

# Megaplex-1

## Multiservice Pseudowire Access Gateway



- Grooming, consolidating and transmitting analog voice and TDM-based services over Ethernet, IP or MPLS networks using standard-compliant pseudowire technology
- Bridge functionality for packet switched networks with 2 optical/copper GbE uplinks and 1 FE user interface
- Hitless PW redundancy
- Wide range of services including: FXS or E&M toll-quality analog voice channels, IEEE C37.94-compliant optical tele-protection, programmable serial ports
- 1U, 19" fanless enclosure with redundant wide-range power supply (AC and DC)

Megaplex-1 is a multiservice pseudowire gateway that transports analog and TDM traffic (originating from legacy circuit-switched networks) over packet-switched networks (PSNs).

### MARKET SEGMENTS AND APPLICATIONS

Various users can benefit from the Megaplex-1 solution:

- Users with mixed Ethernet and TDM services
- Users looking for a future-proof migration path to IP connectivity
- Owners of facilities sensitive to space or climate constraints

Its ability to handle a broad range of Ethernet, data and voice services in a single compact managed node, makes Megaplex-1 an ideal access solution for diverse network operators and service providers. It also provides a perfect fit for utilities and transportation companies that require an efficient way to transport and provision multiple legacy and next-generation services over their high capacity pipes.

### SERVICES

Megaplex-1 provides a variety of services, via its many user interfaces, such as:

- IEEE C37.94 fiber optic teleprotection ports
- Serial synchronous/asynchronous data ports
- Voice ports (FXS, E&M)
- Fast Ethernet (10/100BaseT)

### ETHERNET SWITCH

Megaplex-1 features a powerful internal Layer-2 Ethernet switch that provides Ethernet user ports with rate limiting and VLAN-based/port-based classification capabilities.

Megaplex-1 includes the following Ethernet ports:

- Two fiber optic or copper Gigabit Ethernet network (NNI) ports
- One copper Fast Ethernet user (UNI) port (available on some ordering options)
- One copper FE port for out-of-band management.

The GbE Network (NNI) ports provide the physical connection to the packet switched network. These ports provide Megaplex-1 with a multirate FE/GE interface, for optical or electrical media, and can be ordered with one of the following interfaces:

- 10/100/1000BASE-T copper ports. This type of ports support autonegotiation,

with user-specified advertised data rate (10, 100 or 1000 Mbps) and operating mode (half- or full-duplex). The ports also support automatic polarity and crossover detection, and polarity correction, for connection through any type of cable to any type of Ethernet port (hub or station).

Alternatively, autonegotiation can be disabled and the rate and operating mode be directly specified.

- SFP sockets, for installing 100/1000BASE-X SFP plug-in modules. Support for standard SFP optical transceivers for the GbE link interfaces enables selecting the optimal interface for each application. This type of ports does not support autonegotiation. RAD offers a wide variety of SFPs, for meeting a wide range of operational requirements.

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The UNI Ethernet port has 10/100BASE-TX interface terminated in RJ-45 connector capable of autonegotiation. The user can configure the advertised data rate (10 or 100 Mbps) and operating mode (half-duplex or full-duplex). Alternatively, autonegotiation can be disabled, and the rate and operating mode be directly specified. In addition to autonegotiation, MDI/MDIX polarity and cross-over detection and automatic cross-over correction are also supported.

### PSEUDOWIRE

The device uses its embedded pseudowire engine to encapsulate the user services for low-latency transmission over packet-switched networks.

The powerful pseudowire engine provides up to 6 protected (or up to 12 unprotected) PWs with up to 31 timeslots per each PW port.

A remote pseudowire device converts the packets back to the original user traffic format.

### SERIAL DATA TRAFFIC

The serial data rates are independently selectable for each channel and depend on the selected encapsulation mode:

- **None:** each channel operates at high speed rates of  $n \times 56$  or  $n \times 64$  kbps, where  $n = 1$  to 31 (that is, maximum 1984 kbps).
- **V110:** each channel operates at low speed sync rates of 2.4, 4.8, 9.6, 19.2 or 38.4 kbps, performing rate adaptation in accordance with ITU-T Rec. V.110.
- **3-bit transitional:** the interface provides transitional encoding to transmit asynchronous data at rates up to 19.2/38.4 kbps. It operates by encoding asynchronous data in a 3-bit transitional code, which is then transmitted over the Megaplex uplink at a rate of 64/128 kbps. This mode covers all asynchronous character formats.

The interface terminates in two 68-pin SCSI-4 female connectors. Each connector includes 3 channels. This provides a simple and easy SW-configurable selection of serial interface (V.35, RS-422 or RS-232) according to the deployment needs.

Adapter cables, available upon order, are offered by RAD to split each connector into three separate channel interfaces with standard connectors: V.35, RS-530, RS-232, X.21 or V.36/RS-449.

Each channel has local support of interface control signals (CTS, RTS, DCD, DSR and DTR). In addition, each channel can be configured to transmit control signals end-to-end.

### OPTICAL TELE-PROTECTION

The interface can be used for both user and network ports – either for inter-substation communication or for transmitting distance teleprotection information.

The dual-port fiber optic interface operates at a nominal wavelength of 850 nm and nominal line rate of 2.048 Mbps. Each port is terminated in a pair of ST connectors for connection to standard multimode fiber.

The interface complies with IEEE C37.94 standard for distances of up to 2 km.

### VOICE TRAFFIC

The voice interface provides 8 FXS or 4 E&M toll-quality analog voice channels. Voice signals are digitized using PCM, in compliance with ITU-T G.711 and AT&T Pub. 43801 standards.

Encoding and decoding are in full compliance with ITU-T requirements G.711. Voice channel companding is selectable for A-law or  $\mu$ -law.

Table 1. Transmit and Receive Levels for Voice Interfaces

Interface	Transmit [dbm]		Receive [dbm]	
	min	max	min	max
E&M	-8	+5	-17	+2
FXS	-5	+5	-17	+1

The **E&M** interface operates with different types of E&M signaling: EIA RS-464 Types I, II, III and V (British Telecom SSSC5). Both 2-wire and 4-wire lines are supported (user-selectable).

The E&M interface provides EIA RS-464 Type I signaling without the need for an external DC power supply. For other signaling types, the internal -12 VDC provided by the chassis is sufficient for connection to most PBX systems.

However, for *full* support of EIA RS-464 Types II, III and V (BT SSSC5) standards, a -48 VDC power source is required.

The **FXS** interface employs both loop-start and wink-start signaling methods. FXS interfaces are typically used for direct connection to 2-wire telephones in the following loop-start applications:

- Off-Premises Extension (OPX), where a local telephone on the PBX can be connected to an off-premises telephone, by dialing only the extension number;

- Private Line, Automatic Ringdown application (PLAR) (also referred to as Hot Line), where two telephones are connected directly via the E1/T1 link. When the telephone on one side goes off-hook, the other telephone rings;
- Direct connection to 2-wire telephones in PSTN applications.

When operating in PCM mode, battery polarity is reversed for wink-start signaling, used in direct inward dialing (DID) applications.

The E&M interface provides signaling at +12V for applications that require positive signaling voltage (for example, radio transmitters) and perform fault propagation.

Both E&M and FXS interfaces require a nominal -48 VDC (-37 to -75 VDC) source. This power can be provided either by an appropriate DC-powered chassis, or by an external standalone Ringer power supply unit in accordance with the number of ports.

Gain control is user-selectable for both receive and transmit directions, enabling easy installation in all environments.

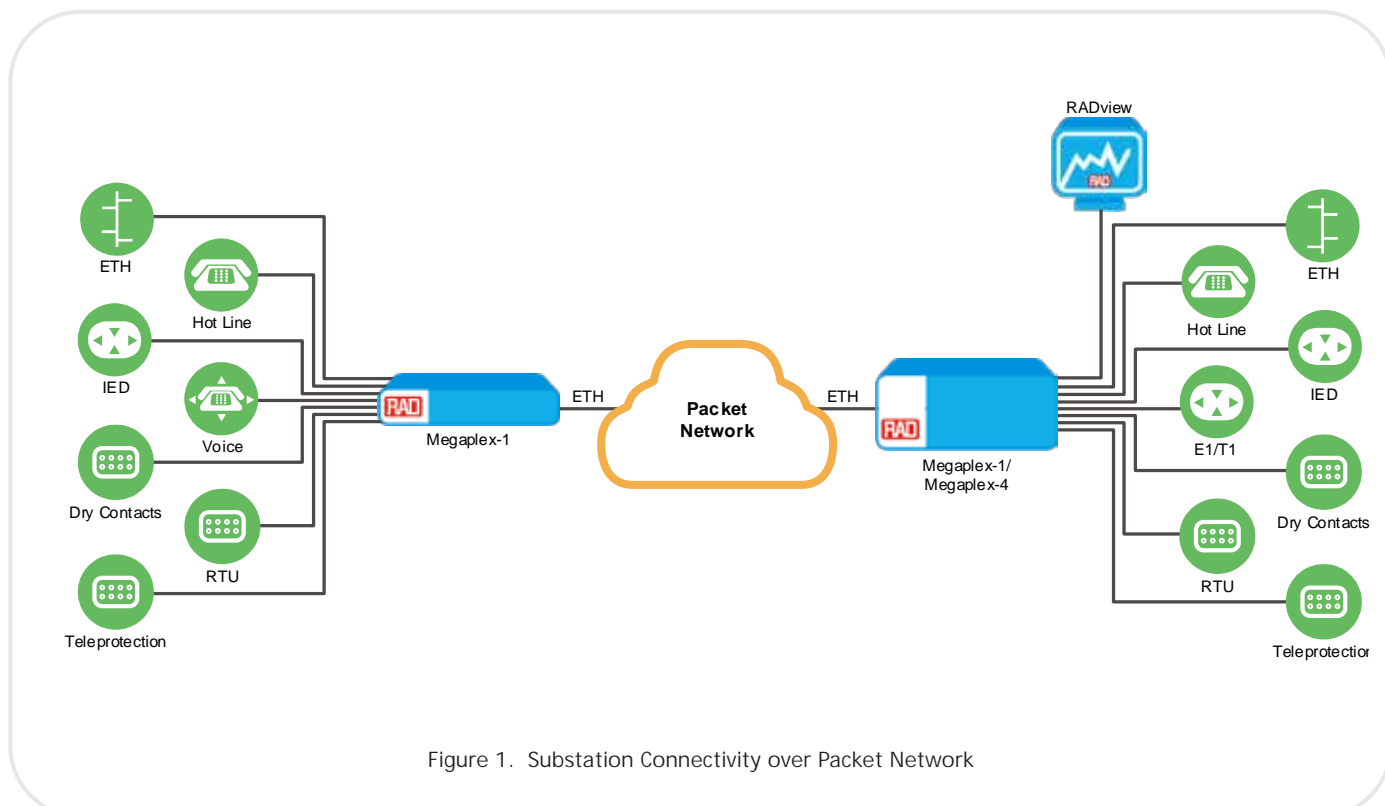


Figure 1. Substation Connectivity over Packet Network

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### RESILIENCY

Service reliability in Megaplex-1 is based on the following resiliency features:

- Fanless operation
- Redundant wide range power supply
- Dual NNI ports
- Hitless PW protection

### MANAGEMENT AND SECURITY

The device can be managed via RADview, RAD's carrier-class NMS, or any SNMP-based management system.

Megaplex-1 supports a variety of access protocols, including CLI over Telnet, SNMPv3, and TFTP. Security features include SNMPv3, RADIUS (client authentication), TACACS+ (client authentication, authorization, and accounting), SSH, and SFTP. Access Control Lists (ACL) can also be used to flexibly filter and mark management traffic, enabling service providers to maintain network security by dropping unwanted packets.

### MONITORING AND DIAGNOSTICS

Comprehensive diagnostic capabilities include:

- Local and remote loopbacks
- Real-time alarms to alert the user on fault conditions

Megaplex-1 collects statistics per physical port and per connection for 15-minute intervals, which enables the network operator to monitor the transmission performance and thus the quality of service provided to users, as well as identify transmission problems. Statistics for the last 24 hours are stored in the device and can be retrieved by the network management station.

The Performance Management Portal is an SLA assurance system that is part of the RADview management system, enabling real-time monitoring of Ethernet service performance by collecting KPI data from RAD devices.

## Specifications

### SERIAL INTERFACE

#### Interface (Electrical)

V.24/RS-232, V.35 or V.11/RS-422  
RS-485 (4-wire master only)

#### Interface (Physical)

V.24/RS-232, V.35, V.36/RS-449, RS-530,  
X.21 (via adaptor cables)

#### Connectors

Two 68-pin SCSI, female  
(one per 3 data channels)

#### Encapsulation Modes

None  
V.110  
3-bit-transitional

#### Interface Control Signals

Local support for all types of control signals

End-to-end transfer of local RTS and DTR lines

#### Signal Format

Asynchronous or synchronous, full duplex

#### Data Rates

Depend on encapsulation mode:

- None: n' 56 or n' 64 kbps (n = 1 to 31)
- V110 (sync only): 2.4, 4.8, 9.6, 19.2, 38.4 kbps
- 3-bit-transitional: rates up to 38.4 kbps (DS1 rate 1 or 2 \*64 kbps)

#### Clock Mode

DCE (channel provides both RX and TX clocks to the user DTE)

#### Diagnostics (per port)

Local digital loopback

Remote digital loopback

**C37.94 INTERFACE****Compliance**

IEEE C37.94, optical part

**Number of Ports**

2

**Connectors**

Pair of ST connectors, female

**Nominal Data Rate**

2.048 Mbps

**Wavelength**850nm  $\pm$  40nm**Fiber Type**

62.5/125 mm multimode

50/125 mm multimode

**Transmitter Type**

LED

**Power Coupled into Fiber**

62.5/125 mm: -11 to -19 dBm

50/125 mm: -11 to -23 dBm

**Minimum Receiver Sensitivity**

-32 dBm

**Maximum Receiver Input Power**

-11 dBm

**Receiver Dynamic Range**

21 dB

**Range (Typical)**

2 km/1.25 miles

**LED Indicators**

SYNC (green/red):

- Lights steadily in green – the corresponding port is operating properly
- Flashes in green – the corresponding port is operating properly, but serves as the standby port when link protection is enabled
- Lights in red – the corresponding port detects loss of synchronization or loss of signal
- Flashes in red – the corresponding port serves as the standby port, and detects loss of synchronization

REM SYNC (yellow):

- On – the corresponding port detects loss of remote synchronization
- Off – the corresponding port is not connected.

**Diagnostics (per port)**

Local digital loopback

Remote digital loopback

**VOICE INTERFACE (BOTH FXS AND E&M)****Voice Encoding Technique**

Per ITU-T G.711 and AT&amp;T

Pub. 43801,  $\mu$ -law or A-law**Diagnostics**

Local digital loopback for each channel, towards the local user equipment

Remote digital loopback for each channel, towards the remote user equipment

1 kHz, 0 dBm0 test tone injection for each channel, towards the remote user equipment

1 kHz, 0 dBm0 backward test tone injection for each channel, towards the local user equipment

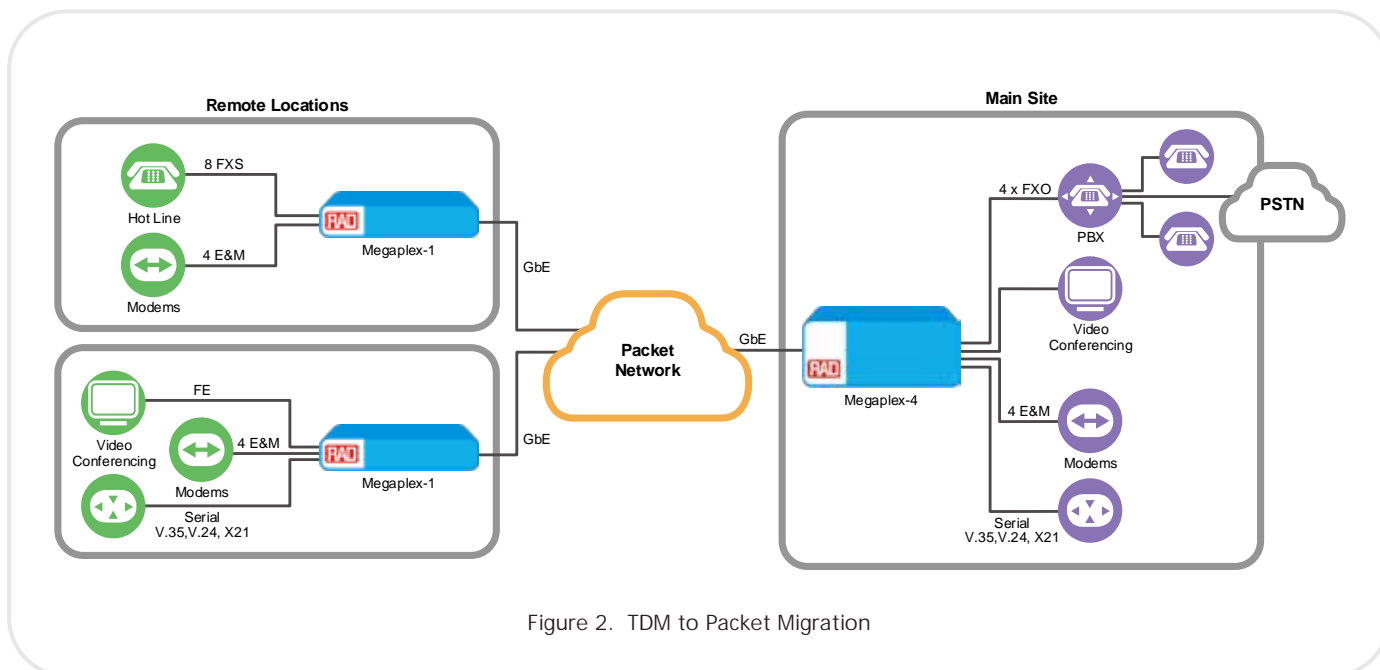


Figure 2. TDM to Packet Migration

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### Analog Parameters

Nominal level: 0 dBm  
 Nominal impedance: 600W  
 Return loss (ERL) at 300 to 3400 Hz:  
   better than 20 dB  
 Frequency response (Ref:1020 Hz):  
   ±0.5 dB at 300 to 3000 Hz  
   ±1.1 dB at 250 to 3400 Hz  
 Level adjustment (soft-selectable):  
   see *Table 1*.  
 Steps: 0.5 dB (±0.5 dB), nominal  
 Signal to total distortion (G.712):  
   -30 to 0 dBm0: better than 33 dB  
   -45 to +3 dBm0: better than 22 dB  
 Idle channel noise: better than -65 dBm0  
   (+25 dBnc)  
 Far-end cross-talk (2W&4W): -65dBm0  
   max  
 Go-to-return cross-talk (4W): -60dBm0  
   max

### E&M INTERFACE

#### Number of Ports

4

#### Line Type

4-wire or 2-wire (soft-selectable)

#### Connectors

4 x RJ-45

#### Signaling Method (selectable)

EIA RS-464 Type I  
 EIA RS-464 Types II, III, and  
 V (British Telecom SSSDC5) using -12 VDC  
 in place of -48 VDC

**Note:** For full support of Types II, III, and V (SSDC5) signaling standards, -48 VDC power supply is required.

#### Pulse Dial Distortion

±2 msec max

#### Transformer Isolation

1500 VRMS

#### Indicators

M On when the M line of the corresponding channel is off-hook (channel in use)

E On when the E line of the corresponding channel is off-hook (channel in use)

### FXS INTERFACE

#### Number of Ports

8

#### Line Type

2-wire (ITU-T standard: G.712)

#### Connectors

4 x RJ-12 (one per two channels)

#### Signaling Methods

EIA RS-464 loop-start or wink-start

#### On-Hook/Off-Hook Threshold

Off-Hook Threshold: Loop current >11 mA

On-Hook Threshold: Loop current <8 mA

#### Indicators

Number: 8

Color: green/yellow

Name: LOC/REM

Lights steadily in green – Local “OFF-HOOK”

Lights steadily in yellow – Remote “OFF-HOOK”

Flashes in green/yellow – Local and Remote “OFF-HOOK”/conversation state  
 Off: port is not connected or both directions of signaling are “ON-HOOK”

#### Loop Resistance

Min: 300Ω

Max: 1600ΩΩ

#### Feed Current

20 mA (±10%) per active channel

#### Reverse Polarity Pulse Distortion

6 ms max

#### -48 VDC (nominal) Current

#### Consumption

35 mA (±10%) per active channel

#### Ringer

Overload protected, 1 sec ON, 3 sec OFF  
 54 VRMS

### GBE INTERFACE

#### Number of Ports

2 UTP (RJ-45 shielded) or 2 SFP sockets

#### SFP Transceivers

For full details, see the [SFP/XFP Transceivers data sheet](#) on [www.rad.com](http://www.rad.com)

**Note.** It is strongly recommended to order this device with original RAD SFPs. RAD cannot guarantee full compliance to product specifications for units using non-RAD SFPs.

#### Data Rate

10/100/1000 Mbps

Autonegotiation (copper only)

#### Frame Size

9600 bytes

#### LED Indicators

LINK On (green): Link is up

LINK Off: Link is down

ACT Flashes (yellow): Data is being transferred

ACT Off: No data transfer

### FAST ETHERNET INTERFACE

#### Number of Ports

1 x 10/100BaseT

#### Connector

RJ-45, shielded

#### Data Rate

10/100 Mbps (Fast Ethernet)

Autonegotiation

#### Frame Size

9140 bytes

#### LED Indicators

LINK On (green): Link is up

LINK Off: Link is down

ACT Flashes (yellow): Data is being transferred

ACT Off: No data transfer

**PSEUDOWIRE****Standard Compliance**

IETF RFC 5086 (CESoPSN)

MEF 8

**Number of PW Connections**

Up to 12 (unprotected)

Up to 6 (fully protected)

**Jitter Buffer Size**

0.25 –256 msec, in 1 msec steps with 125 msec granularity (the value entered by the user is rounded upward to the closest n\*125 msec value)

**Diagnostics**

(per DS1 port or timeslot)

Local digital loopback

Remote digital loopback

**MANAGEMENT****Management Options**

CLI

RADview management and VF orchestration suite

Standalone Shelf View application

**Tools**

Telnet/SSHv2, SNMPv3, SFTP

RADIUS, TACACS+

**Connectivity**

Out-of-band

Inband, via UNI or any of the NNI Ethernet ports

**Ethernet Management Port**

Interface: 10/100BaseT

Connector: RJ-45

**TIMING****Clock Sources**

Users can define the following clock sources:

- Internal crystal free-running oscillator-based clock
- Derived from the receive clock of a specified user port
- Adaptive clock recovered (ACR) from a pseudowire circuit
- External station clock

**Internal Clock Quality**

ST-4

**Station Clock**

Line code: AMI/HDB3/B8ZS

Mode: Input and output

Impedance:

120W, balanced

75W, unbalanced (via adapter cable)

Bit rate:

- 2.048 MHz/2.048 Mbps (E1)
- 1.544 Mbps (T1)

Connector: RJ-45

**DIAGNOSTICS****Alarm Relay**

1 inbound relay – RS-232 levels (dry contact)

2 outbound relays triggered by major/minor alarms

Operation: normally open, normally closed, using different pins

**Diagnostic Loopbacks**

Local and remote loopbacks (see under various interfaces)

BERT per timeslot of internal DS1 port

**GENERAL****Power**

AC: 100-240 VAC ( $\pm 10\%$ ), 50/60 Hz

DC: 48 VDC (40-60 VDC)

Autodetection

**Power Consumption**

30W (max.)

**Physical**

Height: 44 mm (1.7 in) (1U)

Width: 440 mm (17 in)

Depth: 325 mm (12.8 in)

Weight: 4.1 kg (9 lb) max.

**Environment**

Designed for future IEEE-1613 compliance

Operating temperature: -20°C to 65°C (-4°F to 149°F)

Storage temperature: -20°C to +70°C (-4°F to +160°F)

Humidity: up to 95%, non-condensing

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### Ordering

#### RECOMMENDED CONFIGURATIONS

##### MP-1/PSR/2GEU/6S/C37/1FEU

##### MP-1/PSR/2GES/6S/C37/1FEU

Uplink ports: 2 GbE ports with 10/100/1000BaseT copper or empty SFP receptacles and redundant power supplies

User ports: 6 serial ports, 2 C37.94 ports, Fast Ethernet UTP port

##### MP-1/PSR/2GEU/6S/4E&M/1FEU

##### MP-1/PSR/2GES/6S/4E&M/1FEU

Uplink ports: 2 GbE ports with 10/100/1000BaseT copper or empty SFP receptacles and redundant power supplies

User ports: 6 serial ports, 4 E&M voice ports, Fast Ethernet UTP port

##### MP-1/PSR/2GEU/8FXS/4E&M

##### MP-1/PSR/2GES/8FXS/4E&M

Uplink ports: 2 GbE ports with 10/100/1000BaseT copper or empty SFP receptacles and redundant power supplies

User ports: 4 E&M voice ports, 8 FXS voice ports

#### SPECIAL CONFIGURATIONS

Please contact your local RAD partner for additional configuration options.

#### SUPPLIED ACCESSORIES

Alarm connector

DC power inlet adapter

##### RM-50

Hardware kit for mounting one Megaplex-1 unit in a 19-inch rack

#### OPTIONAL ACCESSORIES

TB plug for Ringer connection

AC power cable

##### CBL-RJ45/D9/F/6FT

Control cable

##### CBL-SCS68/3/\*/#/ &

Cable for converting each of the VS 68-pin SCSI connectors into 3 separate channel connectors with the physical interface specified.

*Note:* A separate cable is required for each of the 2 channel connectors.

#### Legend

\* Interface:

**232** V.24/RS-232, 25-pin

**V35** V.35 interface, 34-pin

**V36** V.36/RS-449, 37-pin

**530** RS-530, 25-pin

**X21** X.21, 15-pin

# Length (Default=2m / 6.5 ft):

**3M** for 3m (9.8 ft)

**5M** for 5m (16.4 ft)

& Connector:

**F** female

**M** male

#### CBL-VS-VOICE

Cable for splitting each of the four RJ-12 connectors of FXS interface into two RJ-12 connectors intended for end-user equipment

All the cables listed in this section are 2m (6.6 ft) long. For additional cable lengths available, contact your local sales representative.

#### International Headquarters

24 Raoul Wallenberg Street  
Tel Aviv 69719, Israel  
Tel. 972-3-6458181  
Fax 972-3-6498250, 6474436  
E-mail market@rad.com

#### North American Headquarters

900 Corporate Drive  
Mahwah, NJ 07430, USA  
Tel. 201-5291100  
Toll free 1-800-4447234  
Fax 201-5295777  
E-mail market@radusa.com