MEGAPLEX-2000/2100 Module

HS-2

2-Channel High Speed Data Module

FEATURES

- Supports two high speed data channels
- Programmable data rates up to 1,984 kbps in any multiple of 64 or 56 kbps
- User-selectable V.35 or V.11/RS-422 interface for each channel
- Separate DB-25 connector for each channel
- Fits into any I/O slot of the following Megaplex chassis:
  - MP-2000/2004
  - MP-2100/2104
  - MP-2100B
  - MP-2100F

DESCRIPTION

- The HS-2 module supports two high speed synchronous data channels. Each channel is independently set by user for either V.35 or V.11/RS-422 interface (electrical). The V.11/RS-422 selection is used for RS-530, V.36/RS-449, or X.21 interface (physical) operation.
- Each channel can support data rates of n x 56 or n x 64 kbps, where n = 1 to 24 for T1 links, and 1 to 31 for E1 (CEPT) links. Total combined bandwidth for both channels is up to 1,536 kbps for T1 links or 1,984 kbps for E1 links.
- Each channel of the local module may be directed to any channel of another HS-2 module at the remote site (the remote module may also be any other compatible HS module, such as HS-Q, HS-3, etc.). The timeslots used on the T1 or E1 links are assigned by the user (with MP-2000/2004 they are assigned automatically).
- Each channel can be independently configured for DCE, External-DCE or DTE timing modes. The External-DCE mode is used for tail-end applications: it provides Rx clock, while receiving Tx clock from the user equipment.
- Each high speed data channel terminates on a separate DB-25 connector. Pin assignment is compatible with RS-530 specifications. Special adapter cables are used to connect each HS-2 channel to standard V.35, V.36/RS-449, or X.21 equipment (see *Ordering*). The adapter cables are wired according to the required clock mode.
- Local support of CTS, RTS, DCD and DSR control signals for each channel is provided.
- Extensive diagnostics, including local and remote channel loopbacks, as well as an integral BER test, reduce downtime to a minimum.
- Channel data rates and all other operating parameters of the HS-2 are soft-selectable through the Megaplex management system.

MEGAPLEX-2000/2100 Module

HS-2

2-Channel High Speed Data Module

SPECIFICATIONS

- **Data Channels**
  Two
- **Interface (Electrical)**
  V.35 or V.11/RS-422, selectable
- **Interface (Physical)**
  RS-530 (convertible to V.35, V.36/RS-449, or X.21 via adapter cables – see *Ordering*)
- **Interface Direction**
  DCE
  - For RS-530: convertible to DTE/Ext-DCE via crossover cables
  - For other interfaces: convertible to DTE/Ext-DCE via adapter cables (see *Ordering*)
- **Connectors**
  Two DB-25, female
  (one for each channel)
- **Data Rates**
  Synchronous,
  n x 56 or n x 64 kbps, where:
  - *for T1:* n = 1 to 24
  - *for E1:* n = 1 to 31
- **Clock Modes**
  DCE:
  HS-2 channel provides both Rx and Tx clocks to the user DTE
  External-DCE (DTE1):
  HS-2 channel provides Rx clock to the user, while accepting Tx clock from the user. Used for connection to tail-end DCE
  DTE (DTE2):
  HS-2 channel accepts both Rx and Tx clocks from the user DCE
- **Control Signals**
  CTS follows RTS or is constantly ON, soft-selectable
  DCD constantly ON, unless in Red Alarm (one DCD signal for all four channels)
  DSR constantly ON when channel is connected, unless engaged in test
- **Diagnostics**
  Local loopback
  Remote loopback
  Internal BERT
- **Configuration**
  Programmable via Megaplex management system

ORDERING

MP-2000M-HS-2
4U-high module for MP-2000/2004

MP-2100M-HS-2
4U-high module for MP-2100/2104

MP-2100BM-HS-2
6U-high module for MP-2100B

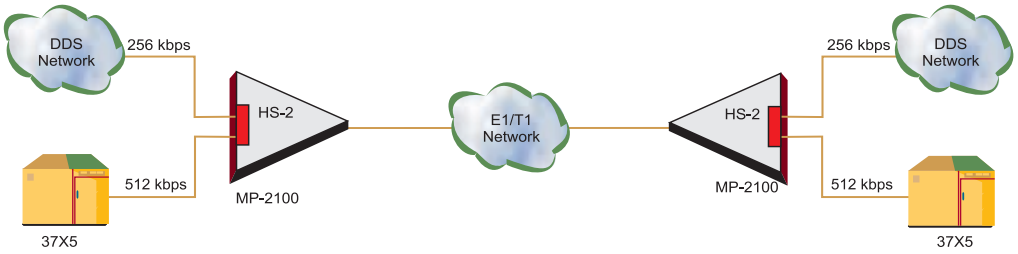
MP-2100FM-HS-2
6U-high module for MP-2100F

CBL-HS2/*/#
Adapter cable for HS-2's DB-25 channel connectors. Converts to connector of type specified (separate cable is needed for each connector). Cable must be chosen to match the desired clock mode. Cable length is 2 m (6 ft).

* Specify interface, clock mode:
V1 for 34-pin V.35, DCE
V2 for 34-pin V.35, Ext-DCE
V3 for 34-pin V.35, DTE
R1 for 37-pin V.36/RS-449, DCE
R2 for 37-pin V.36/RS-449, Ext-DCE
R3 for 37-pin V.36/RS-449, DTE
X1 for 15-pin X.21, DCE
X2 for 15-pin X.21, Ext-DCE

Specify cable connector type (on user side):
F for female
M for male

APPLICATION



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Megaplex-2100 Modules

ML-1/2E1/T1, MLF-1/2E1/T1

Copper or Fiber Optic Interface, Single/Dual E1/T1 Main Link Modules

FEATURES

- Connect Megaplex-2100 to various E1 and T1 services
- Support one or two E1 or T1 link interfaces with built-in non-blocking cross connect
- Built-in CSU (T1) or LTU (E1) on copper interface ML modules
- E1 modules support V5.1 and R2 CAS signaling
- MLF modules available with variety of fiber optic interfaces, with ranges up to 100 km (62 miles)
- Multiple clock source selection
- Station clock interface for external clock (except MLF-2)
- Bypass for all voice and data channels between any pair of links
- 1:1 protective switching within 50 msec between links on dual link modules
- Fit into any I/O slot of the MP-2100 or MP-2104 chassis

DESCRIPTION

- The electrical copper interface ML-1/2 and fiber optic interface MLF-1/2 family of main link modules, each enable direct connection of the Megaplex-2100 to one or two E1/T1 lines. Multiple main link modules can be installed in a single chassis, providing the Megaplex-2100 with up to four full E1/five full T1 link capacity, for both point-to-point and point-to-multipoint applications. Alternatively, multiple Fractional E1/T1 links can be supported.
- E1 link modules are compatible with all carrier provided E1 services, meeting the requirements of ITU-T Recommendations G.703, G.704 and G.732. They support both two (256N) and 16 (256S) frames per multiframe formats. CRC-4 and E bit are also supported, complying with G.704 recommendations. Zero suppression over the lines is HDB3.
- T1 link modules are compatible with all carrier provided T1 services, meeting ANSI and AT&T requirements. They support both D4 and ESF framing formats. Zero suppression is selectable for either Transparent, B7ZS, or B8ZS.
- The copper interface ML-1T1 and ML-2T1 modules are equipped with an integral user-enabled CSU, ensuring ranges of up to 1.6 km (1 mile). ML-1E1 and ML-2E1 modules are equipped with an integral user-enabled LTU, ensuring ranges of up to 2 km (1.2 miles).
- The fiber optic interface MLF main link modules enable direct connection of the Megaplex-2100 to fiber optic lines, eliminating the need for an external fiber optic modem or repeater. Links of these modules operate at either E1 (2.048 Mbps) or T1 (1.544 Mbps) rate, providing secure links in hazardous or hostile environments.
- With MLF modules, the E1 or T1 electrical signal is converted into a transmitted optical signal using a LED or laser. At the opposite end of the fiber line, the optical signal is converted back into an electrical signal and amplified to the required level by the remote MLF module.

Megaplex-2100 Modules

ML-1/2E1/T1, MLF-1/2E1/T1

Copper or Fiber Optic Interface, Single/Dual E1/T1 Main Link Modules

- Four optical interfaces are available for MLF modules:
  - 850 nm LED for use over multimode fiber with typical distances up to 5 km (3 miles);
  - 1300 nm LED for use over single mode fibers with typical distances up to 47 km (29 miles);
  - 1300 nm laser diode for use over single mode fibers for extended range up to 62 km (38 miles);
  - 1550 nm laser diode for use over single mode fibers for maximum range of up to 100 km (62 miles).

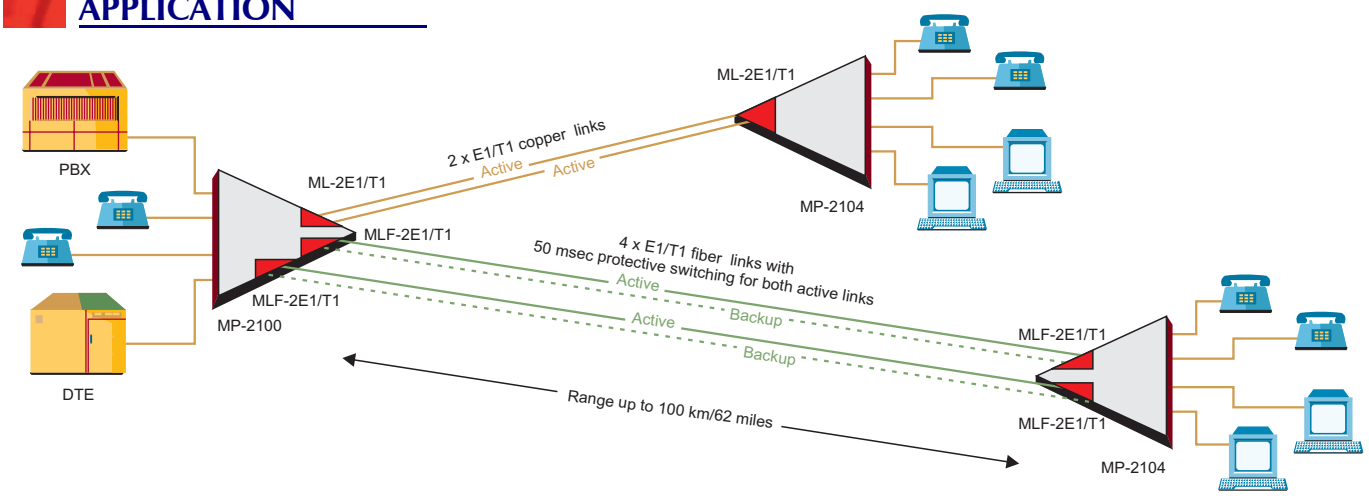
  Interfaces are terminated with a pair of ST, FC/PC or SC type connectors (see *Ordering*).
- MLF modules are compatible with RAD's stand-alone fiber modem FOM-E1/T1, as well as with fiber modules of FCD, DXC and other Megaplex systems.
- The internal cross-connect matrix of the ML and MLF main link modules, allows routing of voice and data channels from any I/O module installed in the chassis, to any installed main link. In addition, the matrix enables voice and data traffic to be routed from any link to any other link. The non-blocking full cross-connect feature enables greater flexibility in assigning timeslots and more efficient utilization of E1/T1 bandwidths, as well as facilitates drop&insert, bypass or broadcast multi-link applications.

Note: A total of 124 timeslots can be allocated, either for transmission of I/O channels or for bypassing timeslots between links of different modules.

- Additional main link modules can be installed in the Megaplex-2100 chassis to operate as hot standby modules. The backup module's links and the active module's links are connected to the same E1/T1 lines via Y-cables, providing full redundancy in case of main link hardware failure. Alternatively, multiple links can be configured for load sharing with optional priority bumping, ensuring continuous operation of the most important channels in the event one of the links fail.
- Extensive transmission reliability can be provided by 1:1 protective switching between any two links in case of line failure. 1:1 protective switching between the two links of a dual link module takes place within 50 msec of a link failure.
- A Megaplex chassis can be equipped with a combination of fiber and non-fiber main link modules (although all links must be of the same E1/T1 type).
- In dual copper link modules, an optional port bypass relay interconnects between both E1/T1 main links when the module is not powered. This feature is designed to enable in-band network management traffic to pass undisrupted through the links of a non-powered unit, to connected units which are operating.
- E1 links modules support **R2** signaling with transparent MFC/DECADIC for setting up, metering and disconnecting phone calls. This enables placing a Megaplex-2100 between an older R2-PBX and a digital (E1-CAS) PBX. In addition to the ITU-T standard R2 protocol, several predefined national PTT protocols, as well as user-definable variations, are also supported.
- E1 link modules support the **V5.1** in-band protocol to facilitate the connection of PSTN and ISDN residential and SOHO users to V5.1 local exchanges. V5, the ETSI standard interface, operates between the access network and the switch for basic telephony, ISDN and semi-permanent leased lines.

  V5.1 support enables providing the same types of services and features that are available to PSTN or ISDN subscribers directly connected to the exchange subscriber ports, to those that are connected via the Megaplex-2100 E1/T1 links.

APPLICATION



ML-1/2E1/T1, MLF-1/2E1/T1

Copper or Fiber Optic Interface, Single/Dual E1/T1 Main Link Modules

- System timing can be derived from an external station clock. This clock can then be passed to other connected Megaplex units. A dedicated RJ-45 connector is provided on the module panel for receiving the external station clock signal.

  Note: The station clock connector is *not* provided on dual link fiber MLF modules.

- Diagnostic capabilities include local and remote loopbacks on each main link for fault detection. Performance statistics for each of the two main links may be obtained and analyzed via the Megaplex-2100 management system.
- T1 link modules support code-activated network line and network payload loopbacks. When in ESF format, T1 main link statistics are stored in memory, in compliance with both ANSI and AT&T requirements.
- Main link and system parameters are monitored and controlled via a terminal interface, or via the RADview-PC or RADview-HPOV Network Management System.

SPECIFICATIONS

- **Number of Links (per module)**
  ML-1E1, ML-1T1,
  MLF-1E1, MLF-1T1: 1
  ML-2E1, ML-2T1,
  MLF-2E1, MLF-2T1: 2

E1 INTERFACE (all E1 modules)

- **Standards Compliance**
  ITU-T G.703, G.704, G.732 (Including CRC-4 and E bit)
- **Framing**
  2 frames (256N), or 16 frames (256S) per multiframe
- **Data Rate (per link)**
  2.048 Mbps
- **Line Code**
  HDB3
- **Jitter Performance**
  As per ITU-T G.823

T1 INTERFACE (all T1 modules)

- **Standards Compliance**
  AT&T TR-62411, PUB 54016; ANSI T1.107 and T1.403
- **Framing**
  D4, ESF
- **Data Rate (per link)**
  1.544 Mbps
- **Line Code**
  Bipolar AMI
- **Zero Suppression**
  Transparent, B7ZS, B8ZS
- **Jitter Performance**
  As per AT&T TR-62411

COPPER E1 INTERFACE (ML-1E1, ML-2E1)

- **Impedance**
  Balanced 4-wire: 120Ω
  Unbalanced coax: 75Ω
- **Signal Level**
  Receive:
  Without LTU: 0 to -10 dBm
  With LTU: 0 to -33 dBm
  Transmit:
  Balanced: ±3V (±10%)
  Unbalanced: ±2.37V (±10%)
- **Connectors (per link)**
  Balanced: RJ-45
  Unbalanced: pair of mini BNC (1.0/2.3 mm SMC), female

  Note: CBL-MINIBNC-BNC cable is available for converting from mini BNC connector to standard BNC coax interface (see *Ordering*)

COPPER T1 INTERFACE (ML-1T1, ML-2T1)

- **Impedance**
  Balanced 4-wire: 100Ω
- **Signal Level**
  Receive:
  Without CSU: 0 to -10 dBm
  With CSU: 0 to -34 dBm
  Transmit:
  Without CSU: ±3V (±10%), user adjustable, measured at 0 to 655 ft
  With CSU: 0, -7.5, -15, -22 dBm
- **Connectors (per link)**
  RJ-45

Table 1. Fiber Optic Interface Specifications and Range

Wavelength	Fiber Type	Transmitter Type	Power Coupled into Fiber	Receiver Sensitivity	Optical Budget	Maximum Receiver Input Power	Receiver Dynamic Range	Typical Maximum Range
850 nm	62.5/125 µm multi-mode	LED	-18 dBm	-38 dBm	20 dB	-10 dBm	28 dB	5 km (3 miles)
1300 nm	9/125 µm single-mode	LED	-18 dBm	-40 dBm	22 dB	-12 dBm	28 dB	45 km (28 miles)
1300 nm	9/125 µm single-mode	Laser	-12 dBm	-40 dBm	28 dB	-12 dBm	28 dB	62 km (38 miles)
1550 nm	9/125 µm single-mode	Laser	-12 dBm	-40 dBm	28 dB	-12 dBm	28 dB	100 km (62 miles)

Megaplex-2100 Modules

ML-1/2E1/T1, MLF-1/2E1/T1

Copper or Fiber Optic Interface, Single/Dual E1/T1 Main Link Modules

FIBER OPTIC INTERFACE (MLF-1E1, MLF-2E1, MLF-1T1, MLF-2T1)

- **Specifications and Range**
  See *Table 1* on previous page
- **Connectors (per link)**
  Pair of ST, FC/PC or SC (see *Ordering*)

GENERAL

- **Station Clock Interface**
  (not available on MLF-2)
  Bit rate:1.544 (T1)/2.048 MHz (E1)
  Line code: AMI
  Connector: RJ-45
  Format: Unframed 1s or RS-422 squarewave (jumper-selectable)
- **Diagnostics**
  - Local main link loopback
  - Remote main link loopback

  T1 modules only:
  - Network line loopback
  - Network payload loopback
- **Statistics (T1 modules only)**
  Full statistical diagnostics capability according to ANSI T1.403-1989
  Local support of ESF diagnostics according to AT&T PUB 54016
- **Surge Protection**
  E1: ITU-T K.21
  T1: FCC 68.302
- **Indicators**
  Per module: Alarm
  Per link:
  On-line, Test,
  Local and Remote sync loss (E1),
  Red and Yellow alarms (T1)
- **Configuration**
  Programmable via terminal interface, or RADview-PC or RADview-HPOV Management Systems
- **Power Consumption**

Module	Current	Power
ML-1E1	1.2A	6.1W
ML-2E1	1.3A	6.3W
ML-1T1	1.2A	6.1W
ML-2T1	1.8A	8.9W
MLF-1E1	1.6A	8.0W
MLF-2E1	1.8A	9.0W
MLF-1T1	1.6A	7.9W
MLF-2T1	1.8A	9.0W

Note: ML and MLF modules utilize the +5V power line only.

ORDERING

MP-2100M-ML-1@
Single Copper Interface Main Link Module for MP-2100/2104

MP-2100M-ML-2@/$
Dual Copper Interface Main Link Module for MP-2100/2104

MP-2100M-MLF-1@/#+
Single Fiber Optic Interface Main Link Module for MP-2100/2104

MP-2100M-MLF-2@/#+
Dual Fiber Optic Interface Main Link Module for MP-2100/2104

ORDERING OPTIONS

@ Specify for E1/T1 interface type:
E1 for E1 link(s)
T1 for T1 link(s)

$ Specify **BP** for optional port bypass between dual copper links.
Default is without port bypass

\# Specify fiber optic connector type:
ST for ST type connector
SC for SC type connector
FC for FC/PC type connector

\+ Specify fiber optic interface wavelength and transmitter type:
85 for 850 nm, multimode, LED
13 for 1300 nm, single mode, LED
13L for 1300 nm, single mode,laser
15L for 1550 nm, single mode, laser

CBL-MINIBNC-BNC
Cable for converting from ML-1E1/ML-2E1 module's mini BNC unbalanced connectors to standard BNC interface.
(A separate cable must be ordered for each individual mini BNC connector.)

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764-109-09/01

Megaplex-2100/2104

Modular Integrated Access Multiplexers

TDMoIP Driven™

FEATURES

- Flexible Integrated Access Multiplexers
- Integrate data, voice/fax and video traffic over up to 4 full E1 or 5 full T1 main links with non-blocking, DS0 cross-connect
- Supports multiple Fractional E1/T1 main links, with combined TDM capacity of 8 Mbps (124 timeslots)
- 10/100 Mbps IP access link for transparent circuit extension over IP using RAD's TDMoIP technology
- Support ring topology:
  - Self-healing TDM E1/T1 rings
  - Resilient Fast Ethernet Ring (RFER) technology providing Fast Ethernet networks with self-healing protection within 50 msec
- PCM, ADPCM digitization and G.723.1 low-bit-rate compressed voice
- Optional redundant configurations support critical applications
- Wide range of I/O modules support multiple channels:
  - 40 high speed data
  - 132 low speed data
  - 55 full BRI (2B+D)
  - 120 PCM voice
- Two chassis types:
  - MP-2100 (4U-high) supports up to 12 modules
  - MP-2104 (2U-high) compact version supports up to five modules
- V5.1 support for standard POTS and ISDN interface to the local exchange
- Support R2 signaling
- Ethernet LAN modules
- Built-in fiber optic and HDSL modems reduce deployment and maintenance costs
- Management through ASCII terminal or SNMP
- RADview SNMP management with graphical user-interface on PC or UNIX (HP OpenView) platform
- Telnet support for remote management
- Non-volatile, Flash memory for software upgrade and configuration download
- DL (download) and TFTP support for Common Logic software upgrade
- Support standard management protocols: SLIP, PPP, PPPHDLC, IP Over Frame Relay (RFC 1450) and RIP2

Megaplex-2100/2104

Modular Integrated Access Multiplexers

DESCRIPTION

- Megaplex-2100/2104 is a modular integrated access TDM multiplexer, that enables integration of multiple dedicated data, voice, ISDN, video and LAN channels over multiple main (network) links. Megaplex features a traffic payload capacity of up to 124 DS0 timeslots. This 8 Mbps capacity can be transmitted over 4 full E1 or 5 full T1 links, or alternatively, over multiple Fractional E1/T1 links.

  Note: Megaplex units with CL.2 common logic provide a maximum payload capacity of 124 timeslots (8 Mbps). Units with CL.1 common logic have a maximum capacity of 62 timeslots (4 Mbps).

- Megaplex's modular design with its wide choice of I/O (user interface) modules, has the flexibility to support applications ranging from small campus networks to multi-site corporate networks or extensive carrier access solutions. Due to Megaplex's standards-adherence, central office based cross-connect units (DACS) can separate voice and data, sending each to the appropriate carrier or service.

- Megaplex enables carriers to successfully deploy bundled services, ISDN services and Internet access. The integration of a broad range of services makes Megaplex a cost-effective access device, with reduced deployment and maintenance costs.

- Megaplex conforms to international standards, ensuring compatibility in multi-vendor environments worldwide.

TDMoIP

- Megaplex offers an optional IP main link module that transmits TDM traffic directly over IP networks. This TDMoIP access module converts user TDM traffic into IP frames that can be transmitted on 10/100BaseT or 100BaseF Ethernet networks. Megaplex with TDMoIP technology provides a cost-effective and versatile, modular solution for supporting legacy TDM equipment over IP networks. This is especially suitable for large corporations, utilities or power companies that are seeking a gradual migration to IP networks.

SYSTEM

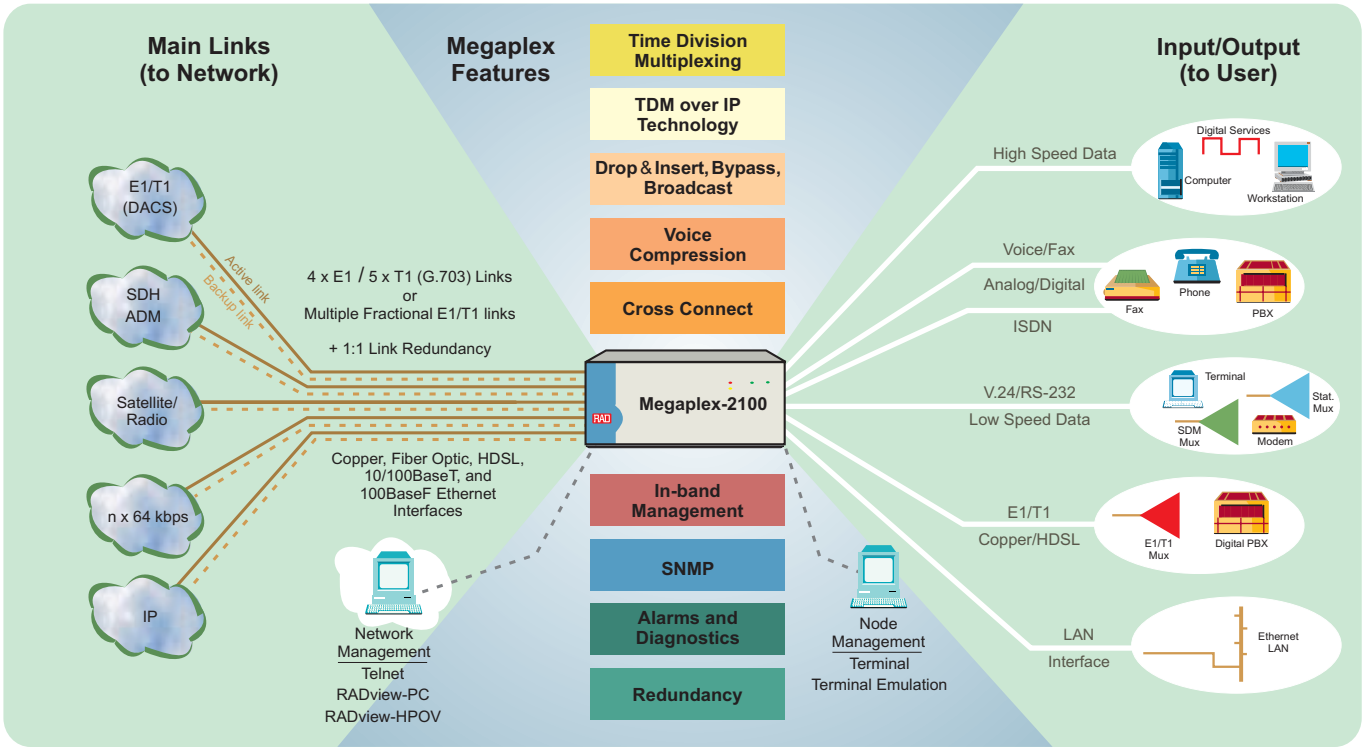
Chassis

- Megaplex is available in two basic unit chassis variants:
  - **Megaplex-2100** (4U high) chassis providing slots for up to 12 ML and I/O modules
  - **Megaplex-2104** (2U high) chassis providing slots for up to 5 main link and I/O modules.

Timing

- Multiple system timing options are available:
  - Internal crystal oscillator clock
  - Clock received from any link (loopback)
  - Clock from any high speed module channel
  - External station (master) clock
  - Adaptive timing received from any bundle (with ML-IP only).

  Any clock source can be set as fallback in the event of primary clock source failure.



Megaplex-2100/2104

Modular Integrated Access Multiplexers

System Redundancy

- Megaplex's modular, distributed architecture enables redundancy at different levels of the network and provides a system with no single point of failure.
- System hardware redundancy is provided through optional redundant power supply and common logic (MP-2100 chassis only).
- 1:1 protection switching on the main link modules protects against network or cable failure. Additional ML modules can be installed and interconnected via Y-cables to provide protection against ML hardware failures.
- Bundle redundancy provides backup for IP transmissions (functions similarly to E1/T1 link "parallel TX" redundancy).
- In case of link failure, Megaplex enables alternate routing. This is achieved by storing multiple configuration databases and flipping (switching) between them in case of any network event.

RING REDUNDANCY

- Megaplex supports RAD's ring topology to provide higher transmission reliability with no single point of failure for critical applications. This topology is based on two transmission paths for each Megaplex unit, to form a closed dual-ring topology (as in SDH network rings).
- Although data is received simultaneously from two different paths, only the signals received from one is processed. If that link is interrupted, the signal received from the other path is used instead. The ring topology is best implemented using the dual-port main link modules, although it can also be supported using ports located on different modules.
- The TDMoIP link module features RAD's Resilient Fast Ethernet Ring (RFER) technology for creating self-healing Ethernet ring networks. RFER reroutes traffic within 50 msec of a ring segment failure, providing fast redundancy performance similar to SDH networks. Survivability is further enhanced by RFER's scalable support for multiple rings.

FULL CROSS-CONNECT

- The built-in, non-blocking, DS0 cross-connect matrix enables freely routing any channel's timeslots to any link. This capability enables, for example, Megaplex to maximize efficiency by splitting voice and data channels and redirecting the traffic, via separate links, to the appropriate service.
- The cross-connect matrix also enables routing timeslots from any link to any other link. This facilitates drop insert, bypass or broadcast multi-link applications.
- A total of 124 timeslots can be allocated, either for transmission of I/O channels or for bypassing timeslots between links of different modules.

Note: Refer to the *Megaplex-2100/2104 with CL.2 System Version* data sheet or the *System Installation and Operation Manual* for which modules can utilize the full 124 timeslot payload.

APPLICATIONS

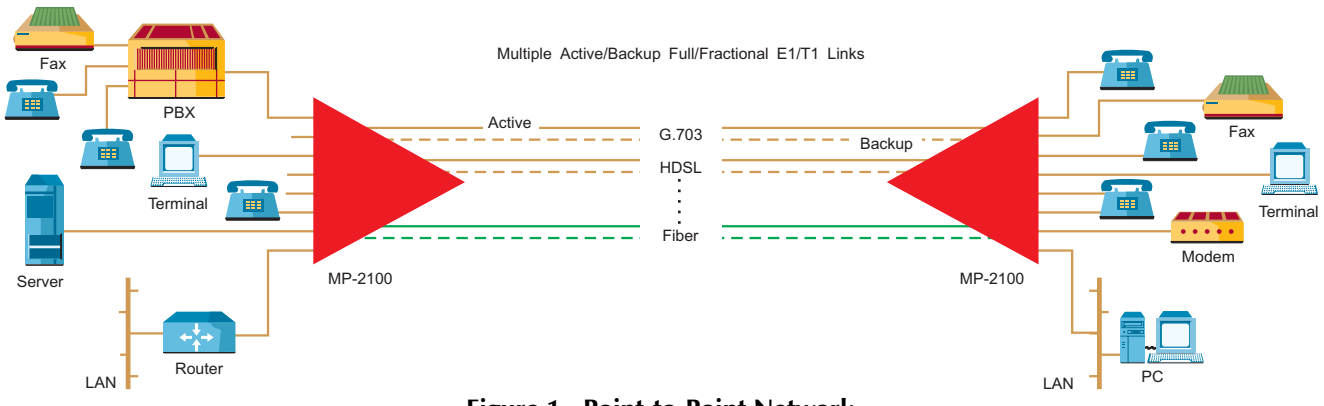


Figure 1. Point-to-Point Network

Megaplex is suitable for integrating all the traffic requirements between two sites, over a wide variety of E1/T1 links: leased lines, fiber optic, HDSL, radio or satellite.

Multiple fractional or full E1/T1 links can support load sharing between the links, as well as automatic backup, with prioritization of voice and data services. Link redundancy is supported, providing 1:1 protective switching between any two links (within 50 msec between dual links of same ML module).

Megaplex-2100/2104

Modular Integrated Access Multiplexers

V5.1 SUPPORT

- Megaplex's V5.1 main link interfaces facilitate the connection of both residential and SOHO PSTN and ISDN BRI users to V5.1 local exchanges. The V5.1 protocol provides concentration similar to ISDN PRI.

R2 SIGNALING SUPPORT

- Main link (ML) modules support R2 signaling with transparent MFC/DECADIC, so that the Megaplex can be placed between an older R2-PBX and a digital (E1-CAS) PBX. The MFC/DECADIC signaling is not terminated by the Megaplex, but passed on to the PBX. In addition to the ITU-T standard R2 protocol, several predefined national PTT protocols, as well as user-defined variations, are also supported. Since the R2 signaling support is provided by the ML, all voice module types support R2.

COMMON LOGIC MODULES

- The Common Logic (CL) module controls the Megaplex's operation and is the interface for its configuration and management. It stores the application software and up to 10 configuration databases (depending on complexity) for multiple independent configurations. The CL also stores all system event information. Flash EPROM for software download is provided.
- Two dedicated ports are provided on the CL module for management purposes. One port has a 9-pin DCE interface for direct connection of a management terminal or PC. The other is ordered with one of the following interface options:
  - Ethernet 10BaseT (UTP)
  - Ethernet 10Base2 (BNC)
  - V.24/RS-232 DTE.

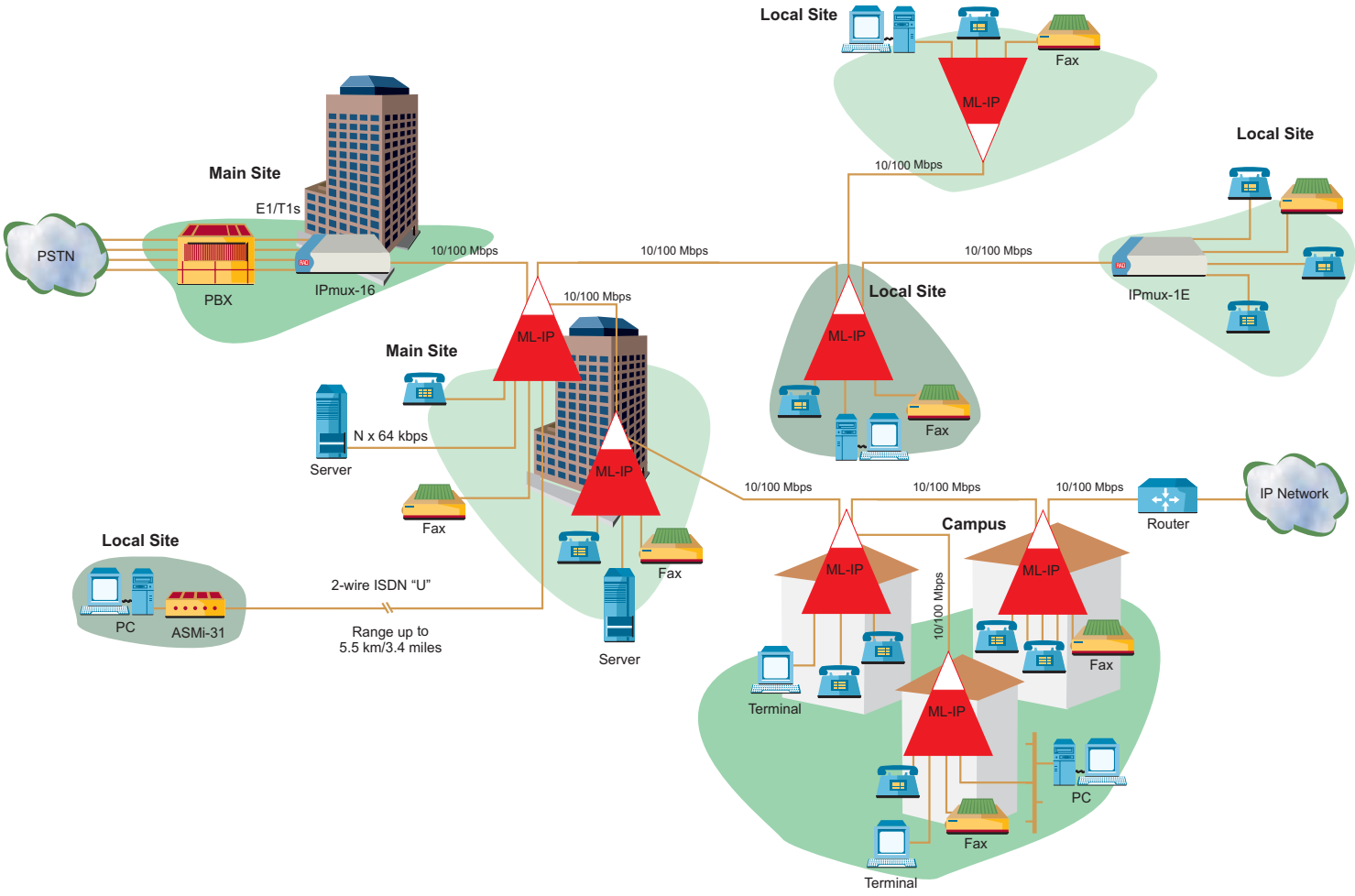


Figure 2. Megaplex with ML-IP Extending TDMVoice and Data Services to Multiple Sites over an IP Network

ML-IP provides standard Ethernet connectivity for the Megaplex. The module can work opposite other standard 10/100BaseT or 100BaseF Ethernet equipment, including RAD's IPmux family of TDMoIP Gateway units, to be part of an integrated corporate/campus IP network.

MAIN LINK MODULES

E1/T1 Main Links

- Megaplex TDM E1/T1 main link modules allow direct connection to a wide range of services, eliminating the need for external equipment. Multiple active links can operate in each chassis. Additional modules can also be installed for link redundancy.
- The various ML modules can be used for a broad range of configurations: from single link non-redundant operation, to multiple full or Fractional E1/T1 link applications supporting drop & insert and broadcast.
- Single or dual E1/T1 link modules with built-in fiber optic modems (range up to 100 km/62 miles) or E1 link modules with HDSL modems (range up to 4.0 km/2.5 miles) are available. These special links reduce the cost of local loop solutions by lowering equipment deployment and maintenance costs.
- The dual-trunk main link modules increase efficiency and support 1:1 protective switching between the two links within 50 msec.

TDMoIP Main Link

- The unique ML-IP main link module converts the TDM bit stream delivered over the internal Megaplex back plane into IP frames, for transmission over IP networks. ML-IP provides three Ethernet ports, with 10/100BaseT or 100BaseF interfaces. The module conforms to IEEE 802.3 and 802.3u and provides reliable, high quality of service (QoS), including VLAN tagging and priority labeling (ToS).
- ML-IP places TDM timeslots into IP bundles with VLAN tagging that can be used for supporting point-to-multipoint applications. Duplicate bundles can be transmitted simultaneously on different paths for redundancy.
- Each ML-IP module can convert and uplink a TDMoIP payload of up to 4 Mbps (a second module can be installed in the Megaplex to increase this capacity to 8 Mbps). The module's multiple Ethernet ports can be employed for daisy-chaining the output of additional ML-IP equipped Megaplex units. This enables transmitting a TDM capacity of up to the equivalent of 40 E1/50 T1 links, over a single 100 Mbps Ethernet link.
- ML-IP's uplink ports feature RAD's Resilient Fast Ethernet Ring (RFER) technology to construct self-healing Fast Ethernet fiber or copper ring topologies. In case of link failure on any segment of the ring, RFER reroutes the traffic (both the TDMoIP traffic and the protected IP traffic) within 50 msec, fast enough to maintain required voice quality. ML-IP's resilient ring performance was independently tested and certified for service resilience and quality by an independent network test center.

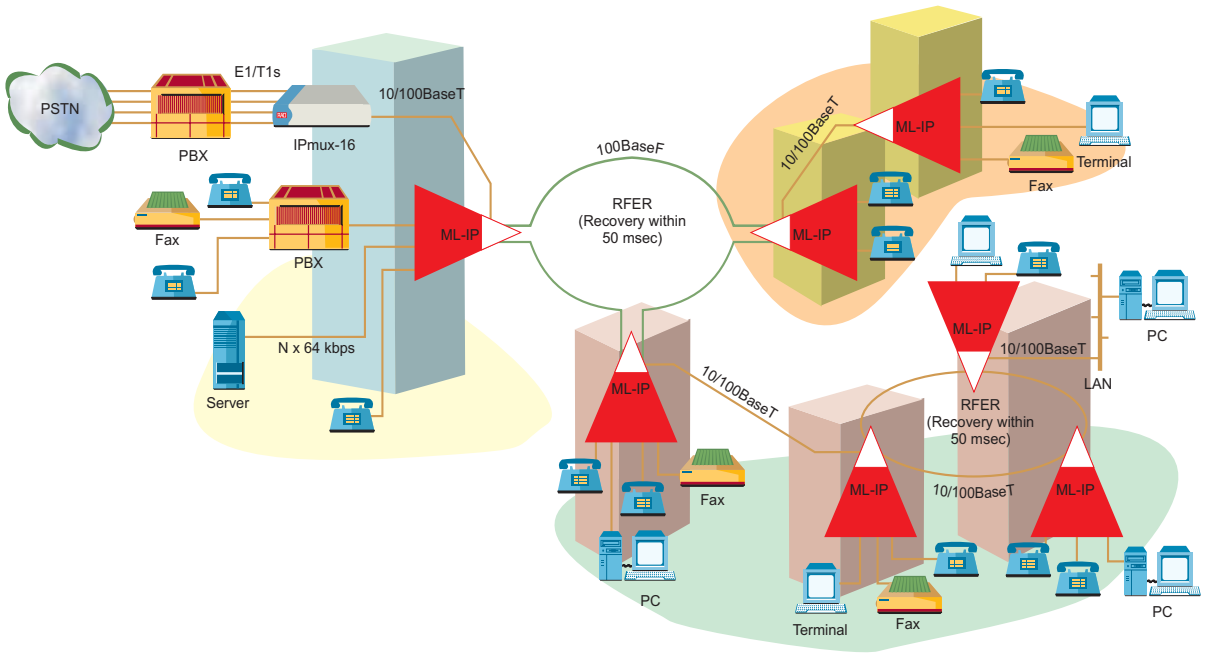


Figure 3. Resilient Fast Ethernet Ring (RFER) Provides 50 msec Self-healing IP Networks

Megaplex ML-IP with RAD's RFER technology, enables corporations, campuses, utilities, and transportation companies to create highly reliable IP networks with 50 msec link protection switching, using dark fiber or copper wire in a ring topology.

Megaplex-2100/2104

Modular Integrated Access Multiplexers

I/O MODULES

- Up to 11 I/O modules can be placed in an MP-2100 chassis (up to 4 I/O modules in an MP-2104). If more I/O modules are required, multiple Megaplex units can be cascaded.

High Speed Data Modules

- High speed data interface modules, operating at multiples of 56 or 64 kbps, up to 2.048 Mbps, support connection to routers, bridges, front-end processors, and other high speed devices.
- E1 interface modules with built-in HDSL modems, enable cost-effective long range deployment of high speed services over 2 or 4-wire copper lines. Range up to 4.0 km.
- ISDN BRI modules with up to 12 channels, enable extension of ISDN services over non-ISDN facilities, supporting data, voice and video applications. The "U" interface modules include IDSL technology for "last mile" applications.

Low Speed Data Modules

- Sub-rate multiplexer modules for low speed (2.4 to 19.2 kbps) synchronous and asynchronous data channels. Modules available to support standard X.50, X.58 or SDM (DS0-B) multiplexing techniques.
- Low speed modules with 6 or 12 sync/async V.24/RS-232 channels, with independent channel rates up to 64 kbps are available. A 4-channel sync/async data module with V.110 rate adaptation is also available.

Voice/Fax Modules

- Voice/fax modules provide toll-quality voice transmission using standard PCM (ITU-T G.711), as well as ADPCM (G.726), MPMLQ (G.723.1), or P-CELP 4.8 kbps compression. Standard analog interfaces are available to enable direct connection to POTS, public payphones, LB (local battery) field phones, PBX extensions or 2/4-wire E&M trunks. Alternatively, voice compression modules with E1 and T1 digital PBX interfaces are available. Loop, wink and ground-start signaling are also supported.

LAN Modules

- Ethernet router/bridge internet modules, compatible with the LAN RANger remote access family or third party routers/bridges are featured. These modules enable LAN to LAN extension over E1/T1 services.

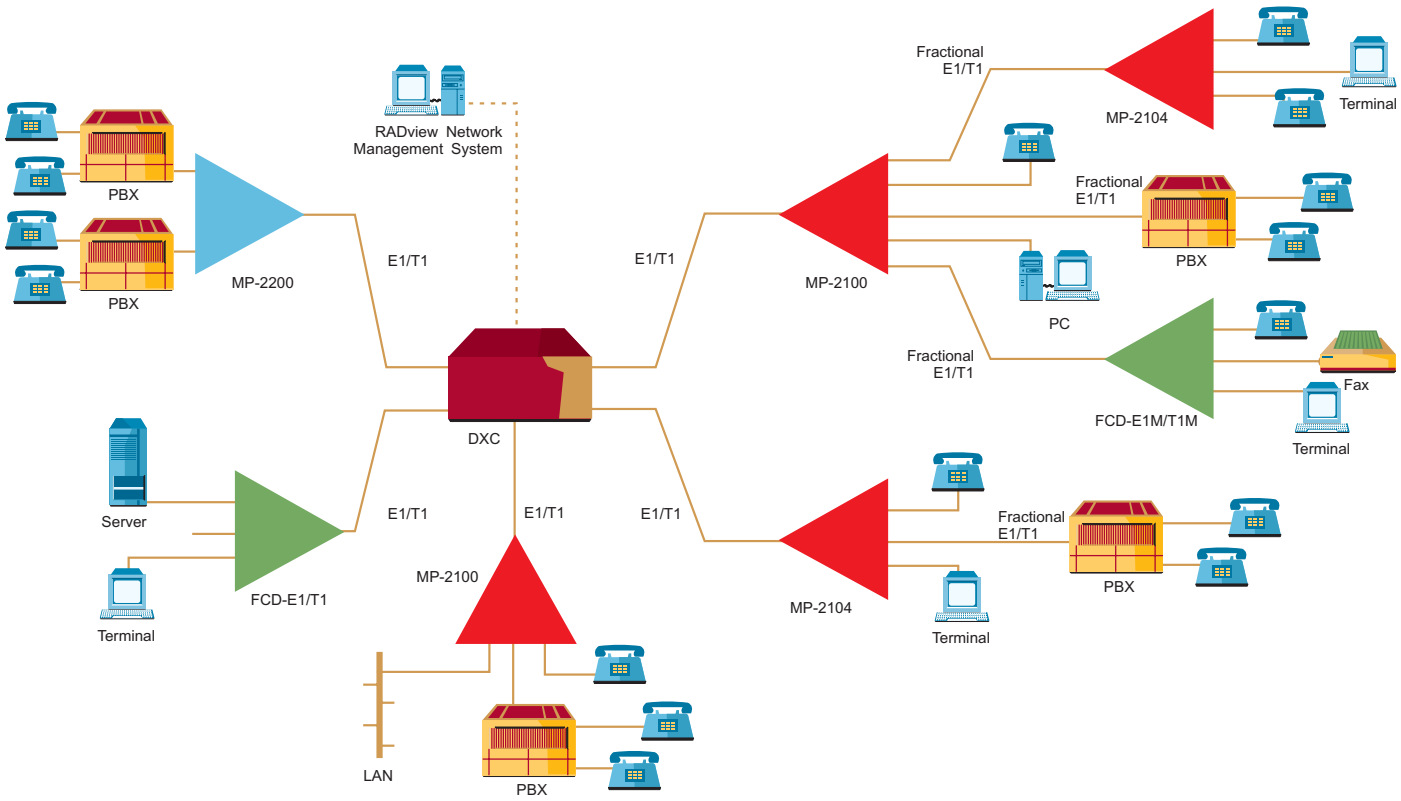
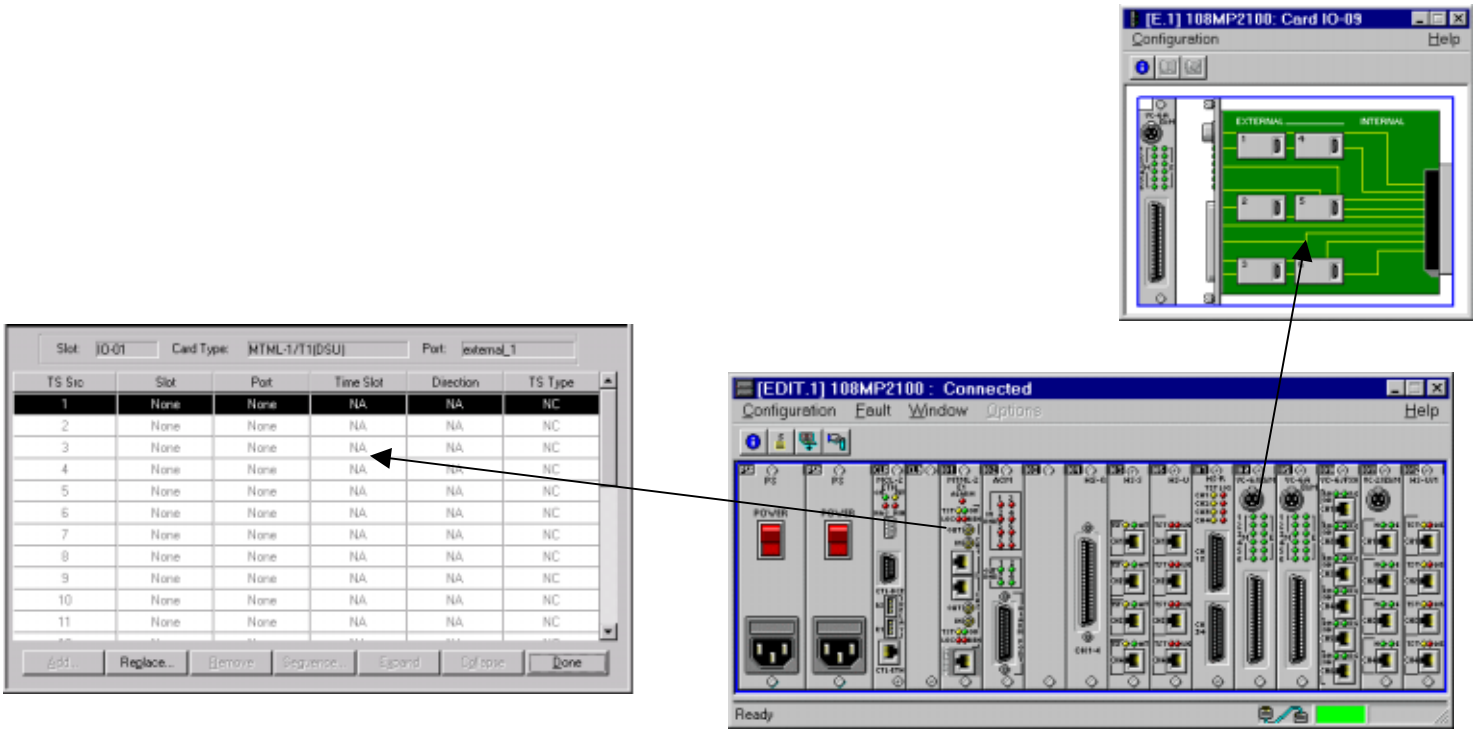


Figure 4. Mesh Corporate Network

RAD's DXC (Digital Cross-connect) DACS complements Megaplex's own cross-connect capabilities, to provide a comprehensive network solution. DXC enables flexible routing of timeslots between different Megaplex and other E1/T1 equipment sites, together with an integrated network management for easy control and monitoring.



GUI-based RADview Network Management System for Megaplex-2100/2104

MANAGEMENT

- Megaplex's configuration parameters are user-programmable, with all configurations saved in non-volatile memory.
- Megaplex communicates with the management station by means of its SNMP agent (via a SLIP/PPP or TCP/IP connection). Network management provides centralized control of all network nodes, including interface configuration, connection setup, alarms and management.
- Megaplex can be managed by SNMP network management systems. The user-friendly *RADview* network management applications are GUI-based to facilitate management of both individual units and entire networks.
- Programming and setup of a remote Megaplex can be performed:
  - Out-of-band, using the Ethernet management port. This simple and efficient method takes advantage of IP bandwidth on demand, while saving link bandwidth for user traffic
  - In-band over a dedicated timeslot, supporting standard PPP, FR encapsulation, and RIP2 protocols
  - Over a modem link or over a FRAD, via the control port of the remote unit.

Diagnostics

- Megaplex incorporates test features for rapid fault detection and easy maintenance. Upon power-up, all system and modules perform self-testing. Any problems are reported to the management system. Loopbacks, BERTs and tone injections can be run on individual channels or main links, towards both the network and users side.
- Megaplex features a signal monitoring capability useful for voice application diagnostics. It enables displaying a "snapshot" of the current ABCD signaling bit states of any selected timeslot that carries voice traffic.

Alarms

- All alarms, including state and frequency of occurrence, are stored in the CL's alarm status buffer. Last 256 alarms are kept in a separate alarm history buffer.
- Alarm status can be automatically read online by the management system from any node. User-set alarm masking, filtering and inversion, as well as 5-level prioritization are also supported.

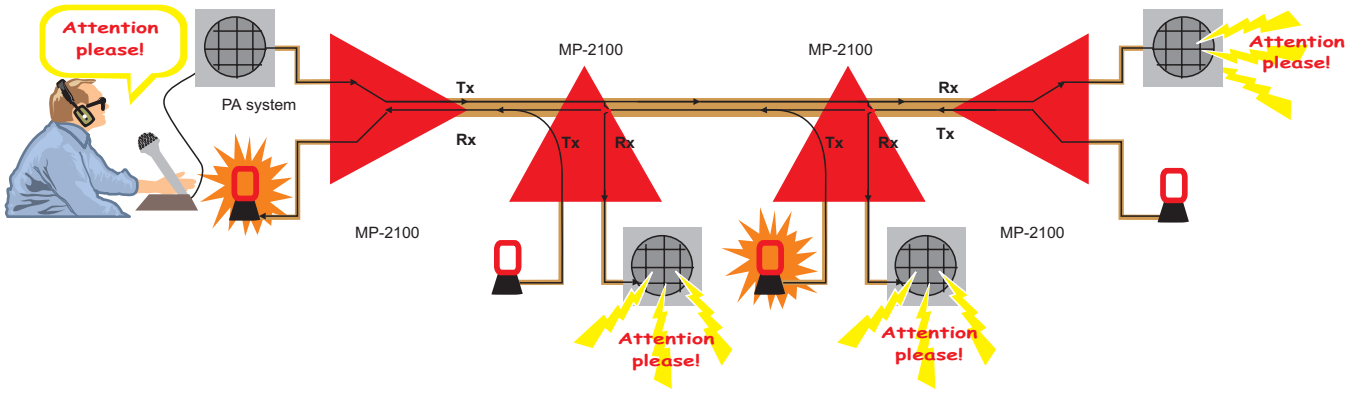


Figure 5. Chain Topology Application with Unidirectional Broadcast

For connectivity between three or more sites, Megaplex supports drop & insert, and bypass applications in V, ring, or chain topologies.

Enhanced Unidirectional Broadcast capability improves bandwidth utilization for applications with asymmetric traffic. In the application above, a public announcement is transmitted to all sites using a timeslot in the Tx line only. Meanwhile, the same timeslot in the Receive (Rx) direction, is utilized to carry an alarm signal from one of the sites back to the main site.

Megaplex-2100/2104

Modular Integrated Access Multiplexers

NEBS-COMPLIANT EQUIPMENT

- The Megaplex-2100 is also offered in a special NEBS-compliant version which meets the Type 3 and Type 4 requirements, and permits reliable operation at harsher temperatures and environmental conditions.
- To meet the Type 3 requirements in applications where the lines extend outdoors, a line protection unit may be required. RAD offers a dedicated line protection unit, MP-2100-LP-MN, to safeguard the lines of up to 12 Megaplex voice modules.

  Contact your RAD distributor for more information on NEBS-compliant equipment.

SPECIFICATIONS

- **Main Link and I/O Modules**
  See accompanying data sheets
- **Configuration**
  Performed by ASCII Terminal or PC, connected to terminal interface or via Telnet;
  Using RADview SNMP management system
- **Physical – MP-2100 (4U-high)**
  - 2 power supply module slots
  - 2 CL module slots
  - 12 slots for I/O and ML modules
  - Height: 18 cm / 7 in (4U)
  - Width: 44 cm / 17 in
  - Depth: 33 cm / 13 in
  - Weight: less than 12 kg / 26 lb
- **Physical – MP-2104 (2U-high)**
  - Built-in power supply (optional built-in ringer for voice/ISDN power feeding is available)
  - 1 CL module slot
  - 5 slots for I/O and ML modules
  - Height: 9 cm / 3.5 in (2U)
  - Width: 44 cm / 17 in
  - Depth: 33 cm / 13 in
  - Weight: less than 6 kg / 13 lb

  (All weights are for fully loaded units)
- **Power Supply Input**

  MP-2100:
  - AC: 100, 115 or 230 VAC
  - DC: 24 or -48 VDC

  MP-2104:
  - AC: 100, 115 or 230 VAC
  - DC: 24 or -48 VDC
- **Power Supply Output Currents per Internal Voltage Line (in Amps)**

Power Supply	+5V	-5V	+12V	-12V	-48V	+72V/ +60V
MP-2100						
PS180/AC	25	5	1.2	0.6	-	-
PS200/AC	40	6.5	2	2	-	-
PS180/48V	25	1.5	1	1	-	-
PS130/24V	10	1.5	1	1	-	-
MP-2104						
AC	10	0.8	4	0.8	-	-
DC	5	1	3	1	-	-
ACw/Ringer	10	0.8	4	0.8	0.6	0.5
DCw/Ringer	5	1	3	1	-	0.5

- **Environment**
  Temperature
  Operating: 0–45°C / 32–113°F (NEBS version: up to 55°C / +131°F)
  Storage: -20–70°C / -4–160°F
  Humidity: up to 90%, non-condensing

NEBS-Compliant Megaplex-2100 Chassis

Megaplex-2100/2104

Modular Integrated Access Multiplexers

ORDERING

BASIC UNITS

Standard Megaplex-2100/2104 systems are comprised of a **Basic Unit**, as well as **Main Link** and **I/O Modules**, which are ordered separately.

Basic units include a chassis, single CL module, single power supply, and power supply cables.

See *separate module data sheets* for main link and I/O module details and ordering information.

MP-2100/*/&/#
4U-high chassis with 12 module slots and CL.1 common logic

MP-2100/*/&/2#
4U-high chassis with 12 module slots and CL.2 common logic

MP-2104/*/+/#
2U-high chassis with 5 module slots and CL.1 common logic

MP-2104/*/+/2#
2U-high chassis with 5 module slots and CL.2 common logic

SYSTEM MODULES

System modules can be ordered separately for redundancy or special requirements

MP-2100M-PS180/*
Power Supply Module for MP-2100 (not available for 24 VDC input)

MP-2100M-PS200/*
Higher Power Supply Module for MP-2100
(available only for AC input)

MP-2100M-PS130/24
24 VDC Input Power Supply Module for MP-2100

MP-2100M-CL/#
Common Logic 1 Module

MP-2100M-CL.2/#
Common Logic 2 Module

ORDERING OPTIONS

* Specify power supply input voltage:
100 for 100 VAC
115 for 115 VAC
230 for 230 VAC
24 for 24 VDC
48 for -48 VDC

& Specify redundancy (MP-2100 only):
R for full (2 x PS, 2 x CL)
RP for partial (2 x PS, 1 x CL)
Default is for 1 x PS, 1 x CL

+ Specify **RI** for built-in ringer (MP-2104 only)

Specify CL second management port (*in addition to standard 9-pin DCE port*):
UTP for Ethernet 10BaseT (UTP)
BNC for Ethernet 10Base2 (BNC)
V24 for V.24/RS-232 DTE

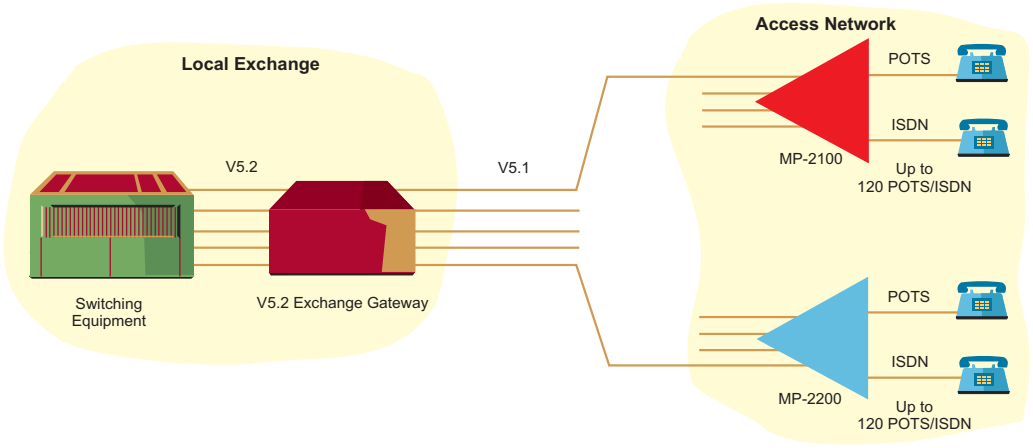


Figure 6. V5 Application

Megaplex-2100 supports the V5.1 protocol and can be used, together with a V5.2 exchange gateway, for connection to local exchanges that use the V5.2 protocol. Each Megaplex-2100 or ETSI/ANSI compliant chassis Megaplex-2200 unit can support up to 120 POTS or ISDN phones.

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