Data Sheet

Megaplex-2100/2104 Modules

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

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

Connecting Megaplex-2100/2104 to various E1 and T1 services

- One or two E1 or T1 link interfaces with built-in non-blocking DS0 cross connect between any ML modules
- Built-in CSU (T1) or LTU (E1) on copper interface ML modules
- MLF modules available with a variety of fiber optic interfaces, with ranges of up to 100 km (62 miles)
- Main link module redundancy, including ring redundancy

The electrical copper interface ML-1/2 and fiber optic interface MLF-1/2 family of main link modules enable direct connection of Megaplex-2100/2104 to one or two E1/T1 lines. Multiple main link modules can be installed in a single chassis, providing Megaplex-2100 with up to four full E1 or five full T1 link capacity, for both point-to-point and point-to-multipoint applications.

Alternatively, multiple Fractional E1/T1 links can be supported.

RAD
data communications
The Access Company

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

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

The E1/T1 ring functionality can be configured in a single database, allowing an unlimited number of nodes per ring with protection speed of up to 5 seconds.

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, for transmission ranges of up to 1.6 km (1 mile). ML-1E1 and ML-2E1 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 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.

The following optical interfaces are available for MLF modules:

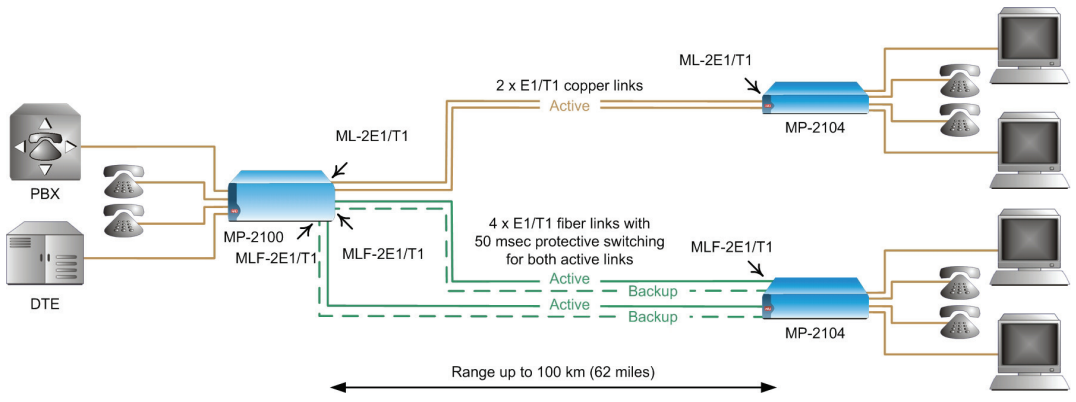
- 850 nm laser for use over multimode fiber with typical distances of up to 5 km (3 miles)
- 1310 nm laser diode for use over single mode fibers for extended range of up to 62 km (38 miles)
- 1550 nm laser diode for use over single mode fibers for maximum range of up to 100 km (62 miles)

Interfaces are terminated with a pair of ST, FC/PC or SC type connectors (see *Ordering*).

MLF modules are compatible with RAD's standalone 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 routs voice and data channels from any I/O module installed in the chassis, to any installed main link. The matrix can route voice and data traffic from any link to any other link. The non-blocking full cross-connect feature enables flexible timeslot assignment and efficient utilization of E1/T1 bandwidth, and also 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.*



Voice and Data Transfer over E1/T1 Links

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 if one of the links fails.

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.

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 critical traffic (such as inband network management bits) to pass undisrupted through the links of a non-powered unit, to other units connected in a daisy chain topology.

***Note**: The bypass relay is not to be used in the Y-cable protection mode.*

E1 link modules support **R2** signaling with transparent MFC/DECADIC for setting up, metering and disconnecting phone calls. This enables placing a Megaplex 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** inband protocol to connect 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 provides 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.

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.*

Table 1. Fiber Optic Interface Specifications and Range

Wavelength [nm]	Fiber Type	Transmitter Type	Power Coupled into Fiber [dBm]	Receiver Sensitivity [dBm]	Maximum Receiver Input Power [dBm]	Receiver Dynamic Range [dB]	Typical Maximum Range [km]	[miles]
850	62.5/125 µm multimode	Laser	-18	-38	-10	28	5	3
1310	9/125 µm single-mode	Laser	-12	-40	-12	28	62	38
1550	9/125 µm single-mode	Laser	-12	-40	-12	28	100	62

Diagnostic capabilities of dual-port modules feature local and remote loopbacks on each module port, local and remote loopbacks per timeslot (including split timeslots), and BER tests per port and per timeslot. Single-port modules feature local and remote loopbacks on each module port. 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 Element 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

Table 2. Megaplex Main Link Modules

	ML-E1/T1	MLF-E1/T1	ML-8E1/T1	MSL-8	ML-IP	ML-20N
Interface Type	E1/T1	E1/T1	E1/T1	SHDSL	ETH (TDMoIP)	n x 64 kbps
Number of Channels	1/2	1/2	8	8	2	1/2
Redundancy	Link	Link	None	None	Bundle	Link
Ring	E1/T1	E1/T1	None	None	RFER	None

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

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

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

Impedance
Balanced 4-wire: 120Ω
Unbalanced coax: 75Ω

Signal Level
Receive:
Without LTU: 0 to -12 dBm
With LTU: 0 to -36 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

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

Specifications and Range
See *Table 1*

Connectors (per link)
Pair of ST, FC/PC or SC (see *Ordering*)

TIMING

Transmit Timing
Internal clock
Loopback (recovered from the receive signal)
External clock from I/O module interface
Station clock (not for MLF-2)

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)

GENERAL

Diagnostics
Local and remote loopbacks on each module port
Local and remote loopbacks per timeslot

Two-port modules only:
Local BER test toward local side on port and timeslot (including split timeslots)
Remote BER test toward remote side on port and timeslot (including split timeslots)
Local test tone injection toward local side
Remote test tone injection toward remote side

T1 modules only:
Network line loopback
Network payload loopback
CSU network 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

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
See *Table 2*.

Table 2. Power Consumption

Module	Current [A]	Power [W]
ML-1E1	1.22	6.1
ML-2E1	1.26	6.3
ML-1T1	1.22	6.1
ML-2T1	1.26	8.9
MLF-1E1	1.60	8.0
MLF-2E1	1.80	9.0
MLF-1T1	1.60	8.0
MLF-2T1	1.80	9.0

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

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

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

Legend

@ Link type:
- **E1** E1 link(s)
- **T1** T1 link(s)

Fiber optic connector type:
- **ST** ST type connector
- **SC** SC type connector
- **FC** FC type connector

+ Fiber optic interface wavelength:
- **85** 850 nm, multimode, laser
- **13L** 1310 nm, single mode, laser
- **15L** 1550 nm, single mode, laser

^ **BP** Optional port bypass between dual copper links

Default is without port bypass

OPTIONAL ACCESSORIES

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.)

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

Legend

* Cable length:
- **2.5METER** 2.5m/8.2 ft
- **5METER** 5m/16.4 ft

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