are fully supported.

The following figure shows the parts of the MSIC.

FIGURE 6-16 MSIC



The card LEDs help you to diagnose problems in your system. The following table describes the LEDs on the MSIC.

TABLE 6-11 MSIC LEDs and Buttons

LEDs and Buttons	Description
Power LED	The power LED is green. This LED is always on to indicate there is power to the ASIC.
Top Three Feature Processor LEDs	The three feature processor LEDs just below the white ejector should normally be flashing green. (This pattern is called the *MX shuffle*.)
Restart Button	When you press the restart button, the card restarts after 10–20 seconds, using information stored on the card. This generates a hardware reset. Use this button when the data on the card is correct. This button does not affect system operation. Pushing this button is equivalent to using the **Restart Card** option from the System Center Application (SycAp) menu. (Select **Maintenance**, **Card**, and **Restart Card**. For more information about the SycAp menu, refer to the *Tradenet MX System Center Manual 14.1*, part number B0086185104.)
Reload Button	When you press the reload button, the card reloads after two–three minutes, using new data and information from the System Center. This generates a non-maskable interrupt. Use this button when there is a problem with the data loaded on the card. This button does not affect system operation. Pushing this button is equivalent to using the **Load Card Processor** option from the System Center Application (SycAp) menu. (Select **Maintenance**, **Card**, and **Load Card Processor**. For more information about the SycAp menu, refer to the *Tradenet MX System Center Manual 14.1*, part number B0086185104.)
3 Pairs of Receive/Transmit LEDs	The green LEDs are the transmit LEDs and the red LEDs are the receive LEDs. These LEDs represent links to the SELCs. There is one receive/transmit pair of LEDs for each SELC to which the ASIC is connected. When the top receive/transmit pair is lit, it indicates the SELC in slot #15 is communicating properly. When the middle pair is lit, it indicates the SELC in slot #16 is communicating properly. When the bottom pair is lit, it indicates the SELC in slot #17 is communicating properly.
Middle Three Feature Processor LEDs	The three feature processor LEDs in the middle of the card should normally be flashing green in the MX shuffle pattern.
LOS LED	This LED is normally lit green to indicate the card is loaded. If it is lit yellow, the ASIC is in the process of receiving data from the System Center. If it is lit red, the ASIC is not loaded.
5 Digital Link Status LEDs	The MSIC provides five digital links. There is one LED to indicate status for each of the links. Normally, the LED is lit green to indicate the MSIC is linked to the D/A box and at least one station is assigned to a speaker on this link. If this LED is unlit, it indicates the MSIC is not connected, or the MSIC is connected but no speakers are assigned to any stations and the link is idle. If this LED is flashing, it indicates the MSIC is connected but is in an alarm state. Alarms are sent to the System Center.
Card Busy LED	Normally, the card busy LED is unlit. If any of the speakers on any link is assigned to a line, the card busy LED is lit red.

The MSIC is not used for interfacing with the public network because it is not intended to interface to the public telephone network. To allow for speaker expansion at a trader's desk, you can distribute speaker channels by not fully populating a digital link (and its associated D/A box).

The following table describes to what TU slots are connected.

TABLE 6-12 MSIC Relation to Digital Links

MSIC Slot	Digital Links	P28/P26 Line Connector Pins
slot 5	link offsets 0–4	P28 1–20
slot 6	link offsets 0–4	P28 21–40
slot 7	link offsets 0–4	P28 41–50 and P26 1–10
slot 8	link offsets 0–4	P26 11–30
slot 9	up to five more links[a]	P26 31–50

a. These digital link positions are shown for *wiring position* only, not to indicate that there might be more than four MSICs per shelf.

Note *The maximum number of MSICs that you can equip in a single TU is four.*

When you use the DataMan tools to set up your database, the first MSIC is usually placed in slot 5 of the MSIC TU. However, MSIC can be installed in any line card position. Wiring for slots 5–9 is repeated for slots 10–14 (respectively). Refer to the line and wire reports for physical wire connections.

The MSIC provides the digital link which contains 24 voice channels. These 24 voice channels must be converted from digital to analog to use with analog audio components. The IPC Bridge D/A box does this conversion.

The IPC Bridge D/A box (IPC Bridge part number ASSY0010) is shipped with one mini-DIN power connector (for local power). The D/A box is made up of a T1 interface, a DSP, and 24 CODECs. The DSP initializes the T1 chipset according to the DIP switch settings upon reset. The DSP then continuously transfers acoustic data from the T1 chipset to the CODECs and from the CODECs to the T1 chipset. The other function of the DSP is to monitor alarms conditions and to detect loop codes.

Note *Default MX database values employ ESF framing parameters for the (T1) digital link used between the MSIC and the D/A box.*

The IPC Bridge D/A box provides:

- A-D and D-A conversion for 24 channels of a T1-type digital link
- 24 line-level 600 ohm two-pair (one pair transmit, one pair receive) analog interfaces
- DIP switch configurable for various T1 interfaces
- D4 and ESF framing
- AMI and B8ZS zero code suppression
- signaling bits forced to all 1s or all 0s

- red and yellow alarm LED indicators for digital link status
- local or remote power

The D/A box is 9.75 inches (24.8 cm) wide and 2.375 inches (6.0 cm) tall. The case measures 8.75 in. (22.0 cm) deep but requires approximately 11 inches (28.0 cm) depth to include rear cable connections. The D/A box is in a black metal enclosure with rubber feet.

Resetting the D/A box interrupts audio on the channels provided by that D/A box, but it re-synchronizes and re-establishes audio within a second or two.

If the D/A box detects a loss of signal or a loss of synchronization (LOS), it lights the red alarm LED and transmits a yellow alarm to the distant end. The D/A box must have clock synchronization for two seconds before it comes out of this alarm state.

If the D/A box detects a yellow alarm from the distant end it lights the yellow alarm LED. The D/A box must have clock synchronization for two seconds before it comes out of this alarm state.

The D/A box has the ability to detect loop up and loop down codes. This feature is useful for diagnostics, although it is generally not used for MSIC implementation. If the D/A box receives a loop up code from the far end, it loops back (remote loop back) the link input such that the far end gets back whatever it transmits. The loop up code must be present for five seconds before the D/A box loops back the digital link. If the loop down code is received for five seconds, the digital link is taken out of loopback.

Note *Only a loop down code, a receive carrier loss (RCL), or a power down takes the unit out of a loop up state.*

For more information about loop up and loop down, contact IPC Bridge or IPC Systems Support Engineering.

The LEDs on the D/A box are labeled on the front panel. The following table describes the LEDs on the D/A box.

TABLE 6-13 D/A Box LED

Label	Purpose
DSP or HB	This LED is green and represents the heart beat of the DSP. This LED should flash at a steady rate.
PWR	This LED is green and indicates power status to the D/A box. This LED is normally lit steady green.
YA	This LED is yellow and is the yellow alarm for T1/digital link; that is, it indicates yellow alarm is being received from the far end.) This LED is yellow.
RA	Red Alarm for T1/digital link. (Indicates LOS or RCL and that yellow alarm is being transmitted to the far end.) This LED is red.

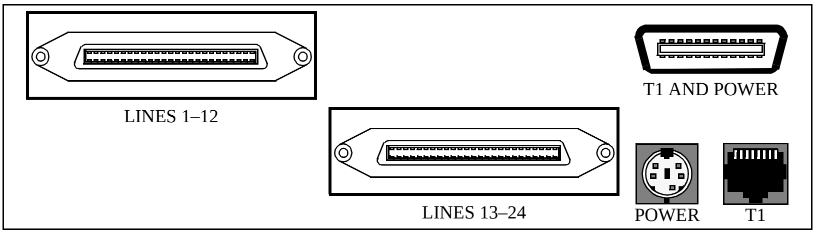
Note *Remote loop back is indicated by the RA and the YA LEDs blinking simultaneously.*

The rear panel of the D/A box has the following connections:

- T1 AND POWER—Amp Champ 12-pair male connector
- POWER—Mini-DIN 5-pin connector (two conductors used)
- T1—RJ48C input 8-position modular jack, non-keyed

- LINES 1–12—Amp 25-pair female connector w/ velcro restraint
- LINES 13–24—Amp 25-pair female connector w/ velcro restraint

FIGURE 6-17 D/A Box Rear Panel Connectors



The D/A box provides a total of 48 analog audio connections (24 discrete bi-directional ports), each providing a 600 ohm termination. The audio inputs and outputs are silenced under the following conditions:

- during RESET or power up cycle (usually lasts a second or two)
- the reception of receive carrier loss (RCL)
- the reception of loss of synchronization (LOS)
- the reception of yellow alarm on the digital link
- during remote loop back mode

Two 25-pair analog output connectors are provided on the back of the D/A box, for lines 1–12 and lines 13–24, by two female amphenol connectors. Each 25-pair connector provides a total of 24 audio outputs (12 discrete pairs of analog transmit and analog receive) with 600 ohm termination.

FIGURE 6-18 LINES 1–12 Connector Pinout

66-Block Clip	25-Pr Cable Color Code	25-pr/Amp Pin-out	Lead Designation	Connects to
1	WHT BLU	26	Tx1T	Mic 1
2	BLU WHT	1	Tx1R	
3	WHT ORG	27	Rv1T	Speaker 1
4	ORG WHT	2	Rv1R	
5	WHT GRN	28	Tx2T	Mic 2
6	GRN WHT	3	Tx2R	
7	WHT BRN	29	Rv2T	Speaker 2
8	BRN WHT	4	Rv2R	
9	WHT SLT	30	Tx3T	Mic 3
10	SLT WHT	5	Tx3R	
11	RED BLU	31	Rv3T	Speaker 3
12	BLU RED	6	Rv3R	
13	RED ORG	32	Tx4T	Mic 4
14	ORG RED	7	Tx4R	
15	RED GRN	33	Rv4T	Speaker 4
16	GRN RED	8	Rv4R	
17	RED BRN	34	Tx5T	Mic 5
18	BRN RED	9	Tx5R	
19	RED SLT	35	Rv5T	Speaker 5
20	SLT RED	10	Rv5R	
21	BLK BLU	36	Tx6T	Mic 6
22	BLU BLK	11	Tx6R	
23	BLK ORG	37	Rv6T	Speaker 6
24	ORG BLK	12	Rv6R	
25	BLK GRN	38	Tx7T	Mic 7
26	GRN BLK	13	Tx7R	
27	BLK BRN	39	Rv7T	Speaker 7
28	BRN BLK	14	Rv7R	
29	BLK SLT	40	Tx8T	Mic 8
30	SLT BLK	15	Tx8R	
31	YEL BLU	41	Rv8T	Speaker 8
32	BLU YEL	16	Rv8R	
33	YEL ORG	42	Tx9T	Mic 9
34	ORG YEL	17	Tx9R	
35	YEL GRN	43	Rv9T	Speaker 9
36	GRN YEL	18	Rv9R	
37	YEL BRN	44	Tx10T	Mic 10
38	BRN YEL	19	Tx10R	
39	YEL SLT	45	Rv10T	Speaker 10
40	SLT YEL	20	Rv10R	
41	VIO BLU	46	Tx11T	Mic 11
42	BLU VIO	21	Tx11R	
43	VIO ORG	47	Rv11T	Speaker 11
44	ORG VIO	22	Rv11R	
45	VIO GRN	48	Tx12T	Mic 12
46	GRN VIO	23	Tx12R	
47	VIO BRN	49	Rv12T	Speaker 12
48	BRN VIO	24	Rv12R	
49	VIO SLT	50		n/c
50	SLT VIO	25		

The lines 13–24 connector on the D/A box is similar to the lines 1–12 connector. Its wiring pinout is as follows.

FIGURE 6-19 LINES 13–24 Connector Pinout

66-Block Clip	25-Pr Cable Color Code	25-pr/Amp Pin-out	Lead Designation	Connects to
1	WHT BLU	26	Tx13T	Mic 13
2	BLU WHT	1	Tx13R	
3	WHT ORG	27	Rv13T	Speaker 13
4	ORG WHT	2	Rv13R	
5	WHT GRN	28	Tx14T	Mic 14
6	GRN WHT	3	Tx14R	
7	WHT BRN	29	Rv14T	Speaker 14
8	BRN WHT	4	Rv14R	
9	WHT SLT	30	Tx15T	Mic 15
10	SLT WHT	5	Tx15R	
11	RED BLU	31	Rv15T	Speaker 15
12	BLU RED	6	Rv15R	
13	RED ORG	32	Tx16T	Mic 16
14	ORG RED	7	Tx16R	
15	RED GRN	33	Rv16T	Speaker 16
16	GRN RED	8	Rv16R	
17	RED BRN	34	Tx17T	Mic 17
18	BRN RED	9	Tx17R	
19	RED SLT	35	Rv17T	Speaker 17
20	SLT RED	10	Rv17R	
21	BLK BLU	36	Tx18T	Mic 18
22	BLU BLK	11	Tx18R	
23	BLK ORG	37	Rv18T	Speaker 18
24	ORG BLK	12	Rv18R	
25	BLK GRN	38	Tx19T	Mic 19
26	GRN BLK	13	Tx19R	
27	BLK BRN	39	Rv19T	Speaker 19
28	BRN BLK	14	Rv19R	
29	BLK SLT	40	Tx20T	Mic 20
30	SLT BLK	15	Tx20R	
31	YEL BLU	41	Rv20T	Speaker 20
32	BLU YEL	16	Rv20R	
33	YEL ORG	42	Tx21T	Mic 21
34	ORG YEL	17	Tx21R	
35	YEL GRN	43	Rv21T	Speaker 21
36	GRN YEL	18	Rv21R	
37	YEL BRN	44	Tx22T	Mic 22
38	BRN YEL	19	Tx22R	
39	YEL SLT	45	Rv22T	Speaker 22
40	SLT YEL	20	Rv22R	
41	VIO BLU	46	Tx23T	Mic 23
42	BLU VIO	21	Tx23R	
43	VIO ORG	47	Rv23T	Speaker 23
44	ORG VIO	22	Rv23R	
45	VIO GRN	48	Tx24T	Mic 24
46	GRN VIO	23	Tx24R	
47	VIO BRN	49	Rv24T	Speaker 24
48	BRN VIO	24	Rv24R	
49	VIO SLT	50		n/c
50	SLT VIO	25		

The D/A box operates from 48 V DC @ 150 mA. Power can be connected using either the POWER connector (mini-DIN), or if using remote power connections, using the T1 AND POWER connector. Because of the low power consumption, heat and ventilation considerations for the D/A box installations are minimal.

The D/A box can be connected for remote power or local power. If remote power is used, then the remote power connector (an AMP Champ 12-pair connector) is used to connect both power and the digital link to the D/A box. If local power is used, then the local power connector (mini DIN) should be used for power and the RJ48C for the digital link.

Local power is connected to the POWER connector on the back of the D/A box using a mini-DIN connector, which is provided with the D/A box.

TABLE 6-14 D/A Box Mini-DIN Connector

DIN Pin #	Pin function
1	48 V DC
2	not connected
3	48 V DC return
4	48 V DC
5	48 V DC return

Note *If using the T1 AND POWER connector, do **not** use the local POWER connector and do **not** use the T1 connector.*

The D/A box can be powered remotely using the 12-pair Amp Champ connection to the rear of the D/A box. This 12-pair connection also contains the digital link connection.

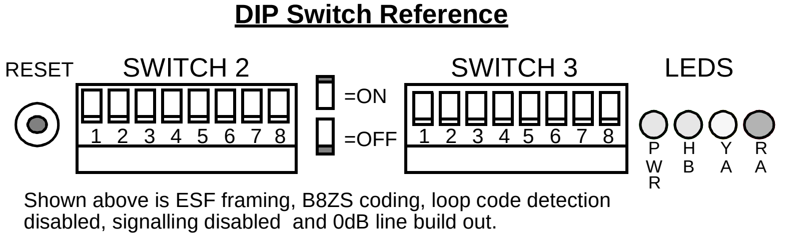
TABLE 6-15 D/A Box Connections

Pin Name	Pin #	Pin Name	Pin #
T1 Out Tip	1	T1 Out Ring	13
T1 In Tip	2	T1 In Ring	14
n/c	3	n/c	15
n/c	4	n/c	16
n/c	5	n/c	17
n/c	6	n/c	18
48 V DC	7	48 V DC Return	19
48 V DC	8	48 V DC Return	20
48 V DC	9	48 V DC Return	21
48 V DC	10	48 V DC Return	22
48 V DC	11	48 V DC Return	23
48 V DC	12	48 V DC Return	24

Note *If using the T1 AND POWER connector, do **not** use the local POWER connector and do **not** use the T1 connector.*

DIP switches are provided on the front panel of the D/A box for configuration settings. The DIP switches are read upon reset only. If the DIP switches are changed, the RESET button must be pressed for the new settings to take effect. Below are the default DIP switch settings on the D/A box, for MSIC applications, using ESF (MX default), shown in these tables in **bold** typeface: *TABLE 6-16 DIP Switch 2 Options* on page 6-47, *TABLE 6-17 DIP Switch 3 Options* on page 6-48, and *TABLE 6-18 Line Build-Out Options of DIP Switch 3* on page 6-48.

FIGURE 6-20 Default DIP Switch Settings for MSIC



DIP switch 2 is an 8-switch package. Its switches configure the digital link parameters.

TABLE 6-16 DIP Switch 2 Options

Switch 2	Function	ON	OFF
8	Framing Select	D4	**ESF**
7	Zero Code Suppression	AMI	**B8ZS**
6	Force Signaling Bits (ones or zeroes)	SIG BITS=1s	**SIG BITS=0s**
5	Loop Code Detection	Enabled	**Disabled**
4	Robbed Bit Signaling	Enabled	**Disabled**
3	Yellow Alarm Type (D4 Only, see text)	Standard	**Frame Bits**
2	Not Used		**x**
1	Not Used		**x**

TABLE 6-17 DIP Switch 3 Options

Switch 3	Switch Name	ON	OFF
8	Not Used		**X**
7	Not Used		**X**
6	Not Used		**X**
5	Not Used		**X**
4	Mod for Rev. 01 D/A Box (4db mod) only	Rev. -01 only	**Normal**
3	Line Build Out 0 (see *TABLE 6-18 Line Build-Out Options of DIP Switch 3* on page 6-48)	1	**0**
2	Line Build Out 2 (see *TABLE 6-18 Line Build-Out Options of DIP Switch 3* on page 6-48)	1	**0**
1	Line Build Out 2 (see *TABLE 6-18 Line Build-Out Options of DIP Switch 3* on page 6-48)	1	**0**

DIP settings on switch 3 affect the line length of the digital link.

TABLE 6-18 Line Build-Out Options of DIP Switch 3

SW3-3	SW3-2	SW3-1	Line Length of Digital Link
0	**0**	**0**	0 to 133 feet / CSU 0dB / **MSIC**
0	0	1	133-266 feet
0	1	0	266-399 feet
0	1	1	399-533 feet
1	0	0	533-655 feet
1	0	1	CSU –7.5dB
1	1	0	CSU –15dB
1	1	1	CSU –22dB

Other applications for the D/A box can use other DIP3 settings (future only).

The MSICs, in one direction, are connected to the MX by way of the MX backplane/system’s bus and in turn to SELCs acting as access switches. In the other direction, the MSIC is connected to some number of D/A boxes by way of digital links.

Note *The digital links on the MSIC are for internal use only and are not suitable for interfacing directly to a central office (CO).*

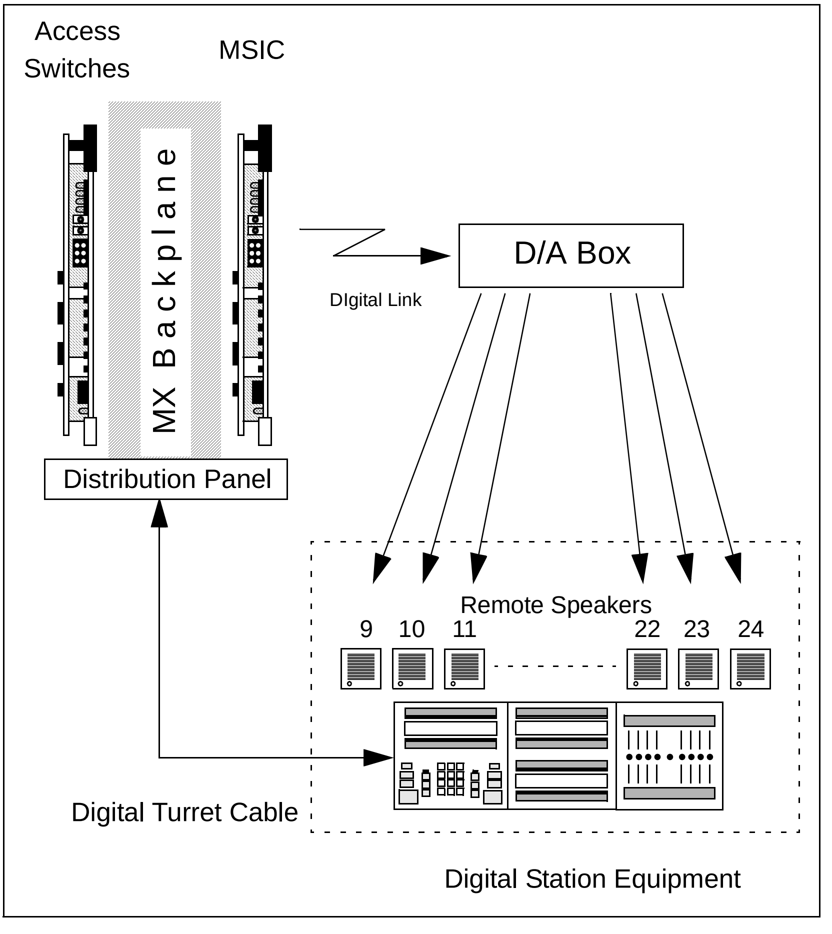
The output of the D/A boxes are connected to the remote speakers which are distributed to the station desk locations. The number of remote speakers installed at each station is variable and can range from none to 24.

In addition to the MSIC to remote speaker path, there is the MX to station equipment path. In the latter case, the MX is connect to the individual stations in traditional fashion: distribution panel to the station modules by way of the turret cable.

Note *The MSIC data/voice path is not connected, in any physical or electrical way, to the MX station equipment data/voice path.*

The following figure shows a simplified view of the MSIC, shown with a speaker module. Notice that the individual speakers listed start at number 9, which would be the case if an 8-channel Tradenet MX speaker module were also used for this turret position.

FIGURE 6-21 MSIC Application, Simplified View



While the remote speakers and the station equipment are physically in the same location, the data/voice paths are different.

Note *If the BRIC/MSIC loads while the i_remote_speaker table is being saved, the remote speaker data might not be downloaded to the card.*

NEMC, NESC, NTMC, NTSC

The networking cards are used for the line networking feature. The networking card supports up to 30 E1 channels or 24 T1 channels and can be either master or slave. The networking card has four different configurations:

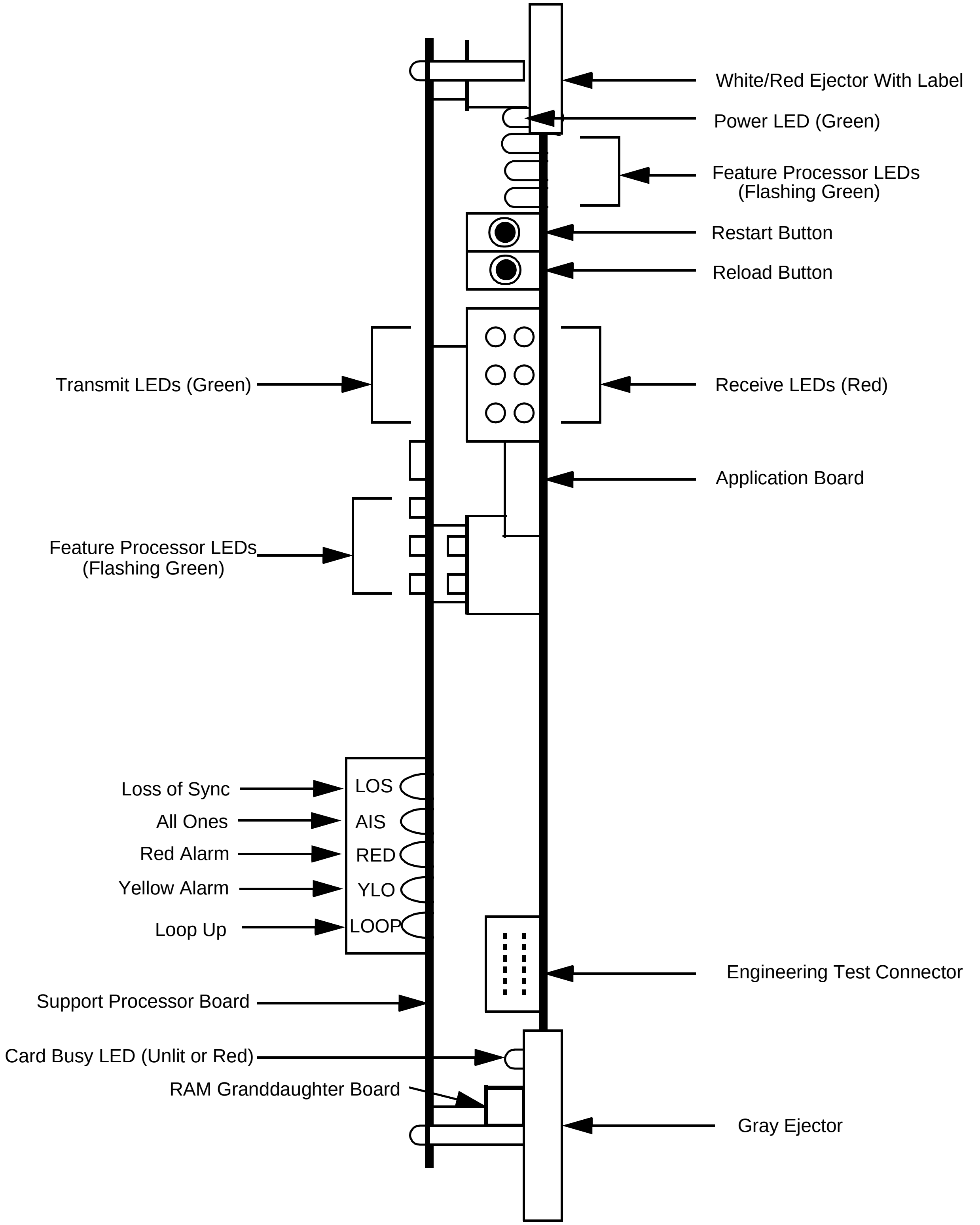
- NTMC—T1 where the connection is master
- NTSC—T1 where the connection is slave
- NEMC—E1 where the connection is master
- NESC—E1 where the connection is slave

Master cards provide clock source, slave cards get their clocking from the master source. Tradenet MX Systems normally get their clock source from the CO. Therefore, in general, you should not need T1 or E1 master networking cards, only T1 and E1 slave cards. The T1 master cards look identical to the T1 slave cards, except for the stamp on the ejector. Likewise, for E1 master and slave cards.

You cannot mix T1 and E1 networking cards on the same TU.

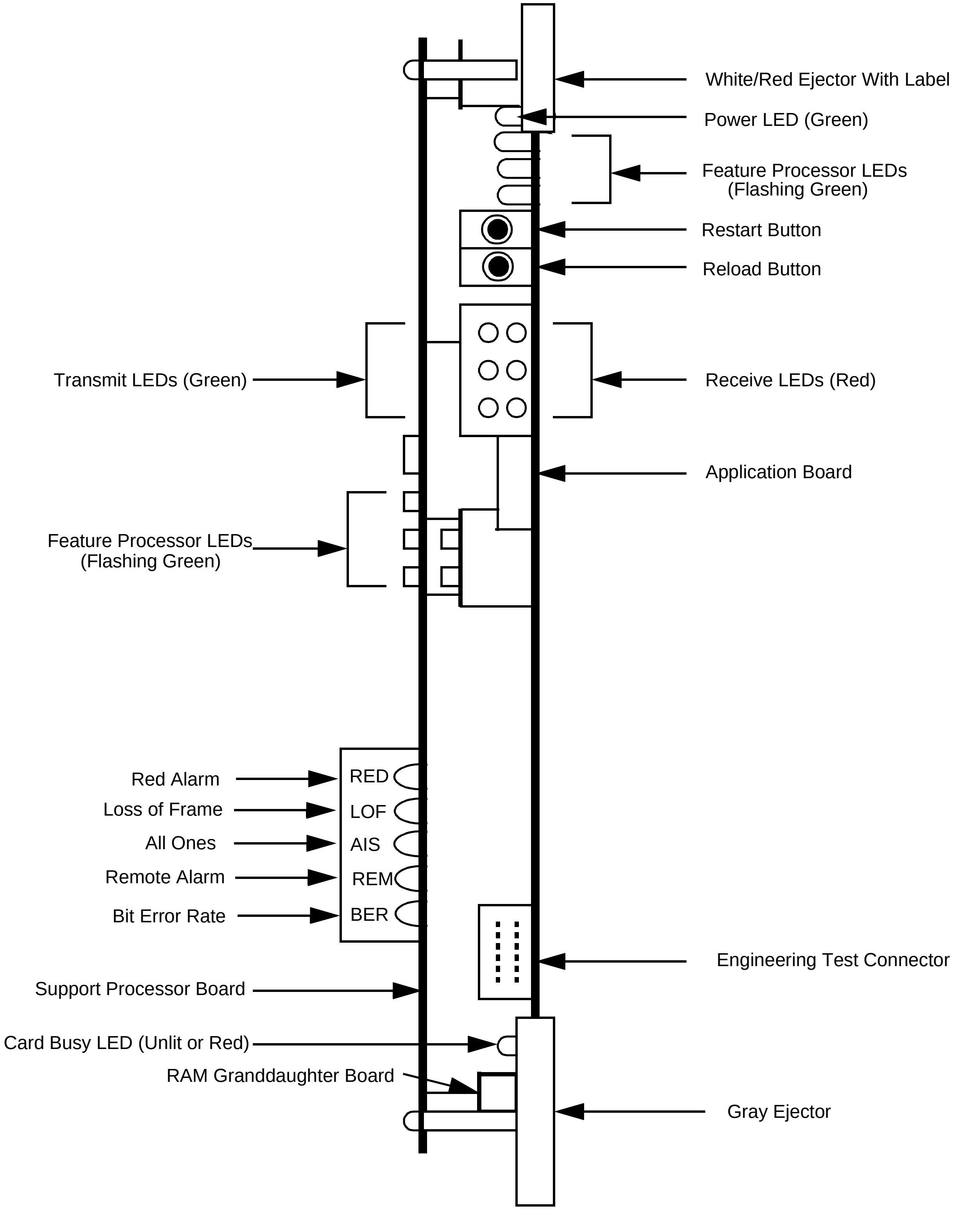
The following figure shows the parts of the T1 master/slave networking card.

FIGURE 6-22 T1 Master/Slave Networking Card



The following figure shows the parts of the E1 master/slave networking card.

FIGURE 6-23 E1 Master/Slave Networking Card



The card LEDs help you to diagnose problems in your system. The following table describes the LEDs on the networking card.

TABLE 6-19 Networking Card LEDs and Buttons

LEDs and Buttons	Description
Power LED	The power LED is green. This LED is always on to indicate there is power to the card.
Top Three Feature Processor LEDs	The three feature processor LEDs just below the white ejector should normally be flashing green. (This pattern is called the *MX shuffle*.)
Restart Button	When you press the restart button, the card restarts after 10–20 seconds, using information stored on the card. This generates a hardware reset. Use this button when the data on the card is correct. This button does not affect system operation. Pushing this button is equivalent to using the **Restart Card** option from the System Center application menu. (Select **Maintenance**, **Card**, and **Restart Card**. For more information about the SycAp menu, refer to the *Tradenet MX System Center Manual 14.1*, part number B0086185104.)
Reload Button	When you press the reload button, the card reloads after 2–3 minutes, using new data from the System Center. This generates a non-maskable interrupt. Use this button when there is a problem with the data loaded on the card. This button does not affect system operation. Pushing this button is equivalent to using the **Load Card Processor** option from the System Center Application (SycAp) menu. (Select **Maintenance**, **Card**, and **Load Card Processor**. For more information about the SycAp menu, refer to the *Tradenet MX System Center Manual 14.1*, part number B0086185104.)
Three Pairs of Receive/Transmit LEDs	The green LEDs are the transmit LEDs and the red LEDs are the receive LEDs. These LEDs represent links to the SELCs. There is one receive/transmit pair of LEDs for each SELC to which the ASIC is connected. When the top receive/transmit pair is lit, it indicates the SELC in slot #15 is communicating properly. When the middle pair is lit, it indicates the SELC in slot #16 is communicating properly. When the bottom pair is lit, it indicates the SELC in slot #17 is communicating properly.
Middle Three Feature Processor LEDs	If present, the three feature processor LEDs in the middle of the card should normally be flashing green in the MX shuffle pattern.
(T1) LOS, AIS, RED, YLO, LOOP (E1) RED, LOF, AIS, REM, BER	If the database does not match the hardware installed, these five LEDs will blink in a walking pattern.
Card Busy LED	Normally, the card busy LED is unlit. If any channel on any link is in use to a line, the card busy LED is lit green.

PLIC

There are two basic analog line interface cards, the analog line interface card (ALIC) for common battery (dialtone) lines, and the private line interface card (PLIC) for dry private lines. (See *ALIC* on page 6-13.) PLICs do not initiate voice paths, but voice paths are their destination. The 7.68 mbits from the access switch cards are converted by a dedicated link interface integrated circuit to a 6.144 MHz data stream that is fed through the switch port of the card. There, channels containing data packets are switched to the feature processors for control purposes, and the voice channels are switched on to the DSP. If a multi-party conference is involved on any channel, the DSP compresses the resulting greater-than-13-bit-word back to 13 bits nominal magnitude. Any other digital processing is also handled by the DSP. Because of this, it is possible for IPC Engineering to alter levels by changing simple algorithms. After the DSP processes the 6.144 MHz data stream (which will contain some empty channels), it provides a 2.048 MHz m-law data stream as its output.

Dual subscriber line access circuits (DSLACs) terminate the 2.048 MHz data stream from the DSP. Each DSLAC codes and decodes each of two channels to a two-wire analog voice circuit. The two-wire analog voice circuit is provided to the public network using a transformer and a complex impedance circuit. The complex impedance circuit is formed in part by discrete terminating components and in part by digital manipulation performed by the DSLAC.

On PLICS, ring generator switching circuits are incorporated as part of the line termination. You can dial on the network in one of two ways: *dual tone multi-frequency* (DTMF), used throughout North America, and by truck carriers and pax elsewhere; and *dial pulse* (also called *out pulse* in the USA and *loop disconnect* in the UK).

The PLIC and the ALIC are physically identical (except for the color of the top ejector).

The PLIC is a line card that interfaces between the digital switching center and 10 private lines. PLICs are used with dry manual lines (no loop current present). Each card has 10 ports (lines) numbered 0 to 9. A ring generator in the cabinet or triplet supplies ring to the PLIC.

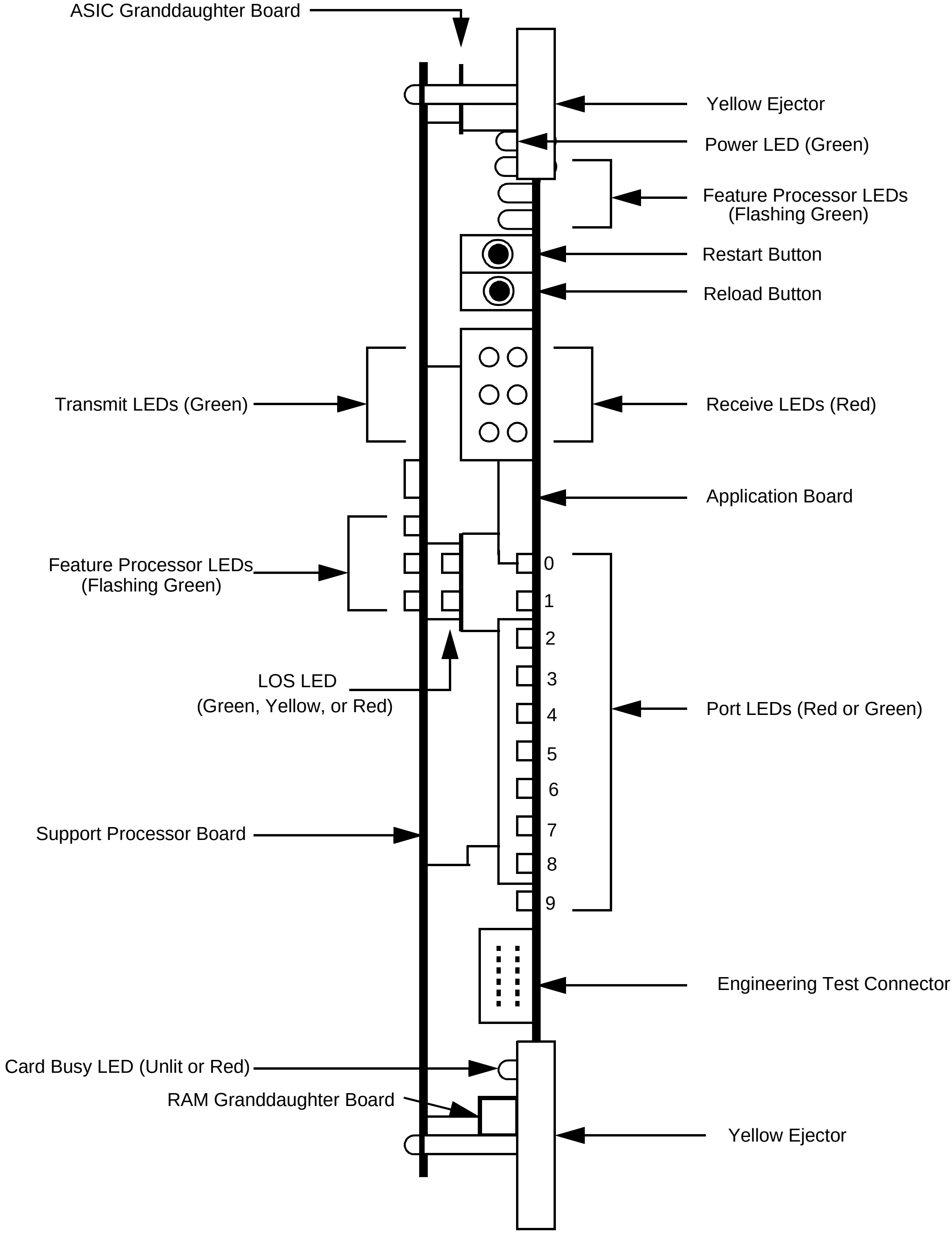
The PLIC performs the following functions:

- interfaces to manual ringdown lines (known as Figure#2 in the UK)
- A/D and D/A conversion of voice
- ring detection
- hold
- on/off hook
- lamping
- signaling—automatic and manual

All signals are passed to or from the SELC acting as an access switch in the TU and onwards to the applicable turrets.

The following figure shows the parts of the PLIC.

FIGURE 6-24 PLIC



The card LEDs help you to diagnose problems in your system. The LEDs are as follows starting at the top LED:

TABLE 6-20 PLIC LEDs and Buttons

LEDs and Buttons	Description
Power LED	The power LED is green. This LED is always on to indicate there is power to the PLIC.
Top Three Feature Processor LEDs	The three feature processor LEDs just below the white ejector should normally be flashing green. (This pattern is called the *MX shuffle*.)
Restart Button	When you press the restart button, the card restarts after 10–20 seconds, using information stored on the card. This generates a hardware reset. Use this button when the data on the card is correct. This button does not affect system operation. Pushing this button is equivalent to using the **Restart Card** option from the System Center Application (SycAp) menu. (Select **Maintenance**, **Card**, and **Restart Card**. For more information about the SycAp menu, refer to the *Tradenet MX System Center Manual 14.1*, part number B0086185104.)
Reload Button	When you press the reload button, the card reloads after two–three minutes, using new data and information from the System Center. This generates a non-maskable interrupt. Use this button when there is a problem with the data loaded on the card. This button does not affect system operation. Pushing this button is equivalent to using the **Load Card Processor** option from the System Center Application (SycAp) menu. (Select **Maintenance**, **Card**, and **Load Card Processor**. For more information about the SycAp menu, refer to the *Tradenet MX System Center Manual 14.1*, part number B0086185104.)
3 Pairs of Receive/Transmit LEDs	The green LEDs are the transmit LEDs and the red LEDs are the receive LEDs. These LEDs represent links to the SELCs. There is one receive/transmit pair of LEDs for each SELC to which the ALIC is connected. When the top receive/transmit pair is lit, it indicates the SELC in slot #15 is communicating properly. When the middle pair is lit, it indicates the SELC in slot #16 is communicating properly. When the bottom pair is lit, it indicates the SELC in slot #17 is communicating properly.
Middle Three Feature Processor LEDs	The three feature processor LEDs in the middle of the card should normally be flashing green in the MX shuffle pattern.
ASIC LED	On the ASIC granddaughter card in the center of the card, there is an ASIC LED just above the LOS LED. This LED is normally lit light green and it indicates proper communication between the ASIC and application board.

LEDs and Buttons	Description
LOS LED	This LED is normally lit green to indicate the card is loaded. If it is lit yellow, the PLIC is in the process of receiving data from the System Center. If it is lit red, the PLIC is not loaded.
10 Port LEDs	The port LEDs are for the 10 ports, or lines, on the PLIC. The top port LED is associated with port #1 (offset 0), the second port LED is associated with port #2 (offset 1), and so on. When a port LED is lit light red, it indicates the port is active or busy. When a port LED is lit light green, it indicates a call is ringing in on that port (line). When a port LED is lit light orange, it indicates the signal key on the turret was selected.
Card Busy LED	Normally, the card busy LED is unlit. If any of the 10 port LEDs are active or busy, the card busy LED is lit red.

QSIC

The QSIC is a CPIC with a different software load (QSIP). The QSIC provides the interface between a QSIG PBX and the MX System. The QSIC layout and its LEDs are equivalent to those on the CPIC. (See *CPIC* on page 6-18.)

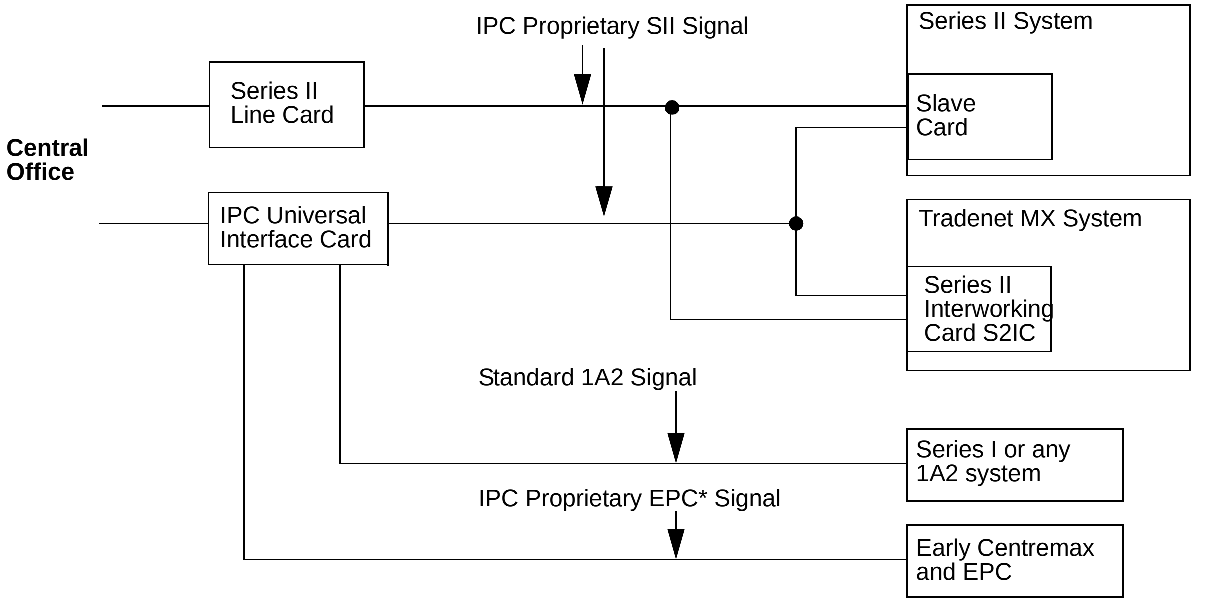
S2IC

Series II interworking cards (S2IC) can be used to translate between Tradenet MX equipment and Tradenet or Series II equipment. The S2ICs do not directly interface with outside telephone lines, rather they interface with installer-defined lines already terminated on Series II or Tradenet line cards, or on IPC universal interface cards. The Series II and universal line cards do not provide a safety barrier on the line card, unlike Tradenet MX line cards, so this barrier is provided on the S2ICs. The Series II dialtone line card (S2DC) handles 10 dialtone lines, and the Series II private line card (S2PC) handles 10 manual ringdown lines. These cards are functionally interchangeable Series II interworking cards (S2IW), except that S2PCs and S2DCs do not support mixing of line types on a single card.

In a Series II or Tradenet system, the S2DCs and S2PCs act as a turret, allowing direct access to lines terminated on Series II-compatible line cards. The S2DCs and S2PCs can also be used to access lines terminated on the IPC universal interface card. This allows the MX System to share lines with Series I, early Centremax, and other IPC products, as well as with any 1A2-compatible products from other manufacturers. In addition, variations on the universal line card are available to share lines with certain products, from other manufacturers, that are not 1A2 compatible: Contact IPC Systems Support Engineering for further information.

Note *Because earlier IPC products cannot select a line from the MX System, it is not cost efficient to terminate lines on the MX System and then hand them off to the earlier systems through an S2DC or S2PC. Therefore, lines can be terminated on Series II only and bridged to the MX System. Lines* ***cannot*** *be terminated on the MX System and bridged to Series II.*

FIGURE 6-25 S2PC or S2DC Card Usage



*EPC (Exchange Phone Conversion) was the keyset system developed before Centremax, and was based on the Exchangefone. EPC used a signalling convention like 1A2, but with DC voltages only, to signal between the line cards and the station equipment. Early CentreMax also used this convention.

The S2DC and S2PC can be plugged into any spare line card slot on the TU. It replaces a standard ALIC or PLIC. The S2DCs and S2PCs both provide and detect the *common mode voltage* used in Series II to communicate between the line card and the station equipment. This voltage is a DC level, referenced to ground, that is imposed equally on both tip and ring, or common mode. The line cards and station equipment send each other different common mode voltages to define the status of the line and to control the line status. These voltages are arranged so that any station can always override any line status voltage from a line card, to command the line card to seize the line.

The S2DC and S2PC is connected in parallel to the OUTS of the existing Series II line cards or universal line interface cards. When a Series II turret accesses a line, the common mode voltage change is detected by the S2IC, which signals the turrets on the MX System. If a turret in the MX System accesses a line, it generates the proper common mode voltage that signals the Series II turret.

The S2DC and S2PC provide and read Series II signalling to perform the following functions on Series II line cards or on universal interface cards:

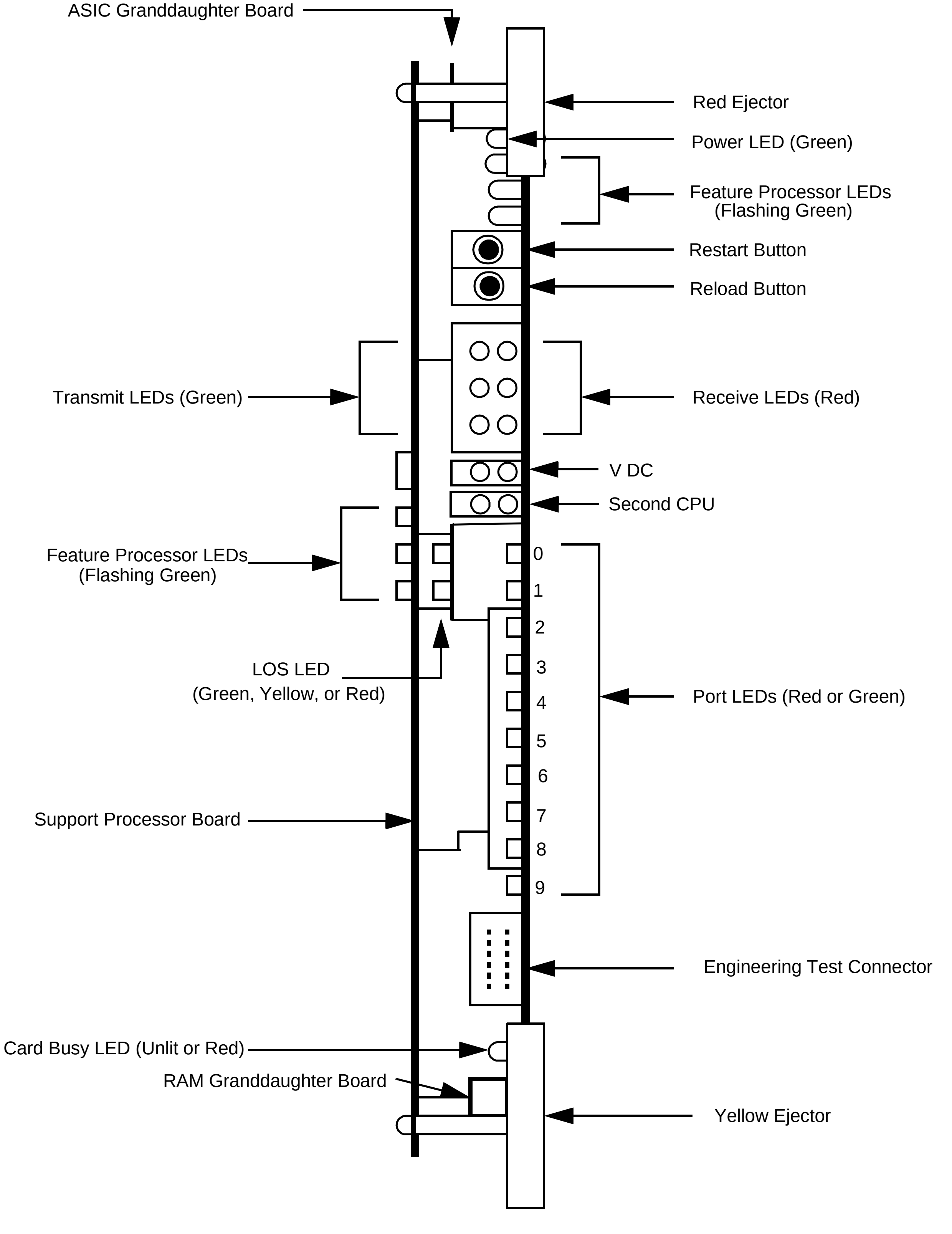
- analog voice communication
- ring detection
- common lamping and call supervision

- hold
- on/off hook
- ring generation

The S2DC and S2PC convert the analog Series II signal to digital control as used in the MX System. All signals are passed to or from the SELC acting as an access switch in the TU and onwards to the applicable turrets.

The following figure shows the parts of the S2DC and S2PC.

FIGURE 6-26 S2DC and S2PC



The card LEDs help you to diagnose problems in your system. The LEDs are as follows starting at the top LED:

TABLE 6-21 S2DC and S2PC LEDs and Buttons

LEDs and Buttons	Description
Power LED	The power LED is green. This LED is always on to indicate there is power to the PLIC.
Top Three Feature Processor LEDs	The three feature processor LEDs just below the white ejector should normally be flashing green. (This pattern is called the *MX shuffle*.)
Restart Button	When you press the restart button, the card restarts after 10–20 seconds, using information stored on the card. This generates a hardware reset. Use this button when the data on the card is correct. This button does not affect system operation. Pushing this button is equivalent to using the **Restart Card** option from the System Center Application (SycAp) menu. (Select **Maintenance**, **Card**, and **Restart Card**. For more information about the SycAp menu, refer to the *Tradenet MX System Center Manual 14.1*, part number B0086185104.)
Reload Button	When you press the reload button, the card reloads after two–three minutes, using new data and information from the System Center. This generates a non-maskable interrupt. Use this button when there is a problem with the data loaded on the card. This button does not affect system operation. Pushing this button is equivalent to using the **Load Card Processor** option from the System Center Application (SycAp) menu. (Select **Maintenance**, **Card**, and **Load Card Processor**. For more information about the SycAp menu, refer to the *Tradenet MX System Center Manual 14.1*, part number B0086185104.)
3 Pairs of Receive/Transmit LEDs	The green LEDs are the transmit LEDs and the red LEDs are the receive LEDs. These LEDs represent links to the SELCs. There is one receive/transmit pair of LEDs for each SELC to which the ALIC is connected. When the top receive/transmit pair is lit, it indicates the SELC in slot #15 is communicating properly. When the middle pair is lit, it indicates the SELC in slot #16 is communicating properly. When the bottom pair is lit, it indicates the SELC in slot #17 is communicating properly.
Middle Three Feature Processor LEDs	The three feature processor LEDs in the middle of the card should normally be flashing green in the MX shuffle pattern.
ASIC LED	On the ASIC granddaughter card in the center of the card, there is an ASIC LED just above the LOS LED. This LED is normally lit light green and it indicates proper communication between the ASIC and application board.
LOS LED	This LED is normally lit green to indicate the card is loaded. If it is lit yellow, the PLIC is in the process of receiving data from the System Center. If it is lit red, the PLIC is not loaded.
V DC	This green LED flashes green 50 times per minute when the 6 V DC supply is properly connected.

LEDs and Buttons	Description
Second CPU	This red LED rapidly flashes red when the second CPU is loaded.
10 Port LEDs	The port LEDs are for the 10 ports, or lines, on the S2DC or S2PC. The top port LED is associated with port #1 (offset 0), the second port LED is associated with port #2 (offset 1), and so on. When a port LED is flashing red, it indicates the port is active or busy. When a port LED is flashing green, it indicates a call is ringing in on that port (line). When a port LED is lit steady red, it indicates the line is on hold.
Card Busy LED	Normally, the card busy LED is unlit. If any of the 10 port LEDs are active or busy, the card busy LED is lit red.

Universal Line Cards

The universal line card allows the MX System to share lines with Series I, early Centremax, and other IPC products, as well as with any other manufacturer’s 1A2-compatible products. Two modified universal line cards are available to permit interworking with V-Band VK6000 and VK7000 station equipment.

The V-Band private line interface offers on-card private line on hold and automatic ringdown. Because this card has an extra jumper that allows it to be used with 1A2 lines rather than V-Band lines, these on-card features can be used with Series II and 1A2 lines if so desired. Note that when the V-Band private line card is used, the line must be configured at the station as a dialtone (exchange) line.

Along with the universal line cards, one interrupter card needs to be installed. The interrupter card is plugged into the right hand slot on the shelf (as viewed from the front), with the line cards occupying the remaining fifteen slots.

All cards are plugged in with their component sides facing to the left. The line card slots are numbered as follows: the left hand slot is designated as slot #1, the next slot #2, all the way to slot #15 which is adjacent to the interrupter card.

The terminal block on the backplane is used for power and ring generator inputs to the universal line card shelf. The power needed to support this shelf is as follows:

- + 12 V DC @ 10 amps
- - 24 V DC @ 5 amps
- 10 V AC @ 10 amps
- ring generator (75–100 V AC @ 20 or 30Hz) @ 0.5 amps

For interfacing to V-Band equipment, the 10 V AC connection is not used.

The universal line card can be used to interface IPC's Tradenet or Tradenet MX System to Series II, EPC and 1A2 equipment. Each universal line card interfaces to two dialtone lines.

The top three LEDs (amber, yellow, and green) are the LEDs for circuit A of the universal line card. The bottom three LEDs (amber, yellow, and green) are the LEDs for circuit B. The following table shows the status indications for each of these LEDs.

TABLE 6-22 Universal Line Card LED Indications

Status	Amber LED	Yellow LED	Green LED
idle	off	off	off
incoming	on	off	off
active	off	off	on
hold	off	on	off

The two center LEDs indicate that there is power to the board, and that the fuses are installed properly and not blown. The upper of the two LEDs is for 10 V AC. The lower of these LEDs is for 12 V DC (power for the card).

The manual ringdown/dialtone jumpers are located in the center of the card. These sets of two five-conductor jumpers must always be moved as a pair, although it is not necessary to have both lines on the card set the same way. The M position is used with manual ringdown lines, and the D position is for dialtone (exchange) lines.

The defeat jumpers are located at the top of the card. These jumpers, when removed, continually place an additional load on CO tip and ring during 1A2/V-Band operation. These jumpers were intended for use with antiquated 1A2 style keysets, where A-lead does not adequately trail the loss of loop current while acquiring a hold state. The default jumper setting is installed, and they should remain installed whenever possible. If the jumpers are not installed, reduced volume at the turret occurs.

The option jumpers, located next to the manual ringdown/dialtone jumpers, can be set as follows:

- short/long hold (hold abandon)
- ring time-out
- ring bit override
- orator cutoff

Short/long hold jumper (hold abandon): This jumper (SH) is installed for short hold abandon (20 ms) and removed for long hold abandon (500ms). The default jumper setting is 500 ms.

Ring time-out jumpers: These four jumpers provide ring time-out values of 10 seconds (10), 20 seconds (20), 30 seconds (30), or infinite ring (INF). Install only one jumper for the desired ring time-out. If no jumper is installed, the ring time-out value is 30 seconds. The default jumper setting is 10 seconds.

Ring bit override jumpers: These three jumpers (1A2, EPC, and SII) override the ring delay/interrupted ring feature. When installed, these jumpers provide continuous ring for Tradenet Systems, Tradenet MX Systems, and Series II systems, and interrupted ring for V-Band equipment (EPC), at whatever the ring time-out jumpers are set for. The default jumper setting is all jumpers removed.

Continuous cutoff jumpers: These two jumpers (OP1 and OP2) are used to provide continuous Orator whether line is active or inactive. Removed, these jumpers provide Orator cutoff when the line is active. The default jumper setting is all jumpers installed.

Note *Both OP1 and OP2 jumpers must be removed or installed together or noise will result.*

The eight-position switches can be set to provide incoming ring and lamping delay to the turrets. The switches can be set to provide different incoming ring delays, for each different station type connected. Each DIP switch setting represents a delay of one ring cycle (six seconds).

For example, to delay incoming ring to a V-Band turret by two rings, set the switch labeled EPC to the following setting:

- switches 1 and 2 off
- switches 3–8 on

To control incoming ring delay to the Tradenet System or Tradenet MX System, use the switches labeled SII. If no delay is required, all switches are turned on. The default setting is all switches in the on position.

There are two universal line cards that have been modified to operate with V-Band VK-6000 or VK-7000 station equipment.

V-Band uses a special hold wink flutter, that can be provided on a shelf-by-shelf basis by using the interrupter card. This card interferes with EPC lamping, preventing EPC sets from sharing lines with V-Band equipment that requires the flutter.

Note that the EPC lamp lead can replace the 1A2 A-lead normally carried in connectors J17-J22. On the V-Band dialtone card, which is otherwise identical to the universal line card, the jumper shown does not exist, and the card is permanently set for EPC lamping. Because the V-Band private line on hold card does provide features not available on other 1A2 line cards, it has been designed to be jumpered for either V-Band or 1A2 use.

The hold flutter used in V-Band systems appears as erratic lamping on an EPC: for this reason, it is not advised to use EPC sets when these cards are used with V-Band stations, and the V-Band private line on hold interrupter card is installed.

As stated for the universal line card, do not connect an incoming line to both the EPC and 1A2 CO tip and ring pairs on either V-Band compatible card: either can be used, but not both.

The universal line card, VB, can be used to interface IPC's Tradenet and Tradenet MX Systems to V-Band’s VK 6000 and VK 7000 equipment. Each universal line card interfaces to two dialtone lines. The only difference in this card’s LED indications is that the 10 V AC LED can not be lit, because the card does not use 10 V AC lamping. In every other respect, this card is identical to the universal line card. This card differs from the standard universal line card only in that the EPC lamp is permanently connected to the 1A2 lamp out, thus providing a V-Band compatible output in a single cable, rather than requiring that both the EPC and 1A2 cables be cut down and cross connected together. When 1A2 is required, use the conventional universal line card.

The only difference in this card’s LED indications is that the 10 V AC LED might not be lit, because the card does not use 10 V AC lamping. In every other respect, this card is identical to the universal line card.

The universal line card, VB private, provides private line on hold and automatic ringdown. By moving the VB/1A2 jumper, it can be used to interface IPC’s Tradenet and Tradenet MX Systems to V-Band’s VK 6000 and VK 7000 equipment, or to 1A2 lines. Each card has two lines.

This card appears to the station equipment as a dialtone line card. Therefore, all station equipment on the line must be set for a dialtone line, regardless of whether the card is jumpered for V-Band or 1A2 lines. This card puts a private line on an apparent hold whenever it receives a dialtone hold command from the station equipment. Therefore the A-lead, normally used for signalling private lines, cannot be used to signal on this card. The only available signaling is an automatic 15 second ring burst provided by this card whenever the line is seized. To ring the line again, the line must be dropped and re-seized.

Note *Always set the station equipment to dialtone when using this card.*

The two-position option jumpers can be set as follows:

- ring time-out
- ring bit override
- Orator cutoff
- Orator ringburst mute

Note *The following jumpers are three pin two-position jumpers. The two possible settings are the* ***1 and 2 position*** *(on), and the* ***2 and 3 position*** *(off).*

The four ring time-out jumpers provide ring time-out values of 10 seconds (JP6 and JP15), 20 seconds (JP5 and JP16), 30 seconds (JP4 and JP17), or infinite ring (JP7 and JP14). Set only one jumper to the 1 and 2 position (Selected) for the desired ring time-out. The default jumper setting is 10 seconds.

The ring bit override jumpers (1A2, EPC, and SII) override the ring delay/interrupted ring feature. When placed in the 1 and 2 positions these jumpers provide continuous ring for Tradenet and Tradenet MX Systems, and interrupted ring for V-Band equipment (EPC), at whatever the ring time-out jumpers are set for. The default jumper setting is all jumpers in the 2 and 3 position.

Note *The 1A2 jumper cannot be used when interfacing with the V-Band equipment. Leave in the 2 and 3 position.*

The two Orator cutoff jumpers (JP9 and JP10 for circuit A, and JP12 and JP11 for circuit B) when placed in positions 1 and 2, are used to provide continuous Orator, regardless of the status of the line. Placed in the 2 and 3 position (NC), these jumpers provide Orator cutoff when the line is active. The default jumper setting is all jumpers in 1 and 2 position (installed).

Note *Both Orator cutoff jumpers, for each circuit must be removed or installed together, or noise will result.*

These two jumpers (JP23 and JP24 for circuit A, and JP22 and JP21 for circuit B) when placed in the 1 and 2 position, ringburst is audible on the monitoring Orator during ringdown. When placed in the 2 and 3 position these jumpers mute the audible ringburst.

Note *Both Orator ringburst mute jumpers for each circuit must be removed or installed together, or noise will result.*

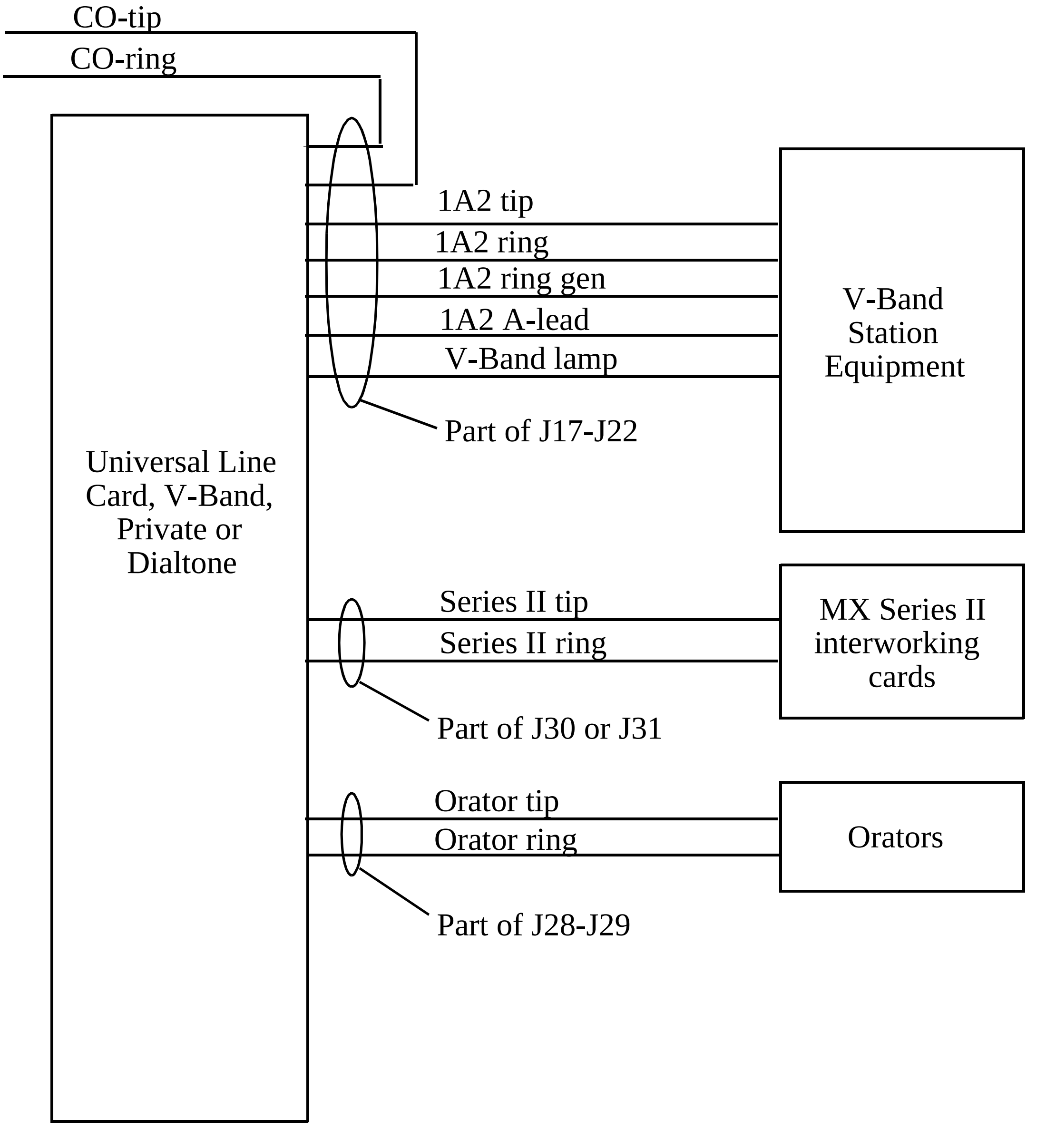
The eight-position switches can be set to provide incoming ring and lamping delay to the turrets. The switches can be set to provide different incoming ring delays, for each different station type connected. Each DIP switch setting represents a six second count.

For example, to delay incoming ring to a V-Band turret by two rings (12 seconds), set the switch labeled EPC to the following setting:

- switches 1 and 2 off
- switches 3–8 on

To control incoming ring delay to the Tradenet and Tradenet MX Systems use the switches labeled SII. If no delay is required, all switches are turned on. The default setting is all switches in the on position.

The following figure is a block diagram of V-Band's dialtone or private universal line card.



Universal Line Card Series II and Orator Outputs (J28-J31)

J30		J31
Tip-1A	WHT BLUE	Tip-11A
Ring-1A	BLUE WHT	Ring-11A
Tip-1B	WHT ORG	Tip-11B
Ring-1B	ORG WHT	Ring-11B
Tip-2A	WHT GRN	Tip-12A
Ring-2B	GRN WHT	Ring-12B
Tip-3A	WHT BRN	Tip-13A
Ring-3A	BRN WHT	Ring-13A
Tip-3B	WHT SLT	Tip-13B
Ring-3B	SLT WHT	Ring-13B
Tip-4A	RED BLUE	Tip-14A
Ring-4A	BLUE RED	Ring-14A
Tip-4B	RED ORG	Tip-14B
Ring-4B	ORG RED	Ring-14B
Tip-5A	RED GRN	Tip-15A
Ring-5A	GRN RED	Ring-15A
Tip-5B	RED BRN	Tip-15B
Ring-5B	BRN RED	Ring-15B
Tip-6A	RED SLT	NC
Ring-6A	SLT RED	NC
Tip-6B	BLK BLUE	NC
Ring-6B	BLUE BLK	NC
Tip-7A	BLK ORG	NC
Ring-7A	ORG BLK	NC
Tip-7B	BLK GRN	NC
Ring-7B	GRN BLK	NC
Tip-8A	BLK BRN	NC
Ring-8A	BRN BLK	NC
Tip-8B	BLK SLT	NC
Ring-8B	SLT BLK	NC
Tip-9A	YEL BLUE	NC
Ring-9A	BLUE YEL	NC
Tip-9B	YEL ORG	NC
Ring-9B	ORG YEL	NC
Tip-10A	YEL GRN	NC
Ring-10A	GRN YEL	NC
Tip-10B	YEL BRN	NC
Ring-10B	BRN YEL	NC
Ground	YEL SLT	Ground
Ground	SLT YEL	Ground
Ground	VIO BLUE	Ground
Ground	BLUE VIO	Ground
Ground	VIO ORG	Ground
Ground	ORG VIO	Ground
Ground	VIO GRN	Ground
Ground	BRN VIO	Ground
Ground	VIO BRN	Ground
Ground	BRN VIO	Ground
Ground	VIO SLT	Ground
Ground	SLT VIO	Ground

STATION INTERFACE CARDS

Station interface cards include:

- analog turret interface card (ATIC), used with analog turrets
- basic rate interface card (BRIC), used with digital turrets and TradePhone MXs
- basic speaker interface card (BSIC), used with digital turrets with speakers
- ISDN station interface card (ISIC), used with ISDN (AT&T) keysets
- station interface card (STIC), offers increased speaker capacity and enhanced digital recording

The station interface cards perform the following functions:

- voice handling
- downloading of the configuration tables from the System Center
- running diagnostics at boot-up, upon reset, and on a continuing basis
- assembly and transmission of lamp status messages for each turret
- reception of button press messages from the turrets (line selection)

The ejectors at the top and bottom of these cards are color coded so that you can easily recognize the different cards. The following table shows the ejector colors of these cards.

TABLE 6-23 Ejector Color of Cards

Card	Top Ejector Color	Bottom Ejector Color
ATIC	blue	blue
BRIC	white	blue
BSIC	white	blue
ISIC	white	blue
STIC	black	blue

ATIC

The analog turret interface card (ATIC), also known as the *Tradenet turret interface card*, provides the interface between the switching network and the Tradenet analog turrets. Up to 12 talkpaths or tip and ring for 6 non-DTP or 6 DTP turrets can be supported by each card. The ATIC can also be used with receive only speakers (FTS-4 or FTS-8). However, the turrets and the FTS speakers must be on the same ATIC card when speakers are used. The speakers act like turrets because they use tip and ring ports of an ATIC card. Speakers are connected to the analog distribution panel using auxiliary cables.

Each turret or speaker is supplied with data from the ATIC to support its function of providing line status information. The ATIC receives command information from each turret for control of the switch, that is, line selection. The following table describes how many speakers and handsets ATICs can support.

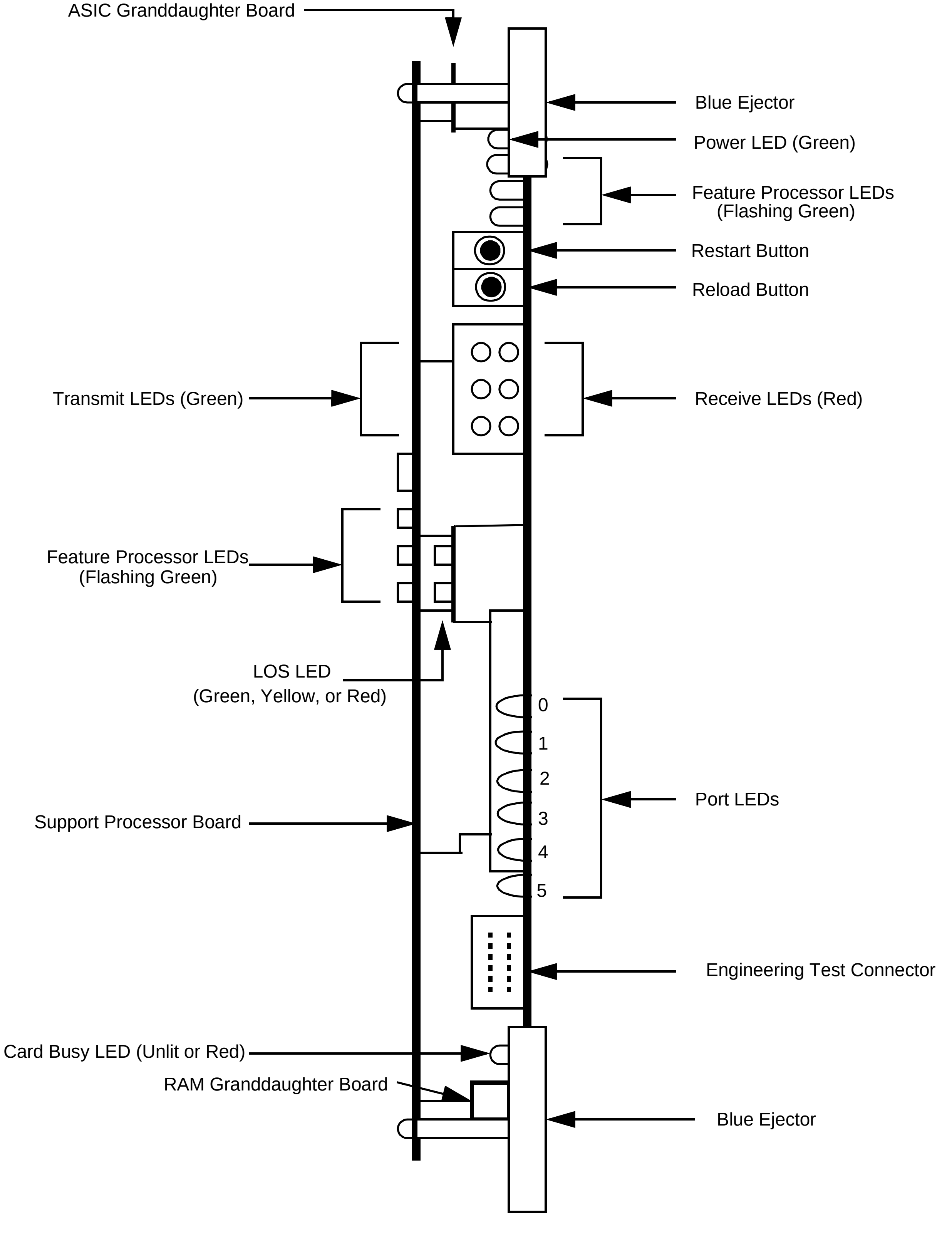
TABLE 6-24 Number of Speakers and Handsets Supported by ATICs

With FTS-8 Module	**With FTS-4 Module**	**Handsets per Station**	**Speakers per Station[a]**	**Stations per card**	**Comments**
1	0	2	8	1	The last two channels on the line card cannot be used with FTS-8 speakers. There are 12 channels per line card if only handsets are used.
0	2	2	4	2	The last two channels are not lost.
	1	2	1 with 4, 4 with 0	5	One Turret with FTS4, plus four with no speakers
1	1	2	10	1	Only two channels in the FTS-4 are used
	3	2	2	3	Only two channels in each FTS-4 are used
0	0	2	0	6	No speakers

a. Orators can be substituted for FTS channels. If so, reduce the FTS size accordingly.

The following figure shows the parts of the ATIC.

FIGURE 6-27 ATIC



The card LEDs help you to diagnose problems in your system. The LEDs are as follows starting at the top LED:

TABLE 6-25 ATIC LEDs and Buttons

LEDs and Buttons	Description
Power LED	The power LED is green. This LED is always on to indicate there is power to the PLIC.
Top Three Feature Processor LEDs	The three feature processor LEDs just below the white ejector should normally be flashing green. (This pattern is called the *MX shuffle*.)
Restart Button	When you press the restart button, the card restarts after 10–20 seconds, using information stored on the card. This generates a hardware reset. Use this button when the data on the card is correct. This button does not affect system operation. Pushing this button is equivalent to using the **Restart Card** option from the System Center Application (SycAp) menu. (Select **Maintenance**, **Card**, and **Restart Card**. For more information about the SycAp menu, refer to the *Tradenet MX System Center Manual 14.1*, part number B0086185104.)
Reload Button	When you press the reload button, the card reloads after two–three minutes, using new data and information from the System Center. This generates a non-maskable interrupt. Use this button when there is a problem with the data loaded on the card. This button does not affect system operation. Pushing this button is equivalent to using the **Load Card Processor** option from the System Center Application (SycAp) menu. (Select **Maintenance**, **Card**, and **Load Card Processor**. For more information about the SycAp menu, refer to the *Tradenet MX System Center Manual 14.1*, part number B0086185104.)
3 Pairs of Receive/Transmit LEDs	The green LEDs are the transmit LEDs and the red LEDs are the receive LEDs. These LEDs represent links to the SELCs. There is one receive/transmit pair of LEDs for each SELC to which the ALIC is connected. When the top receive/transmit pair is lit, it indicates the SELC in slot #15 is communicating properly. When the middle pair is lit, it indicates the SELC in slot #16 is communicating properly. When the bottom pair is lit, it indicates the SELC in slot #17 is communicating properly.
Middle Three Feature Processor LEDs	The three feature processor LEDs in the middle of the card should normally be flashing green in the MX shuffle pattern.
ASIC LED	On the ASIC granddaughter card in the center of the card, there is an ASIC LED just above the LOS LED. This LED is normally lit light green and it indicates proper communication between the ASIC and application board.
LOS LED	This LED is normally lit green to indicate the card is loaded. If it is lit yellow, the PLIC is in the process of receiving data from the System Center. If it is lit red, the PLIC is not loaded.
6 Port LEDs	The port LEDs are for the 6 turrets, one per turret. When a port LED is lit, it indicates the attached turret is equipped. When a port LED is flashing, it indicates the ATIC did not find an attached turret; the turret might be unplugged. When a port LED is unlit, it indicates the turret is not equipped.
Card Busy LED	Normally, the card busy LED is unlit. If any of the 10 port LEDs are active or busy, the card busy LED is lit red.

BRIC

The BRIC connects the Tradenet MX System with digital turrets only; analog turrets are connected with the ATIC. (See *ATIC* on page 6-68.)

The 7 MB BRIC is required for Release 14.1. The 7 MB BRIC has a 4 MB support processor board and a 3 MB RAM granddaughter board.

A BRIC upgraded with a digital speaker daughter board (DSDB) is used with digital turrets and digital speakers, and is called a BSIC. (See *BSIC* on page 6-75.)

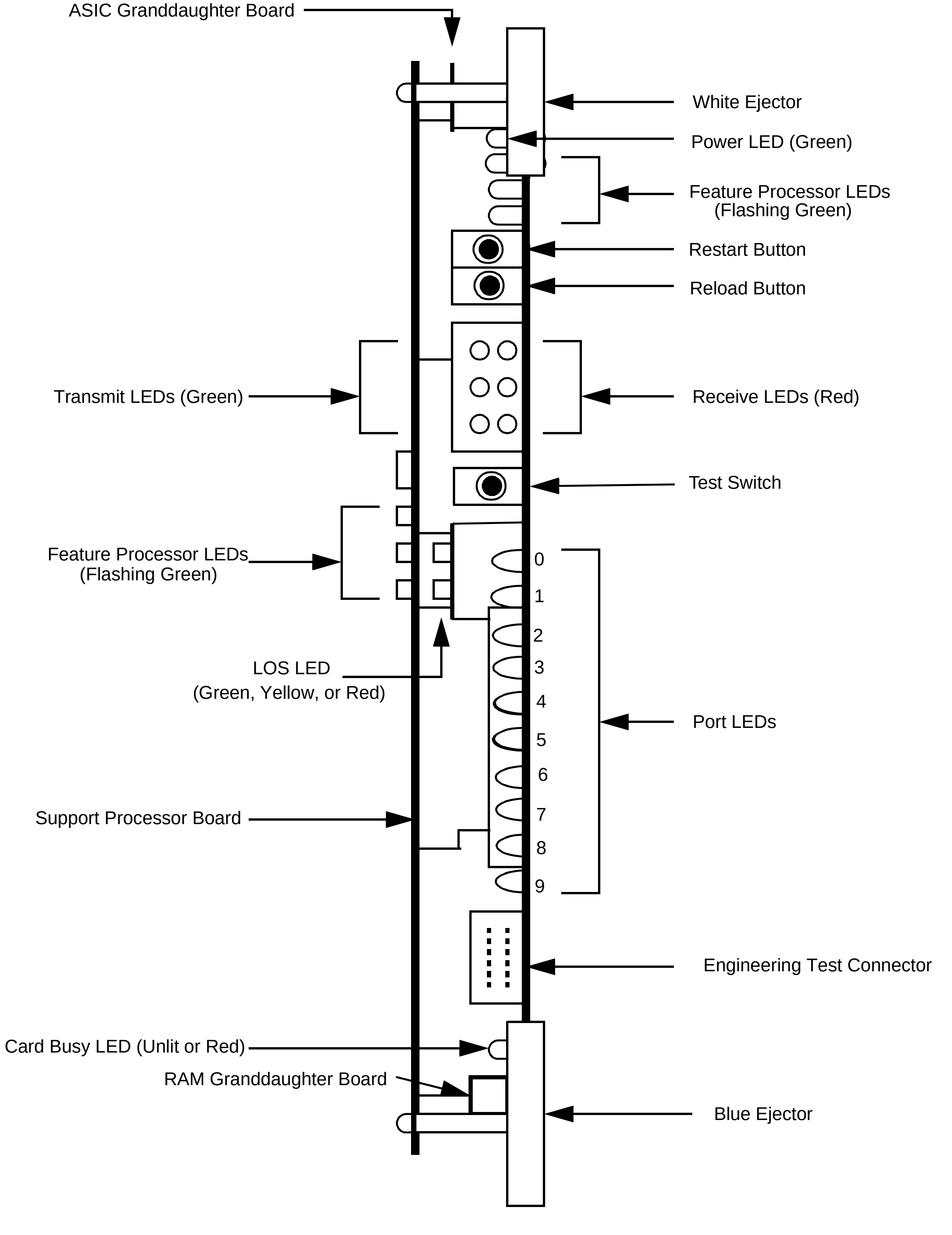
A BRIC can have single or dual digital signal processors (DSPs). The DSPs are chips on the card. There is a command you can use on the System Center that lists the size of the BRICs and how many DSPs they have. For information about this script refer to the *Tradenet MX Installation & Maintenance Manual 14.1* (part number B0108900003).

The BRIC provides two sets of transmit and receive talkpaths (one set per handset) for each turret. The maximum number of digital ports (2B+D) per card is ten. The maximum number of digital turrets per card is eight, and the maximum number of TradePhone MXs is 10 (if the BRIC is dual DSP).

Each turret is supplied with data from the BRIC to support its functions, for example, line status information and voice activity indication. The BRIC receives command information from each turret for control of the switch, for example, line selection and volume control or talkback options.

The following figure shows the parts of the BRIC.

FIGURE 6-28 BRIC



The card LEDs help you to diagnose problems in your system. The LEDs are as follows starting at the top LED:

TABLE 6-26 BRIC LEDs and Buttons

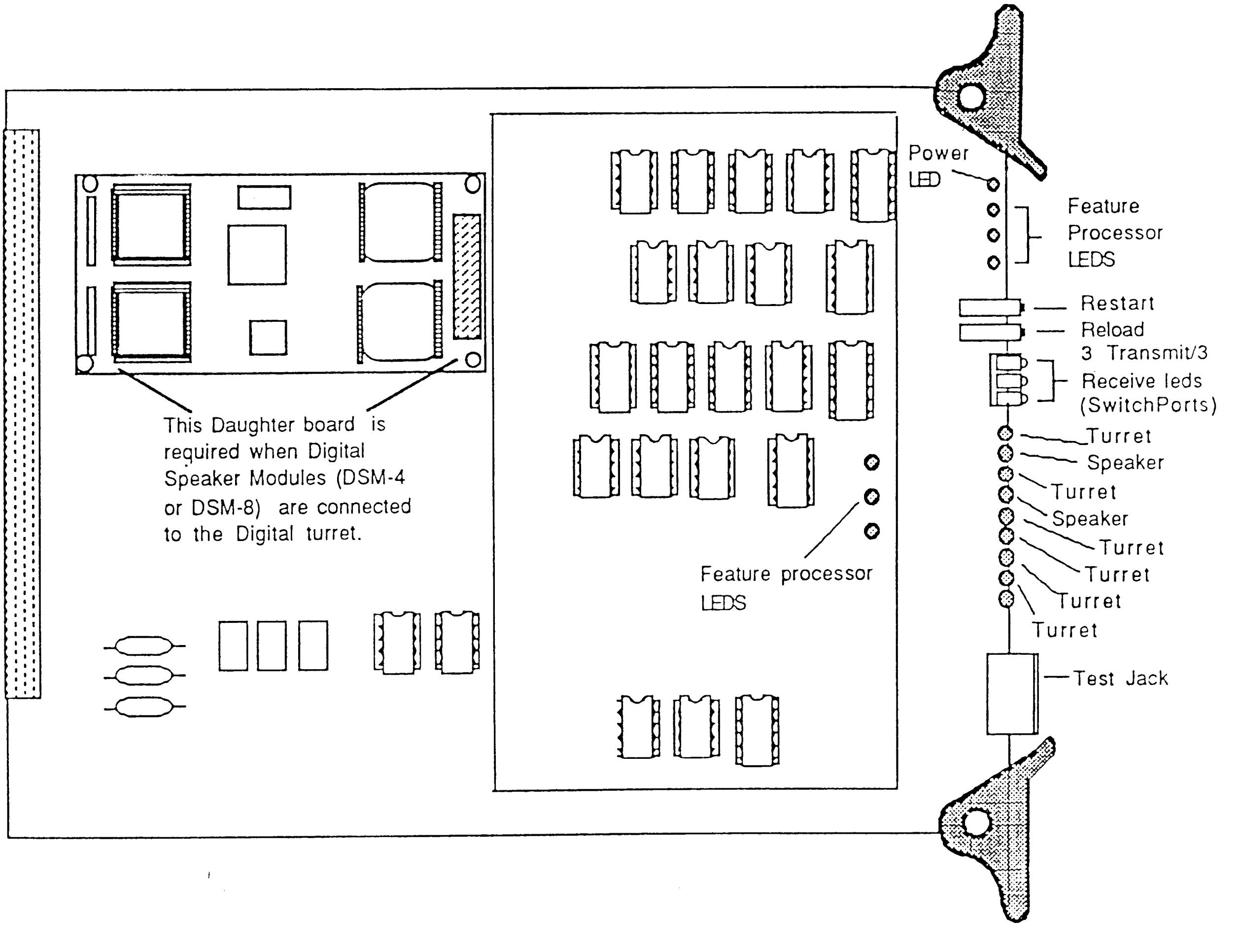
LEDs and Buttons	Description
Power LED	The power LED is green. This LED is always on to indicate there is power to the PLIC.
Top Three Feature Processor LEDs	The three feature processor LEDs just below the white ejector should normally be flashing green. (This pattern is called the *MX shuffle*.)
Restart Button	When you press the restart button, the card restarts after 10–20 seconds, using information stored on the card. This generates a hardware reset. Use this button when the data on the card is correct. This button does not affect system operation. Pushing this button is equivalent to using the **Restart Card** option from the System Center Application (SycAp) menu. (Select **Maintenance**, **Card**, and **Restart Card**. For more information about the SycAp menu, refer to the *Tradenet MX System Center Manual 14.1*, (part number B0086185104.)
Reload Button	When you press the reload button, the card reloads after two–three minutes, using new data and information from the System Center. This generates a non-maskable interrupt. Use this button when there is a problem with the data loaded on the card. This button does not affect system operation. Pushing this button is equivalent to using the **Load Card Processor** option from the System Center Application (SycAp) menu. (Select **Maintenance**, **Card**, and **Load Card Processor**. For more information about the SycAp menu, refer to the *Tradenet MX System Center Manual 14.1*, (part number B0086185104.)
3 Pairs of Receive/Transmit LEDs	The green LEDs are the transmit LEDs and the red LEDs are the receive LEDs. These LEDs represent links to the SELCs. There is one receive/transmit pair of LEDs for each SELC to which the ALIC is connected. When the top receive/transmit pair is lit, it indicates the SELC in slot #15 is communicating properly. When the middle pair is lit, it indicates the SELC in slot #16 is communicating properly. When the bottom pair is lit, it indicates the SELC in slot #17 is communicating properly.
Test Switch	This switch is not on all BRICs. It is used only for IPC Manufacturing purposes.
Middle Three Feature Processor LEDs	The three feature processor LEDs in the middle of the card should normally be flashing green in the MX shuffle pattern.
ASIC LED	On the ASIC granddaughter card in the center of the card, there is an ASIC LED just above the LOS LED. This LED is normally lit light green and it indicates proper communication between the ASIC and application board.

LEDs and Buttons	Description
LOS LED	This LED is normally lit green to indicate the card is loaded. If it is lit yellow, the PLIC is in the process of receiving data from the System Center. If it is lit red, the PLIC is not loaded.
10 Port LEDs	The port LEDs are for the BRIs. Depending on the types of digital turrets you are using with the BRIC (single/dual handset, no speakers, ClearDeal, or FTS speaker module), you can use up to eight turrets with a BRIC. When a port LED is lit, it indicates an attached turret is installed. When a port LED is flashing, it indicates there is no attached turret; the turret might be unplugged. When a port LED is unlit, it indicates the turret is not equipped.
Card Busy LED	Normally, the card busy LED is unlit. If any of the 10 port LEDs are active or busy, the card busy LED is lit red.

BSIC

A basic speaker interface card (BSIC) is a BRIC upgraded with a digital speaker daughter board (DSDB). A BSIC is used with digital turrets and digital speakers. You can upgrade a BRIC to a BSIC by installing the DSDB. The following figure shows a BSIC.

FIGURE 6-29 BSIC



The DSDB is required when digital speaker modules are connected to a digital turret. This DSDB provides a maximum of 31 voice sources.

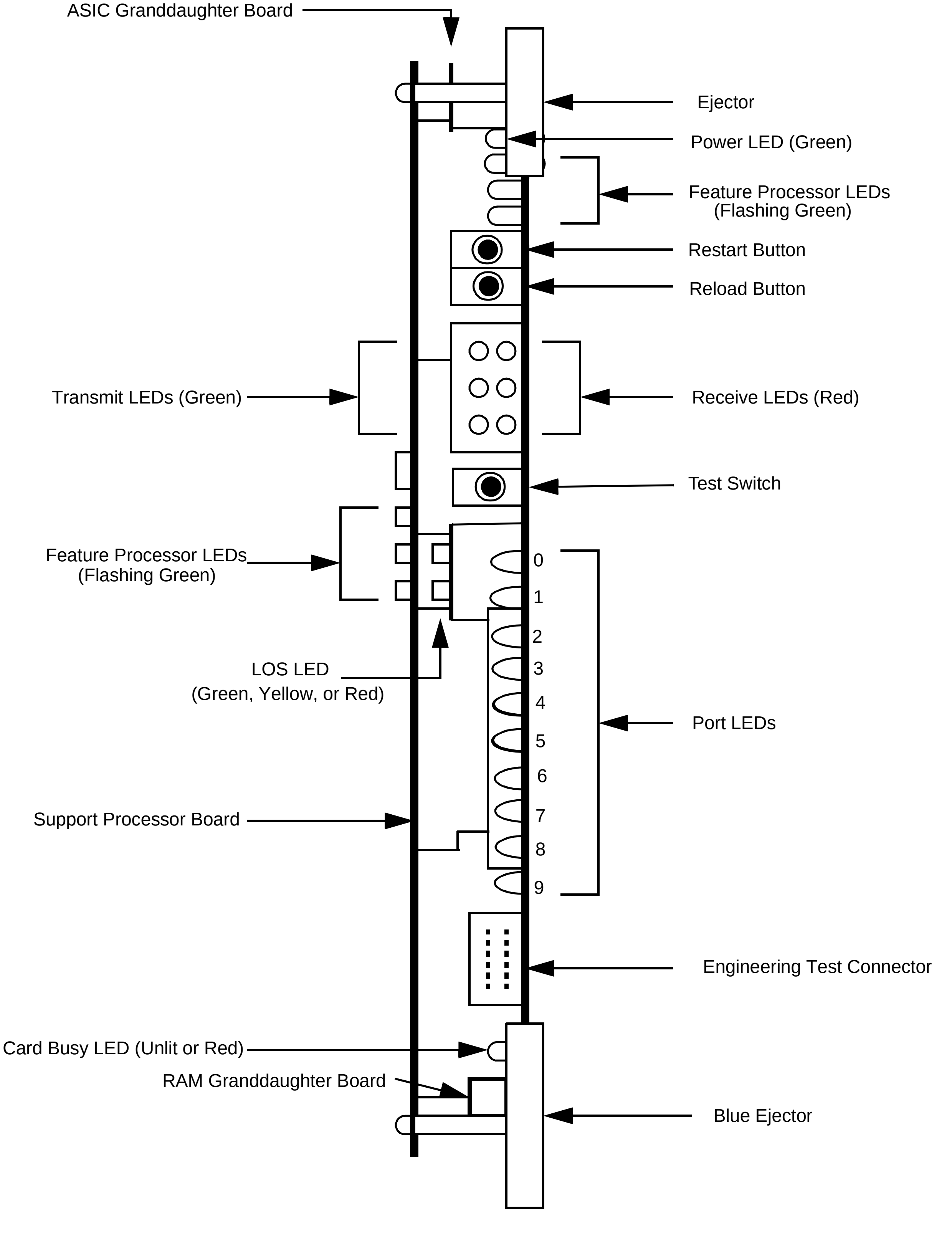
Note *A digital speaker module (ClearDeal with four speaker channels, ClearDeal with eight speaker channels, dFTS-4, or dFTS-8) requires one basic rate port. The maximum number of speakers per BSIC is five.*

Each turret and speaker is supplied with data from the BSIC to support its functions, for example, line status information and voice activity indication. The BSIC receives command information from each turret and speaker for control of the switch, for example, line selection and volume control or talkback options.

The configurator generator (CGEN) software is used to configure the MX System. Configurations should not be attempted manually. CGEN's placement of digital speakers uses the rule that the total number of different voice channels available to speakers on one card is 31, with each speaker requiring a turret.

The following figure shows the parts of the BSIC.

FIGURE 6-30 BSIC



The card LEDs help you to diagnose problems in your system. The LEDs are as follows starting at the top LED:

TABLE 6-27 BSIC LEDs and Buttons

LEDs and Buttons	Description
Power LED	The power LED is green. This LED is always on to indicate there is power to the PLIC.
Top Three Feature Processor LEDs	The three feature processor LEDs just below the white ejector should normally be flashing green. (This pattern is called the *MX shuffle*.)
Restart Button	When you press the restart button, the card restarts after 10–20 seconds, using information stored on the card. This generates a hardware reset. Use this button when the data on the card is correct. This button does not affect system operation. Pushing this button is equivalent to using the **Restart Card** option from the System Center Application (SycAp) menu. (Select **Maintenance**, **Card**, and **Restart Card**. For more information about the SycAp menu, refer to the *Tradenet MX System Center Manual 14.1*, part number B0086185104.)
Reload Button	When you press the reload button, the card reloads after two–three minutes, using new data and information from the System Center. This generates a non-maskable interrupt. Use this button when there is a problem with the data loaded on the card. This button does not affect system operation. Pushing this button is equivalent to using the **Load Card Processor** option from the System Center Application (SycAp) menu. (Select **Maintenance**, **Card**, and **Load Card Processor**. For more information about the SycAp menu, refer to the *Tradenet MX System Center Manual 14.1*, part number B0086185104.)
3 Pairs of Receive/Transmit LEDs	The green LEDs are the transmit LEDs and the red LEDs are the receive LEDs. These LEDs represent links to the SELCs. There is one receive/transmit pair of LEDs for each SELC to which the ALIC is connected. When the top receive/transmit pair is lit, it indicates the SELC in slot #15 is communicating properly. When the middle pair is lit, it indicates the SELC in slot #16 is communicating properly. When the bottom pair is lit, it indicates the SELC in slot #17 is communicating properly.
Test Switch	This switch is not on all BRICs. It is used only for IPC Manufacturing purposes.
Middle Three Feature Processor LEDs	The three feature processor LEDs in the middle of the card should normally be flashing green in the MX shuffle pattern.
ASIC LED	On the ASIC granddaughter card in the center of the card, there is an ASIC LED just above the LOS LED. This LED is normally lit light green and it indicates proper communication between the ASIC and application board.

LEDs and Buttons	Description
LOS LED	This LED is normally lit green to indicate the card is loaded. If it is lit yellow, the PLIC is in the process of receiving data from the System Center. If it is lit red, the PLIC is not loaded.
10 Port LEDs	The port LEDs are for the 6 turrets, one per turret. When a port LED is lit, it indicates an attached turret/speaker is installed. When a port LED is flashing, it indicates there is no attached turret/speaker; the turret might be unplugged. When a port LED is unlit, it indicates the turret/speaker is not equipped.
Card Busy LED	Normally, the card busy LED is unlit. If any of the 10 port LEDs are active or busy, the card busy LED is lit red.

IPIC

The TradePhone MX interface card (IPIC) is physically equivalent to a BRIC (except for the color of the bottom ejector). The TradePhone MX interface card (IPIC) is used to interface the TradePhone MX to the MX System. The IPIC is a BRIC with a different software load (IPIP). The IPIC can support up to 10 TradePhone MX keysets (6 with a single DSP BRIC). The IPIC layout and its LEDs are equivalent to those on the BRIC. (See *BRIC* on page 6-72.)

ISIC

An ISDN interface card (ISIC) is physically equivalent to a BRIC (except for the color of the bottom ejector). This ISIC connects analog (Tradenet System) turrets and the BRIC connects the digital turrets. The ISIC layout and its LEDs are equivalent to those on the BRIC. (See *BRIC* on page 6-72.)

STIC

The station interface card (STIC) offers increased speaker capacity and enhanced digital recording. The STIC provides expanded speaker-to-line connections for up to 64 speaker channels, in addition to 20 handset channels, for a total of 84 channels. (The STIC supports Kanji turrets and Kanji ClearDeal speaker modules in Release 10.1 Maintenance and later.) When digital recording is enabled, the connection is made using the tenth port. Each card supports the following configurations:

- 10 BRIs using analog wired recording (same as BRIC or BSIC)
    - 5 turrets with 1 ClearDeal
    - 5 turrets with 2 ClearDeals (using a hoot pool)
    - 8 turrets with no speakers
    - 4 turrets with 2 ClearDeals and 1 turret with no speakers
    - 3 turrets with 3 ClearDeals (using a hoot pool)

- 9 BRIs with digital recording
    - 4 turrets with 1 ClearDeal
    - 4 turrets with 2 ClearDeals (using a hoot pool)
    - 8 turrets with no speakers
    - 4 turrets with 2 ClearDeals and 1 turret with no speakers
    - 3 turrets with 3 ClearDeals (using a hoot pool)
    - 2 turrets with 4 ClearDeals and 3 turrets with no speakers

---

Note *The STIC has a maximum of 64 separate speaker channels; applications requiring more than 64 channels will need to use a hoot pool.*

In the 5 turrets with 16 speakers configuration each station can have 11 dynamic and 3 shared speakers (hoots) as long as the hoot_pool_size as defined in t_system_data does not exceed 7. In the 3 turrets each with 24 speaker configuration each station can have 18 dynamic and 4 shared speakers (hoots) as long as the hoot_pool_size as defined in t_system_data does not exceed 4.

The STIC is a BRIC with a digital speaker daughter board (DSDB-64) for connecting up to 64 lines for speakers. It has 10 basic rate interface (BRI) ports and is installed in the same digital TU card slot as the BRIC (up to four STICs per TU). All station and TU cabling are the same as for the BRIC.

Note *Software limits the total speaker and handset channels connected to each STIC to a default of 56. This will reduce the above configurations to retain N+1 redundancy.*

The STIC and BRIC are not interchangeable. The STIC does not support the TradePhone MX.

The AutoQuote tools are set to default to 56 channels per STIC. Using the current TU backplane, each STIC provides N+1 voice path redundancy only for 56 or fewer voice paths. This parameter dictates that all turrets connected to a STIC cannot exceed 56 channels per STIC (including speakers plus handsets). If all available 64 speaker channels are in use, a SELC failure results in some calls being dropped on turrets in that TU only. The default of 56 can be overwritten by entering the stic64 option in AutoQuote.

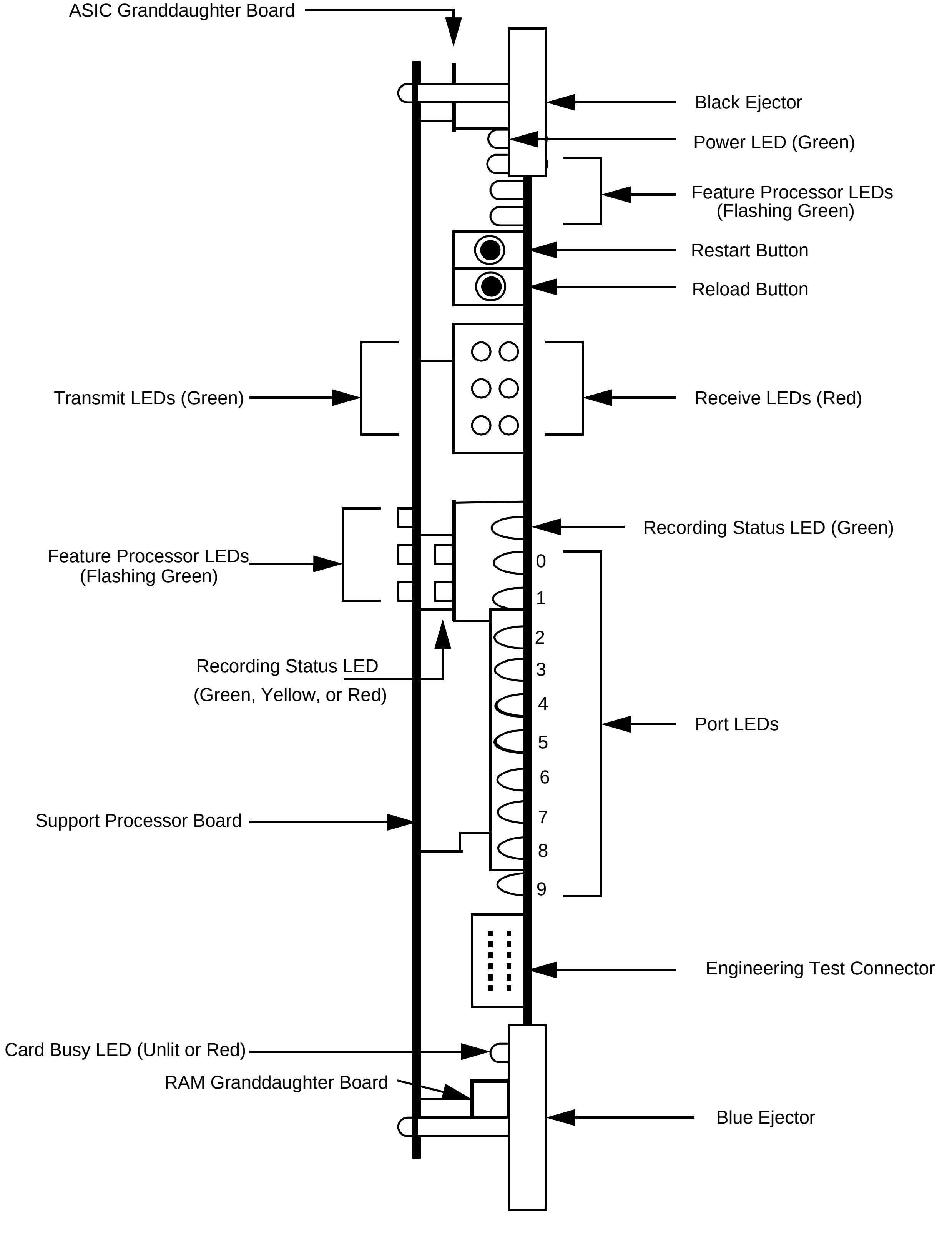
Digital voice recording (DVR) is provided by an E1 port on the card and will support any E1-compatible recording device. The digital recording interface uses port 10 (offset 9) on the STIC for connection to the recording system. Backplane cable assemblies to convert the standard turret 12-pair backplane connector to an 8-pin modular connector are specified and included. The STIC can be installed with or without the recording hardware. A STIC without the recording option is called a SNIC.

When the digital voice recording function is enabled, a relay on the STIC card activates switching the recorder connections to the appropriate pin positions. The green status LED on the front edge of the STIC directly above the red turret LEDs indicates a *solid on* condition.

When digital voice recording is enabled, the STIC uses only 18 of the 30 channels available (nine BRIs @ two channels per BRI).

The following figure shows the parts of the STIC.

FIGURE 6-31 STIC



The card LEDs help you to diagnose problems in your system. The LEDs are as follows starting at the top LED:

TABLE 6-29 STIC LEDs and Buttons

LEDs and Buttons	Description
Power LED	The power LED is green. This LED is always on to indicate there is power to the STIC.
Top Three Feature Processor LEDs	The three feature processor LEDs just below the white ejector should normally be flashing green. (This pattern is called the *MX shuffle*.)
Restart Button	When you press the restart button, the card restarts after 10–20 seconds, using information stored on the card. This generates a hardware reset. Use this button when the data on the card is correct. This button does not affect system operation. Pushing this button is equivalent to using the **Restart Card** option from the System Center Application (SycAp) menu. (Select **Maintenance**, **Card**, and **Restart Card**. For more information about the SycAp menu, refer to the *Tradenet MX System Center User Manual 14.1*, part number B0086185104.)
Reload Button	When you press the reload button, the card reloads after two–three minutes, using new data and information from the System Center. This generates a non-maskable interrupt. Use this button when there is a problem with the data loaded on the card. This button does not affect system operation. Pushing this button is equivalent to using the **Load Card Processor** option from the System Center Application (SycAp) menu. (Select **Maintenance**, **Card**, and **Load Card Processor**. For more information about the SycAp menu, refer to the *Tradenet MX System Center User Manual 14.1*, part number B0086185104.)
3 Pairs of Receive/Transmit LEDs	The green LEDs are the transmit LEDs and the red LEDs are the receive LEDs. These LEDs represent links to the SELCs. There is one receive/transmit pair of LEDs for each SELC to which the STIC is connected. When the top receive/transmit pair is lit, it indicates the SELC in slot #15 is communicating properly. When the middle pair is lit, it indicates the SELC in slot #16 is communicating properly. When the bottom pair is lit, it indicates the SELC in slot #17 is communicating properly.
Middle Three Feature Processor LEDs	The three feature processor LEDs in the middle of the card should normally be flashing green in the MX shuffle pattern.
ASIC LED	On the ASIC granddaughter card in the center of the card, there is an ASIC LED just above the LOS LED. This LED is normally lit green and it indicates proper communication between the ASIC and application board.
LOS LED	This LED is normally lit green to indicate the card is loaded. If it is lit yellow, the PLIC is in the process of receiving data from the System Center. If it is lit red, the PLIC is not loaded.

LEDs and Buttons	Description
Recording Status LED	When the green recording status LED is lit, it indicates the digital voice recording function is enabled.
10 Port LEDs	The port LEDs are for the stations, one per station. When a port LED is lit, it indicates recording is enabled. When a port LED is flashing, it indicates a loss of sync. When a port LED is unlit, it indicates the turret is not equipped.
Card Busy LED	Normally, the card busy LED is unlit. If any of the 10 port LEDs are active or busy, the card busy LED is lit red.

With station interface cards (STIC) in Release 11.1, you can sometimes lose communication and get the following center line message on turrets connected to the STIC: **No Communication With Master**. When this problem occurs, the I/O port LEDs (ISDN LEDs) on the STIC are unlit. Also, at the System Center, you can get a **Poll Time Out** alarm (alarm **ID 3**). This problem was corrected in Release 11.2.

There is a RACAL recorder cable assembly and a Nice recorder cable assembly you can use with the STIC. For more information, refer to the *Tradenet MX Installation & Maintenance Manual 14.1* (part number B0108900003).

SWITCHING AND NETWORK CARDS

Switching and network cards include:

- fiber cable connection card (FCCC)
- network loop back card (NLBC)
- switch element card (SELC)
- section switch loop back card (SSLC)

The SELC has a white top ejector and a red bottom ejector. The FCCC, NLBC, and SSLC do not have ejectors.

Mounted on the back of the section shelf is the network loop back shelf. It has eight card slots: only six slots are used. In systems with three to five TUs, this shelf is empty. This shelf is similar in construction to the card cable assembly on the rear of the reflection shelf.

Note The first and last slots on this shelf are reserved for future use.

The network loop back shelf, when not empty, contains either four or six section switch loop back cards (SSLC) or, a total of four or six of some combination of NLBCs and FCCCs.

Each card in the network loop back shelf is associated with two SELCs acting as section switches in the section shelf.

TABLE 6-28 Description of the Network Loop Back Shelf

Network Loop Back Shelf Slot #	Card in Section Shelf Slot #
P27	for future use
P28	3 and 9
P29	4 and 10
P30	5 and 11
P31	6 and 12
P32	7 and 13
P33	8 and 14
P34	for future use

FCCC

The fiber cable connection card (FCCC) is used to build links in the switch having 11 TUs or more. When section shelves and reflection shelves are located in separate cabinets, fiber optic cards with fiber optic cables attached are used. Fiber optic cables can be used either between reflection shelves, or between a section shelf and a reflection shelf, depending upon the configuration requirements.

When the section switch cards and reflection switch cards in the same plane are located in separate cabinets, fiber optic cards with fiber optic cables attached are used to interconnect them. These cards are installed using screws and a metal face plate for each card. In double-sided systems, these cables are also used to interconnect the reflection switches in the two sides of the system.

NLBC

The network loop back card (NLBC) is a shelf interconnection card used with systems containing 11 TUs or more. It is located in the back of either the reflection shelf or section shelf. Using copper cables, it connects the section shelf and the reflection shelf when both shelves are in the same cabinet.

Up to six NLBCs are used for full population in slots B4–B14 of the network loop back shelf, as indicated by the System Center. These cards are installed using screws and a metal face plate for each card. The NLBC does not have components, just traces located near the edge connectors.

SELC

The switch element card (SELC) acts as an access switch, section switch, and reflection switch.

Access Switch

Based on traffic requirements, the Tradenet MX configuration generator (CGEN) places two or three access switch SELCs on each TU, regardless of the number of turret or line cards that occupy the shelf. This configuration ensures compliance with traffic and line status broadcast requirements, and eliminates a possible single point of failure. The access switch SELCs are installed in slots 15 and 17 in all Tradenet MX Systems, and in slot 16 in a two access switch system. The access switches provide the switching network for turret and line connections internal and external to each TU. Each access switch SELC consists of 19 bi-directional switch ports, a data port, and a real time controller.

Communication paths between the access switch SELCs are formed as:

- a point to point, as in turret to line interface or turret to turret (intercom) interface
- a point to multi-point, as in broadcasting
- a multi-point sum to point, as in bridging or conferences

The access switch SELCs in the first TU of the first cabinet or triplet of an MX System provide the data path between the system and the System Center Gateway Card (SCGC), which in turn communicates with the System Center. All initialization of the system is made through the access switch SELCs and all monitoring of the system alarms after initialization is reported to the System Center through the access switch SELCs.

The three access switch SELCs have a total switching bandwidth of 437.76 megabits. This capacity far exceeds the requirements needed for speech. Call activity is load-shared across the three cards to ensure fault tolerance and fast latch time. The unused switching capacity provides the throughput necessary for new business applications, such as video and ISDN.

Section Switch

The number and placement of section switches is determined by CGEN once the number of interface card shelves (TUs) is known. Any system with three or more TUs requires section switches. Each section switch group contains six section switches. To determine the number of section switch groups needed by a particular MX System, take the number of TUs in your system and divide it by five; round up if necessary. This gives you the number of section switch groups you need for your system.

Reflection Switch

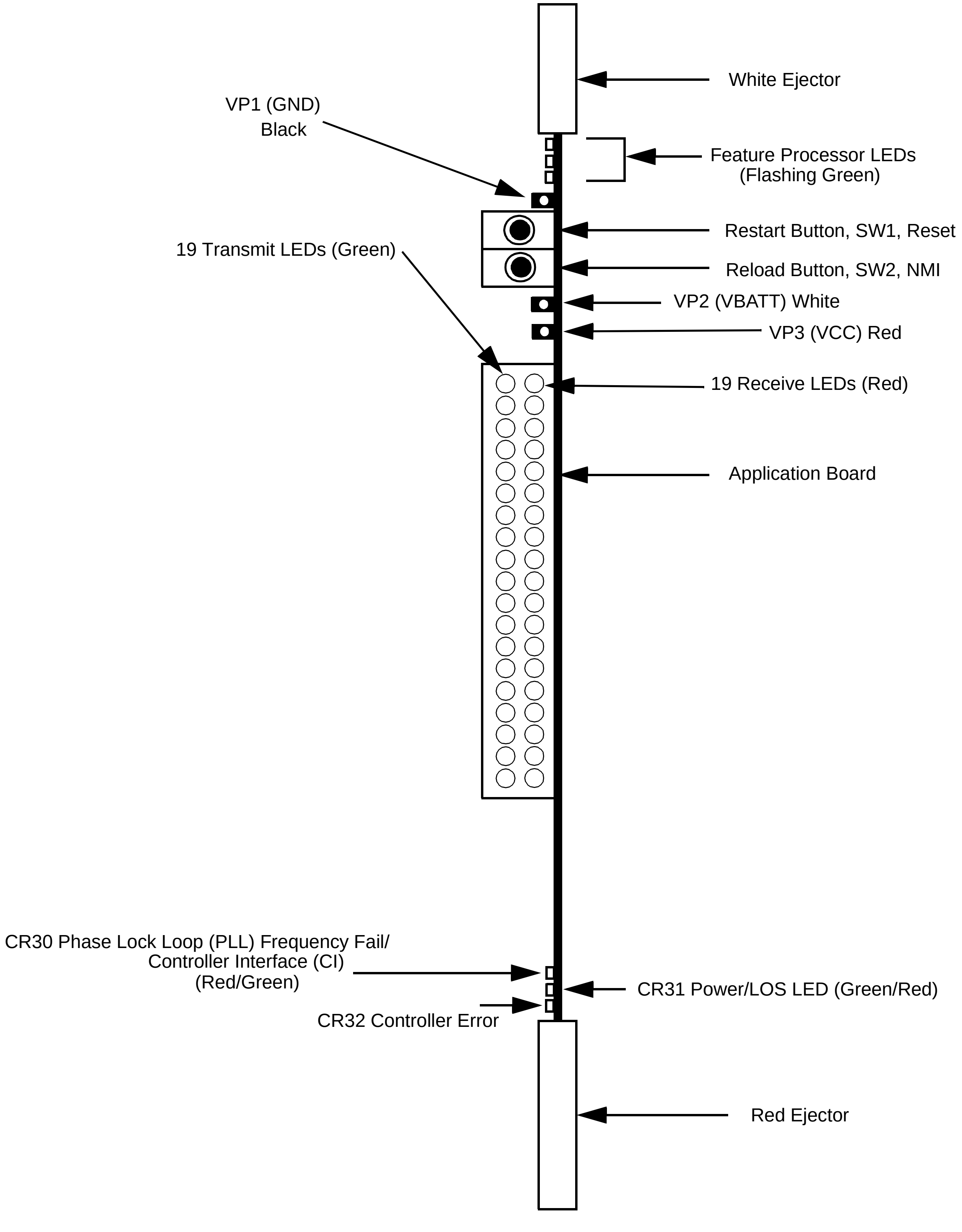
The number and placement of reflection switches is determined by CGEN. The typical MX System contains two shelves, each with three groups of three reflection switches. This is used in single sided systems with from 11 to 30 TUs (two or three triplets), or in each side of double sided systems with up to 40 TUs (four triplets). Larger systems require three shelves, each with two groups of four reflection switches. This is used in single sided systems with up to 45 TUs (five triplets), or in each side of double sided systems with up to 60 TUs (six triplets). This is also used in single sided systems of 7, 8, or 9 triplets and double sided systems of 10 triplets.

SELC LED Indicators

The card LEDs help you to diagnose problems in your system. There are two types of SELC: the older one with part number 400066003 and the SELC that is currently being shipped from IPC’s factory in Westbrook, CT with part number 500066101. (These two cards function identically and you can have both types of SELCs in the same MX System. The newer SELC is more streamlined than the older one. The newer SELC works with Release 8.0.4 and later.)

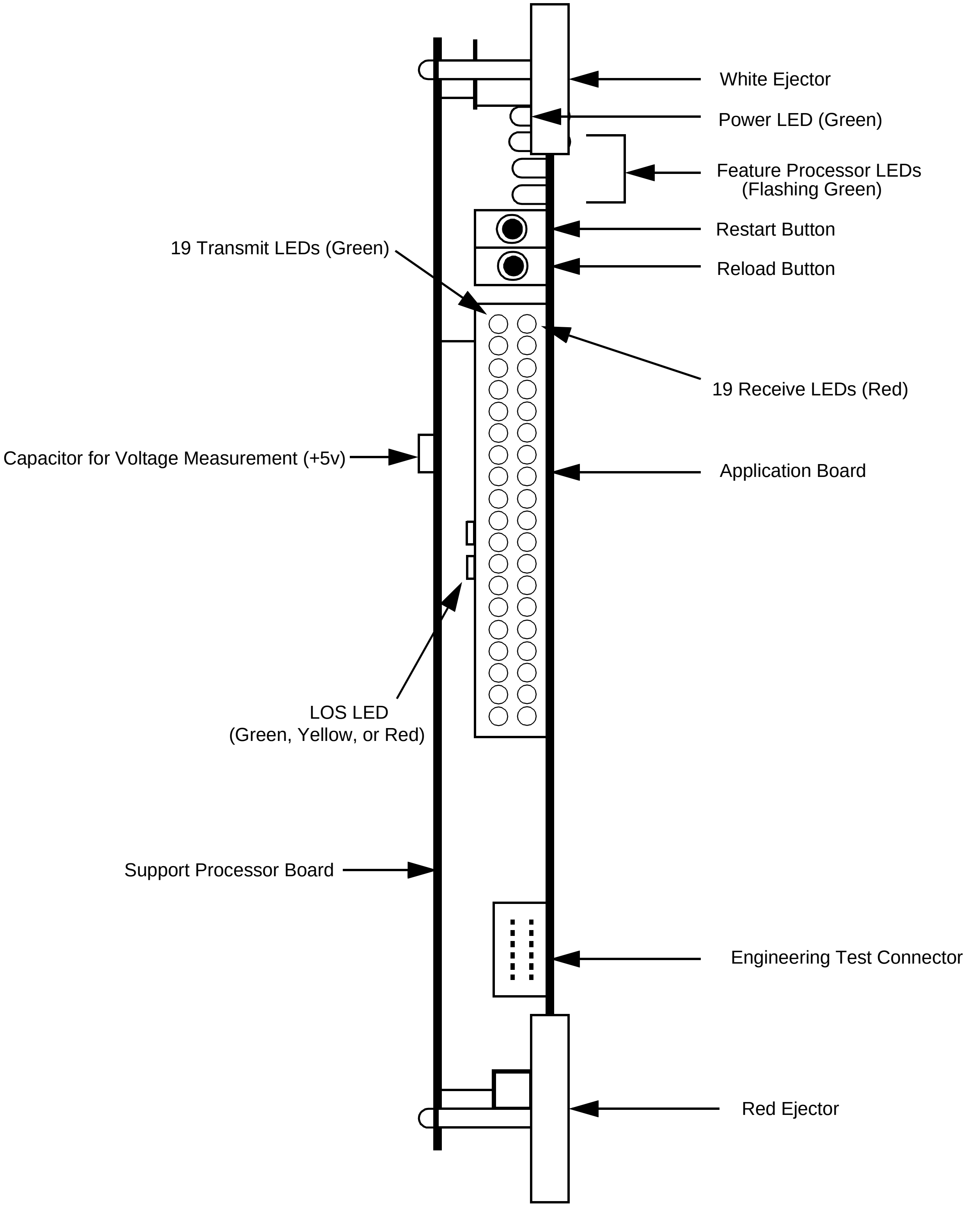
You can recognize a SELC by the ejector colors, white on the top and red on the bottom. The following figure shows the newer SELC.

FIGURE 6-31 Newer SELC



The following figure shows the older SELC.

FIGURE 6-32 Older SELC



The following table describes the LEDs and buttons on the SELC. (The LEDs on the older and the newer SELC are the same with the exception of the power and LOS LEDs on the newer SELC. On the newer SELC, one multi-colored LED is used for power and LOS.)

TABLE 6-29 SELC LEDs and Buttons

LEDs and Buttons	Description
Top Three Feature Processor LEDs	The three feature processor LEDs just below the white ejector should normally be flashing green. (This pattern is called the *MX shuffle*.)
Restart Button	When you press the restart button, the card restarts after 10–20 seconds, using information stored on the card. This generates a hardware reset. Use this button when the data on the card is correct. This button does not affect system operation. Pushing this button is equivalent to using the **Restart Card** option from the System Center Application (SycAp) menu. (Select **Maintenance**, **Card**, and **Restart Card**. For more information about the SycAp menu, refer to the *Tradenet MX System Center Manual 14.1*, part number B0086185104.)
Reload Button	When you press the reload button, the card reloads after two–three minutes, using new data and information from the System Center. This generates a non-maskable interrupt. Use this button when there is a problem with the data loaded on the card. This button does not affect system operation. Pushing this button is equivalent to using the **Load Card Processor** option from the System Center Application (SycAp) menu. (Select **Maintenance**, **Card**, and **Load Card Processor**. For more information about the SycAp menu, refer to the *Tradenet MX System Center Manual 14.1*, part number B0086185104.)
19 Pairs of Receive/Transmit LEDs	The green LEDs are the transmit LEDs and the red LEDs are the receive LEDs. The 19 pairs of receive/transmit LEDs vary based on how you are using them. See *Using the SELC as an Access Switch* on page 6-90, *Using the SELC as a Section Switch* on page 6-90, and *Using the SELC as a Reflection Switch* on page 6-91 for information about these LEDs.
Phase Lock Loop (PLL)/Frequency Fail LED	CR30 is a multi-color, or dual, LED of both red and green. Red is for the PLL Frequency Fail indication and it is normally off. If PLL Frequency Fail is lit red, this indicates the clock source frequency is out of tolerance. Green is for the CI and it is normally lit dim green. If CI is off, this indicates the controller is not accessing the switch ports.
Power/Loss of Signal (LOS) LED	On the newer SELC, there is one multi-colored LED for power and loss of signal (LOS). On the older SELC, the indications for power and LOS are on separate LEDs. The power LED is green and the LOS LED is red. The green LED is always on to indicate there is power to the SELC. The red LED is normally off. If the red LED is lit, the SELC has not found a valid clock source. On the newer SELC, if the red LOS LED is lit and the green power LED is lit, the Power/LOS LED might appear yellow.
Controller Error LED	CR32 is a red LED. It is normally off. If it is lit red, this indicates the controller is not running.
VP1, VP2, VP3	VP1, VP2, and VP3 are test points used to measure voltage on the card.

Using the SELC as an Access Switch

If you are using the SELC as an access switch, the first 14 LEDs indicate the status of the 14 slots on that shelf. The transmit LEDs should normally be lit steady green to indicate the SELC is communicating with that particular slot of the ATIC; likewise, the receive LEDs should normally be lit steady red.

LED pairs 15–18 are used for network connection. These LEDs indicate the status of communication with the next shelf in the system. The following table describes with what plane each SELC acting as an access switch is communicating.

TABLE 6-30 SELCs Acting as Access Switches

Access Switch	Communicates With Plane	
	Three Access Switches:	Two Access Switches:
slot 15 of the TU	3, 4, 5, and 6	2, 3, 5, and 6
slot 16 of the TU	1, 2, 3, and 4	not installed
slot 17 of the TU	1, 2, 5, and 6	2, 3, 5, and 6

For more information about planes, see *Planes* on page 2-21. The 19th LED pair is not used.

Using the SELC as a Section Switch

If you are using the SELC as a section switch, the first 10 LEDs indicate the status of the 5 TUs served by the card. The transmit LEDs should normally be lit steady green to indicate the SELC is communicating with that particular TU; likewise, the receive LEDs should normally be lit steady red. The following list describes which LEDs are associated with which TUs.

TABLE 6-31 SELCs Acting as Section Switches

LED	Communicates With
1 and 6	TU #1 (counting from top)
2 and 7	TU #2
3 and 8	TU #3
4 and 9	TU #4
5 and 10	TU #5

The last nine LEDs indicate the status of communication with the next network layer. If you have 1–5 TUs (a half-triplet system), these LEDs are unused. If you have 6–10 TUs (a triplet), these LEDs indicate the status of communication with the section switch loop back cards (SSLB). If you have more than 10 TUs, these LEDs indicate the status of communication with the reflection switch cards in the associated plane. These vary by system size as described in the following table.

TABLE 6-32 SELCs Acting as Section Switches

Number of Reflection Cards in a Plane	LED Communicates With	Reflection Cards in Plane
3	LED 11, 14, and 17	1
	LED 12, 15, and 18	2
	LED 13, 16, and 19	3
4	LED 11 and 15	1
	LED 12 and 16	2
	LED 13 and 17	3
	LED 14 and 18	4
	LED 19	none
9	LED 11–19	1–9

Using the SELC as a Reflection Switch

If you are using the SELC as a reflection switch, all 19 LEDs pairs are used for network connections. In all systems the links are in sequence to the left and right side section switch card in each triplet. These also vary by system size as described in the following table.

TABLE 6-33 SELCs Acting as Reflection Switches

Reflection Cards in a Plane	LED	Communicates With Section Cards in Triplet:
3	LEDs 1,7, and 13	1 left
	LEDs 2, 8, and 14	1 right
	LEDs 3, 9, and 15	2 left
	LEDs 4, 10, and 16	2 right
	LEDs 5, 11, and 17	3 left
	LEDs 6, 12, and 18	3 right

Reflection Cards in a Plane	LED	Communicates With Section Cards in Triplet:
4	LEDs 1 and 11	1 left
	LEDs 2 and 12	1 right
	LEDs 3 and 13	2 left
	LEDs 4 and 14	2 right
	LEDs 5 and 15	3 left
	LEDs 5 and 16	3 right
	LEDs 6 and 16	4 left
	LEDs 7 and 17	4 right
	LEDs 8 and 18	5 left
	LEDs 9 and 19	5 right
	LED 10	none
9	LEDs 11–19	triplets 1–9, alternately left and right side of triplets

In double-sided systems, the links used for symmetrical back-to-back connections are as follows.

- 3: LEDs 5, 6, 11, 12, 17, and 18
- 4: LEDs 7, 8, 9, 17, 18, and 19
- 9: LED 13, 14, 15, 16, 17, and 18

Keep in mind that these links are not available for connections to triplets.

SSLB

The section switch loop back card (SSLB) is a shelf interconnection card used with Tradenet MX Systems of 3–10 TUs. It bridges the *left* half of the shelf with the *right* half of the shelf.

Six SSLCs are used in slots B4–B14 of the NLBC when the system has only one triplet. In systems with less than five TUs in only two cabinets, these cards are not required. The SSLC does not have components, just traces located near the edge connectors.

SYSTEM CENTER CARDS

The System Center cards are the System Center access card (SCAC) and the VME tower's System Center Gateway card (SCGC).

The SCAC has black top and bottom ejectors. The SCGC does not have ejectors.

SCAC

The System Center access card (SCAC) loops the data lines within TU #1 so that the System Center can access (with the link converter card) the correct processor on port #14 of SELCs #15, #16, and #17 in TU #1. This card is in the same location on every Tradenet MX System: triplet #1, cabinet #1, TU #1, slot #14. It enables the MX System to communicate with the VME tower and System Center.

The SCAC is a relatively blank card with no LEDs. The ejector tabs are black. The SCGC does not have components, just traces located near the edge connectors.

Note *The SCAC for port #14 is used in SELCs #15, #16, and #17 of TU #1 and forms a backplane bus interconnection.*

SCGC

The System Center Gateway card (SCGC) interfaces between the Tradenet MX System and the System Center so that the following functions can be performed:

- initializing the system
- monitoring the system status
- monitoring system alarms

Ethernet Interface Kit

New systems use the new Ethernet Interface kit instead of a SCGC in a VME tower. This kit replaces the VME tower and is made up of two parts, the Ethernet network interface card (ENIC), and the physical interface card (PIC). The ENIC is installed in the front of the cabinet and the PIC is installed in the back.

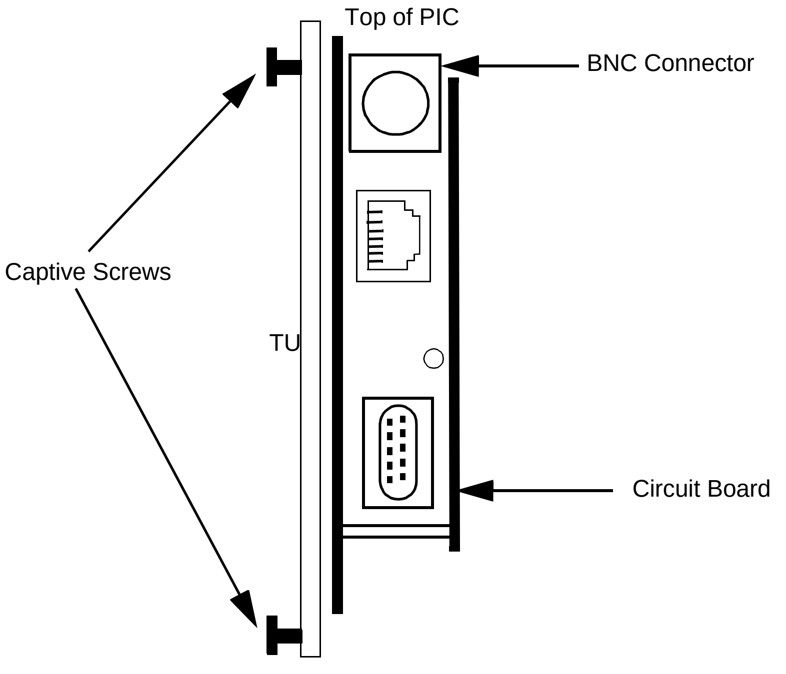
This new Ethernet card operates the same way as the present System Center gateway card (SCGC). This card works with the Sun SPARCstation 5, 10, and 20. It is not supported on the SPARCstation IPC or SPARCstation Classic. This card works with Tradenet MX Release 10.1.28 or later.

The new Ethernet Interface kit replaces the following cards and components:

- VME Gateway card
- Ethernet card
- VME cage or VME shelf
- fiber cable connected to the VME tower
- link converter box in the back of terminal unit (TU) #1
- CentreCOM MX 10 unit with terminators
- old System Center access card (SCAC) in slot #14 of TU #1

The PIC of the new Ethernet Interface kit replaces the VME Gateway card, the old Ethernet card, the VME cage or VME shelf, the fiber cable connected to the VME tower, the SCAC, and the link converter box. The following figure shows the PIC of the new Ethernet card.

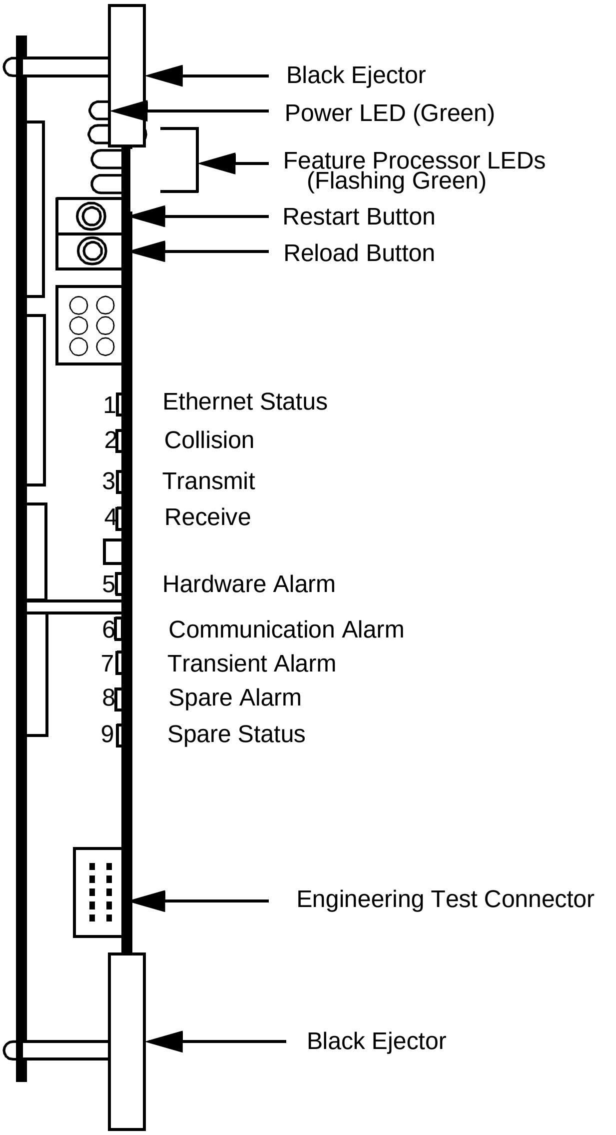
FIGURE 6-33 PIC



The PIC has a BNC connector for thin, Ethernet coaxial (ThinNet) cable. This connector is at the top of the board and is used for connecting to the SPARCstation. Below the BNC connector there is a standard RJ-45 female 8-pin modular connector. The RJ connector is used with the 10Base-T Category 5 cable configuration. Directly below the RJ-45 connector is a green power LED. This LED lights when you insert the PIC in the J2 ISC Fibre connector on the rear of TU #1. The serial port connector at the bottom of the PIC is for IPC Manufacturing and Engineering use.

The ENIC of the new Ethernet Interface kit replaces the MX 10 CentreCOM unit and the old SCAC in slot #14 of TU #1. The following figure shows the new ENIC.

FIGURE 6-34 ENIC



Starting at the top of the card, after the power LED, three feature processor LEDs, restart button, reload button, and three pairs of transmit/receive LEDs, there are nine additional LEDs on the ENIC. The following table describes these LEDs.

TABLE 6-34 ENIC LEDs

LED Type	Position	Description	Color
Ethernet Status LED	1	Line Status, lights only if you are using the 10Base-T cable method to connect the new Ethernet card	Green
Ethernet Status LED	2	Collision, if lit, it indicates collisions detected	Red
Ethernet Status LED	3	Transmit	Green
Ethernet Status LED	4	Receive	Green
Software Status LED	5	Hardware Alarm, if lit, it indicates you need to replace your card	Red
Software Status LED	6	Communication Alarm, not used	Red
Software Status LED	7	Transient Alarm, not used	Red
Software Status LED	8	Spare Alarm, not used	Red
Software Status LED	9	Spare Status, used by IPC only	Green

The first four LEDs are the same as those on the connection to the System Center. These LEDs describe the Ethernet status. The last five LEDs describe the card status. The Line Status LED lights only if you are using the 10Base-T cable method to connect the new Ethernet card.

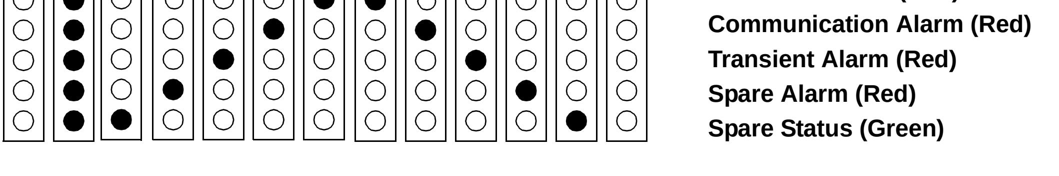
The new Ethernet card does not load like the other Tradenet MX System cards.

When you reload the Ethernet card by pressing the reload button on the ENIC, the LEDs turn off and the following actions take place on the card.

1. The card begins its self-test procedure and turns on the software status LEDs in positions 5–9.
2. The software status LEDs turn off one at a time.
3. The software status LEDs turn on one at a time.
4. The software status LEDs turn off.

The following figure displays the software status LED blink pattern of the card.

FIGURE 6-35 Ethernet Card LED Blink Pattern



After the LEDs turn off, the card goes through a serial port test to determine if a loopback cable has been installed, and then a RAM test. The following text is a log of the output of serial port A during a normal self-test operation.

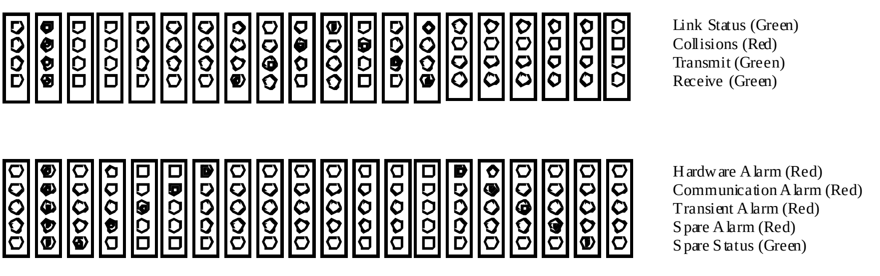
```
#ENIC:IPC INFORMATION SYSTEMS: Serial Port Diagnostic ... Successful.
#ENIC:Ram Test . Successful.
#ENIC:LED TEST ...................... Finished.
#ENIC:etherNet EEPROM Checksum Test  .. Successful.
#ENIC ID:SEQUENCE 65535     MAC Address  = 00-E0-A7-01-FF-FF
#ENIC:etherNet Internal LoopBack Test  . Successful.

auto-booting...
Attaching network interface eth0... done.
Attaching network interface lo0... done.
#ENIC SELF TEST Successful.
Loading... RSH 1145920 + 221072 + 549824
Starting at 0x355400...
```

The next test is for the Ethernet. This test is performed by the Ethernet status LEDs in positions

1–4. You must watch the LEDs to check that this test is successful. The following figure displays the Ethernet status LEDs.

FIGURE 6-36 Ethernet Status LEDs



The card then goes through more Ethernet hardware tests.

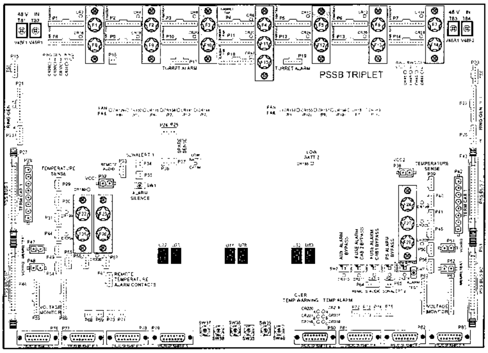
After the self-test, errors on the card are indicated by the three feature processor LEDs. The first feature processor LED indicates an error condition exists; the second and third feature processor LEDs indicate the error condition code. To determine the error condition code, count the number of times the second feature processor LED blinks and multiply it by ten. Then, count the number of times the third feature processor LED blinks and add that number to the first number. This is your error condition code.

In the Mini system and Tradenet MX Systems using HC or Unipower, the SCGC is in the System Center’s Versa Module Europa (VME) tower in slot #1. In Compact systems, the SCGC is located in a small card cage located in the rear of the switch cabinet. In KEPCO MX Systems, the SCGC is located in the VME cage above the section shelf.

The System Center Gateway Card is connected to the System Center with an Ethernet connection. In the Mini system and Tradenet MX Systems using HC or Unipower, the SCGC is connected to the system switch with fiber optic connectors. In Compact systems an RS422 cable is used within the cabinet. In KEPCO systems, the SCGC is connected with ThinNet cable.

Warning! ***Do not insert or remove the SCGC while the Tradenet MX System is powered up.***

Chapter 7 Miscellaneous Equipment



In addition to the cabinets, shelves, and cards described in *Chapter 5 Cabinets and Shelves* on page 5-1, the Tradenet MX System can contain the following miscellaneous equipment:

- power supply status board
- clocks
- TU backplane
- distribution panel
- 99-CHEP-0043-4
- 99-CHEP-0055
- ring generator
- fans
- battery backup
- VME tower
- OpenCall server
- protocol converters
- echo canceller
- RTIC

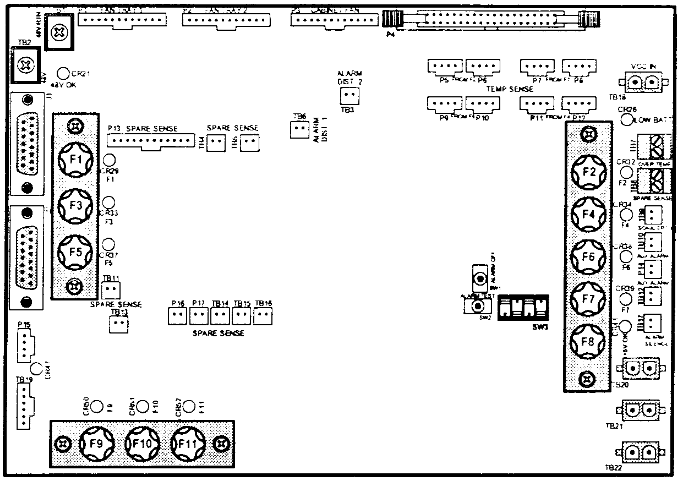
POWER SUPPLY STATUS BOARDS

There are two types of power supply status (PSS) boards used, depending on the size of the system. The PSSA is used in Mini and Compact systems. For these systems, the PSSA is mounted in the rear of the system, adjacent to the power supply modules (PSM). The PSSB is used in other systems. For these systems, the PSSB is mounted behind the PSMs in cabinet #2. With multi-triplet systems, a PSSB is used in each triplet.

The PSSA's and PSSB's status reporting function communicates through the switch element cards (SELC) to the System Center. Faults are reported to the System Center in the same manner. When a fault occurs, you hear an alarm on the PSSA or PSSB and the LEDs on the board help you find the failure. The PSSB has dual inputs, to accommodate split or non-split systems.

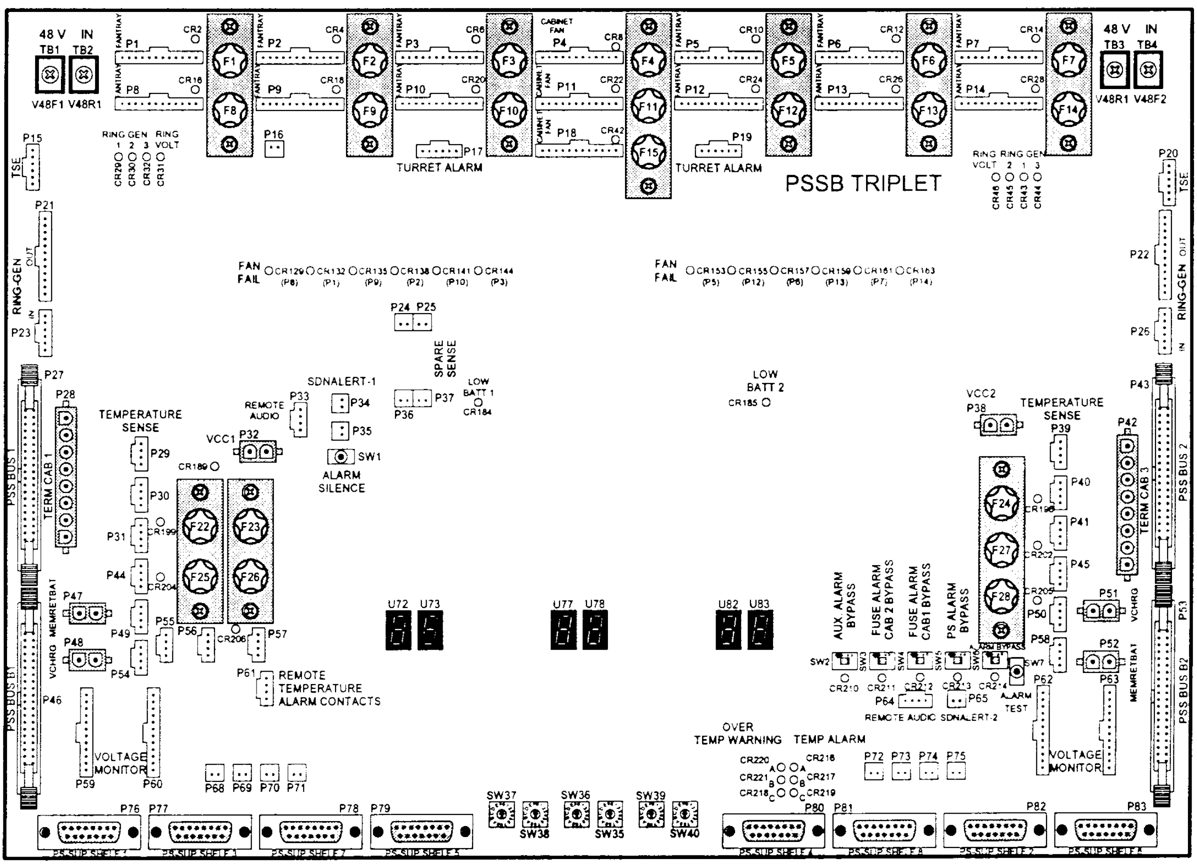
The following figure shows the PSSA and PSSB. These boards are used with HC power.

FIGURE 7-1 PSSA and PSSB



PSSA

PSSB



The function of the PSSA and PSSB is to monitor the following items:

- AC and DC PSMs used within the MX System
- condition of the DC battery back-up for on-card memory
- cooling fans and fan power

- system cabinet temperatures, both ambient and shelf exhaust
- ring generator (20 or 30 Hz ringing, depending on your system and country)

The SELC in slot #17 on each TU in the system reads the status from the PSSA or PSSB. Any status change information is reported to the System Center.

PSSA

The following table describes the PSSA’s fuses, connections, and LEDs.

TABLE 7-1 PSSA

<table>
<tr><th>Type of Function</th><th>Specific Function</th><th>Location ID</th><th>Description of Function</th></tr>
<tr><td rowspan="12">Fan Trays</td><td></td><td>TB1</td><td>48 V RTN</td></tr>
<tr><td></td><td>TB2</td><td>+48 V</td></tr>
<tr><td rowspan="3">Fan Tray 1</td><td>P1</td><td>fan tray 1 connector</td></tr>
<tr><td>CR29</td><td>LED (normally off when F1 is okay)</td></tr>
<tr><td>F1</td><td>fuse for P1</td></tr>
<tr><td rowspan="3">Fan Tray 2</td><td>P2</td><td>fan tray 2 connector</td></tr>
<tr><td>CR37</td><td>LED (normally off when F5 is okay)</td></tr>
<tr><td>F5</td><td>fuse for P2</td></tr>
<tr><td rowspan="3">Cabinet Fan</td><td>P3</td><td>cabinet fan connector</td></tr>
<tr><td>CR33</td><td>LED (normally off when F3 is okay)</td></tr>
<tr><td>F3</td><td>fuse for P3</td></tr>
<tr><td></td><td>P4</td><td>PSSA bus connector; connects to P20 on the TU1 logic backplane</td></tr>
</table>

Type of Function	Specific Function	Location ID	Description of Function
Temperature	**Temperature Sense Connectors P5 and P6**	F2	fuse for P5 and P6
		CR32	LED (on indicates a fuse failure)
	Temperature Sense Connectors P11 and P12	F6	fuse for P11 and P12
		CR34	LED (on indicates a fuse failure)
	Temperature Sense Connectors P9 and P10	F6	fuse for P9 and P10
		CR38	LED (on indicates a fuse failure)
	Temperature Sense Connectors P7 and P8	F7	fuse for P7 and P8
		CR29	LED (on indicates a fuse failure)

Type of Function	Specific Function	Location ID	Description of Function
Power Supplies		TB16	spare Sense
		J1 and J2	spare power supply connectors
		TB13	TSE connector
		TB18	VCC power supply (+5 V DC)
		CR41	LED (lit indicates good input)
		TB26	spare VCC power supply (+5 V)
		TB29	ground return for power supply
		TB20	V charge from power supply
	Ring Generator #1	in: TB19 pins 1 and 2 P15; out: P15 pins 1,3,2, and 4	ring generator #1
		F9	fuse for TB20
		CR50	LED (lit indicates good input)
	Ring Generator #2	in: TB19 pins 3 and 4 P15; out: P15 pins 1,3,2, and 4	ring generator #2
		F10	Input Fuse for TB23
		CR51	LED (lit indicates good input)
	Ring Generator #1	in: TB19 pins 5 and 6 P15; out: P15 pins 1,3,2, and 4	ring generator #1
		F11	input fuse for TB20
		CR52	LED (lit indicates good input)
	Output Ring	in: none; out: P15 pins 1,3,2, and 4	output ring
		CR47	LED (lit indicates good input)

Type of Function	Specific Function	Location ID	Description of Function
Memory Retention Battery		TB27	ground battery (–5 V DC) connector
		TB28	memory retention battery (+) connector
		TB8	V battery backplane #2 connector; powers memory logic on cards; connects to TB50 on backplane #2
		TB13	Telecom service Earth (TSE) connector for PBX or CO ground
Alarm		TB6	alarm signal input to distribution panel #1
		TB3	alarm signal input to distribution panel #2
		TB10	audible alarm output for sonar alert electronic buzzer located on top of cabinet
		TB7 and TB8	over temperature relays (cabinet and ambient)
		TB19—pins 1 and 2 TB19—pins 3 and 4 TB19—pins 5 and 6	ring generator #1 ring generator #2 ring generator #3
		TB22	audio alarm silencer
Switches		SW2	audible alarm (sonar alert) test (momentary contact)
		SW1	audio alarm silencer (push to silence)
		SW3	4PST dip switch; see *TABLE 7-2 PSSA Switch Settings* on page 7-10

The following table describes the switches on the PSSA board.

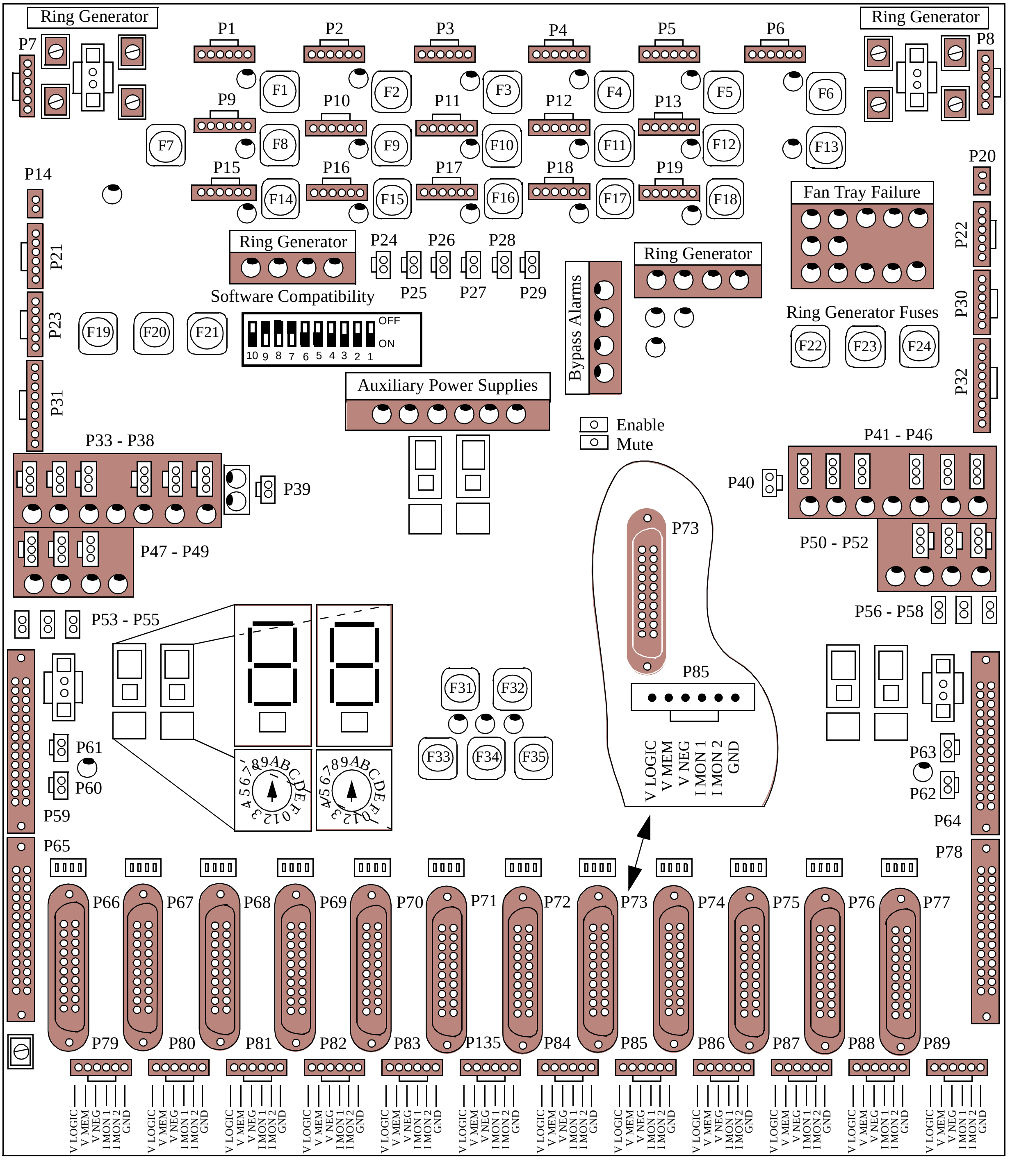
TABLE 7-2 PSSA Switch Settings

PSSA Switch Number	PSSA Switch Label	Switch Definition	Default Setting
SW1	ALARM OFF‘	turns off the sonic buzzer during a failure	n/a
SW2	ALARM TEST	sonic buzzer test	n/a
SW3-1	no label	external sensor (TB9)	on
SW3-2	no label	high temperature, fan, or temperature module fuse bypass	off
SW3-3	no label	not used	n/a
SW3-4	no label	enables SW2	off

PSSB

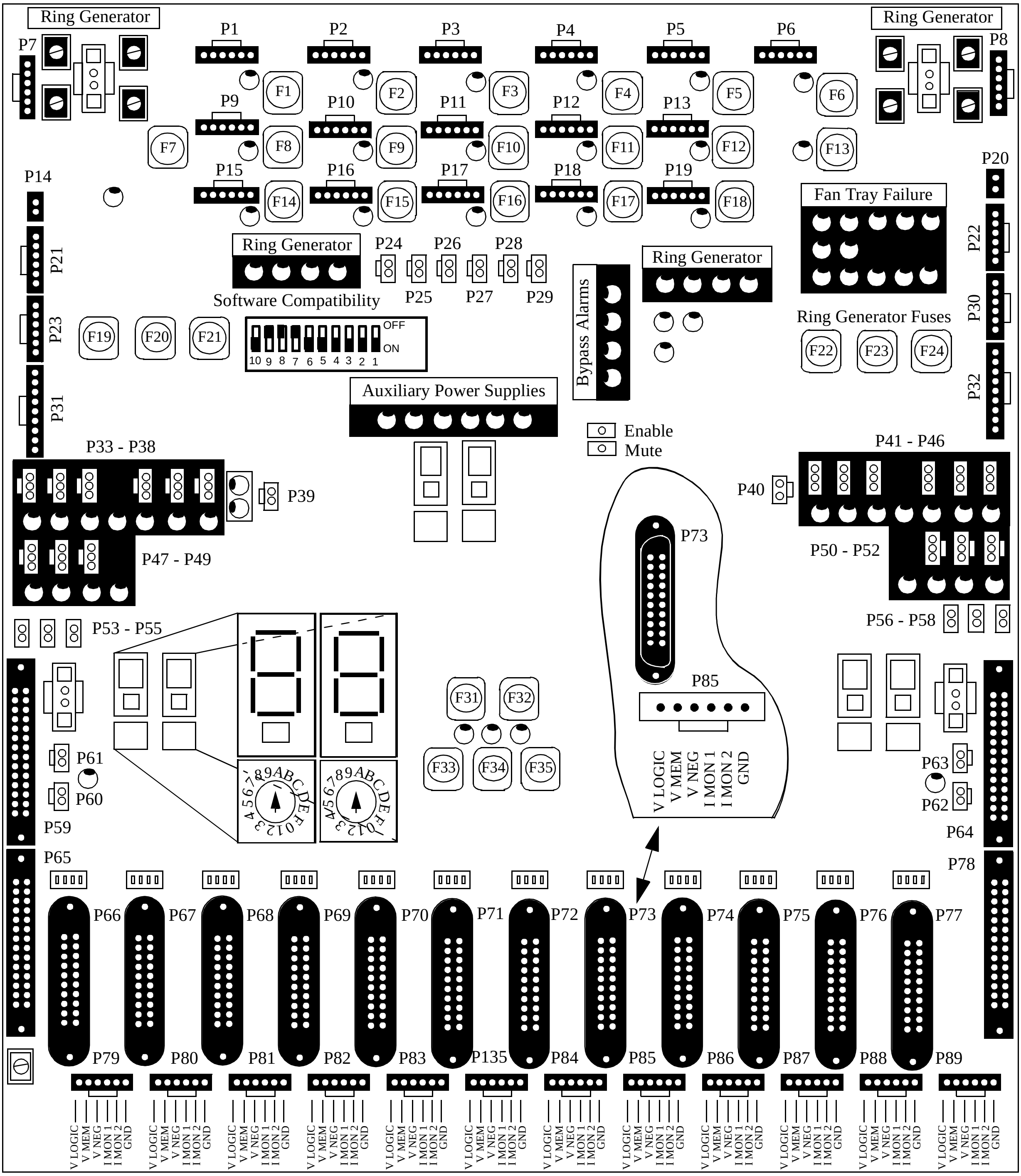
FIGURE 7-1 PSSA and PSSB on page 7-5 show the PSSB used with HC power. The following figure shows the Unipower PSSB.

FIGURE 7-2 Unipower PSSB



The following figure shows the KEPCO PSSB.

FIGURE 7-3 KEPCO PSSB



The following table describes the PSSB's fuses, connections, and LEDs.

TABLE 7-3 PSSB

Type of Function	Specific Function	Location ID	Description of Function
Fan Tray Connectors, Fuse Failure LEDs, and Fuses	**Cabinet A**	P1, CR2, F1	TU #1 connector, LED, fuse for P1
		P8, CR16, F8	TU #2 connector, LED, fuse for P8
		P2, CR4, F2	TU #3 connector, LED, fuse for P2
		P9, CR18, F9	TU #4 connector, LED, fuse for P9
		P10, CR20, F10	TU #5 connector, LED, fuse for P10
		P4, CR8, F4	cabinet exhaust fan A
	Cabinet C	P7, CR14, F7	TU #6 connector, LED, fuse for P7
		P14, CR28, F14	TU #7 connector, LED, fuse for P14
		P6, CR12, F6	TU #8 connector, LED, fuse for P6
		P13, CR 26, F13	TU #9 connector, LED, fuse for P13
		P12, CR24, F12	TU #10 connector, LED, fuse for P12
		P18, CR42, F15	cabinet exhaust fan C
	Cabinet B	P3, CR6, F3	shelf #1 (section shelf) connector, LED, fuse for P3
		P5, CR10, F5	shelf # 2 (reflection shelf) connector, LED, fuse for P5
		P11, CR22, F11	cabinet exhaust fan B
Fan Failure Indicator LEDs	**Cabinet A**	CR132	TU #1 fan fail indicator (on when failure)
		CR129	TU #2 fan fail indicator (on when failure)
		CR138	TU #3 fan fail indicator (on when failure)
		CR135	TU #4 fan fail indicator (on when failure)
		CR141	TU #5 fan fail indicator (on when failure)
	Cabinet C	CR161	TU #6 fan fail indicator (on when failure)
		CR163	TU #7 fan fail indicator (on when failure)
		CR157	TU #8 fan fail indicator (on when failure)
		CR159	TU #9 fan fail indicator (on when failure)
		CR155	TU #10 fan fail indicator (on when failure)
	Cabinet B	CR144	shelf #1 (section shelf) fan fail indicator (on when failure)
		CR153	shelf #2 (reflection shelf) fan fail indicator (on when failure)

Type of Function	Specific Function	Location ID	Description of Function
Temperature Sense Connectors, Fuses, and Overhead LEDs	**Cabinet A**	P29, F22, CR199	TU #1 temperature sense connector, fuse, LED (off when fuse blows)
		P30, F22, CR199	TU #2 temperature sense connector, fuse, LED (off when fuse blows)
		P31, F22, CR199	TU #3 temperature sense connector, fuse, LED (off when fuse blows)
		P44, F25, CR204	TU #4 temperature sense connector, fuse, LED (off when fuse blows)
		P49, F25, CR204	TU #5 temperature sense connector, fuse, LED (off when fuse blows)
		P54, F25, CR204	air intake from bottom of cabinet
	Cabinet C	P39, F27, CR202	TU #6 temperature sense connector, fuse, LED (off when fuse blows)
		P40, F27, CR202	TU #7 temperature sense connector, fuse, LED (off when fuse blows)
		P41, F27, CR202	TU #8 temperature sense connector, fuse, LED (off when fuse blows)
		P45, F28, CR205	TU #9 temperature sense connector, fuse, LED (off when fuse blows)
		P50, F28, CR205	TU #10 temperature sense connector, fuse, LED (off when fuse blows)
		P58, F28, CR205	air intake from bottom of cabinet
	Cabinet B	P55, F26, CR206	shelf #1 (section shelf), fuse, LED (off when fuse blows)
		P56, F26, CR206	shelf #2 (reflection shelf), fuse, LED (off when fuse blows)
		P57, F26, CR206	shelf #3, fuse, LED (off when fuse blows)

Type of Function	Specific Function	Location ID	Description of Function
Power Supply Alarm Inputs		P15 and P20	Telecom service Earth (TSE) input/output
		P23, CR32, CR31	ring generator #1, cabinet A, LED, LED ring present
		P23, CR30	ring generator #2, cabinet A, LED
		P23, CR44, CR46	ring generator #1, cabinet C, LED, LED ring present
		P23, CR45	ring generator #2, cabinet C, LED
		P17	alarm signal input from distribution panels in cabinet A
		P19	alarm signal input from distribution panels in cabinet C
		P76	+5 V power supply alarm input shelf #1 A, B, or C
		P82	+5 V power supply alarm input shelf #2 A, B, or C
		P77	+5 V power supply alarm input shelf #3 A, B, or C
		P80	+5 V power supply alarm Input shelf #4 A, B, or C
		P79	+48 V power supply shelf #1 or #5 cabinet A, B, or C
		P83	+48 V power supply shelf #2 or #6 cabinet A, B, or C
		P78	+48 V power supply shelf #3 or #7 cabinet A, B, or C
		P81	+48 V power supply shelf #4 or 8 cabinet A, B, or C
Power Supply Voltage Monitoring Connections to Bus Bars		TB1	terminal block to +48 V bus bar
		TB2	terminal block to +48V RTN bus bar
		P32-1	connector to 5 V RTN bus bar cabinet A
		P32-2	connector to 5 V bus bar cabinet A
		P38-1	connector to 5 V RTN bus bar cabinet C
		P38-2	connector to 5 V bus bar cabinet C
Power Supply Voltage Monitor Fuses and LEDs		F23, CR189	P32-2 fuse and LED indicator for cabinet A
		F24, CR 196	P38-2 fuse and LED indicator for cabinet C
Ring Generator Input and Output Connectors		P21	input connector cabinet A shelves 1–5 ring generator
		P22	input connector cabinet C shelves 1–5 ring generator
		P23, CR29, CR30	output connector cabinet A ring generator and LEDs
		P26, CR44, CR46	output connector cabinet C ring generator and LEDs
		CR31, CR46	ring present LEDs cabinet A and cabinet C

Type of Function	Specific Function	Location ID	Description of Function
Alarm Outputs		P33	remote alarm audio cabinet A
		P64	remote alarm audio cabinet C
		P61	fan trays, distribution panel, temperature cabinet A, B, and C
		P34	sonar alert #1 for cabinet A
		P65	sonar alert #2 for cabinet C
Alarm Bypass and Test Switches		SW1	audio alarm disable for cabinet A and C
		P35	remote alarm disable input for cabinets A and C
		SW2	auxiliary alarm disable
		SW3	cabinet A fuse alarm disable
		SW4	cabinet B fuse alarm disable
		SW5	power supply alarm disable
		SW6	alarm test
Power Supply Status Bus Outputs		P46	PSS bus B1 to shelf #1 (section shelf) right in
		P53	PSS bus B2 to shelf #1 (section shelf) left in
		P27	PSS bus 1 to cabinet A shelf #1 (TU #1)
		P43	PSS bus 2 to cabinet C shelf #1 (TU #6)

The following table describes the switches on the PSSB board.

TABLE 7-4 PSSB Switch Settings

PSSB Switch Number	PSSB Switch Label	Switch Definition	Default Setting
SW1	ALARM SILENCE	turns off the sonic buzzer during a failure	n/a
SW2	AUX ALARM BYPASS	enables and disables SW3 and SW4	n/a
SW3	FUSE ALARM CAB 2 BYPASS	temperature defeat or enable	off
SW4	FUSE ALARM CAB 1 BYPASS	turret/fan fuse defeat or enable	off
SW5	PS ALARM BYPASS	enables and disables SW3 and SW4	on
SW6	ALARM BYPASS	enables SW7	off
SW7	ALARM TEST	sonic buzzer test	n/a

In addition, SW37 and SW38 belong to U72 and U73, used to indicate the left cabinet's (cabinet #1) status; SW36 and SW35 belong to U77 and U78, used to indicate the center cabinet's (cabinet #2) status; SW39 and SW40 belong to U82 and U83, used to indicate the right cabinet's (cabinet #3) status. These switches are set by IPC's factory in Westbrook as indicated in the following table.

TABLE 7-5 PSSB Cabinet Identification Switch Settings

Cabinet #	Cabinet Type	Triplet Number	SW37	SW38	LED Pair[a]	SW36	SW35	LED Pair	SW39	SW40	LED Pair
1	TU	1							0	1	01
2	network	1				0	2	02			
3	TU	1	0	3	03						
5	TU	2							0	5	05
6	network	2				0	6	06			
7	TU	2	0	7	07						
9	TU	3							0	9	09
10	network	3				0	A	10			
11	TU	3	0	B	11						
13	TU	4							0	D	13
14	network	4				0	E	14			
15	TU	4	0	F	15						
17	TU	5							1	1	17
18	network	5				1	2	18			
19	TU	5	1	3	19						
21	TU	6							1	5	21
22	network	6				1	6	22			
23	TU	6	1	7	23						
25	TU	7							1	9	25
26	network	7				1	A	26			
27	TU	7	1	B	27						
29	TU	8							1	D	29
30	network	8				1	E	30			
31	TU	8	1	F	31						
33	TU	9							2	1	33
34	network	9				2	2	34			

Cabinet #	Cabinet Type	Triplet Number	SW37	SW38	LED Pair[a]	SW36	SW35	LED Pair	SW39	SW40	LED Pair
35	TU	9	2	3	35						
37	TU	10							2	5	37
38	network	10				2	6	38			
39	TU	10	2	7	39						
41	TU	11							2	9	41
42	network	11				2	A	42			
43	TU	11	2	B	43						
45	TU	12							2	D	45
46	network	12				2	E	46			
47	TU	12	2	F	47						

a. Each LED pair corresponds with the two switches listed in the two columns to the left.

Ribbon cables connect the PSSA or PSSB board to every shelf in its cabinet or triplet. The third access switch card (in slot #17) on each TU shelf in the system reads the status from the PSSA or PSSB board, and reports any change to the System Center.

The PSSA and PSSB boards are designed with N+1 redundancy built in, to ensure the integrity of power to the MX System. Secondary power boards cannot be replaced when the system is powered up, because the redundant supplies on each board are brought through isolation diodes to a common output terminal on the board.

Monitoring Power Supplies

The PSSA or PSSB board monitors the power supply modules individually by reading the *power good* signal from each module. This signal is generated by each module, as long as it considers its input and DC output voltages acceptable.

Monitoring the VMEM Battery

The PSSA or PSSB board passes the power from the power supply shelves down to the battery used for backup for the memory on each card. The card monitors the voltage on this feed, and reports to the System Center whenever the voltage drops to an unacceptable level.

Monitoring and Powering Fans

Each cabinet in a non-KEPCO MX System has two top mounted cabinet fans to exhaust air from the cabinet. Cabinet fans are powered by 48 V DC power distributed by the PSSA or PSSB board. A failure LED on the PSSA or PSSB lights to indicate a fuse failure in the 48 V supply lead to these fans.

A fan tray with six fans is mounted under every TU or section or reflection shelf, to provide cooling for the shelf. Fans are powered by the 48 V DC power supply, distributed to the fans through fuses on the PSSA or PSSB board. Each fan has a *go/no go* sense output, which is commoned with the others in its tray. A fan tray assembly alarm signal is generated if any one of the fans' go/no go output signals is high. A sense return signal allows the board to verify that the fan tray and cable have been installed: thus alarms are only generated for fan trays that have been installed. An alarm is also generated if a fan 48 V fuse failure occurs on the PSSA or PSSB board. An LED on the board assists in the location of the failed fuse.

Monitoring Temperature

The PSSA or PSSB board has temperature sensor connectors for sensors that measure ambient air intake at the cabinet’s base and temperature readings at the shelf levels (TU, section shelves, and reflection shelves). An alarm signal is generated when the maximum permissible temperature is exceeded. A fuse failure for the temperature sense is indicated on the board by a failure LED.

Monitoring Ring Generator

Ring voltage is required for private manual line cards. For redundancy, the MX System has two ring generators in cabinets where those lines exist. Each ring generator supply is connected to the PSSA or PSSB board. A fuse failure generates a ring supply failure alarm. Because it is not practical for ring generators to share loads, voltage sense circuits and relays on the PSSA or PSSB board provide connections for an extra ring generator designated as a hot standby for ring voltage. On power up, ring generator #1 is always selected. If it fails, ring generator #2, the hot standby, is selected, and a failure alarm is generated.

CLOCKS

The clock subsystem provides a clock signal for bit synchronous operation of the whole system. It has a hierarchical, fully distributed, master/slave architecture with fast automatic recovery in the unlikely event of failures.

The clock and frame synchronization signals are transmitted throughout the system on channel zero of the same links that carry the data and digitized voice signals.

Every card has its own crystal controlled clock. It can operate either as a master (free-running) local clock, or as a slave frequency clock, locked onto an external master clock. The System Center gateway card (SCGC) and all switch element cards, have an exceptionally accurate clock crystal, with an accuracy of +/-25 parts per million (25 thousandths of a percent). At any time there will be three clocks in the system that have been assigned a rank: rank 3 (master), rank 2 (first reserve), and rank 1 (second reserve). All other clocks will have rank 0. The cards with the three ranking clocks are chosen from those having the more accurate crystal.

Clock information is carried in channel zero of each link, and, as was explained in the link coding is such that clock frequency can be extracted. All cards have their clocks synchronized to the rank 3 clock under normal operation. Should the rank 3 clock card fail, then the rank 2 card will take over, and all the cards will then synchronize to the rank 2 clock.

The accuracy and stability of all the free-running clocks, even those with the lesser accuracy, is high enough to allow communication between cards with reasonably low error rate in situations when the system is not fully synchronized, such as system start up, or during failure of the current system master clock.

By implementing the system mostly in hardware, the clock initialization after reset and the clock switch-over upon failure can occur fully autonomously, within milliseconds. However, the software on the reflection switch cards has the ability to screen clock failure signals to decide whether the signal is system affecting or not. Those that are not system affecting are not passed through the SELC, preventing wider than necessary propagation of clock fault signals.

TU BACKPLANE

The TU backplane, located at the back of the TU where it is partly covered by the distribution panel, passes all signals to and from the inputs and outputs of each card. Communications from the terminal cards to the SELCs acting as access switches are done entirely within the backplane, while all other communications occur between the card connectors and one of the other connectors on the backplane

The ports on the TU backplane are for:

- TU backplane to TU backplane (in a two TU system) or to the section shelf (triplet) connections
- System Center connections
- power supply status board (PSSA or PSSB) connections
- line connections, including those for the T1 and E1 daughter cards, and for power fail transfer
- distribution panel ribbon cable connection (under the distribution panel)
- line busy adaptor card ribbon cable connections (under the distribution panel)

Below the analog distribution panel, there are four male 25-pair connectors on the TU backplane, and one female between them. Each 25-pair male connector handles two-and-a-half cards. The center female power fail transfer connector provides a copper connection to the first two lines on each DLIC whenever the logic power to a DLIC is lost. This fulfills U.K. requirements that at least 20% of exchange lines have automatic provision for bypassing a switch network in case of power failure. The four male connectors are used for incoming lines to the shelf as described in the following table:

TABLE 7-6 TU Backplane Connectors

Connector	Lines	Power Fail Lines
P28	1–25	1, 2, 11, 12, 21, 22
P26	26–50	31, 32, 41, 42
P23	51–75	51, 52, 61, 62, 71, 72
P22	76–100 or 76–90 (TU1)[a]	81, 82, 91, 92

a. Slot #14 on TU #1 always contains the System Center Access Card (SCAC). Therefore, P22 connector is for lines 76–90 on TU #1. All other TUs have 100 lines each.

A daughter board is connected onto the TU backplane whenever T1 or E1 digital lines are used in the MX System. These boards mount on the two vertical connectors marked *E1/T1 Adaptor.* There are two types of daughter boards:

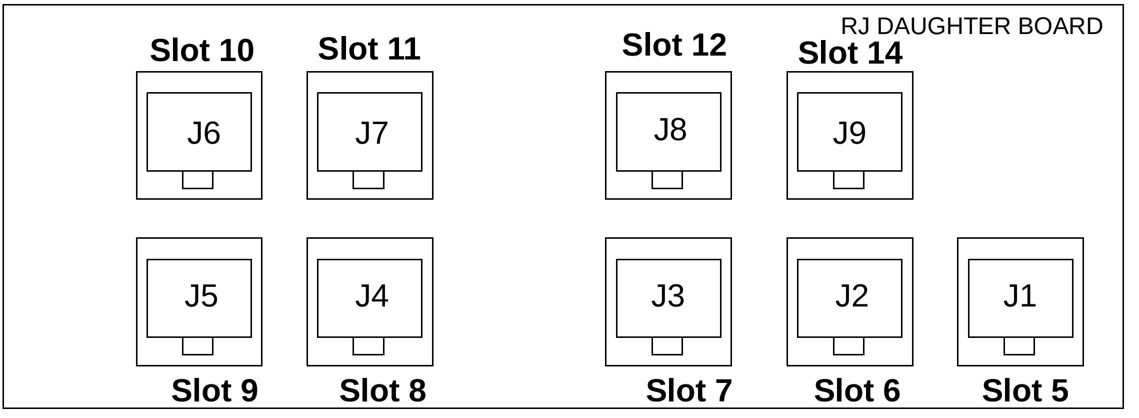
- An RJ daughter board is connected on site to the analog or digital TU backplane whenever T1 digital cards (DLICs) are used on the shelf.
- A BNC daughter board is connected on site to the analog or digital TU backplane whenever E1 digital cards (CPICs) are used on the shelf.

Only one card can mount on the two connectors shown; therefore all of the digital line cards in a shelf must be either Ei1 or T1, depending on the daughter card installed.

Modular Daughter Board

These are used whenever T1 digital line cards (DLICs) are used in the shelf. They are also used (with a balun) in the U.S. whenever E1 digital line cards (CPICs) are used in a shelf. There are nine modular connectors on the T1 daughter board. Each connector handles one card. The RJ daughter board's jacks (one for each T1or E1 interface) are labeled as J1–J9, and the layout of the nine modular jacks is shown in the following figure (viewed from the rear of the cabinet).

FIGURE 7-4 T1 Modular Daughter Board



Unless the T1or E1 is under test (some form of drop and insert apparatus) the T1's RJ48C or E1's RJ48C must be connected to RJ daughterboard at all times. The slots the daughterboard connectors serve are shown in the following table. Connectors are used for incoming digital lines as described in the following table:

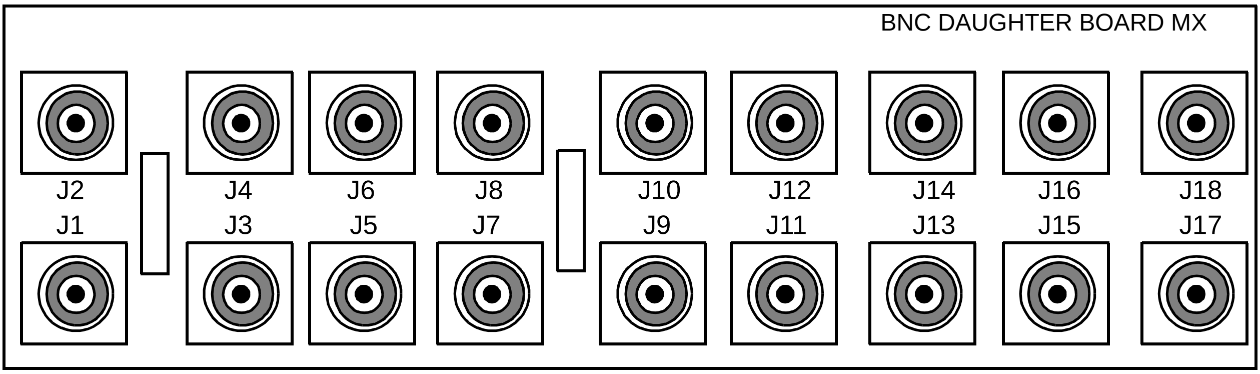
TABLE 7-7 Modular Daughter Board Connectors

Connector	Card Slot on TU
J1	slot #5
J2	slot #6
J3	slot #7
J4	slot #8
J5	slot #9
J6	slot #10
J7	slot #11
J8	slot #12
J9	not used

BNC Daughter Board (E1 Lines Only)

A BNC daughter board is connected to the analog or digital TU backplane whenever E1 digital line cards (CPICs) are used on the shelf, except in the U.S. where a modular daughter board and a balun are used with CPICs (see *Modular Daughter Board* on page 7-22). There are nine pairs of BNC connectors on the E1 BNC daughter board. Each connector pair handles one card. The BNC connectors (two for each E1 interface) are labeled as J1–J18, and the layout is shown in the following figure (as viewed from the rear of the cabinet).

FIGURE 7-5 E1 BNC Connector Daughter Board



The slots the daughter board connectors serve are shown in the following table. These connectors are used for incoming E1 digital lines as follows:

TABLE 7-8 E1 BNC Connectors

Connector	E1 Card Slot on TU
J17 and J18	slot #5
J15 and J16	slot #6
J13 and J14	slot #7
J11 and J12	slot #8
J9 and J10	slot #9
J7 and J8	slot #10
J5 and J6	slot #11
J3 and J4	slot #12
J1 and J2	not used

DISTRIBUTION PANEL

The distribution panel, which terminates cables from stations and from designated auxiliary equipment, is mounted on the rear of the TU shelf it serves. Ribbon cables bring the turret specific signals from the TU backplane to the distribution panel, which provides 12 pair Amplenol™ connectors to terminate the 12 pair cables from the trading floor turrets.

The 48 V DC required to power the turrets is wired directly to the distribution panel, where it is then routed to the appropriate pins for each 12 pair connector. A six amp slow blow glass fuse for each turret protects the 48 V supply from a short circuit in a turret or its cable. Fuse failure due to an ongoing short is indicated by illumination of an LED on the distribution panel (directly above or below the fuse for the same turret), and audible alarm on the PSSA or PSSB. The System Center logs any short that blows the fuse, however transient, and generates alarm messages.

There are separate distribution panels for analog and digital turrets: Therefore, analog and digital turrets cannot be mixed on a TU. The noticeable differences between the analog and digital distribution panels are that the analog has less turret connectors (24 versus 40) and no switches.

Digital Distribution Panel

Turret Cable Connectors

The digital distribution panel can handle 40 digital turrets, each on one 12-pair female connector. Twelve-pair male-ended 180 degree connectors are used for the turrets.

Auxiliary Cable Connectors

The 12-pair from each turret carries an analog tip and ring pair for each handset from the turret back to the back room. These are made available in the back room on J44, J17, J11, and J23, which are female 25-pair amp-type connectors. Recorder channel tip and ring are cross-connected to these pairs. Each auxiliary cable provides two tip and ring pairs for a maximum of ten turrets, as shown in the table below. Five pairs in each cable are not used.

TABLE 7-9 Digital Distribution Panel Auxiliary Cable Connectors

Auxiliary Cable Connector	For Turrets
J44	1–10
J17	11– 20
J11	21–30
J23	31–40

Note *The above cables do not contain Stentofon pairs that are found in the analog auxiliary cables of the MX System. Separate Stentofon cables must be run to each desk, if required at a site.*

Switches for Digital Speakers

Switches are used in installations with digital speaker modules. They are located above the top row of 12-pair connectors (J connector numbers), and below the bottom row. Switches are turned from the off position to on to route an additional 2B+D connection to a turret for speaker modules. However, for each 2B+D used for speakers, a turret connection becomes unavailable. There are two types of switch is use: the older black unit and the newer red unit.

When switch #SW20 (a red switch is shown) above the J22 connector is moved towards the left (on position, reads like OZ), the 2B+D channel from connector J21 is transferred over to J22. The digital speaker module connected to the digital turret with the J22 connector uses one B channel to program the speaker. The J21 connector is a speaker port and cannot be used for a turret. Switch #SW19 is left in the off position.

TABLE 7-10 Digital Speaker Switches

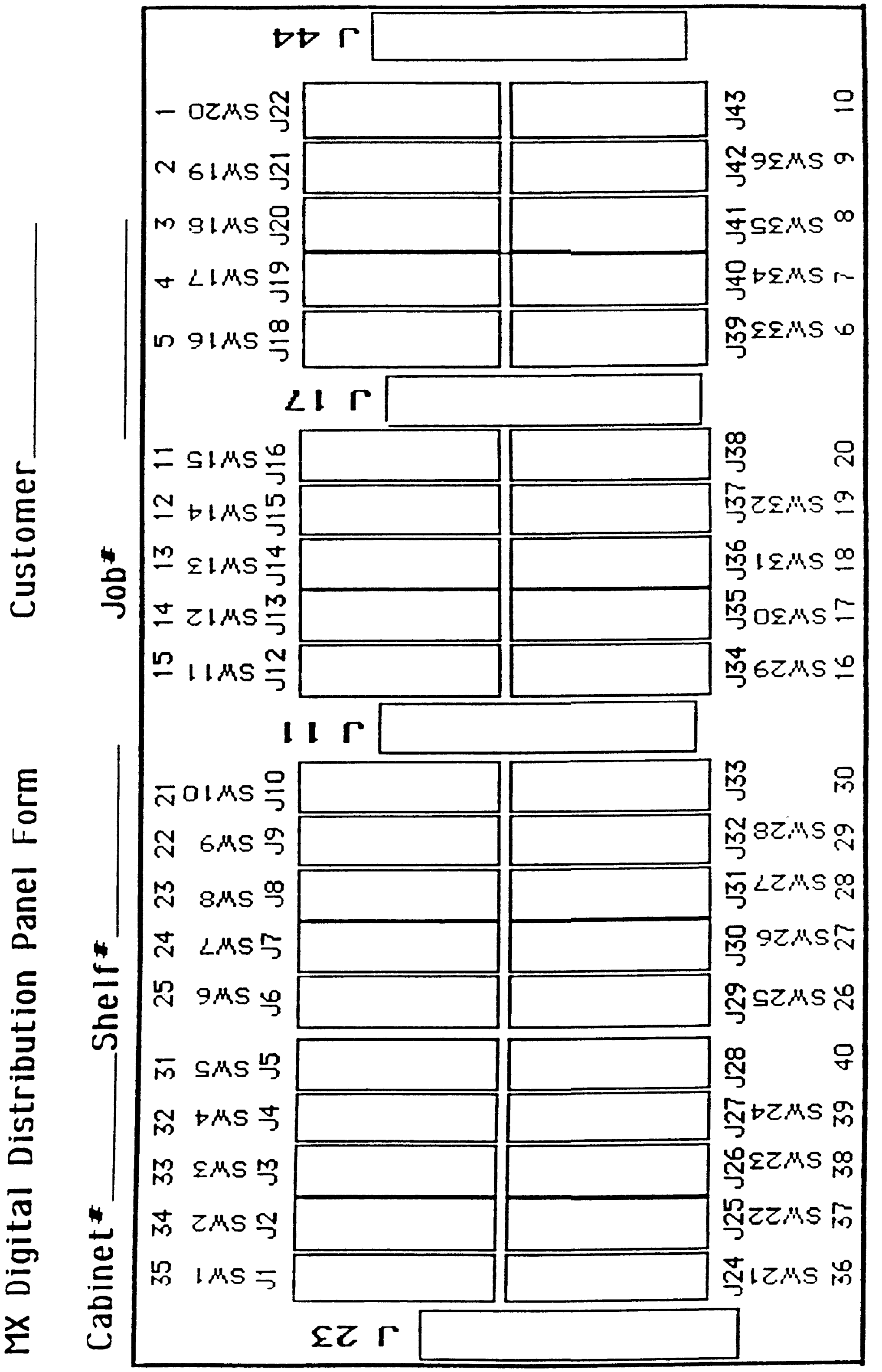
Turret	J Connector Number	Switch Number	Turret	J Connector Number	Switch Number	Turret	J Connector Number	Switch Number	Turret	J Connector Number	Switch Number
1	J22	SW20	11	J16	SW15	21	J10	SW10	31	J5	SW5
2	J21	SW19	12	J15	SW14	22	J9	SW9	32	J4	SW4
3	J20	SW18	13	J14	SW13	23	J8	SW8	33	J3	SW3
4	J19	SW17	41	J13	SW12	24	J7	SW7	34	J2	SW2
5	J18	SW16	15	J12	SW11	25	J6	SW6	35	J1	SW1
6	J39	SW33	16	J34	SW29	26	J29	SW25	36	J21	SW21
7	J40	SW34	17	J35	SW30	27	J30	SW26	37	J22	SW22
8	J41	SW35	18	J36	SW31	28	J31	SW27	38	J23	SW23
9	J42	SW36	19	J37	SW32	29	J32	SW28	39	J24	SW24
10	J43	N/A	20	J38	N/A	30	J33	N/A	40	J25	N/A

Note *A few older installations have black and white switches installed on the distribution panels that turn on and off in reverse of the now standard red switches.*

The red switches have arrows indicating on. Early black and white switches do not have any labels. The off position is to the left. Switches are shipped in the off position.

The following figure shows a digital distribution panel template you can use.

FIGURE 7-6 Digital Distribution Panel Template



Analog Distribution Panel

Turret Cable Connectors

The analog distribution panel can handle 24 analog turrets. Each of the 12-pair connectors are female-ended. Twelve-pair male-ended 180 degree connectors are used for the turrets.

Note *The turret 12-pair cables terminate on the analog distribution panel, eliminating the need for cross connections.*

Auxiliary Cable Connectors

Six female 25-pair connectors for auxiliary equipment, such as recorders, four-wire, or intercom.are also provided. The analog distribution panel auxiliary cable connectors are six female 25-pair connectors numbered J2, J5, J8, J11, J14, and J17.

The auxiliary cables provide access to:

- 12-pair cable spare leads
- tip and ring for the main side and DPT side of the turrets: these parallel those to the turret
- recorders
- four-wire latch
- intercom leads for Stentofon
- FTS speakers (the tip and rings become speaker channels)

Each auxiliary cable supports a maximum of four turrets, as shown in the table below.

TABLE 7-11 Analog Distribution Panel Auxiliary Cable Connectors

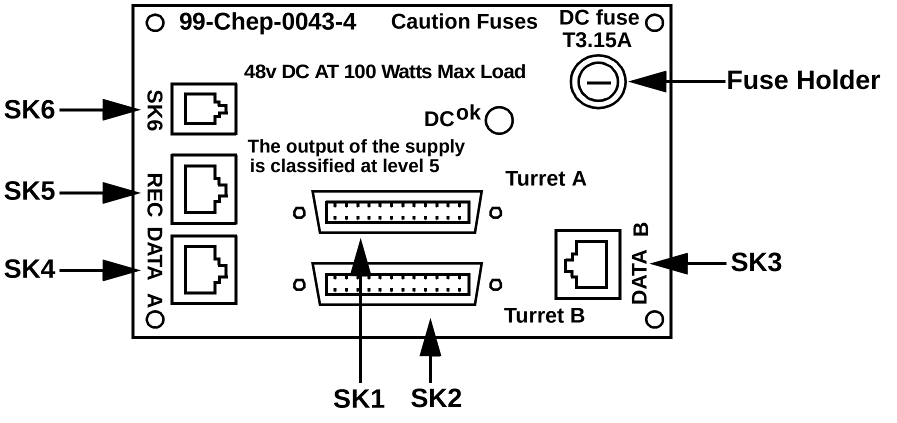
Auxiliary Cable Connectors	For Turrets
J2	1–4
J5	5–8
J8	9–12
J11	13–16
J14	17–J20
J17	21–24

99-CHEP-0043-4

The 99-CHEP-0043-4 is a 100 watt 48 volt front room power supply unit. The 99-CHEP-0043-4 provides both local power to the turret, and connectivity from the backroom to the desktop.

Warning! ***Always install a 99-CHEP-0043 with enough open area surrounding it to provide for adequate ventilation. To prevent overheating the 99-CHEP-0043 should never be fully enclosed.***

FIGURE 7-7 99-CHEP-0043-4 Front Panel



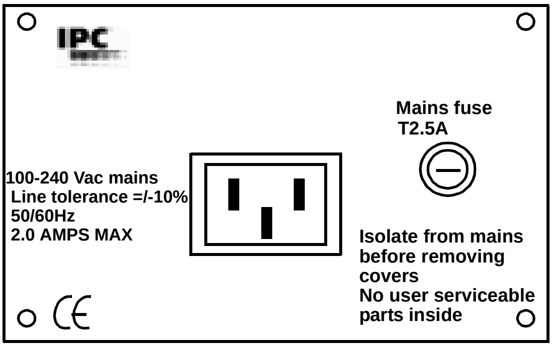
The data outputs from a backroom station card are connected to the DATA A (SK4) and DATA B (SK3) inputs. Each DATA input can carry one or two BRIs. The 99-CHEP-0043-4 can support up to four stations that each require a single BRI or as few as 1 station that uses up to four BRIs.

The combined BRI and +48 volt power outputs to the turret are available at the Turret A (SK1) and the Turret B (SK2) 12 pair connectors.

SK6 is a record input that allows you to connect speaker or other analog audio sources through the 99-CHEP-0043-4. REC (SK5) connects Turret A and Turret B left and right talkpaths, and any analog audio input present on SK6 to an analog recorder.

Both the DATA A (SK4) and DATA B (SK3) inputs, and the combined BRI and +48 volt power outputs can be split by using special cables to direct the BRIs to the desired stations.

FIGURE 7-8 99-CHEP-0043-4 Rear Panel



The 99-CHEP-0043-4 is powered by house 110 VAC or 220 VAC connected on the rear panel.

For information about setting up the 99-CHEP-0043-4, refer to the *Tradenet MX Installation & Maintenance Manual 14.1* (part number B0108900003).

99-CHEP-0055 MIXED HANDS FREE MODULE RECORD INTERFACE

The 99-Chep-0055 mixed hands free module (HFM) record interface (part number 23303821) allows you to record on an HFM associated with a digital turret. (Slimline turrets have other provisions for recording from an HFM.) The 99-Chep-0055 mixed HFM record interface is supported with release 11.1.23 or later. For information on installing a 99-CHEP-0055, see the *Tradenet MX Installation & Maintenance Manual 14.1* (part number B0108900003).

Normally a SUM cable would be used to record on an HFM record interface associated with a digital turret, however the 99-Chep-0055 should be used in the following two situations:

- If there is an absolute requirement for a 600 ohm record path, use the 99-Chep-0055.

Note *In this situation, the SUM cable is not appropriate because it provides a high Z record path.*

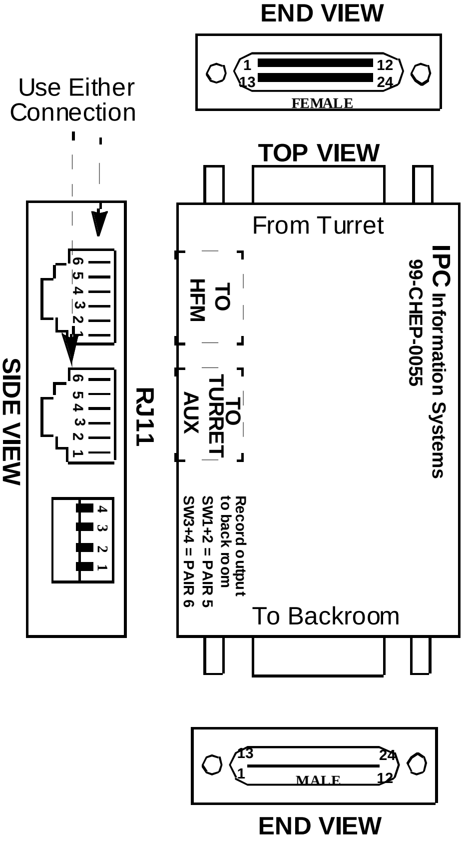
- Where left and right trading takes place, use the 99-Chep-0055 mixed HFM record interface. (That is, where a trader is working on the left handset while his performance is being monitored by intrusion onto the same line by the right handset, and where voice recording during these instances is required.)

Note *Using the SUM cable can cause the right and left signals to cancel each other out.*

The 99-CHEP-0055 is an add-on module that provides a single record output that combines the activity of:

- the transmit and receive path of the HFM
- the left handset of the associated control module
- the right handset of the associated control module

FIGURE 7-9 Mixed HFM Record Interface 99-Chep-0055



The 99-CHEP-0055 mixed HFM record interface is housed in a small plastic box which is connected, using standard connectors, between the HFM and its served control module and the back room equipment. The mixed HFM record interface is designed to be located at the trader station.

TABLE 7-10 Mixed HFM Record Interface 99-Chep-0055 Technical Specification

Dimensions	125x85x35mm
Weight	150 grams
Case Material	ABS 94V0
Connectivity	RJ11 6/6 for control module connection (connected to J27 of the control module) RJ11 6/6 for HFM connection (connected to J1 of the HFM) Amp 226 (12-pair) female for turret connection (connected to pair P24 of the turret connection) Amp 226 (12-pair) male for the back room connection
Supply Requirements	48 V DC ± 10% at <25 mA (derived from the control module to HFM cabling assembly)
Power Usage	<1.2 Watts
Thermal Output	<1.2 Watts
Record Output Level	-20 dBm Note 1: Record output level is dependent on the local talker and the distant talker levels. The specification -20 dBm is for average talker levels. Note 2: While recording on the HFM, the audio levels are approximately equal for the local talker and the distant talker on a standard network connection (8 dB lines). Note 3: While recording on the handsets, the local talker and the distant talkers might not be at equal levels. Dependent on system sidetone levels, it is normal for the distant talker to be predominant.
Dynamic Range	> 75 dB
Noise	< 70 dBm (300 Hz-3.4 KHz) while the HFM is in an idle state
Frequency Response	±1 dB + 300 Hz-3.4 KHz
Record Output	Not switched Note: The 99-CHEP-0055 relies on the HFM going silent in both directions for quieting of the record output.
Record Output Impedance	600-ohms
Caused Crosstalk	< 90 dB Note: The <90 dB level shows the high degree of isolation provided by the 99-CHEP-0055 between the left and the right handset and the HFM. Crosstalk is virtually nonexistent.

RING GENERATOR

The following ring generator is approved for Tradenet MX System installations in the US: Tellabs 8103 ring generator.

The Tellabs model 8103 ring generator provides switch-selectable 96 V AC (nominal) sine-wave ringing voltage at 20 or 30 Hz from the Tradenet MX -48 V DC power supply modules. This output is capable of ringing 10 high-impedance telephone ringers simultaneously. For the MX System, a switch option on the 8103 selects continuous ringing. This ring generator is mounted in an apparatus case using KTU-type rails. Other features include:

- front-panel output-voltage (labelled *ringing*) indicator LED
- operating temperature: 32°–122° F (0º–50º C)

The following table supplies a summary of the four option switches located on the rear of the 8103 when set for the Tradenet MX System.

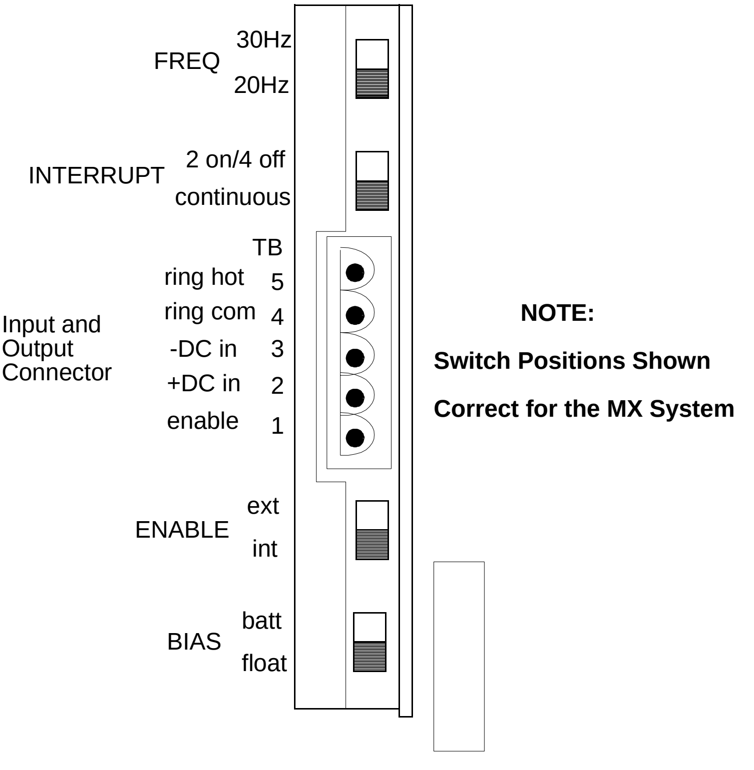
TABLE 7-11 Option Switch Summary and MX Selections

Switch	Selection	Setting	MX System Setting
FREQ	20 Hz sine-wave ringing	20Hz	20Hz
	30 Hz sine-wave ringing	30Hz	
INTERRUPT	continuous ringing	continuous	continuous
	2-second-on/4-second-off ringing interruption	2 on/4 off	
ENABLE	internal: on outside control or ringing output	int	int
	external: in machine-start applications	ext	
BIAS	floating: ringing voltage is not referenced to input voltage	float	float
	battery bias: ringer output common are tied to battery negative	bias	

Ring generators are installed in Tradenet MX Systems using a hot standby configuration where one generator is carrying the entire load, while the other generator is standing by in case the loaded generator fails. The power supply status board in every system or in every triplet in a larger system has a circuit that monitors the output of the loaded generator, as well as of the standby generator. If the loaded generator fails, the power supply status board switches a relay over to connect the standby generator to the load. An alarm is also raised at the System Center, along with an audible alarm at the cabinet.

There is no difference in the installation of the loaded or the standby unit, other than the output cable, nor is there any indication at the generator as to whether it is active or standby.

FIGURE 7-10 Rear panel of Tellabs 8103 Ring Generator



FANS

Tradenet MX Systems have fans in the cabinet for cooling purposes. There is one fan tray for each TU. In addition, Unipower and Mini systems have fans at the top of the cabinets, and HC-powered systems have a fan at the top of the network cabinet (cabinet #2).

BATTERY BACKUP

Tradenet MX Systems have battery backup. There are two batteries at the bottom of each cabinet. These batteries store memory for cards during power failures. The batteries last up to 72 hours.

VME TOWER

Note *Systems using Release 10.1 or later and the Ethernet Interface kit that replaces the VME tower, will not have a VME tower.*

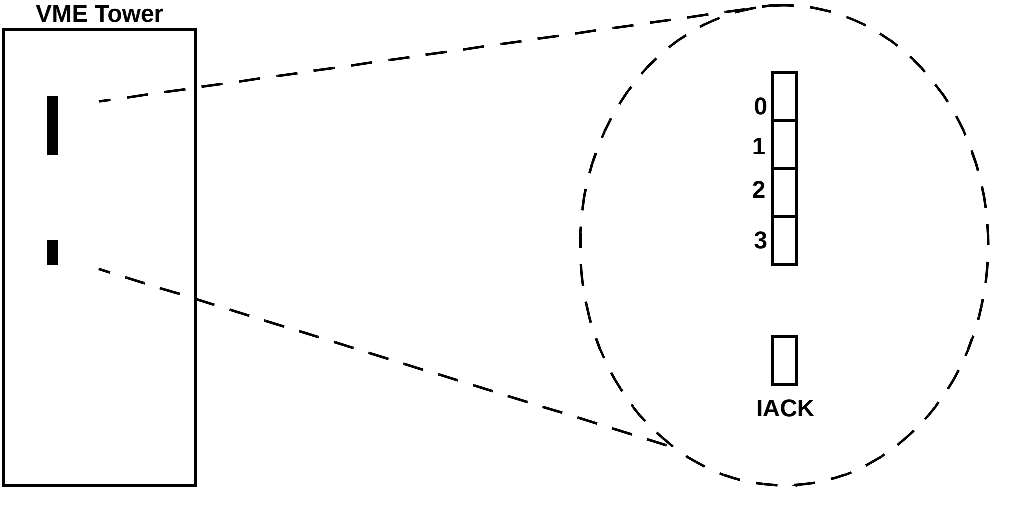
The following table describes the LED indications on the VME tower.

TABLE 7-12 VME Tower Description of LED Functions

LED	Description of Function
LINK 1, LINK 2, and LINK 3	These three links are the fiber connections from the VME gateway card to the MX System shelf #1. Link #1 communicates to the first switch element card on that shelf, and so on. Green LEDs indicate a transmission from the VME to the MX cabinet. Red LEDs indicate a receive from the MX cabinet to the VME.
PWR ON	Power on is indicated with a steady red LED. Using the power switch, the 1 position is on, and the 0 position is off.
FP1, FP2, and FP3	Feature processor LEDs are under software control and flash at different rates and patterns to indicate various states of operation. Engineering Use Only.
BUS MASTER	This yellow LED monitors the activity of the VME master. When lit, it indicates that the SCGC is initiating a VME bus request.
BUS SLAVE	This yellow LED monitors activity of the VME slave. When lit, it indicates that it is responding to a VME bus request.
LSB—MSB	These general purpose line status LEDs flash up and down in normal mode. If these LEDs stop flashing for more than a minute, the processor is hung. Contact Systems Support Engineering.

The newer VME towers are gray instead of white and have two handles on the front. With the newer VME tower, there are five jumpers on the back of the VME tower. Each of these jumpers should be on.

FIGURE 7-11 VME Tower Jumpers

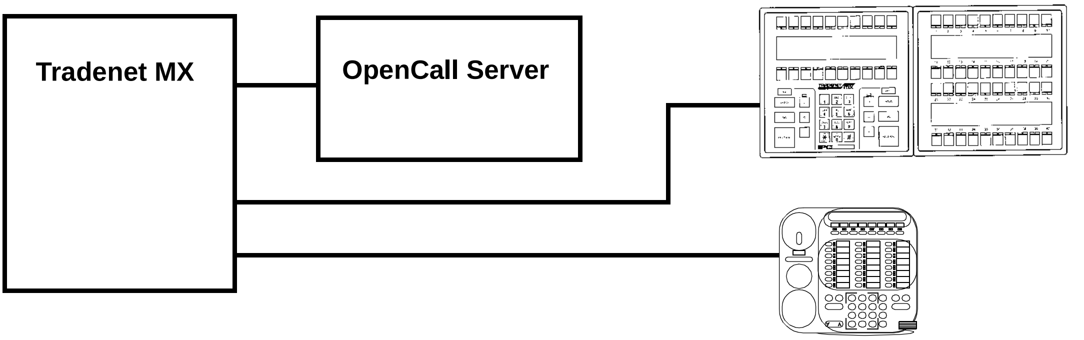


OPENCALL SERVER

Introduction

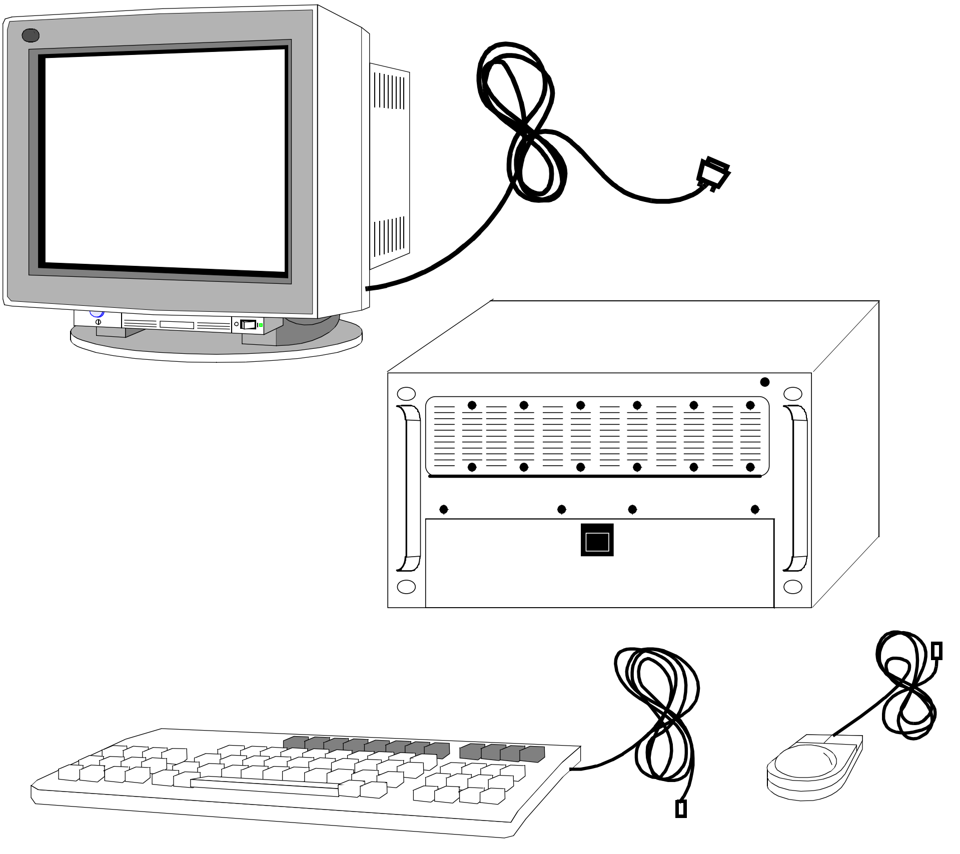
The OpenCall™ server enables the Tradenet MX System to provide call forwarding. With the call forwarding feature, users are able to forward incoming calls to another number or to voice mail. The OpenCall server is connected to a BRIC. Each turret can have a call forward on and a call forward off button on their station. For more information about call forwarding, refer to the *Tradenet MX Digital Turret User Guide 14.1* (part number B0092081304).

FIGURE 7-12 The Tradenet MX System with an OpenCall Server



The OpenCall server is available with 2, 4, 6, or 8 ports capable of monitoring 240, 480, 720, or 960 lines of traffic. For information on purchasing an OpenCall server, contact your local IPC sales representative.

FIGURE 7-13 The OpenCall Server



Hardware

The OpenCall server includes the following hardware:

1. MX interface unit (MXIU)
   - two, four, six, or eight PC interface units (PCIU)
   - Intel Pentium™ 200 Mhz processor card
   - 6.2 GB hard drive
   - 64 MB RAM
   - Ethernet network adapter
   - 10 serial ports
2. mouse
3. monitor
4. keyboard
5. US 110 volt power cord
6. modular to DB78 connector

The following equipment is also available from IPC to house the OpenCall server:

- cabinet without door or side panels (part number 42413184)
- shelf (part number 22817014)
- plexiglas door (part number 43413174)
- side panels (part number 4313054)

Note *The best place to put the server is in the back room near the Tradenet MX System; however, it can be a maximum of 900 feet from the MX System, which is the same maximum distance of the turret.*

Power

The OpenCall server has the following power requirements:

Input	
Input Voltage	115 V AC/230 V AC
Input Frequency Range	47 Hz to 63 Hz
Input Surge Current	Less than or equal to 30 A at 115 V AC
Input Current	6.0 A for 115 V AC ~ 3.0 A for 230 V AC
Hold-up Time	Less than or equal to 20 ms at full load
Input Voltage	Equal to that of the server
Power Requirement (Monitor)	Less than 75 watts

Software

The OpenCall server includes the following software:

1. Windows NT 4.0 with service pack 3™
2. Adobe Acrobat Reader™
3. SYMANTEC pcANYWHERE™
4. Call Forward software
5. Administrative software - for performing OpenCall MAC operations

Tradenet MX System Requirements

For information about setting up an OpenCall server, refer to the *Tradenet MX Installation & Maintenance Manual 14.1* (part number B0108900003).

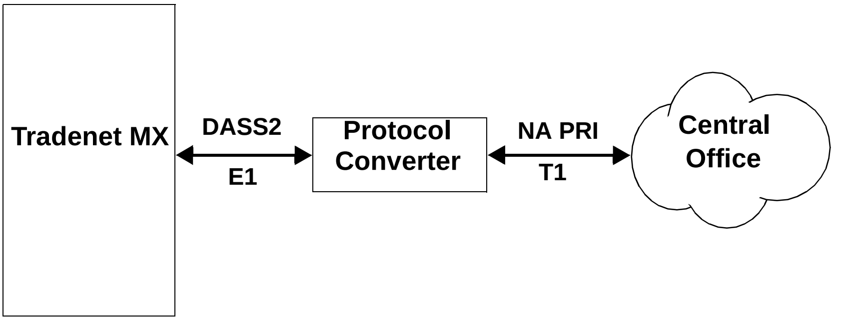
PROTOCOL CONVERTERS

Introduction

With Tradenet MX Release 14.1, the North American Primary Rate Interface (NA PRI) T1 digital line from the central office (CO) needs to be converted to a DASS2 E1 for connection the a Tradenet MX CPIC. You need a protocol converter to convert a NA PRI T1 to a DASS2 E1.

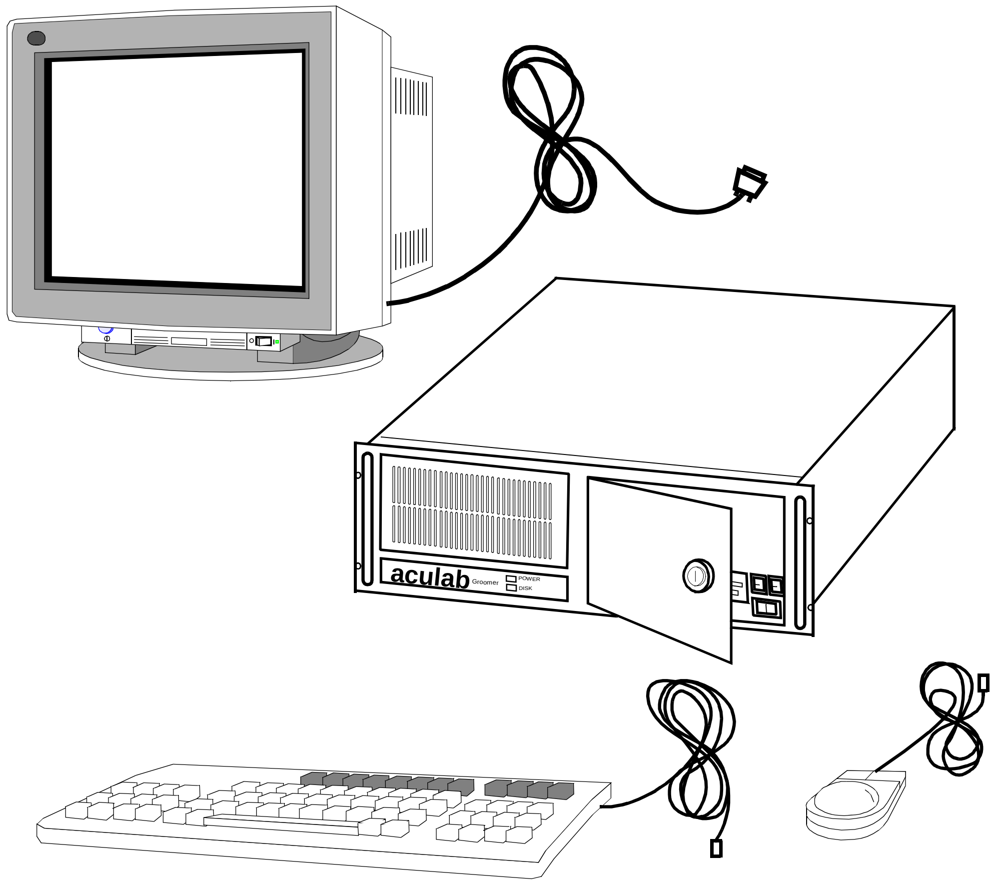
Note *The Tradenet MX tools have been modified in release 14.1 to allow the use of both E1 and T1 cards on the same shelf (TU).*

FIGURE 7-14 Tradenet MX Configurations Using Protocol Converters



The protocol converter used with the Tradenet MX System is the *aculab Groomer*™. For information on purchasing an aculab Groomer, contact your local IPC sales representative. For information about installing an aculab Groomer, refer to the *Tradenet MX Installation & Maintenance Manual 14.1* (part number B0108900003).

FIGURE 7-15 The aculab Groomer



The aculab Groomer is a modular integrated access device that can be used for protocol conversion. The Groomer runs on an OS/2 Warp operating system.

Hardware

The aculab Groomer includes the following hardware:

1. 4U chassis
   - up to 9 mixed port E1/T1 cards
   - single-or dual-cold changeable power supplies
   - Intel Pentium™ processor card
   - 16 MB of RAM
   - CD-ROM drive
   - floppy drive
   - hard drive
   - modem port (COM 2)

2. monitor
3. keyboard

The following equipment is available from IPC to house the Groomer:

- cabinet without door or side panels (part number 42413184)
- shelf (part number 22817014)
- plexiglas door (part number 43413174)
- side panels (part number 4313054)

Software

The aculab Groomer includes the following software:

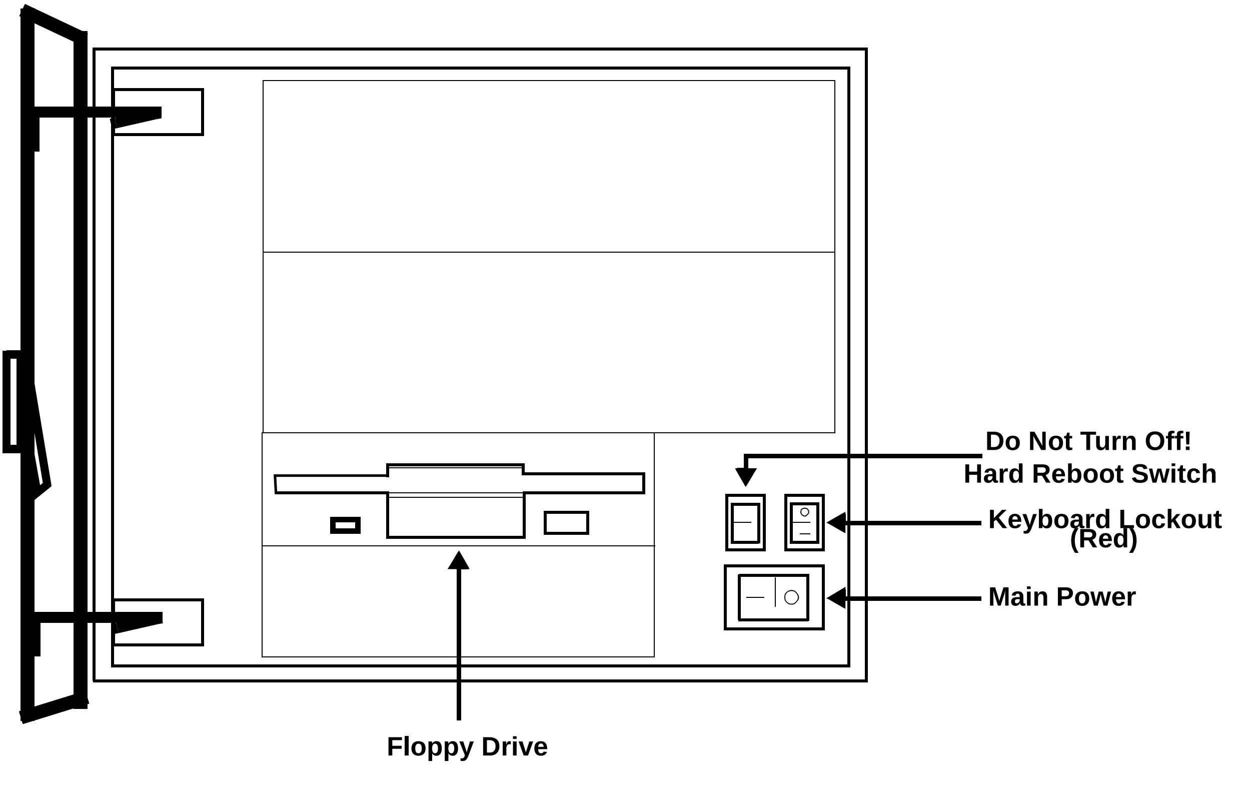
1. IBM OS/2 warp version 6™
2. aculab Groomer system software
3. Remote Service Manager (RSM) also known as PolyPM - an aculab application program that allows access to the groomer for support purposes.

Powering on the Groomer

To power on the aculab Groomer, take the following steps:

1. Ensure the monitor, keyboard, and mouse are connected to the 4U chassis.
2. If a modem is used with your aculab Groomer, ensure it is connected to the 4U chassis.
3. Turn on the monitor and the modem.

FIGURE 7-16 aculab 4U Chassis Front Panel



4. Ensure the hard reboot switch is in the on position, as it should always be.

Warning! ***The hard reboot switch is a spring loaded, momentary rocker switch. The hard reboot switch rests in the up/off position and should not be touched.***

5. Ensure the keyboard lockout switch is in the off position

Note *Place the keyboard lockout switch in the on (—) position when you leave the site. This prevents anyone from making unauthorized changes to the protocol converter settings.*

6. Turn on the main power switch.

   When on, the red LEDs on each aculab E1/T1 card indicate that the E1 or T1 span is connected and that the Groomer is receiving a signal on that span. When on, the green LEDs on each aculab E1/T1 card indicate that the firmware is loaded for that E1 or T1 port on that E1/T1 card.

7. Ensure the red and green LEDs are lit for each E1/T1 card port in use.

Powering off the Groomer

Caution **Ensure that you click the *Shut down* button in the OS/2 console window before turning off the groomer front panel power switch. This protects the hard drive.**

To power off the aculab Groomer, take the following steps:

1. In the OS/2 console window, click **Shut down**.

2. When the shut down is complete, turn off the 4U chassis main power switch (see *FIGURE 7-16 aculab 4U Chassis Front Panel* on page 7-40).

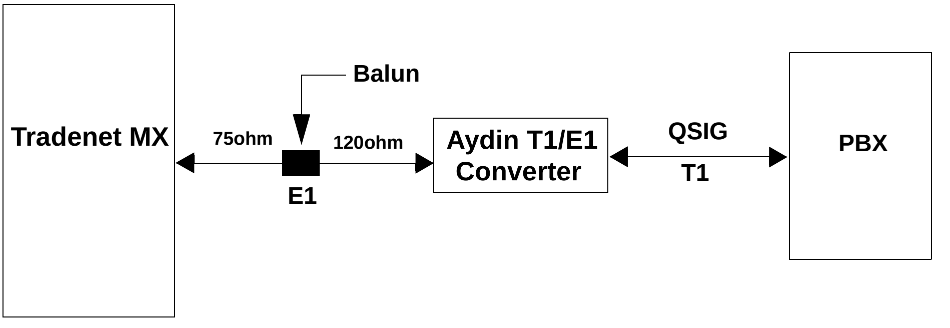
3. Turn off the monitor and the modem.

AYDIN T1/E1 CONVERTER

Introduction

The Aydin T1/E1 converter provides cross-connect and format conversion between E1 and T1 lines. The Aydin T1/E1 converter comes with two or four ports. Two ports are required for conversion of one digital line and four ports are required for conversion of two digital lines. The Aydin T1/E1 converter is used with Release 14.1 whenever a QSIG protocol T1 from a PBX is to go to a CPIC (QSIC). For a detailed description of how to install the Aydin T1 to E1 converter, refer to the *Tradenet MX Installation & Maintenance Manual 14.1* (part number B0108900003).

FIGURE 7-17 Aydin T1/E1 Converter



Physical Description

The Aydin T1/E1 converter is a stand-alone desktop unit.

FIGURE 7-18 Aydin T1/E1 Converter (Front View)

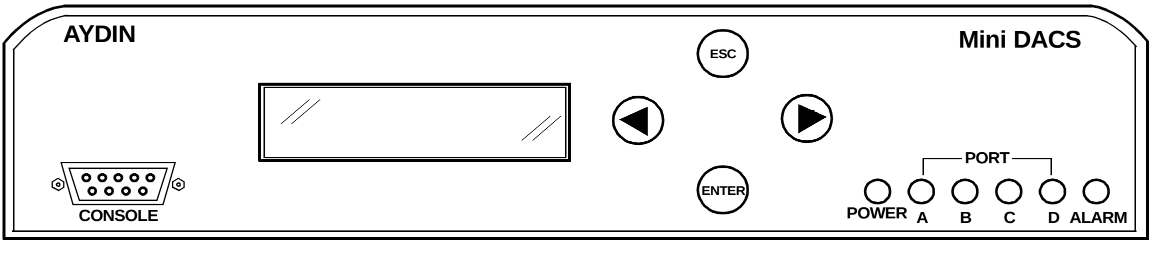


TABLE 7-13 Aydin T1/E1 Converter Weight and Dimensions

Weight	**3.38 pounds (1.53 kg)**
Width	**8.38 inches (213 mm)**
Height	**1.75 inches (44 mm)**
Depth	**8.50 inches (216 mm)**

The Aydin T1/E1 converter dissipates from 3 to 5 watts and is factory configured by Aydin to be powered in one of three ways:

- standard commercial or local power source (90–230 V AC, 47– 63 Hz)
- uninterrupted power source (UPS)
- standard telecom battery facilities (20–60 V DC)

ECHO CANCELLERS

If you are accessing a two wire Tradenet MX line from a remote site located more than 500 miles away (resulting in a total round trip delay of 50 milliseconds or more) where two or more networked Tradenet MX Systems are networked, you can notice echo on the turrets. This problem can occur when you are using remote turrets (RTICs) or line networking.

To solve this problem, you need to install an echo canceller, purchased from an outside vendor. Echo cancellers that solve this problem are listed below.

TABLE 7-14 Echo Cancellers

T1/E1	Echo Canceller
T1	tellabs Echo Canceller 2571 or 2572 with tellabs Uni-directional Enhancer 25VX1 (daughter board) and tellabs Mounting Cage
T1	Coherent EC-6000 Dual Di-Group Echo Canceller
E1	tellabs Echo Canceller 2581 with tellabs Uni-directional Enhancer 25VX1 (daughter board) and tellabs Mounting Cage
E1	Coherent EC-6000 Dual Di-Group Echo Canceller

Whichever echo canceller you choose needs to meet the requirements of ITU G165 recommendations. In addition, make sure your echo canceller meets the specific T1 or E1 requirements for the RTIC or line networking. With your echo canceller, you need a 48 V power supply module.

The way you program the echo canceller depends on the type of each canceller you have. For example, the E1 echo canceller, tellabs Echo Canceller 2581, is available with and without a front panel display that allows you to program echo cancellers on a shelf. For more information about programming the echo cancellers, contact the manufacturer.

The tellabs Echo Cancellers (2571/2572 and 2581) should be set to their default settings except for the following parameters listed in this table.

TABLE 7-15 Tellabs Echo Canceller Setting Modifications

Setting		tellabs Echo Canceller 2571/2572 (T1)	tellabs Echo Canceller 2581 (E1)	Comments
Channel configuration	C.xx	C.01 mode 01 (forced by pass)	E1 C.02 forced bypass (clear channel)	networking data channel
		C.02-C.24 mode 02 (Forced Active)	C.03-C.32 mode 02 (Forced Active)	voice channels
Data Tone disabling	D.xx	d.00 mode 00 (Disable data tone disable)	d.00 mode 00 (Disable data tone disable)	disable on all channels
Non-linear Processor (NLP)	n.xx	n.01 mode 00 (disable NLP)	n.02 mode 00 (disable NLP)	disable on data channel
		n.02-n.24 mode 01 (enable NLP)	n.03-n.32 mode 01 (enable NLP)	enable on voice channels

Setting		tellabs Echo Canceller 2571/2572 (T1)	tellabs Echo Canceller 2581 (E1)	Comments
Clearcall	E.xx	e.01 mode 00 (disable)	e.02 mode 00 (disable)	disable on data channel
		e.02-e.24 mode 01 enable	e.03-e.32 mode 01 enable	enable on voice channels
Minimum ERL	Mode 42 T1	set to 0 db	set to 0 db	
Echo Cancellation Time	Mode 50	set to 32 ms	N/A	
Mode ALC	Mode 75	set to option 1 ALC enable receive side	set to option 1 ALC enable receive side	

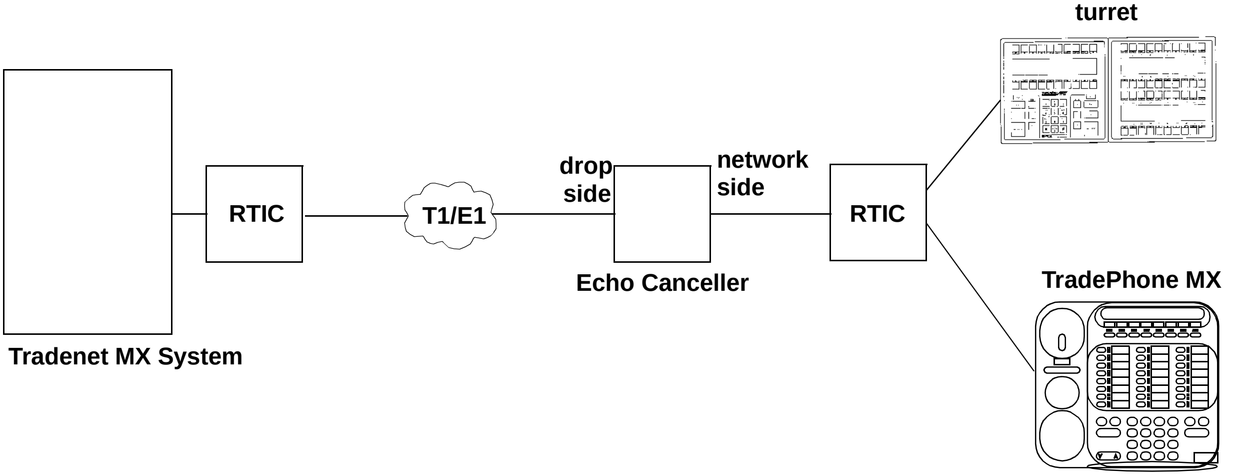
All other options should be set to the default setting except for:

- T1—ESF (20) line coding (60) B8ZS
- E1—CAS HDB3

An echo canceller has a *drop* side and a *network* side. You need an echo canceller at a local T1 drop with an 8 millisecond tail length. The echo canceller needs to be connected so that the Tradenet MX System is on the canceller's drop side. One echo canceller is needed for each Tradenet MX site, for each T1/E1 network line.

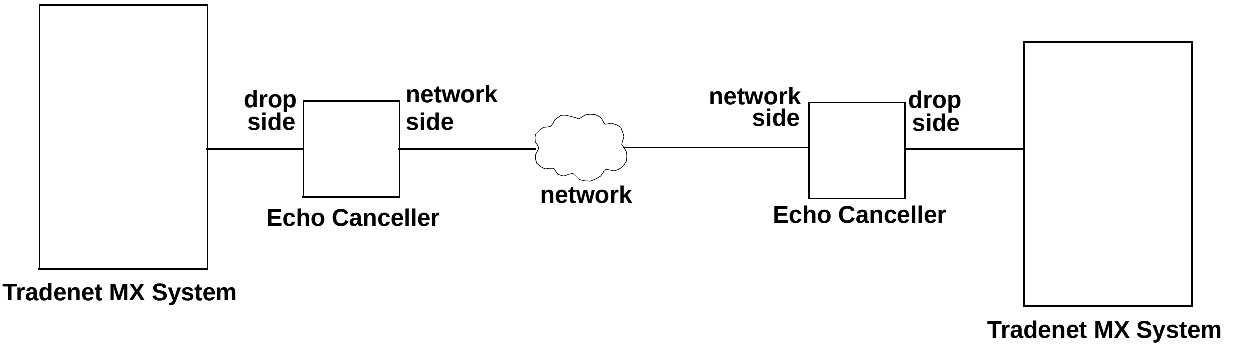
An RTIC only requires one echo canceller.

FIGURE 7-19 RTIC Configuration Using an Echo Canceller



Two networked Tradenet MX Systems need two echo cancellers, one at each Tradenet MX site.

FIGURE 7-20 Line Networking Configuration Using Two Echo Cancellers



If you are using remote turrets, set up your echo canceller so that the BRI data channels (channels 1, 4, 7, 10, 13, 16, 19, and 22) do not have echo cancelling enabled. If you are using line networking, do not compress the data channel (p channel). You can compress the voice channels (up to 16 K), but compressing the voice channels can negatively affect voice quality. Your p channel and voice channels should be clear channels (no raw bit signalling) with no conversion.

If you are using remote turrets, in addition to using an echo canceller, to fix the echo problem you should make sure your basic rate interface card (BRIC) sidetone is disabled on the RTIC connections. The purpose of the echo canceller is to remove all sidetone.

Using an echo canceller might not completely cancel all echo, but using an echo canceller is the best solution to the problem of echo with remote turrets or lines more than 500 miles from the Tradenet MX System.

If auto-balancing is enabled at line interface cards at the Tradenet MX sites, you might notice distorted bursts of audio on your turrets. Disabling auto-balancing can solve this problem. (UK sites should not disable auto-balancing.) For more information about this issue and tuning your system parameters, contact IPC Systems Support Engineering at 1-203-339-7800.

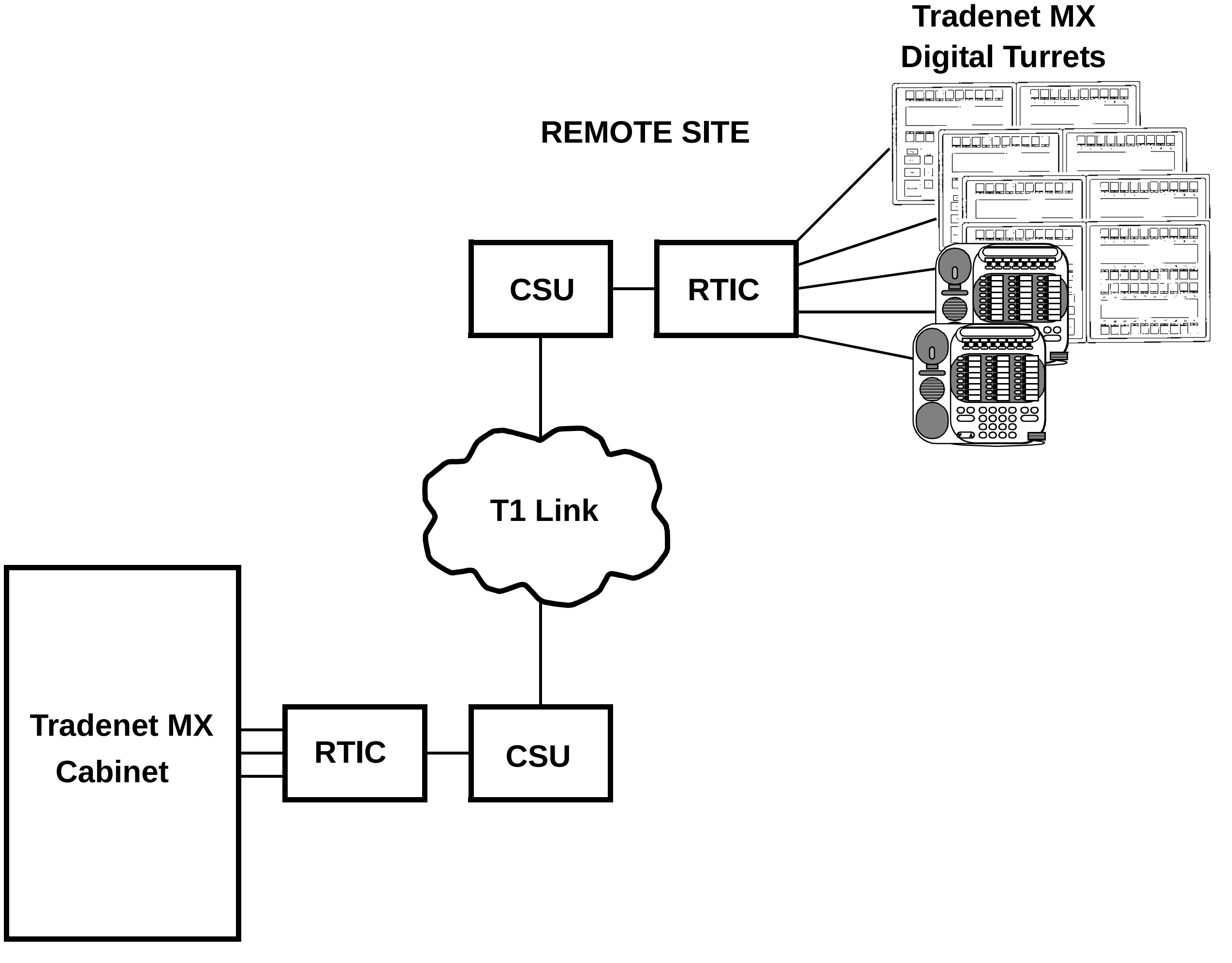
RTICS

The standard Tradenet MX System allows your turret to be located up to 900 feet from the MX cabinet. If you have turrets further away than that and you are using Tradenet MX Release 9.0.1 or later, you can use remote turret interface cards (RTIC) to connect turrets to the MX System, and with Release 10.1 and later you can use RTICs to connect TradePhone MXs to the MX System. An RTIC supports up to eight station modules (for example, control/pagination module, TradePhone MX, and ClearDeal speaker module).

To use remote turrets, you connect one RTIC to the Tradenet MX System in the back room, and one RTIC to the turrets in the front room.

The following figure shows how RTICs are configured.

FIGURE 7-21 Remote Turret Interface

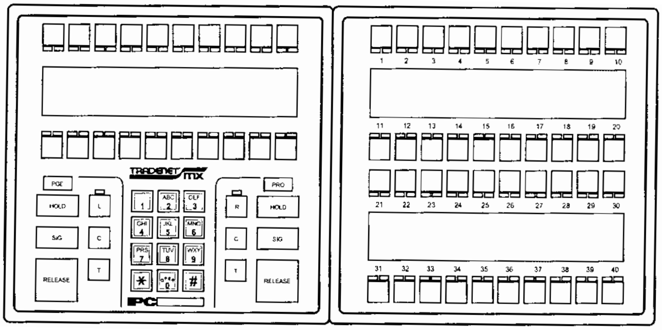


For information about setting up RTICs, refer to the *Tradenet MX Installation & Maintenance Manual 14.1* (part number B0108900003).

To use RTICs, your T1 link must be a clear channel link, ESF with B8ZS.

Each RTIC can be connected to only one BRIC; that is, you cannot connect an RTIC to more than one BRIC.

Chapter 8 Station Equipment



TURRET

The Tradenet MX Systems supports digital and analog turrets. Turrets are made up of different types of modules including:

- control modules
- pagination modules
- fixed, or Paper Copy Display (PCD), modules

Digital turrets provide up to 600 buttons and analog turrets provide up to 400 buttons. These buttons link you to lines and speed dial numbers. Because the Tradenet MX System provides universal line access, you can select a line from any of those supported by the system configuration. You use the line's logical address code (LAC) to program a line to a turret.

Digital Turret

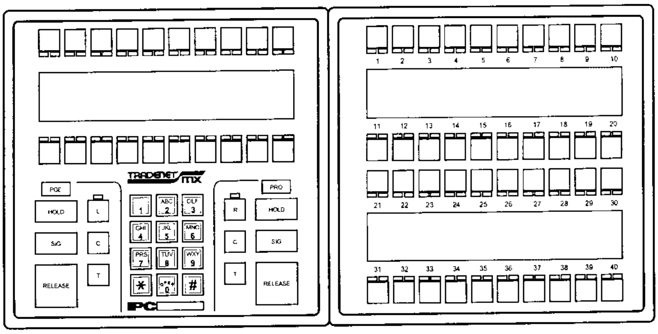
The digital turret modules available with the Tradenet MX System are:

- consolidated control/pagination module
- Slimline consolidated control/pagination module
- stand alone control module
- consolidated control/PCD module
- external pagination module
- PCD module
- digital FTS module (four-channel or eight-channel)

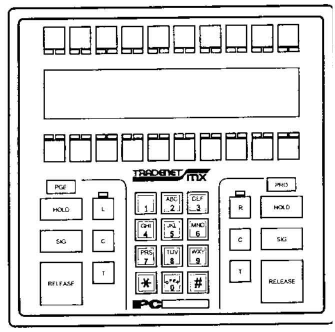
The following figure shows these modules.

FIGURE 8-1 Digital Turret Modules

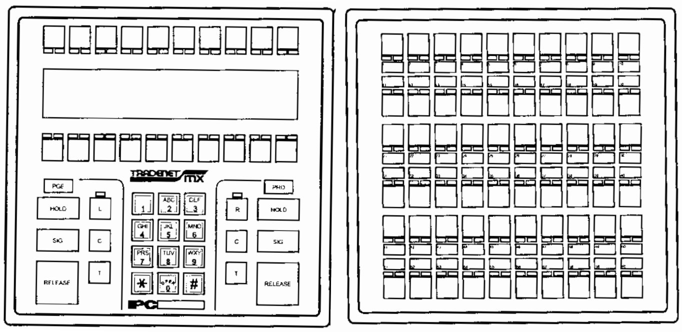
Control/Pagination Module



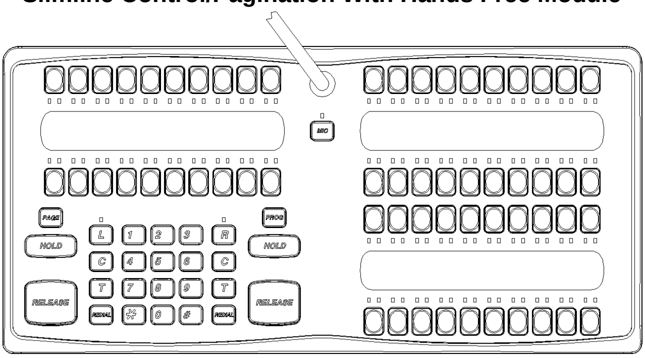
Stand Alone Control Module



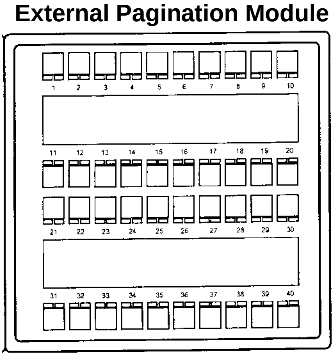
Control/PCD Module



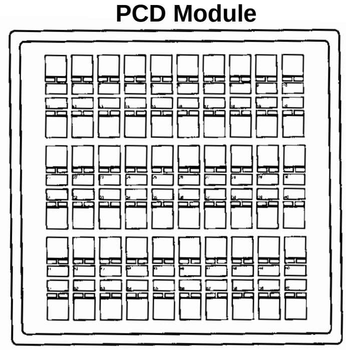
Slimline Control/Pagination With Hands Free Module



External Pagination Module

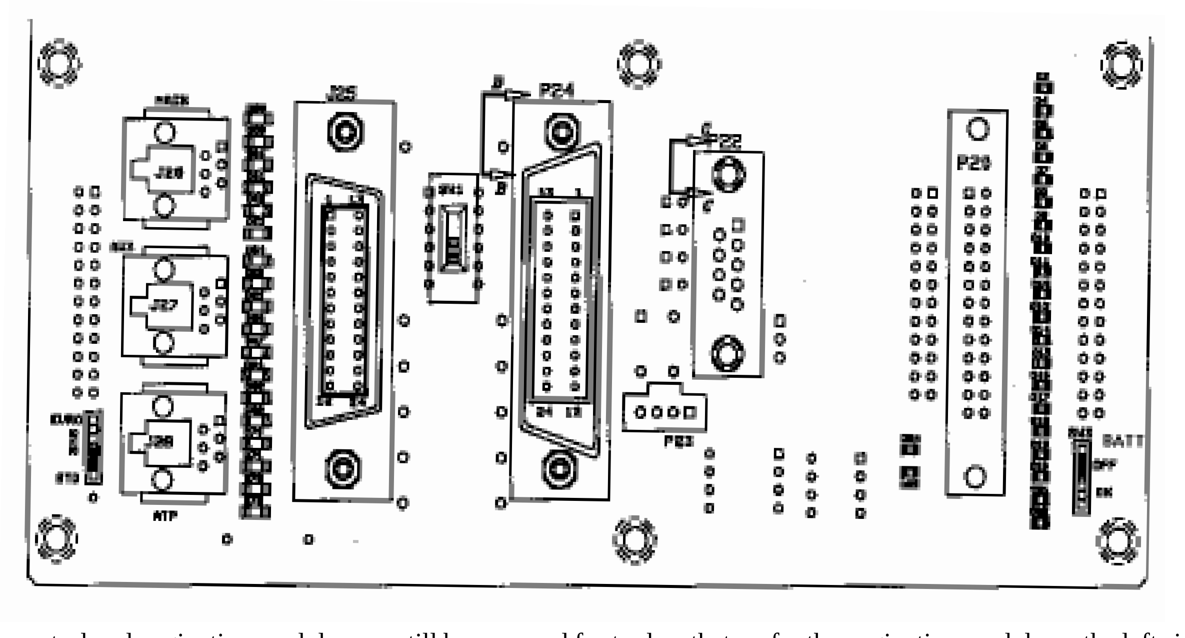


PCD Module



The latest digital turrets use an I/O board that includes two switches, switch 2 and switch 3. Switch 2 is factory-set to EURO (European) for France, Switzerland, and Germany, and is factory-set to STD (standard) for all other installations. Switch 3 replaces the battery jumper on older modules.

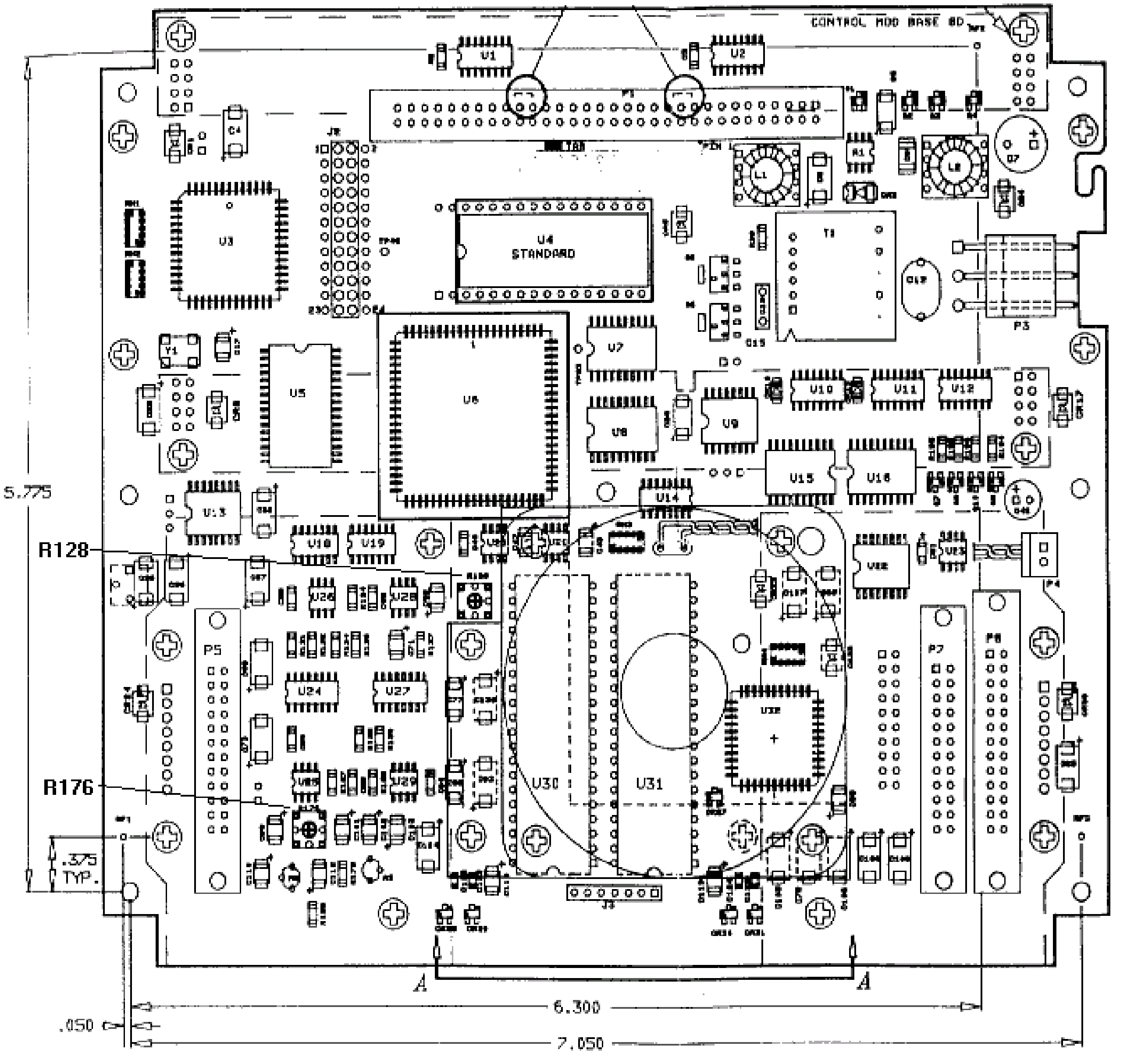
FIGURE 8-2 Digital Turret I/O Board



The control and pagination modules can still be swapped for traders that prefer the pagination module on the left side of the turret. Note that the 44-pin ribbon cable has been replaced with a 64-pin ribbon cable, and that an additional 20-pin cable (for EMI) has been added between the pagination board and the I/O board. All cables are keyed so that there is no danger of cable reversal.

Analog recorder outputs are provided, however, the location of the two pots for adjusting the analog levels are changed. They are labeled as R128 (for main) and R176 (for auxiliary). They are labeled as MAIN and AUX in the silk-screen of the control board. These two pots are set in the factory before you get this board. You should not need to adjust these pots under most conditions.

FIGURE 8-3 Analog Recorder Outputs



Ring Volume

You can adjust the ring volume of the digital turret either at the turret or at the System Center. There is also ring volume attenuators available from IPC.

- CBA, MX, Ring Volume Attenuator—This attenuator is intended for customers who want significant reduction in ring volume. It can be installed in any Tradenet MX unit; however if it is installed in any of the new digital turrets listed in the table below, it will produce extremely low ring volume.
- CBA, MX, Ring Volume Attenuator II—This attenuator is installed as standard equipment on all Tradenet MX digital turrets. It is intended for customers who notice a slight difference in ring volume between new and old turrets, and want to have the same volume on both types.

French Installations

The consolidated control/pagination module is the only French-approved digital turret you can use with the Tradenet MX System. Digital speakers and the add-on intercom module can be used with the French-specification MX digital turrets. Add-on pagination modules and PCD modules can also be used with French digital turrets.

The French-approved modules are not available in Kanji configurations.

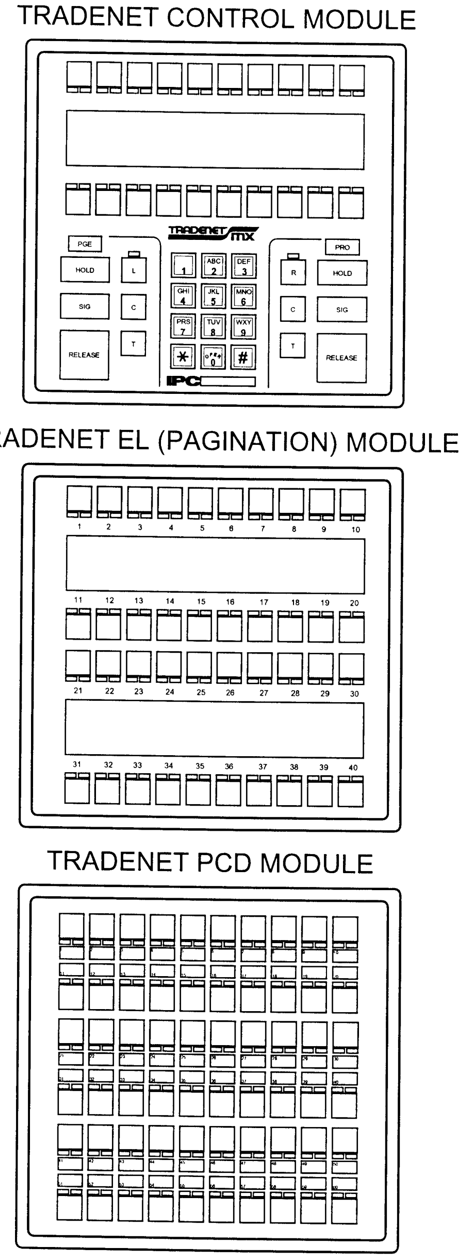
Analog Turret

The analog turret modules available with the Tradenet MX System are:

- Tradenet control module
- Tradenet EL (pagination) module
- Tradenet PCD module
- analog touch screen module
- analog FTS speakers without microphones (four-channel or eight-channel)

The following figure shows some of these modules.

FIGURE 8-4 Analog Turret Modules



A complete analog turret is usually made up of a control module plus one or more of the following modules:

- pagination module
- fixed Paper Copy Display (PCD) module
- touch screen module
- analog FTS speaker module

These modules are used to access lines, speed dial numbers, and features.

French-approved Tradenet MX Systems do not support analog turrets.

Junction Box

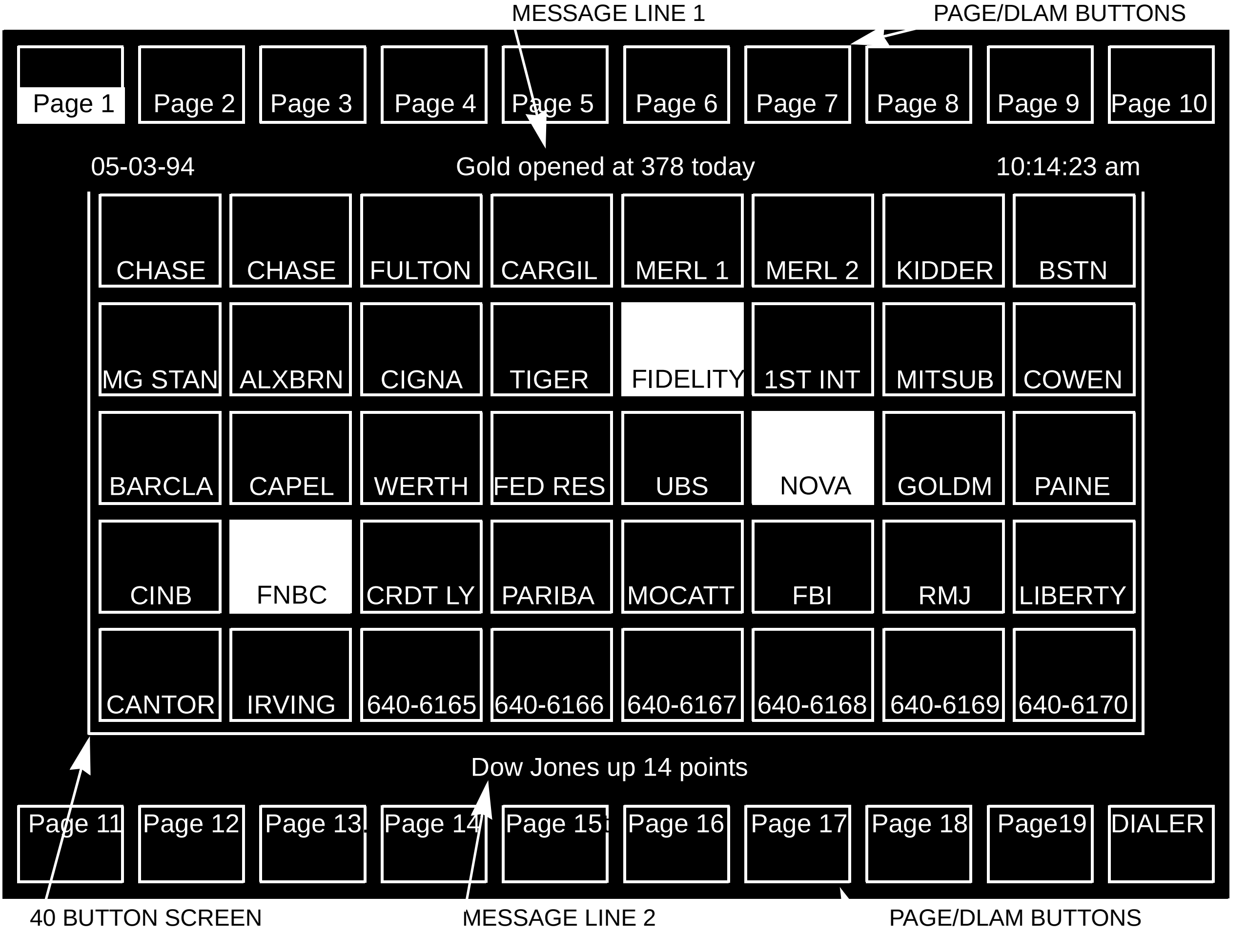
If your analog station requires local recording, intercom capability, or additional power to the analog turrets, you need to connect a junction box to the analog turret. (For installation information, refer to the *Tradenet MX Installation & Maintenance Manual 14.1*, part number B0108900003.) You do not need junction boxes for your analog FTS speaker modules because these speaker modules are connected directly to the Tradenet MX back room.

Analog Touch Screen Module

Touch screen modules can be used with analog turrets. The touch screen module allows you to answer and place calls by touching the module's screen. The touch screen module switches between two modes of operation: the EL (default) mode and the Dynamic Line Activity Monitor (DLAM) mode.

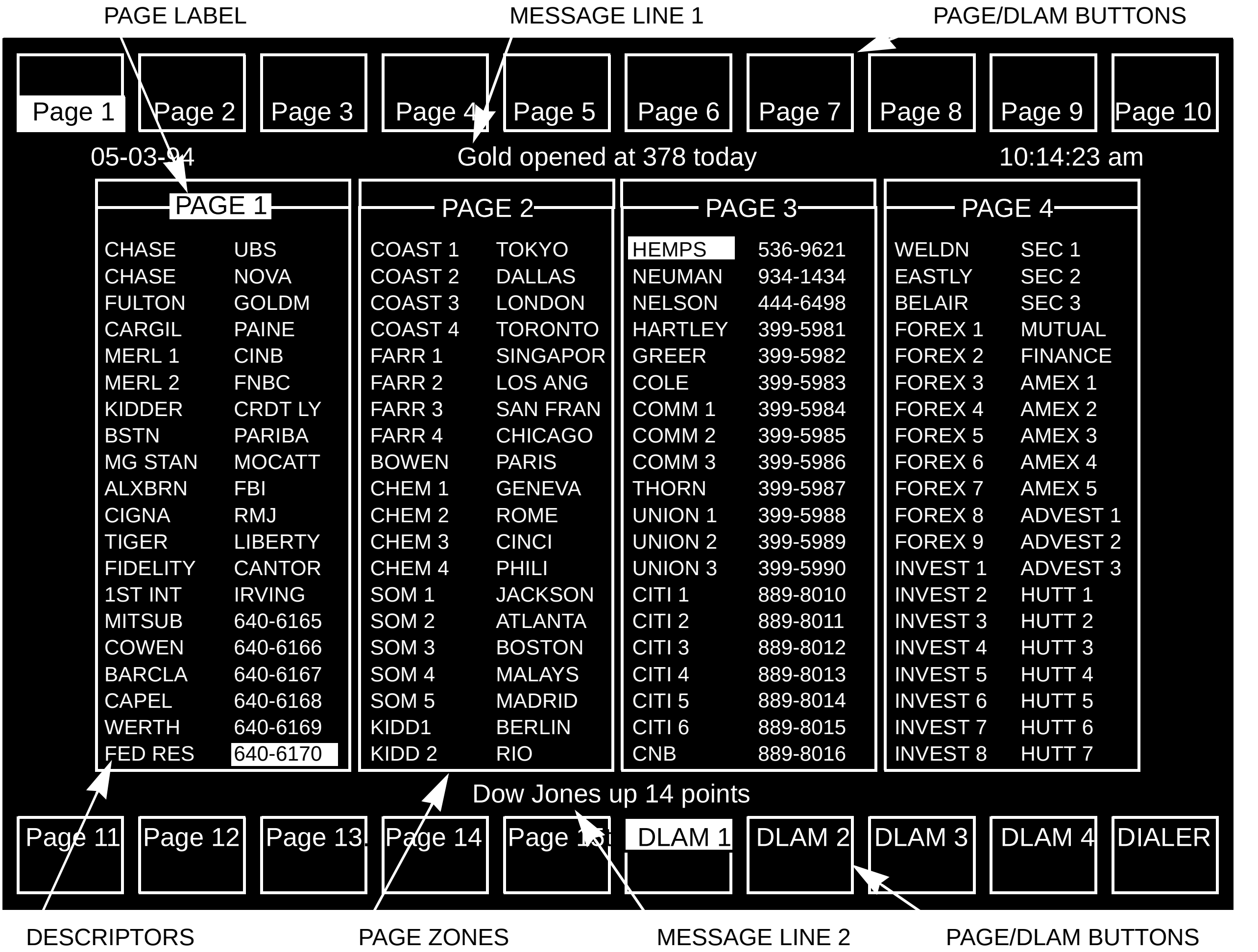
In the EL mode, the touch screen module emulates the control module by displaying the status of 40 buttons. The button labels indicate the line status: idle, busy, incoming call, or on hold. To answer or place a call, touch the line button until the button border lights. The following figure shows the touch screen module in the EL mode.

FIGURE 8-5 Touch Screen Module in the EL Mode



In the DLAM mode, the touch screen module emulates the pagination modules by displaying the status of 160 buttons. The button labels indicate the line status: idle, busy, incoming call, or on hold. To answer or place a call, touch the page zone until the page label lights. The module display changes to the touch screen EL mode where you can answer or place the call. The following figure shows the touch screen module in the DLAM mode.

FIGURE 8-6 Touch Screen Module in the DLAM Mode



For more information about control modules, pagination modules, and PCD modules, see *Control Module* on page 8-12, *Pagination Module* on page 8-15, and *PCD Module* on page 8-18.

Recording Equipment

Audio Levels

All Tradenet MX recording outputs have an audio level range between: 0.2V to 1V peak-to-peak and -14db to 0db. This range is sufficient to accommodate recording equipment.

Tape Recorder

Tape recorders, or any devices that require tip and ring, are connected to the Tradenet MX System either locally on the trading floor or more commonly using the analog distribution panel's six female 25-pair auxiliary cable connections in the back room. Locally, tape recorders are connected through the two modular jacks in the junction box.

Stentofon Intercoms

The Stentofon intercom is connected to Tradenet MX analog turrets through the junction box. (See *Junction Box* on page 8-10.) For information about installing Stentofon intercoms, refer to the *Tradenet MX Installation & Maintenance Manual 14.1* (part number B0108900003).

External Speed Dialers: DASA Dialer (Analog Turrets Only)

Using the DASA dialer with analog Tradenet MX turrets requires setting up the dialer and then connecting it to the analog control module. For more information, refer to the *Tradenet MX Installation & Maintenance Manual 14.1* (part number B0108900003).

Speakerphone Overview

The following Northern Telecom Speakerphones are compatible with the Tradenet MX system and analog turrets.

- Companion 2
- Companion 4S
- PC-4B

For more information, refer to the *Tradenet MX Installation & Maintenance Manual 14.1* (part number B0108900003).

PC-4B Speakerphone

The PC-4B Speakerphone can be connected to the Tradenet MX analog turret. Order the PC-223B adapter with the PC4B Speakerphone.

For more information, refer to the *Tradenet MX Installation & Maintenance Manual 14.1* (part number B0108900003).

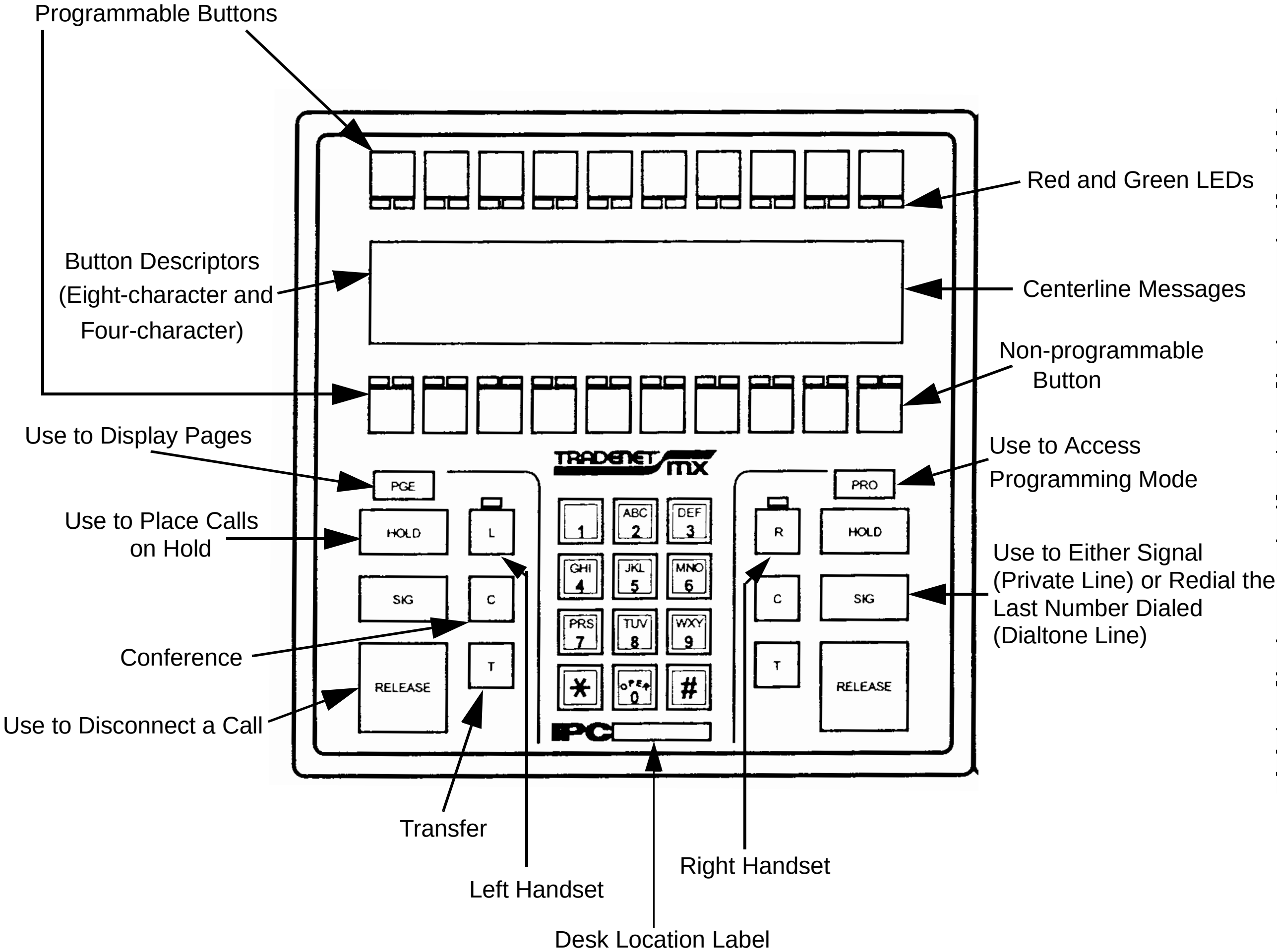
Control Module

The control module (either as a stand alone module, or as a consolidated control/pagination or consolidated control/PCD module), is nearly identical in analog and digital systems. The analog control module supports four-character button descriptors only and the digital control module supports four- and eight-character button descriptors. The analog control module has a slightly bluish display.

Note *The Tradenet analog control module no longer supports the Panasonic external speed dialer. The Tradenet analog control module does support all other speed dialers. If your system is equipped with a Panasonic speed dialer, and you replace a Tradenet analog control module, speed dial functionality is lost. If you return a Tradenet analog control module for repair, it might not have speed dial functionality when it is restored to service.*

The following figure identifies parts of the control module.

FIGURE 8-7 Control Module



The display on the control module shows the 20 button descriptors and the center line messages. The first 10 button descriptors are displayed below the first ten buttons and the last 10 button descriptors are displayed above the last ten buttons. In between the two rows of button descriptors is a line for center line messages, messages up to 42 characters long that display complete button information, page information, line information, programming information, and messages.

The 19 programmable buttons[1] on the control module are also called *soft keys*, or *index keys*. The soft keys displayed on the turret vary by the page of the display. Using the soft keys and the PGE button on the turret, you can create pages of soft keys. You can define up to 600 buttons on your turret with a control module, even a stand alone control module.

The soft keys are set up by you or your administrator. These buttons control the following options of the Tradenet MX System:

- line access
- call forward (call diversion) on/off
- calling line identification (CLI) also known as caller ID
- voice mail notification

1. The 20th button is reserved. This button is used for incoming calls and as a quit key.

- direct page access (with pagination only)
- speaker line assignment
- speed dial
- receive volume adjust
- ringer volume adjust
- message key

For more information on turret button functions, refer to the *Tradenet MX Digital Turret User Guide 14.1* (part number B0092081304).

The button descriptors are four-character on analog turrets and either four- or eight-character on digital turrets. (The button descriptors of the bottom row of buttons cannot be eight-character, only four-character, to allow space for center line messages.) On digital turrets, if you have Release 8.0.2 or earlier, the length of the descriptor is the same across the system; if you have Release 8.0.3 or later, the length of the descriptor can be set for individual traders. For more information about this option, refer to the *Tradenet MX System Center Manual 14.1* (part number B0086185104).

Note *Use the top row of buttons on the control module for line assignments and floating answer keys to take advantage of the eight-character display. Use the bottom row of buttons for turret feature buttons such as volume up, volume down, speed dial, message key, and so on.*

If you are using four-character descriptors, you can enter eight-character descriptors and the turret knows which four-characters to display based on the first character of the descriptor. The following table describes which four characters of an eight-character button descriptor are displayed.

TABLE 8-1 Four-character Button Descriptors

If the first character of the descriptor is…	…the turret displays…
any letter	the first four characters of the eight-character descriptor
[	
]	
{	
}	
space	the last four characters of the eight-character descriptor
any number	
any other punctuation mark	

The red and green LEDs show you the following status:

- incoming ring and ringing priority (high or low)
- voice mail notification
- line on hold
- line in use by other users

- line in use by you
- oldest call waiting

Each turret can have up to two handsets. (For more information about handsets, see *Handsets* on page 8-44.) You can control the following features for each handset on the turret:

- PGE (page)
- HOLD
- PRO (program)
- SIG (signal)
- RELEASE
- L or R (left or right talkpath control on a turret with two handsets)
- C (conference)
- T (transfer)

These buttons on the turret are called *feature keys*.

The Desk Location Label shown in *FIGURE 8-7 Control Module* on page 8-13 can be used to record the desk location of that station. This location should match the location used in the System Center software. For more information about the System Center software, refer to the *Tradenet MX System Center Manual 14.1* (part number B0086185104).

Pagination Module

The pagination module, either as an external pagination module or a consolidated control/pagination module, allows you to see 40 buttons at a time. Using the PGE button on the control module, you can page through button definitions on a pagination module. You can define up to 15 pages of buttons for a total of 600 buttons. A pagination module does not increase the number of buttons you can define, but it does allow you to view more of these button definitions simultaneously.

You can have up to three pagination modules for one trader’s station; one as part of the control/pagination module and two external pagination modules. Depending on the number of pagination modules you have at a station, you can page through 40 buttons, 80 buttons, or 120 buttons at a time.

Each display on the pagination module shows 20 button descriptors and the center line messages.

There are two different pagination modules available: one for digital turrets and one for analog turrets. The analog pagination module can have four-character descriptors only and the digital pagination module can have four- or eight-character descriptors. Also, the analog pagination module has dark amber characters on a light amber background and the digital pagination module has dark blue characters on a light blue background.

Consolidated Control/Pagination Module

The consolidated control/pagination module is the most common module used with the MX System. The consolidated control/pagination module provides the same features as separate control and PCD or pagination modules. The control/pagination module provides line access, optional dual talk-paths, the option of 15 pages of 40 paginated keys or of 60 fixed PCD keys, and dialing capability. The control/pagination module gives you the option of eight-character button descriptors on the top row of the turret’s display and on any additional pagination modules’s displays.

The control/pagination module is a digital module and not available for analog systems. This module is available as shown in *FIGURE 8-1 Digital Turret Modules* on page 1-5, or with the two modules switched; that is, the pagination module on the left and the control module on the right. In addition, the control and pagination modules can be placed above and below each other in a consolidated control/pagination module. The side by side control/pagination module configuration has a single, deeper housing bucket than the analog modules. The above and below configuration uses two single housings.

Each control/pagination module is connected to the backroom with a single 12-pair cable. Signals and voice channels to and from the turret are routed through this 12-pair cable from the digital distribution panel on the terminal shelf backplane. At the backplane the signals are connected to the appropriate station interface card.

The following figure shows the back view of the control/pagination module with the control module on the left (as you are facing the module in front) and the pagination module on the right.

Slimline Consolidated Control/Pagination Module

MX Slimline modules are available in English or Kanji, with legs for free standing capability or without legs for trough mounting.

The MX Slimline has the same functionality as the MX Classic.

The MX Slimline includes the optional integrated hands free module (HFM). The HFM-version of the MX Slimline comes with a microphone and a specially designed IPC Bridge speaker cube. This is the only speaker that can be used with the MX Slimline with HFM.

Note *The HFM cannot be added in the field. If the customer requests the HFM version, the entire MX Slimline must be replaced with the HFM-version of the MX Slimline.*

The microphone transmit button (MIC) is locking. When its LED is lit, the microphone is active.

FIGURE 8-8 Front View of the MX Slimline With the Hands Free Module

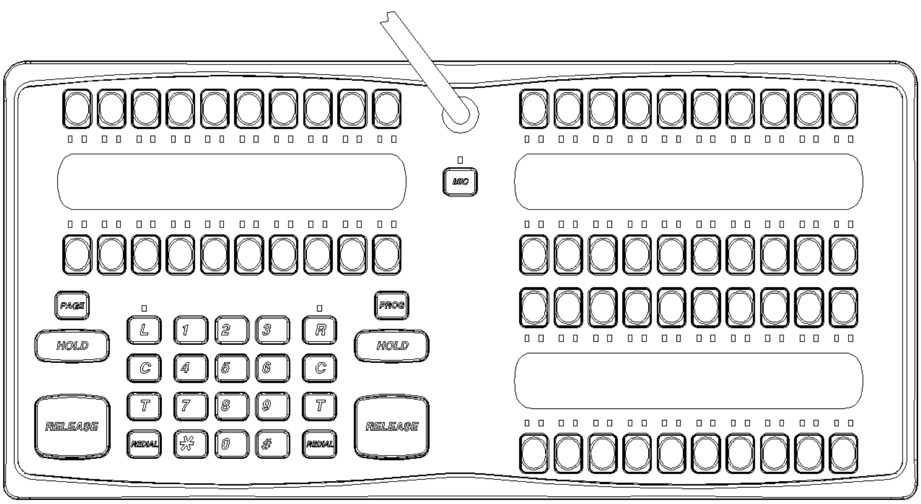
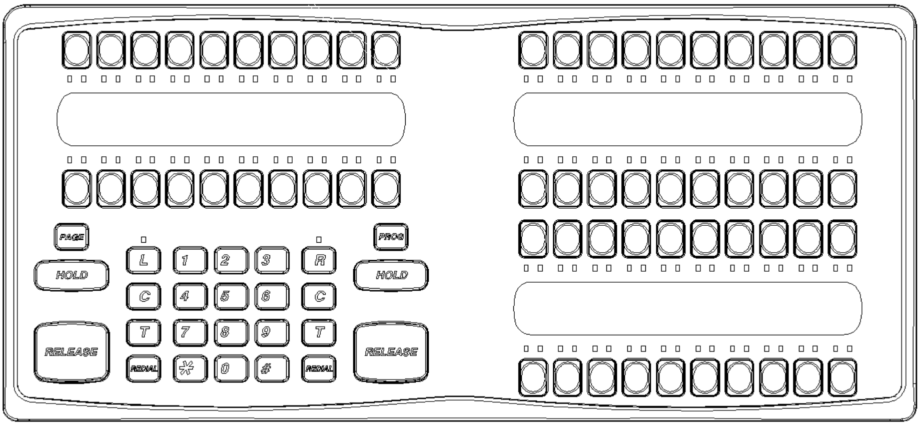


FIGURE 8-9 Front View of the MX Slimline Without the Hands Free Module



The following table describes the possible configurations available for the MX Slimline and the Slimline ClearDeal.

TABLE 8-2 MX Slimline Configurations

Configuration	Purchase Options
one MX Slimline	one MX Slimline with or without the integrated HFM
one MX Slimline connected to one Slimline ClearDeal	one MX Slimline with or without the integrated HFM one Slimline ClearDeal with or without microphone
one MX Slimline connected directly to two Slimline ClearDeals	one MX Slimline with or without the integrated HFM plus one Slimline ClearDeal with microphone (microphone master) *or* one Slimline ClearDeal without microphone plus an external microphone (microphone master) and one Slimline ClearDeal without microphone (microphone slave)
one MX Slimline with one stand-alone Slimline ClearDeal	one MX Slimline with or without the integrated HFM plus one Slimline ClearDeal (legs version) with microphone (microphone master) *or* one Slimline ClearDeal (legs version) without microphone and an external microphone
one MX Slimline with two stand-alone Slimline ClearDeals	one MX Slimline with or without integrated HFM plus one Slimline ClearDeal (legs version) with microphone (microphone master) *or* one Slimline ClearDeal (legs version) without microphone plus an external microphone (microphone master) and one Slimline ClearDeal (legs version) without microphone (microphone slave)[a]
one MX Slimline with three Slimline ClearDeals (two Slimline ClearDeals connected to the MX Slimline and the third ClearDeal as a stand-alone)	one MX Slimline with or without the integrated HFM plus two Slimline ClearDeals with microphone (master) *or* two Slimline ClearDeals without microphone plus an external microphone[b] and one leg Slimline ClearDeal without microphone (microphone slave)

one MX Slimline with three stand-alone Slimline ClearDeals bolted together	one MX Slimline (legs version) with or without the integrated HFM plus two Slimline ClearDeals (legs version) with microphone (master) *or* one leg Slimline ClearDeal without microphone plus an external microphone and one Slimline ClearDeal (legs version) without microphone

a. The two Slimline ClearDeals are bolted together.
b. The two SlimlIne ClearDeals are bolted together.

PCD Module

The PCD module, either as an external PCD module or a consolidated control/PCD module, allows you to see 60 buttons at a time. The buttons on a PCD module are fixed; they are not soft keys. The buttons on a PCD module are labeled because they do not change. The buttons on the PCD module are normally dedicated to frequently used lines, speed dial numbers, and features.

PCD button labels are four characters and printed on paper strips from the System Center software. (For more information about the System Center software, refer to the *Tradenet MX System Center Manual 14.1* (part number B0086185104.) For best results, use a laser printer, either from a call logger or a Sun workstation with an Aurora card that enables it to support a laser printer. After printing the PCD button labels, insert the paper strips into the lexan sleeves on the PCD module faceplate overlay. If you later need to change the button labels, change them in the System Center software and re-print the labels.

If you are not using PCD modules at a station, pagination modules can be used as 40-button PCD modules. Because PCD modules are less dynamic, they are less expensive than pagination modules. However, you might want to use pagination modules as PCD modules for the following reasons:

- If you have free-seating where traders are not always sitting at the same station, the labels on PCD modules would be wrong at different stations.
- If you do not want to bother with labeling by hand the buttons on a PCD module.

The PCD button module is connected to the control module by a 26-pin ribbon cable.

Combinations of Modules

The following table describes some combinations of modules at a station.

TABLE 8-3 Possible Combinations of Pagination Modules

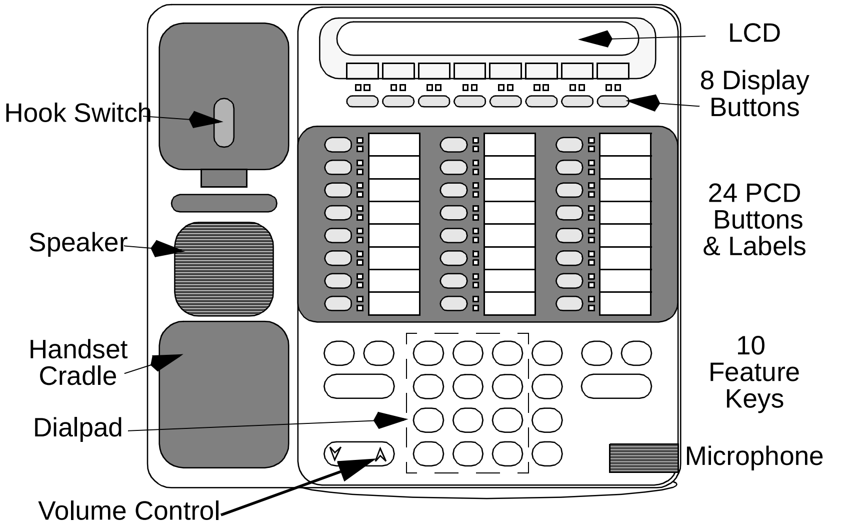
Station Description	Fixed Buttons on PCD Modules (Non-soft Keys)	Programmable Buttons on Pagination Modules (Soft Keys)
one control/pagination module	none	1–600 15 pages at 40 buttons per page
one control/pagination module one external pagination module	none	1–600 7 pages at 80 buttons per page 1 page at 40 buttons per page
one control/pagination module one external PCD module	1–60	61–600 14 pages at 40 buttons per page

TRADEPHONE MX

The TradePhone MX is a 30-line telephony device that combines the functions of a sturdy, stand- alone telephone, offering options for Prime Line and Ringing Line Preference, with a completely simultaneous integrated intercom. Additional features include:

- integrated hands-free intercom, including point-to-point calls, group calls, and broadcast calls
- user programming
- on/off hook dialing
- call forwarding (call diversion) on/off
- calling line identification (CLI) also known as caller id
- voice mail notification
- last number redial
- speed dial and index dial
- line sharing
- do not disturb option
- message waiting
- intercom group answer
- ringer volume and pitch control
- MX and PBX transfer capabilities
- desk or wall mounted
- voice recording
- headset compatible

TradePhone MX Components



LCD

The backlit liquid crystal display (LCD) is a 2-line, 40-character message area with natural gray background and black letters. Messages are displayed on the top display line, and 4-character button descriptors are displayed on the bottom line above their corresponding display buttons. If the keyset is idle for more than 60 minutes, the light turns off (sleep mode). Pressing any key or button turns the light on.

Display Buttons

There are eight display buttons directly below the LCD—each with a red and a green LED above it for status lamping; the first six are programmable as line or feature buttons and the last two are reserved for Group Answerback and Group Transfer.

PCD Buttons & Labels

In the middle of the keyset is a field of 24 programmable PCD (paper copy display) buttons. These are most often used for direct access to lines, but can be programmed for any combination of lines and features. Each button has a red and a green LED for status lamping. In programming mode, the 24 PCD buttons labeled A-X and the two display buttons on the right labeled Y and Z are used to enter the button descriptors. The PCD labels are printed from the System Center by a technician or the System Administrator.

Dialpad

The keyset has a digital telephone dialpad containing standard telephone keys.

Feature Keys

The keyset has 10 dedicated feature keys, some of which can have more than one function, depending upon whether the keyset is in telephone mode or programming mode. For information on programming a TradePhone MX, see the *TradePhone MX User Guide 14.1* (part number B0102081204).

Volume Control

Adjusts the current call volume on either the speakerphone or handset. If both the handset and speakerphone are active, it controls only speakerphone volume.

In programming mode, the up side of the key (^) pages the user forward (More and Next Page) through the menu screens.

Hook Switch

Provides normal off and on hook functions. Going off hook automatically selects the prime line; going on hook releases a call on the handset. If a line call is on the speakerphone, picking up the handset switches it from the speakerphone to the handset.

Speaker

Provides ringing tones to the keyset and the receive path for the speakerphone.

Microphone

Provides the talk path for the speakerphone, and for hands-free answerback to intercom calls.

Handset

The handset has noise-cancelling qualities and is hearing-aid compatible. The TradePhone MX is available with a push-to-cut handset. This handset can be confidencing or non-confidencing.

Five hardware options are available for the TradePhone MX:

- *headset*—An electret headset interface is available.
- *recorder*—An analog recording output allows line calls on the handset, headset, or speakerphone to be recorded.
- *API interface*—An RS-232 interface to which an external computing device can be connected.
- *local power*—A local power supply can be installed at the desk or station.
- *external speaker*—Connecting an external speaker to the phone jack on the bottom of the keyset disables the internal speaker and sends speakerphone audio to the external speaker.

TradePhone MX Buttons

Line Buttons

Each line button is programmed to provide a connection to a voice telephone line—either dialtone or private. Any and all of the 24 PCD and 6 of the display buttons can be programmed as a line button. You can move and change line assignments from the programming mode.

Line Button LED Indicators

Each line button has a red and a green LED that provide call status for that line. If both LEDs are unlit, the button is either unassigned or idle. Your site will use one of the following line-status indicator combinations (either US version or UK version only).

The following table lists the default line status indicators for the U.S. and Canada countrybase.

TABLE 8-4 Default Line Status Indicators for the U.S. and Canada Countrybase

Flash Rate	Color	Indicates
Slow	Green	High priority incoming call
Fast	Green	Call on hold at your keyset
Steady	Green	Line in use at your keyset
Slow	Red	Low priority incoming call
Fast	Red	Call on hold at another keyset or turret
Steady	Red	Line in use at another keyset or turret
		Line in unsupervised conference
		Line in privacy mode at another keyset or turret
Slow	Green and Red	Oldest waiting incoming call
Fast	Green and Red	Oldest u-hold (call on hold at another keyset or turret)

The following table lists the default line status indicators for the U.K. countrybase.

TABLE 8-5 Default Line Status Indicators for the U.K. Countrybase

Flash Rate	Color	Indicates
Fast	Green	High priority incoming call
Slow	Green	Call on hold at your keyset
Steady	Green	Line in use at your keyset
Fast	Red	Low priority incoming call
Slow	Red	Call on hold at another keyset or turret
Steady	Red	Line in use at another keyset or turret
		Line in unsupervised conference
		Line in privacy mode at other keyset or turret

Flash Rate	Color	Indicates
Fast	Green and Red	Oldest waiting incoming call
Slow	Green and Red	Oldest u-hold (call on hold at another keyset or turret)

In the middle of the TradePhone MX is a field of 24 programmable Paper Copy Display (PCD) buttons. These buttons are labeled with special paper. The labels are created by your technician or system administrator. For information about creating these labels, see *PCD Labels* on page 39.

The following table describes the TradePhone MX specifications.

TABLE 8-6 TradePhone MX Specifications

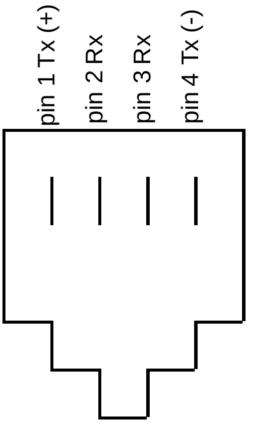
Dimensions	238 mm long, 265 mm wide, and 105 mm high
Cable	8 pin jack: pins 1 and 2 > Record pins 5 and 4 > Receive pins 3 and 6 > Transmit pins 7 and 8 > Power
Color	Black
Distance from the Back Room	900 feet over UTP
Power	Local or from the Back Room
Handset Cord Length	7 feet (15 foot cord option is also available)
Handset	hearing aid compatible
Jackbox	not required

Note *When you receive your TradePhone MX, remember to peel off the protective plastic on the display and labels. The protective plastic is there to make sure the TradePhone MX will not be scratched during shipment.*

The TradePhone MX operates with either a handset or a headset. The headset is automatically recognized when it is connected to the headset jack on the keyset. The TradePhone MX can be locally powered by a separate 48 volt DC power supply. This is not indicated on the order forms, but must be ordered separately.

In addition to the Plantronics headset available from IPC, you can use an outside vendor’s headset with the TradePhone MX. The headset should have a transmit sensitivity of -29 dBV/Pa into 3.3 Kohm AC load impedance and a receive sensitivity of 15–30 dBPa/V when driven from a 300 ohm source impedance. The headset transmitter must draw at least 165 mA under all conditions with a 4 kohm DC source resistance, and less than 1 mA under all conditions. The receiver must be limited to +24 dBPa (+118 dBSPL) output levels for all possible connections. The RJ9 connector must have four positions where positions 2 and 3 (the two middle positions) are receive. When viewed from the end of the headset cable with the tab down, position 1 should be positive transmit and position 4 should be negative transmit.

FIGURE 8-10 Headset Polarity



The TradePhone MX accepts any standard 1/8 inch monotone external speaker using an 1/8 inch jack; for example, Radio Shack’s speaker, part number 274-395. The TradePhone MX supports any high-input impedance self-powered speaker greater than 10 Kohms. When you plug in an external speaker to the TradePhone MX, the TradePhone MX’s own internal speaker is automatically muted.

The TradePhone MX supports the Tradenet MX API. However, the physical interface is different, and requires an API cable different from the one used with the standard turret.

The TradePhone MX is available in all countries where IPC equipment is already approved, with the exception of France and Switzerland.

For information about using the TradePhone MX, refer to the *TradePhone MX User Guide* 14.1 (part number B0102081204).

The TradePhone MX uses an IPIC in the back room, which is a Basic Rate Interface Card (BRIC) with no speaker granddaughter board. The maximum number of TradePhone MX supported on an IPIC is 10; BRICs with single DSPs support six. The BRIC uses a special software load dedicated for the TradePhone MX and a card supporting the TradePhone MX cannot be used in conjunction with the existing turrets or AT&T keysets.

The following table shows receiver type and noise cancellation characteristics.

TABLE 8-7 Receiver Type

Receiver Type	Noise Cancellation	Transmit Sensitivity dB V/Pa	Receive Sensitivity dB V/Pa	Receive Level
In ear	No	-29	+17.5	+8
On ear	No	-29	+14	+10
On ear soft	No	-29	+22	+5
On ear soft	Yes	-29	+22	+5
On ear soft binaural	No	-29	+18	+8
On ear soft binaural	Yes	-29	+18	+8
On ear soft	No	-29	+16	+9

Note *These Plantronics headsets are from the POLARIS series and have model numbers beginning with the letter P. Plantronics sells other headsets with identical part numbers, but with an H prefix. These look the same, but will not work with the Tradenet MX System. One way to differentiate the POLARIS headsets is that they terminate in a smoky gray RJ9 modular plug.*

The headsets listed in the previous table are standard items. Each includes a quick disconnect and a cable that directly interfaces to the Tradephone MX. All have flexible microphone booms. The non-noise cancelling versions are of the *voice tube* type construction.

The Receive Level column shows how many steps the receive level needs to be offset relative to the default value for the Tradephone MX handset in a particular country base. The offset needs to be in place for all calls. For a trader with a particular model of headset, the offset needs to be made manually to the TRID from the backroom since this TRID parameter cannot be updated from the turret. Each increment represents a 1.5 dB change.

Although only the headsets listed in the table are approved, any headset that meets the following specifications can be used with the Tradephone MX:

- Transmit Sensitivity: -29 dBV/Pa into 3.3 k ohm AC load impedance.
- Receive Sensitivity: 15 to 30 dBV/Pa when driven from a 300 ohm source impedance; for some models, headset station receive gain may have to be adjusted slightly on a TRID basis.
- DC Characteristics: The transmitter must draw at least 165 mA under all conditions with a 4k ohm DC source resistance; it must draw less than 1 mA under all conditions.
- Acoustic Shock Protection: The receiver must be limited to +24 dBPa (+118 dBSPL) output level for all possible connections.
- Polarity: The pinout of the RJ9 connector must be as shown in *FIGURE 8-10 Headset Polarity* on page 8-24. This is viewed from the end of the headset cable with the tab down. Receive polarity is not important:

Single DSP BRIC

The TradePhone MX can be used with either single DSP BRICs or dual DSP BRICs. However, only six TradePhone MXs can be used with a single DSP BRIC; ten can be used with a dual DSP BRIC.

If you have a TradePhone MX connected to a single DSP BRIC in position 7, 8, 9, or 10, an alarm is generated in the red alarm window and that TradePhone MX does not operate. There is a script you can use to determine where you have single DSP BRICs. For more information, refer to the *Tradenet MX Installation & Maintenance Manual 14.1* (part number B0108900003).

Migration From AT&T Keysets

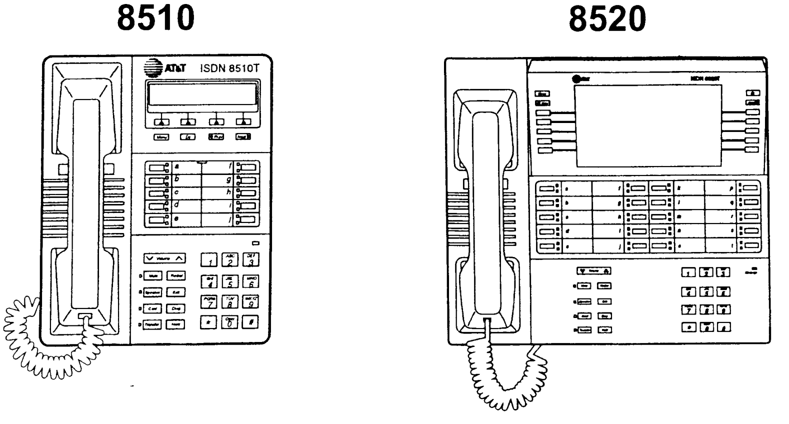
The existing AT&T keysets use the ISDN interface card (ISIC), an ISIP software load on the existing BRIC. Therefore, the existing ISICs can support the TradePhone MX with the new IPIC software. This provides our customers a clear migration path from the existing AT&T keysets to the new, enhanced TradePhone MXs. Note that if an ISIC with a single DSP is used, it supports six TradePhone MXs; a dual DSP ISIC supports up to 10 TradePhone MXs.

AT&T ISDN KEYSET

The AT&T 8510 and 8520 are supported on the Tradenet MX System. (The 7500 series has been discontinued.) Some MX features are not available on the AT&T keyset because pagination is not supported by these keysets. The AT&T keysets are typically used in trader's offices and do not replace turrets located on the trading floor.

The following figure shows the AT&T 8510 and 8520.

FIGURE 8-11 AT&T Keysets



For information about using the AT&T keysets, refer to the *Tradenet MX ISDN Keysets (AT&T 7500 and AT&T 8500 Series) Quick Reference User Guide*, part number B-00868-8-12-01.

Note The only AT&T keysets supported with the Tradenet MX System are the 8510 and the 8520.

French-approved Tradenet MX Systems do not support the AT&T keyset.

EXCHANGEPHONE

The Exchangephone is a consolidated control/pagination module with two handsets. The Exchangephone works identically to a consolidated control/pagination module. The Exchangephone is supported with Release 10.1 and later.

There is a hook switch available with the Exchangephone and the TradePhone MX.

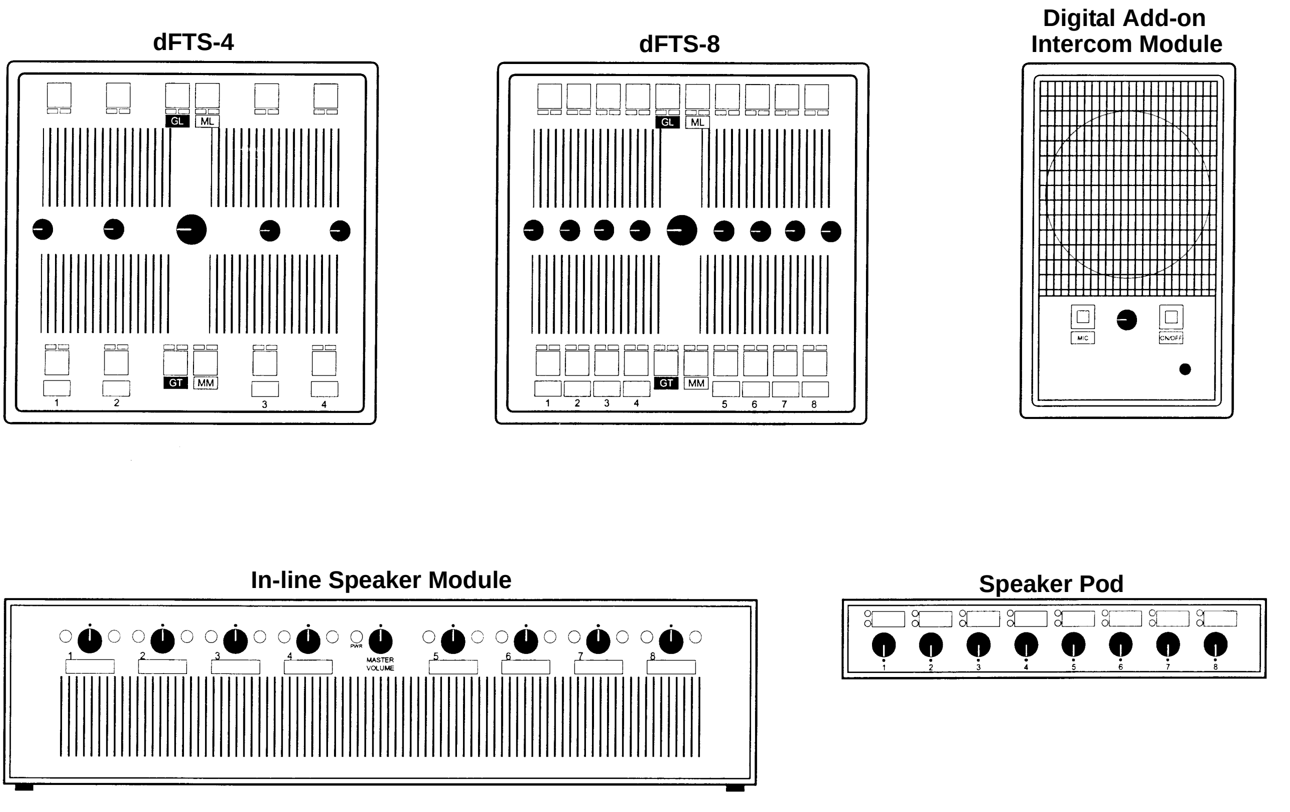
SPEAKERS

The following speaker modules are supported with the Tradenet MX System:

- ClearDeal speaker module (four-channel or eight-channel)
- Slimline ClearDeal speaker module (four-channel or eight-channel)
- dFTS-4 (digital speaker modules with four channels)
- dFTS-8 (digital speaker modules with eight channels)
- FTS-4 (analog speaker modules with four channels)
- FTS-8 (analog speaker modules with eight channels)
- digital add-on intercom module
- in-line speaker module
- speaker pod

The following figure shows what some of these speaker modules look like.

FIGURE 8-12 Digital Speaker Modules

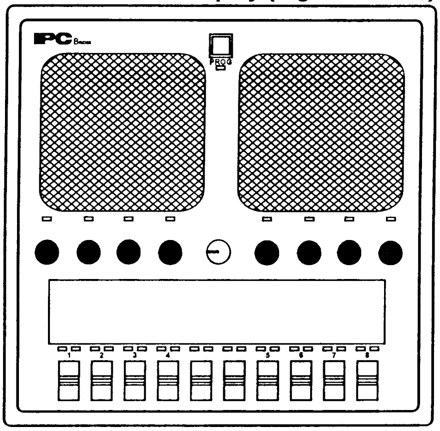


ClearDeal Speaker Modules

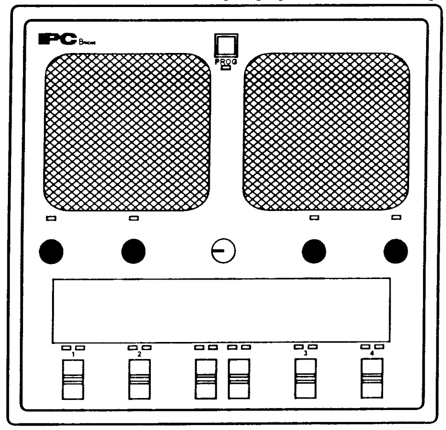
The ClearDeal speaker module is available with Tradenet MX Release 9.0.1 and later. This speaker module is available with four channels or eight channels and is available for digital systems only. ClearDeals are available with and without display screens. The following figure shows what the ClearDeal speaker modules look like.

FIGURE 8-13 ClearDeal Speaker Modules

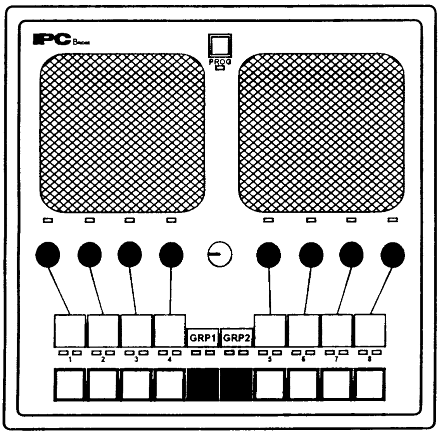
ClearDeal With Display (Eight Channel)



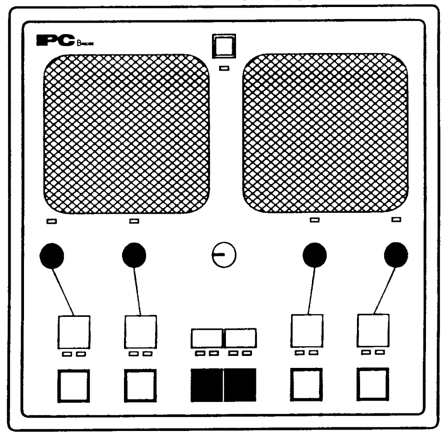
ClearDeal With Display (Four Channel)



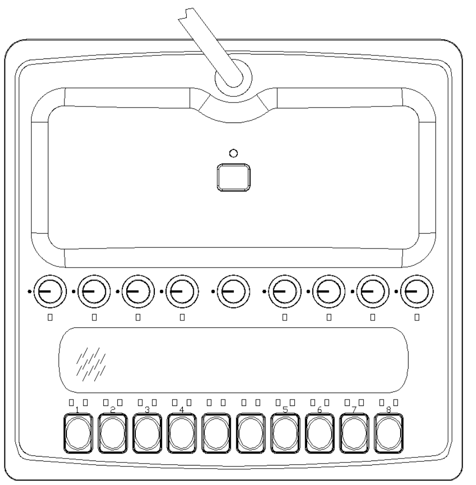
ClearDeal With No Display (Eight Channel)



ClearDeal With No Display (Four Channel)



Slimline ClearDeal



Like the dFTS speaker, the ClearDeal speaker connects directly to a Tradenet MX turret, its operation integrated with the operation of the turret. With Tradenet MX Release 9.0.1 and 9.2, each Tradenet MX turret can be equipped with up to two ClearDeal speakers to allow 16 speaker channels to be associated with a position. With Tradenet MX Release 10.1, each turret can be equipped with up to four ClearDeal speakers to allow 32 speaker channels. You can have both dFTS and ClearDeal speakers in the same Tradenet MX System.

For information about using ClearDeal speakers, refer to the *Tradenet MX Digital Turret User Guide* 14.1 (part number B0092081304). For information about installing ClearDeal speakers, refer to the *Tradenet MX Installation & Maintenance Manual 14.1* (part number B0108900003).

With Release 10.1 Maintenance and later, if you are using Kanji turrets, you must use Kanji ClearDeal speaker modules as well; you cannot use English ClearDeal speaker modules.

Benefits of the ClearDeal Speaker Module

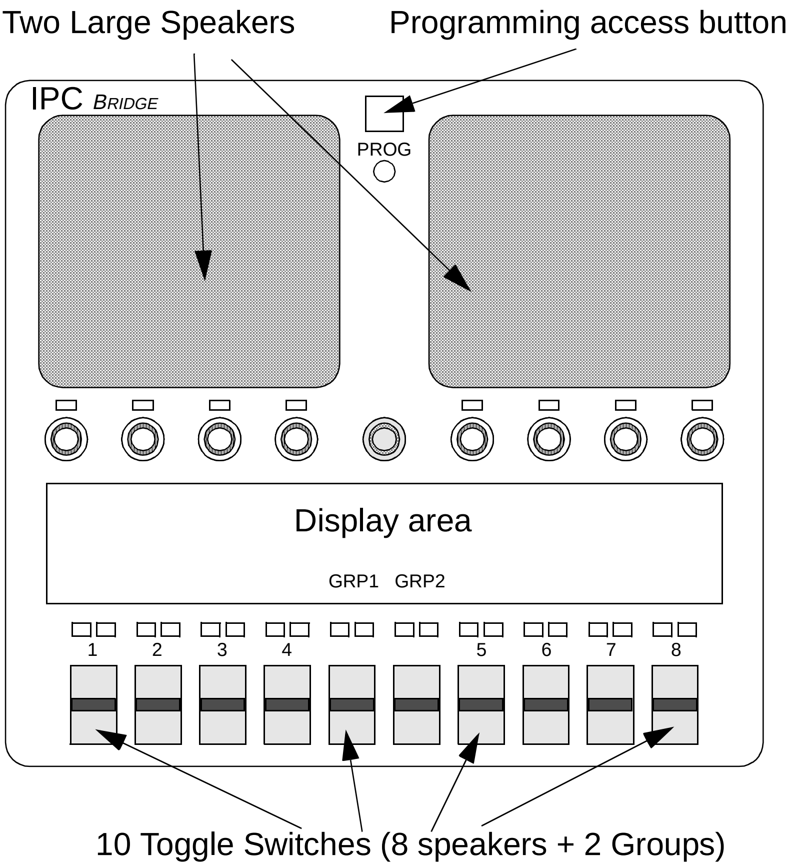
The following list describes the benefits of ClearDeal speaker modules over dFTS speaker modules:

- better audio quality than the dFTS speaker modules
- microphone interface on the ClearDeal speaker module accommodates a wider variety of microphones, including electret microphones
- toggle keys allow you to easily latch or momentarily transmit on a speaker channel with a single motion—Unlike the FTS, broadcasting to two or more channels simultaneously can be done by pressing the associated channel keys at the same time. Bright green and red LEDs on each speaker channel provide intuitive feedback for the trader when using the ClearDeal speaker. While features have been added to the ClearDeal module, the user interface has been simplified so that training for users will be faster. A toggle key associated with each speaker channel on the ClearDeal module allows the user to either momentarily transmit a quick message, or to latch (lock) the selected channel onto the microphone for continuous speech. Pressing the toggle key down causes the microphone to be assigned to the selected channel. When the user stops pressing the toggle key, the switch automatically moves back to the center (microphone off) position. Toggle keys are also used on the two ClearDeal group broadcast keys to provide the user with similar button operation.
- LCD display—This display shows the label (descriptor) of the line when it is assigned to a speaker channel by the user. The display technology that exists for the Tradenet MX turret was used for the ClearDeal speaker so that product consistency is preserved. Use of the display also allows the easier programming of features (for example, group key assignment) by the user.
- clearer recording of trading activity—The ClearDeal speaker module mixes the microphone and speaker channel activity and presents it for voice recording. This improved mixing ensures that transmit and receive signals are recorded at the same level by the recording equipment.

Description of the ClearDeal Speaker Module

The ClearDeal speaker module contains two high quality speakers placed at the top half of the module. Larger speakers are used to improve the sound of the speaker product.

FIGURE 8-14 ClearDeal Speaker, Toggle-Switch model



Each turret position can have the add-on intercom module for a separate intercom channel position. It can also use the individual speakers (if so equipped) for a maximum of 24 programmable speaker channels.

The ClearDeal is enclosed in a Tradenet MX module housing, used with a Tradenet MX digital turret. It provides either four or eight user-programmable speakers with individual volume controls and buttons. A separate microphone can be used for talkback purposes. The ClearDeal allows you to assign any line from the turret to a channel on a speaker module. A trader can have one or two ClearDeals for a maximum of 16 speaker channels. Programming is performed from a programming menu on the ClearDeal speaker, while line-to-speaker assignments are performed from the turret's **SPKV** or **SPKR** program menu options.

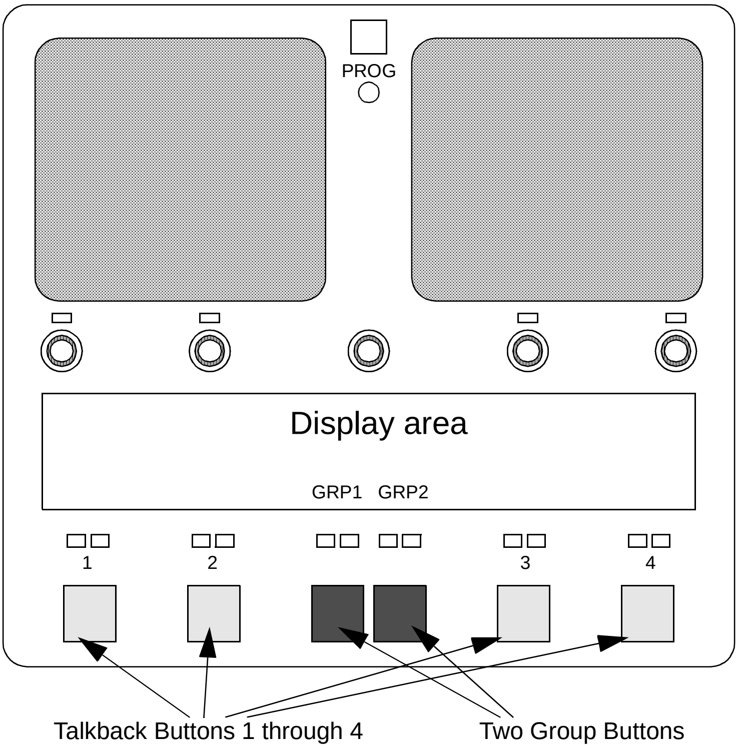
The ClearDeal speaker system can be used with or independent of the multiple speaker interface card (MSIC) available with Release 9.0.1 and later.

ClearDeal speakers can be used in the same system as the original dFTS modules but cannot be mixed at any turret position (that is, a turret cannot have one ClearDeal speaker and one dFTS). ClearDeal speakers and dFTS modules can also be mixed on the same BSIC.

Four-Channel ClearDeal Speaker Module

The ClearDeal provides a four channel configuration by depopulating buttons and potentiometers using logical channels 1, 3, 6, and 8 of the normal ClearDeal, but the channels are programmed and labeled as 1, 2, 3, and 4, respectively. All other ClearDeal features are the same except that there will only be four channels.

FIGURE 8-15 Four-Channel ClearDeal (Push-button)



Dual ClearDeal Configurations

When you need more than eight channels of speakers, you can add a four or eight channel ClearDeal as a slave to the eight-channel ClearDeal already present (the master ClearDeal). Alternately, you can have two four-channel ClearDeals. Group keys and program mode access are controlled by the first or Master ClearDeal, however individual line access is controlled by each speaker’s talkback key.

Note *Dual ClearDeal configurations require that both ClearDeal speakers be of the same type (display or non-display, and toggle-switch or push-button).*

These are the operational differences for dual ClearDeal configurations:

Normal Operation	The **PROG** key, the **GRP1** key, and the **GRP2** key will only function on the master ClearDeal. Group 1 and Group 2 may include channels from both ClearDeals
Program Modes	The program modes will be the same except that on the slave ClearDeal, the LCD labels above the **GRP1** and **GRP2** keys will be left blank
Program Main Menu	The program main menu will only appear on the master ClearDeal
Sub-menus	The sub-menu will appear on both master and slave ClearDeal except that the labels above the slave ClearDeal will be left blank

Slimline ClearDeal Speaker Module

The Slimline ClearDeal carries the same functionality as the ClearDeal. Enhancements to the Slimline ClearDeal include new high efficiency speakers for clear high volume levels and greater power output capability, free standing functionality, and an internal or external microphone option.

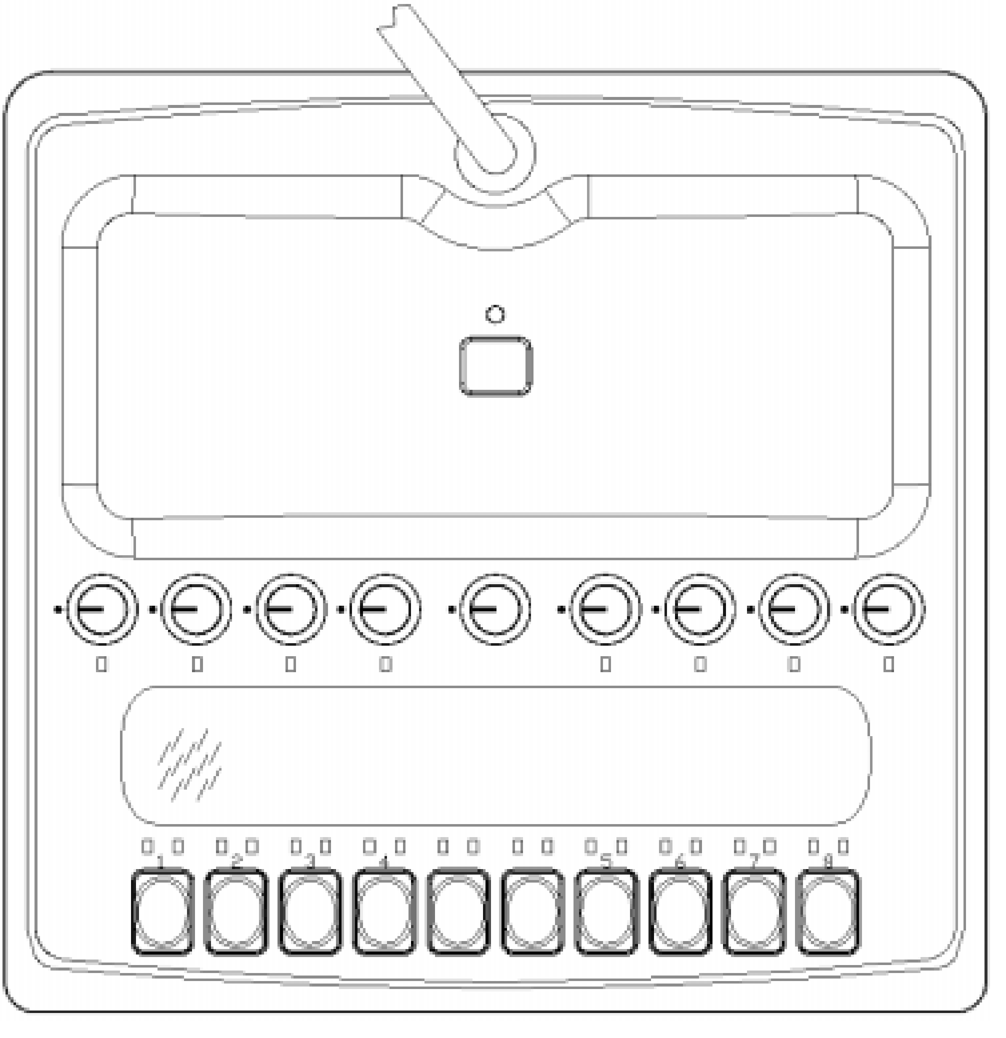
Based on these functional modifications, the Slimline ClearDeal offers the following configuration options:

- buttons or toggles
- four or eight channels
- free standing or desk mounted operation

Note *Slimline speaker modules have a pivot foot with a plastic mechanism at the pivot point. Therefore, care must be taken to not put excessive pressure on the pivot point while adjusting the angle of the Slimline.*

- with or without microphone

FIGURE 8-16 Slimline ClearDeal



The following table describes the possible configurations available for the MX Slimline and the Slimline ClearDeal.

TABLE 8-8 MX Slimline Configurations

Configuration	Purchase Options
one MX Slimline	one MX Slimline with or without the integrated HFM
one MX Slimline connected to one Slimline ClearDeal	one MX Slimline with or without the integrated HFM one Slimline ClearDeal with or without microphone
one MX Slimline connected directly to two Slimline ClearDeals	one MX Slimline with or without the integrated HFM plus one Slimline ClearDeal with microphone (microphone master) *or* one Slimline ClearDeal without microphone plus an external microphone (microphone master) and one Slimline ClearDeal without microphone (microphone slave)
one MX Slimline with one stand-alone Slimline ClearDeal	one MX Slimline with or without the integrated HFM plus one Slimline ClearDeal (legs version) with microphone (microphone master) *or* one Slimline ClearDeal (legs version) without microphone and an external microphone
one MX Slimline with two stand-alone Slimline ClearDeals	one MX Slimline with or without integrated HFM plus one Slimline ClearDeal (legs version) with microphone (microphone master) *or* one Slimline ClearDeal (legs version) without microphone plus an external microphone (microphone master) and one Slimline ClearDeal (legs version) without microphone (microphone slave)[a]
one MX Slimline with three Slimline ClearDeals (two Slimline ClearDeals connected to the MX Slimline and the third ClearDeal as a stand-alone)	one MX Slimline with or without the integrated HFM plus two Slimline ClearDeals with microphone (master) *or* two Slimline ClearDeals without microphone plus an external microphone[b] and one leg Slimline ClearDeal without microphone (microphone slave)
one MX Slimline with three stand-alone Slimline ClearDeals bolted together	one MX Slimline (legs version) with or without the integrated HFM plus two Slimline ClearDeals (legs version) with microphone (master) *or* one leg Slimline ClearDeal without microphone plus an external microphone and one Slimline ClearDeal (legs version) without microphone

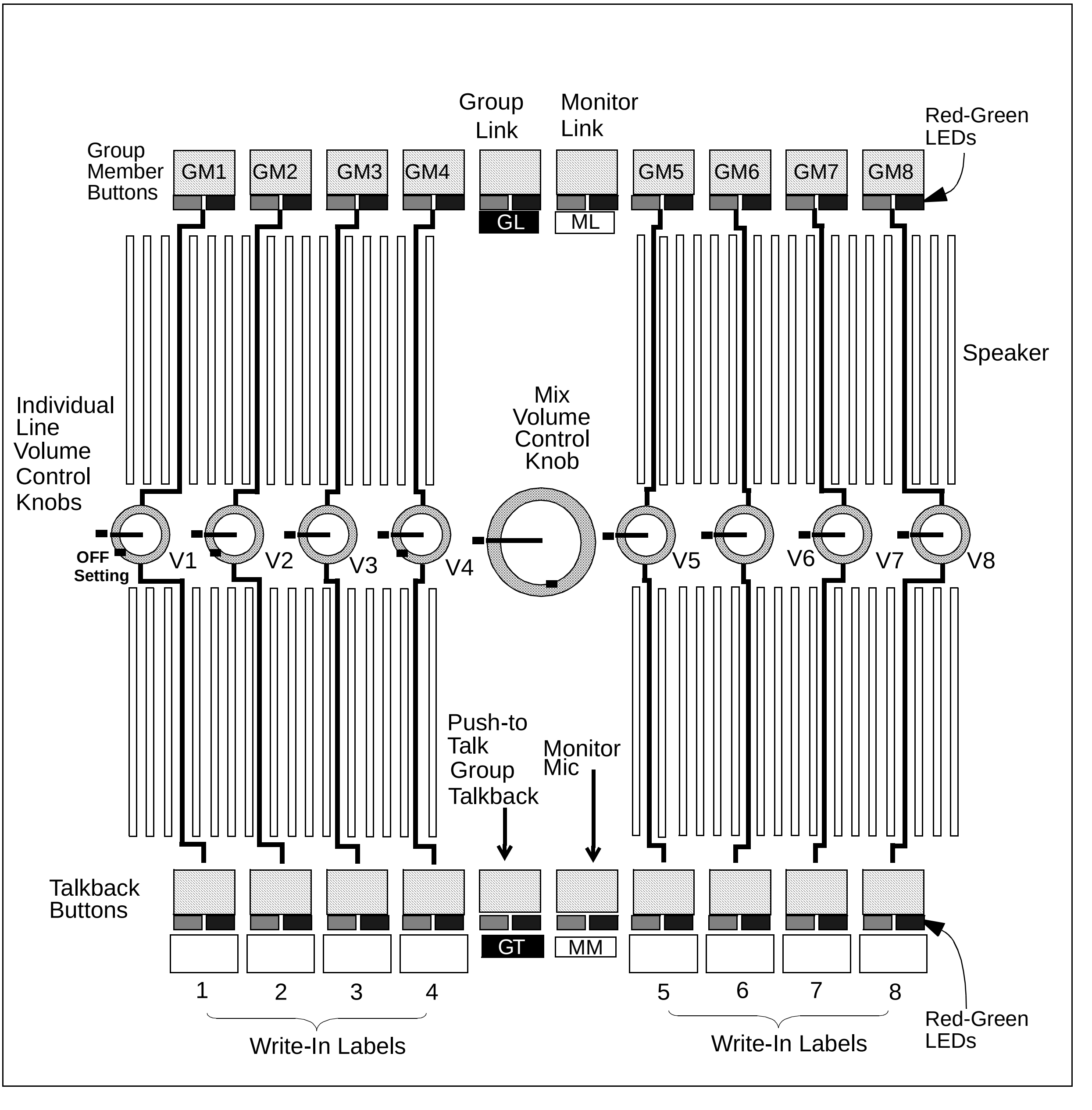
a. The two Slimline ClearDeals are bolted together.
b. The two SlimlIne ClearDeals are bolted together.

Digital FTS-4 Speaker Module and Digital FTS-8 Speaker Module

The digital flexible trading system (dFTS) speakers are digital speaker modules you can use with digital turrets. The dFTS-4 has four speaker channels and the dFTS-8 has eight speaker channels. The dFTS-4 and dFTS-8 speaker modules receive voice data and power through a cable to the digital turret control module. These speakers are available with and without microphones.

The following figure shows a picture of the dFTS-8 speaker module.

FIGURE 8-17 dFTS-8 Speaker Module



The *GM1*, *GM2*, *GM3…GM8* (Group Member) buttons are the left and right four buttons of the row of buttons at the top of the speaker module. Each one of these buttons correspond to the line on the talkback button directly below it at the bottom of the module. Traders can set up combinations of these lines to be in either or both of two groups: talkback (push-to-talk) or monitor (microphone on, latching). A GM button with a red LED is in a talkback group. A GM button with a green LED is in a monitor group. If both red and green LEDs are lit, the line is in both groups.

The *GL* (Group Link) button is used when selecting the lines to be part of the talkback group. To add lines to the talkback group, press the GL button and the button latches and the red LED lights. Then you can press a GM button to add it to the talkback group or remove it from the talkback group.

Use the *ML* (Monitor Link) button to assign lines to the monitor microphone group. When you press this button, the button latches and the green LED lights. Then you can press any GM button to assign it to the monitor group or, if already in the group, to drop it from the group.

Each line has its own stepped volume control knob. Use the *individual line volume control knobs* to change the volume of each line. The highest setting is at the 7 o'clock position. When the individual line volume control knobs are clicked into the off position, the line associated with that button is dropped.

The *mix volume control knob* raises and lowers the volume of the whole speaker. For best results when controlling speaker volume, initially set the mix volume control knob to 12 o'clock. (This is roughly 30% of maximum volume.) Then set the volume for each speaker independently, using each speakers individual line volume control knob. For both individual and mix volume controls, clockwise rotation increases the volume level and the highest setting is at the 7 o'clock position. The off position for the mix volume control knob is not used.

The *TB1, TB2, TB3…TB8* (talkback) are the left and right four buttons of the row of buttons at the bottom of the speaker module. Each talkback button corresponds to the line on the GM button directly above it. Use the talkback buttons to select a line for talkback. Talkback is only active while the individual button is held down. Only one of these buttons can be pressed at a time, to prevent the lines from canceling each other. Use the GT button to answer multiple channels.

The *GT* (Group Talkback) button connects the microphone to a pre-selected group of talkback channels simultaneously. You must press and hold down this button to use it.

The *MM* (monitor microphone) button connects the microphone to the monitor group. This button also indicates power-on status and communication with the system, as described in *TABLE 8-9 LED Channel Activity Indicators for dFTS Speaker Modules With Microphones* on page 8-38.

dFTS-4 and dFTS-8 Speaker Module With Microphone

dFTS-4 and dFTS-8 speakers with microphones allow you to assign any line on your turret to a button on the speaker module. You can also quickly and easily set up a line or combination of lines as *monitor*, that is, the microphone is always on and it is latching, or *talkback groups*, that is, you need to push the button before speaking. You can use a combination of fixed lines and assignable lines.

Warning! ***Extensive damage to the speaker module will result if the acoustic microphone is not grounded.***

There is a special noise cancelling directional microphone (Shure Model 562) available with dFTS-4 speaker modules and dFTS-8 speaker modules.

Note *For the noise cancelling microphone to be effective, you must speak directly into the microphone from a distance of not more than one inch.*

The digital turret can have up to four dFTS-4 or dFTS-8 speaker modules, and dFTS-4 and dFTS-8 speaker modules can be mixed at one station. For an illustration of the dFTS-4 and dFTS-8 speaker modules, see *FIGURE 8-12 Digital Speaker Modules* on page 8-29.

The following table describes what the buttons on the dFTS-8 and dFTS-4 speaker modules with microphones indicate.

TABLE 8-9 LED Channel Activity Indicators for dFTS Speaker Modules[2] With Microphones

Button	Red LED	Green LED	Comment
GM	line is in a talkback group	line is in a monitor group	If both red and green LEDs are lit, the line is in both groups.
GL	establishing talkback group, must be lit to use the GT button	not used	
ML	not used	establishing monitor group, must be lit to use the MM button	
TB	intensity fluctuates with the distant end's voice levels from off, to dim, to light, to bright	when the speaker is active, the line is in receive audio mode and when the microphone is active, the line is in transmit mode	The green LED is off when there is not a line assigned to this button, or the speaker is turned off at its individual volume control. Only one of these buttons can be pressed at a time, or mutual cancellation can result.
GT	when the button is held down, the group talkback lines can be addressed with the microphone	not used	
MM	dim red indicates that speaker power is on and bright red indicates there is no communication between the speaker and the system's back room	Monitor Mic Group selected for talkback with mic.	

dFTS-4 and dFTS-8 Speaker Module Without Microphone

dFTS-4 and dFTS-8 speaker modules without microphones allow you to assign any line from your turret to a button on your speaker module in *receive mode only*. You can use a combination of fixed lines and assignable lines. Speaker modules without microphones *do not* support talkback, so the following buttons on the dFTS-4 and dFTS-8 are *not used* when you do not have microphones:

- Group Member buttons
- Group Link (GL) button
- Monitor Link (ML) button
- Group Talkback (GT) button
- Monitor Mic Groups (MM) button

Analog FTS-4 Speaker Module and Analog FTS-8 Speaker Module

The analog flexible trading system (FTS) speakers are analog speaker modules you can use with analog turrets. The FTS-4 has four speaker channels and the FTS-8 has eight speaker channels. These analog speakers operate in receive mode only. These speakers do not include microphones.

2. This is for both dFTS-4 and dFTS-8 speaker modules.

Digital Add-on Intercom Module

The digital add-on intercom module (also called the *hands free module*) can be used with digital turrets. This module adds intercom capability to a turret with buying a speaker module. The digital add-on intercom module is shown in *FIGURE 8-12 Digital Speaker Modules* on page 8-29. Unlike the dFTS-4 and dFTS-8 speaker modules, the digital add-on intercom module does not use a dedicated voicepath; instead it uses any vacant handset voice path. If there is no handset voice path available, intercom calls to the module will show flash green on the turret intercom (ICM) button, and the distant end will hear ringing. As soon as a voice path becomes available, the intercom call bursts through on the intercom module.

If the trader switches handsets during an intercom call, the intercom automatically switches to the other handset's voice path, without affecting the intercom call in progress.

The digital add-on intercom module provides the following features:

- speaker volume control with Do-Not-Disturb position
- button to transfer call to or from the handset
- microphone mute button for privacy during an intercom call
- microphone for voice transmit
- high quality speaker for voice receive
- rear panel connectors for module bus cable and for cable to turret AUX jack
- it can be located to the right or the left of the turret

An intermittent problem might occur when any external module (such as an add-on intercom module) is connected to an older digital turret.

- *SYMPTOM*—This failure will appear as a non-operating external module.
- *AFFECTED TURRETS*—The turrets most likely to have this problem have part number 21112399 and date code 97/29–97/34.

Note *If your external modules are operating properly with the turret, or if you do not plan to use any external modules, then there is no cause for concern.*

If you encounter this problem, please return *only* the 21112399 turret to the Westbrook factory for repair. On the *Voice Systems Return Tag* in the *OTHER* category under *other*, write *INCOMPATIBLE W/EXTERNAL MODULE*. The factory will replace the bad component in the turret and the turret will be returned to you.

In-line Speaker Module

The in-line speaker module operates in receive mode only, except for one intercom channel). The in-line speaker is shown in *FIGURE 8-12 Digital Speaker Modules* on page 8-29.

Speaker Pod

The speaker pod works with other speaker modules that you mount under your desk and a small box speaker that you put on top of your desk. The speaker pod allows you to save desk space without losing speaker capabilities. The speaker pod is shown in *FIGURE 8-12 Digital Speaker Modules* on page 8-29.

Hoot ‘n’ Holler Speaker Module

The hoot ‘n’ holler speaker module can be used with analog stations in Tradenet and Tradenet MX Systems. This module can be connected to private lines or dialtone lines, or it can be used as an in-house intercom. This module has a volume control knob and an optional microphone.

For four-wire multi-point hoot ’n’ holler circuits, *side tone* is normally generated in the four-wire line card to ensure that all parties can hear the speech generated within a given site. For Tradenet MX, this side tone is represented by the network echo generated by the bridge. Therefore, for this to be operated successfully with analog turrets the:

- microphone output (when available) must be adjusted to the common level before being mixed, and
- echo cancellation must be applied to prevent audible feedback (howl around).

North American Requirements

In the United States & Canada, it is common practice for this side tone amplitude to be adjusted to match the incoming line signal amplitude (normally, –16db). So, all parties are heard at the same level no matter whether they are in the local site or a remote site. If a trader needs to hear his own voice after the echo cancellation, then it may be possible to apply some much lower level of side tone by not completely cancelling the echo in the DSP (Digital Signalling Processor).

United Kingdom Requirements

In the United Kingdom, the requirement is not specified by BABT because there are few hoot ’n’ holler systems. However, the principal of making the “side tone” match the level of the incoming signal is still valid. The same mechanism is used to adjust the effective side tone to the originating microphone.

IPC Bridge Speakers

There are several speaker modules available from IPC Bridge. For more information about IPC Bridge products, contact IPC Bridge at 1-914-369-1200.

DASH Digital Line Card

If you are using the DASH digital line card, and it receives line levels that are extremely low (-35 dB range), the noise reduction feature can cause the transmission to break up, resulting in white noise.

The following speaker boxes, or speaker controllers, can be affected:

- single channel controller (3" metal)
- single channel controller (4" metal)
- single channel controller (plastic)
- single channel controller (front panel only)
- dual channel controller (metal)
- dual channel controller (plastic)

Noise Reduction

IPC Bridge offers a modified speaker controller for each line. This controller has a built-in noise reduction feature.

IPC Bridge also offers the following speakers with noise reduction capabilities:

- MX Single Line Speaker: has a DIP switch on the rear panel that allows you to enable/disable noise reduction on the speaker
- Single Line Speaker: has noise built in to the speaker box.

Both models have dimensions of 3 x 3 x 3 inches, and have a black metal casing. Note that these two speaker boxes are for receive-only applications; they do not work with the DASH digital open line system.

Voice Quality at Loud Volumes

IPC Bridge has received reports of distortion from IPC Bridge speakers at high volume. The problem has been traced to the use of under rated or unregulated power supplies with the IPC Bridge speakers. IPC Bridge speakers idle as low as 50 mA but require approximately 300 mA to operate at high volume.

To verify a power supply problem, take the following steps:

1. Place a voltage meter across the power supply to the speaker.
2. Test the speaker at high volume while monitoring the power supply voltage. A variation of more than 0.5V indicates that the power supply is either over driven or that the power supply is unregulated.

Note *A* ***regulated*** *power supply maintains the same voltage throughout the specified current range. An* ***unregulated*** *power supply characteristically reduces the output voltage as the current approaches the specified output. Always verify the power supply operation when confronted with distortion at high volumes from IPC Bridge speakers.*

3. Use an IPC Bridge power supply listed below according to the total current required by the speakers, or a locally purchased *regulated* 24 volt power supply capable of supplying the total current required by the speakers.
   - TAMURA-24 V DC/400 mA AC/DC transformer
   - APS-24 V DC/1.6 amp local power supply
   - 24 V DC power supply (12 amps)
   - 24 V DC power supply (16 amps)

VTQS Interface for Non-Integrated Speaker Systems

The VTQS speaker interface is a means by which all necessary signaling (including line busy detect) can be supplied to a non-integrated speaker systems. The VTQS Interface includes the:

- VTQS interface card
- VTQS card cage and backplane
- VTQS line busy adapter board
- and necessary interface cabling.

The VTQS backplane receives the busy detect signals from the MX TU via the VTQS busy adapter card and two 25-pair cables. The inputs to the VTQS backplane are a TLL level voltage that goes high when the line is busy.

The output of each VTQS interface is an isolated relay closure with the following options:

- dry relay pair *normally open*
- dry relay pair *normally closed*
- dry relay pair with one common input for all circuits
- dry relay contact providing a ground.

These above mentioned options are available via jumper settings on the VTQS interface card.

The VTQS interface also provides a reinforced barrier to/from the interface system, via relays, board layout, and construction.

For more information, refer to the *Tradenet MX Installation & Maintenance Manual 14.1* (part number B0108900003).

MICROPHONES

In addition to the microphones you can get as part of the ClearDeal and dFTS speaker modules, IPC offers the following microphones:

- Shure gooseneck microphone
- Piker microphones (Piker TM170 and Piker Electret)

IPC Bridge offers the LinkBox microphone to connect to ambient speaker systems with an XLR connector. This is a Peiker-type noise cancelling gooseneck mounted on a compact metal base. The microphone has a push button that can be configured to be either: momentary latching push-to-talk or push-to-cut; or latching push-to-talk or push-to-mute.

HANDSETS

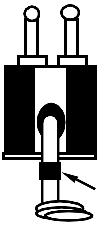
The Tradenet MX handset uses an industry standard carbon or carbon compatible transmitter for better and more consistent acoustics. Handsets compatible with Tradenet turrets and with Series I systems can be used with the Tradenet MX analog or digital turrets. However, a handset with an electret transmitter, such as the IPC Series II handset, is not supported with the Tradenet MX System.

Analog and digital turrets can have either one or two handsets. A turret with one handset is called *single talkpath* because it uses one basic rate interface (BRI) port. A turret with two handsets is called *dual talkpath* because it uses two BRI ports.

All G-style Tradenet MX handsets are hearing aid compatible. A telephone can be classified as *hearing aid compatible* if it meets FCC requirements for hearing aid compatibility. The FCC standards define the magnetic field presented by the receiver of a hearing aid compatible telephone as designed to be compatible with hearing aids with magnetic pickups. These standards are intended to ensure satisfactory telephone service to users of magnetically coupled hearing aids in a high percentage of installations.

IPC handsets that are compatible with the Tradenet MX System are identified with a maroon brady wire wrapped around the cord at the jack connector end of the handset as shown in *FIGURE 8-18 Identifying Tradenet and Tradenet MX Handsets* on page 8-44.

FIGURE 8-18 Identifying Tradenet and Tradenet MX Handsets



The Tradenet MX digital and analog turrets are compatible with the following types of handsets:

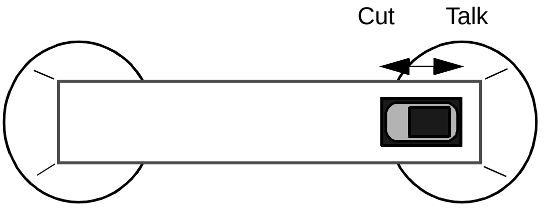
- standard Tradenet MX handsets
- IPC Handset (only with digital turrets)
- push-to-cut handsets (momentary contact or latched rocker switch)
- push-to-talk handsets (momentary contact or latched rocker switch)
- push-to-signal (analog turrets only)

Jackboxes provide the most reliable and long lasting connection between the handsets and the station equipment. The handset is terminated with a standard dual phone plug that plugs into the jackbox. The jackbox and the turret have modular connectors on the back of the control module. A six-conductor cable that is terminated on both ends with modular plugs connects the turret and the jackbox. Grounding the jackboxes is not mandatory for the Tradenet MX System. However, it is recommended for sites where handsets are repeatedly plugged in and then unplugged.

IPC Handset

The IPC handset is available in a push-to-cut version and a slide switch version. The IPC handset works with the US countrybase. The IPC handset is not available with a modular cord.

FIGURE 8-19 Slide Switch Version of the IPC Handset



Swiss-approved Handsets

The following table shows the part numbers of the different types of handsets you can use with the Swiss approved MX.

TABLE 8-10 Valid Handsets for the Swiss Approved MX

Part Number	Push Control	Cord	Receiver	Gain
51413041	none	9 feet	DH60	low
51413140	PTC	modular	DH60	low
51413141	PTC	9 feet	DH60	low

Each handset is labeled with an IPC part number. The *modular* version of the handset has the part number near the modular connector and the *corded* version has the part number affixed to the 396-type plug.

French-approved Handsets

French-approved MX installations require the IPC handset with the digital turrets. The handsets employ the familiar DH60 receiver element, and have low gain attributes. They are noise cancelling and hearing aid compatible. The handset is G-style, black in color, and is available as push-to-cut or not. A modular push-to-cut model is also available.

The handset is not field serviceable. Do not attempt to open the handset; doing so will break a glued-on seal.

Four conductors are used to the handset. Corded handsets are equipped with a 396-type (two prong) plug which mates with a conventional handset jackbox. Modular handsets use a special modular coil cord, black in color, which has a 4P4C modular connector at the handset end, and a 6P4C modular connector at the turret end.

The following handsets are *required* (due to regulatory approvals) for all Tradenet MX installations in France. There are no substitutes or alternates.

TABLE 8-11 French-approved Handsets

Part Number	Push to Cut	Cord	Receiver	Gain
51413041	no	9 feet, 396	DH60	low
51413140	yes	modular	DH60	low
51413141	yes	9 feet, 396	DH60	low

The following modular cords can be used with the modular handset, above.

TABLE 8-12 Handset Cords

Part Number	Cord Length
29608614	9 feet
29608615	15 feet

These handsets already have noise-cancelling attributes, and would not need a confidencer element for loud environments.

TABLE 8-13 IPC Jackbox Assembly for Corded Handsets

Part Number	Description
29112016	IPC Jackbox Assembly
29112017	IPC Jackbox, Tradenet, Push-to-Signal

The push-to-signal jackbox assembly (used with Tradenet) supports six conductors to the handset. The IPC handset uses only four conductors. This jackbox can be used with the IPC handset but is not required, because the extra signal leads it provides are not used.

Handsets used for French MX installations are also required and approved for installations in Germany and Switzerland.

RECORDING EQUIPMENT

Audio Levels

All Tradenet MX recording outputs have an audio level range between: 0.2V to 1V peak-to-peak, or -14db to 0db. This range is sufficient to accommodate the analog recording equipment used in Tradenet MX Systems.

Tape Recorders

Tape recorders, or any devices that require tip and ring only, can be connected to the Tradenet MX System back room at the digital distribution panel's female 25-pair auxiliary cable connectors. The following figure shows the digital recorder cutdowns for handsets on digital turrets.

FIGURE 8-20 Digital Recorder Cutdowns

	J44		J17		J11		J23
TL1	WHT BLUE	TL11	WHT BLUE	TL21	WHT BLUE	TL31	WHT BLUE
RL1	BLUE WHT	RL11	BLUE WHT	RL21	BLUE WHT	RL31	BLUE WHT
TR1	WHT ORG	TR11	WHT ORG	TR21	WHT ORG	TR31	WHT ORG
RR1	ORG WHT	RR11	ORG WHT	RR21	ORG WHT	RR31	ORG WHT
TL2	WHT GRN	TL12	WHT GRN	TL22	WHT GRN	TL32	WHT GRN
RL2	GRN WHT	RL12	GRN WHT	RL22	GRN WHT	RL32	GRN WHT
TR2	WHT BRN	TR12	WHT BRN	TR22	WHT BRN	TR32	WHT BRN
RR2	BRN WHT	RR12	BRN WHT	RR22	BRN WHT	RR32	BRN WHT
TL3	WHT SLT	TL13	WHT SLT	TL23	WHT SLT	TL33	WHT SLT
RL3	SLT WHT	RL13	SLT WHT	RL23	SLT WHT	RL33	SLT WHT
TR3	RED BLUE	TR13	RED BLUE	TR23	RED BLUE	TR33	RED BLUE
RR3	BLUE RED	RR13	BLUE RED	RR23	BLUE RED	RR33	BLUE RED
TL4	RED ORG	TL14	RED ORG	TL24	RED ORG	TL34	RED ORG
RL4	ORG RED	RL14	ORG RED	RL24	ORG RED	RL34	ORG RED
TR4	RED GRN	TR14	RED GRN	TR24	RED GRN	TR34	RED GRN
RR4	GRN RED	RR14	GRN RED	RR24	GRN RED	RR34	GRN RED
TL5	RED BRN	TL15	RED BRN	TL25	RED BRN	TL35	RED BRN
RL5	BRN RED	RL15	BRN RED	RL25	BRN RED	RL35	BRN RED
TR5	RED SLT	TR15	RED SLT	TR25	RED SLT	TR35	RED SLT
RR5	SLT RED	RR15	SLT RED	RR25	SLT RED	RR35	SLT RED
TL6	BLK BLUE	TL16	BLK BLUE	TL26	BLK BLUE	TL36	BLK BLUE
RL6	BLUE BLK	RL16	BLUE BLK	RL26	BLUE BLK	RL36	BLUE BLK
TR6	BLK ORG	TR16	BLK ORG	TR26	BLK ORG	TR36	BLK ORG
RR6	ORG BLK	RR16	ORG BLK	RR26	ORG BLK	RR36	ORG BLK
TL7	BLK GRN	TL17	BLK GRN	TL27	BLK GRN	TL37	BLK GRN
RL7	GRN BLK	RL17	GRN BLK	RL27	GRN BLK	RL37	GRN BLK
TR7	BLK BRN	TR17	BLK BRN	TR27	BLK BRN	TR37	BLK BRN
RR7	BRN BLK	RR17	BRN BLK	RR27	BRN BLK	RR37	BRN BLK
TL8	BLK SLT	TL18	BLK SLT	TL28	BLK SLT	TL38	BLK SLT
RL8	SLT BLK	RL18	SLT BLK	RL28	SLT BLK	RL38	SLT BLK
TR8	YEL BLUE	TR18	YEL BLUE	TR28	YEL BLUE	TR38	YEL BLUE
RR8	BLUE YEL	RR18	BLUE YEL	RR28	BLUE YEL	RR38	BLUE YEL
TL9	YEL ORG	TL19	YEL ORG	TL29	YEL ORG	TL39	YEL ORG
RL9	ORG YEL	RL19	ORG YEL	RL29	ORG YEL	RL39	ORG YEL
TR9	YEL GRN	TR19	YEL GRN	TR29	YEL GRN	TR39	YEL GRN
RR9	GRN YEL	RR19	GRN YEL	RR29	GRN YEL	RR39	GRN YEL
TL10	YEL BRN	TL20	YEL BRN	TL30	YEL BRN	TL40	YEL BRN
RL10	BRN YEL	RL20	BRN YEL	RL30	BRN YEL	RL40	BRN YEL
TR10	YEL SLT	TR20	YEL SLT	TR30	YEL SLT	TR40	YEL SLT
RR10	SLT YEL	RR20	SLT YEL	RR30	SLT YEL	RR40	SLT YEL
NOT USED	VIO BLUE	NOT USED	VIO BLUE	NOT USED	VIO BLUE	NOT USED	VIO BLUE
	BLUE VIO		BLUE VIO		BLUE VIO		BLUE VIO
	VIO ORG		VIO ORG		VIO ORG		VIO ORG
	ORG VIO		ORG VIO		ORG VIO		ORG VIO
	VIO GRN		VIO GRN		VIO GRN		VIO GRN
	BRN VIO		BRN VIO		BRN VIO		BRN VIO
	VIO BRN		VIO BRN		VIO BRN		VIO BRN
	BRN VIO		BRN VIO		BRN VIO		BRN VIO
	VIO SLT		VIO SLT		VIO SLT		VIO SLT
	SLT VIO		SLT VIO		SLT VIO		SLT VIO

J44, J17, J11, and J23 are the tip and ring cables associated with each of the 12-pair turret cable connectors. Record channel tip and ring are cross-connected to these pairs as follows:

- TL1 is tip for the left handset of turret 1
- RL1 is ring for the left handset of turret 1
- TR1 is tip for the right handset of turret 1
- RR1 is ring for the right handset of turret 1
- TL40 is tip for the left handset of turret 40
- RL40 is ring for the left handset of turret 40
- TR40 is tip for the right handset of turret 40
- RR40 is ring for the right handset of turret 40

The TL and RL leads are the tip and rings for each of the digital turrets handsets. TL and RL refer to the left handset and TR and RR refer to the right handset.

The following figure provides details on one cable connector example, J44. There are 80 tip and ring recorder pairs (40 for the left and 40 for the right). Each 25-pair cable has the tip and rings for 10 turrets. The last five pairs of each cable are not used.

FIGURE 8-21 Digital Recorder Cutdown Detail

LEGEND:

TL=TIP LEFT
RL=RING LEFT
TR=TIP RIGHT
RR=RING RIGHT

	J44
TL1	WHT
RL1	BLUE
TR1	BLUE
RR1	WHT
TL2	WHT ORG
RL2	ORG WHT
TR2	WHT GRN
RR2	GRN WHT
TL3	WHT BRN
RL3	BRN WHT
TR3	WHT SLT
RR3	SLT WHT
TL4	RED
RL4	BLUE
TR4	BLUE
RR4	RED
TL5	RED ORG
RL5	ORG RED
TR5	RED GRN
RR5	GRN RED
TL6	RED BRN
RL6	BRN RED
TR6	RED SLT
RR6	SLT RED
TL7	BLK
RL7	BLUE
TR7	BLUE
RR7	BLK
TL8	BLK ORG
RL8	ORG BLK
TR8	BLK GRN
RR8	GRN BLK
TL9	BLK BRN
RL9	BRN BLK
TR9	BLK SLT
RR9	SLT BLK
TL10	YEL
RL10	BLUE
TR10	BLUE
RR10	YEL
	YEL ORG
	ORG YEL
	YEL GRN
	GRN YEL
	YEL BRN
	BRN YEL
	YEL SLT
	SLT YEL
	VIO BLUE
	BLUE VIO

Not Used (YEL ORG through BLUE VIO)

EXAMPLE	RECORDER UNIT
T	Chanel 1 Tip
R	Chanel 1 Ring
T	Chanel 2 Tip
R	Chanel 2 Ring

You will notice that the TL and RL leads are the Tip and Rings for each of the Digital Turrets handsets. The TL and RL refer to the LEFT handset and the TR and RR refer to the RIGHT handset for each turret. There are 80 Tip and Ring Recorder pairs-40 left and 40 right handsets.

Each 25 pair cable has the Tip and Rings for TEN turrets. The last five pairs of each cable is not used.

HEADSETS

The following Brooktel headsets are supported with digital turrets in the Tradenet MX System:

- Starset 2
- Monaural Headset
- Binaural Headset with Noise Cancelling

These headsets are connected through the turret jackbox to the handset connector on the back of the digital control module.

TURRET BUSY INDICATOR

There is a turret busy indicator available with Release 9.0.1 and later. The turret busy indicator requires the API cost option. This cost option is available with Release 9.0.1 and later. For more information about this cost option, refer to the *Tradenet MX System Center Manual 14.1* (part number B0086185104).

The turret busy indicator provides a single screen showing the status of up to 128 lines. These lines are the 64 lines that have been on hold for the most time, plus the 64 lines that have been ringing for the most time. This application is display only; once it is started, it requires no keyboard or mouse.

You can connect up to 4 turret feeds of up to 120 lines each for a total of 480 monitored lines. If you are monitoring more than 240 lines, this application requires a multi-port serial board.

For more information about setting up the turret busy indicator, refer to the *Tradenet MX Installation & Maintenance Manual 14.1* (part number B0108900003).

To start the turret busy indicator application, take the following steps:

1. On the System Center, open a command tool or shell tool window.
2. From the **/usr/sx/db** directory, type **`cd busylamp`** and press ENTER.
3. Type **busylamp** and press ENTER. You see a window with two sections: **RING** and **HOLD**. The **RING** section shows the 64 lines that have been ringing for the most time. The **HOLD** section shows the 64 lines that have been on hold for the most time. Lines are ordered by time with the line ringing or holding the longest at the top.

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