

# Vmux-110

## Voice Trunking Gateway for Remote Sites



Compressing one E1/T1 or four/eight analog (FXS/FXO/E&M) voice ports, and transmitting them over a serial, fractional E1/T1, or a 10/100BaseT uplink

- Unique TDMoIP multiplexing allows transmission of the compressed voice over Packet Switched Networks and/or TDM Networks
- Fully transparent to signaling and telephony features
- Additional Ethernet port for user LAN connectivity, with voice/data prioritization
- Ideal for satellite applications – fully compatible with VSAT equipment

Vmux-110 is a customer-located device that complements RAD's larger modular Vmux-2100 system. It fulfills the need for a low-capacity remote voice trunking gateway for both IP and leased line TDM networks. Vmux-110 is available with a choice of voice channels.

The voice interface includes one of the following:

- One E1 or T1 port receiving E1 or T1 trunks from PBXs
- Four or eight FXS/FXO/E&M analog ports that connect to POTS, faxes, or PBX.

Vmux-110 compresses the voice traffic and transports it over a serial, a fractional E1/T1, or a 10/100BaseT IP link.

The device employs G.723.1, G.729 Annex A and G.711 compression algorithms together with RAD's unique TDMoIP multiplexing, including transparent CAS and CCS.

The following security protocols are provided by Vmux-110 to ensure client-server communication privacy and correct user authentication:

- RADIUS (client authentication only)
- SSH for Secure Shell communication session.

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## Vmux-110

### Voice Trunking Gateway for Remote Sites

Vmux-110 features two 10/100BaseT Ethernet ports, one network and one user. The latter is provided for connecting a user Ethernet LAN to the unit. Together with the Vmux-110 integral Ethernet switch, this allows integrating the user LAN traffic with the compressed voice, over a single uplink (IP, serial, or E1/T1) to the network.

To transfer voice as well as 10/100 Mbps Ethernet data over an uplink with limited bandwidth (such as for satellite applications), the ingress data rate on both Ethernet ports is limited between 128 kbps and 8 Mbps.

Vmux-110 is a compact, 1U-high, half 19-inch wide unit. One or two Vmux-110 units can be mounted in a standard 19-inch rack.

#### IMPROVED BANDWIDTH UTILIZATION

Voice Activity Detection (VAD) and silence suppression allow Vmux units to dynamically allocate bandwidth for voice traffic. This results in efficient bandwidth usage, leaving more bandwidth for data transport.

By preventing packets from being sent when no voice activity is detected, the VAD mechanism conserves bandwidth. Vmux-110 can transport a higher number of channels than is possible by using conventional voice compression methods alone. By performing TDMoIP multiplexing and grouping the timeslots of G.723.1 compressed voice into bundles with a common IP address, the actual link bandwidth can be reduced to as low as 4 kbps per channel (a reduction of 16:1).

#### DATA STREAM TRANSFER

Vmux-110 transfers various data streams that are not processed as voice. The following data streams are supported:

- Up to four independent HDLC data streams per E1/T1. Each data stream may occupy one or more timeslots.
- Up to two independent SS7 data streams per E1/T1. Each data stream may occupy one or more timeslots.
- Transparent connection between n x 64 channels over IP and TDM networks. This feature is available for two Vmux-110 units working opposite each other, as well as for Vmux-2100 working opposite Vmux-110. Up to 8 timeslots per E1/T1 can carry transparent data.

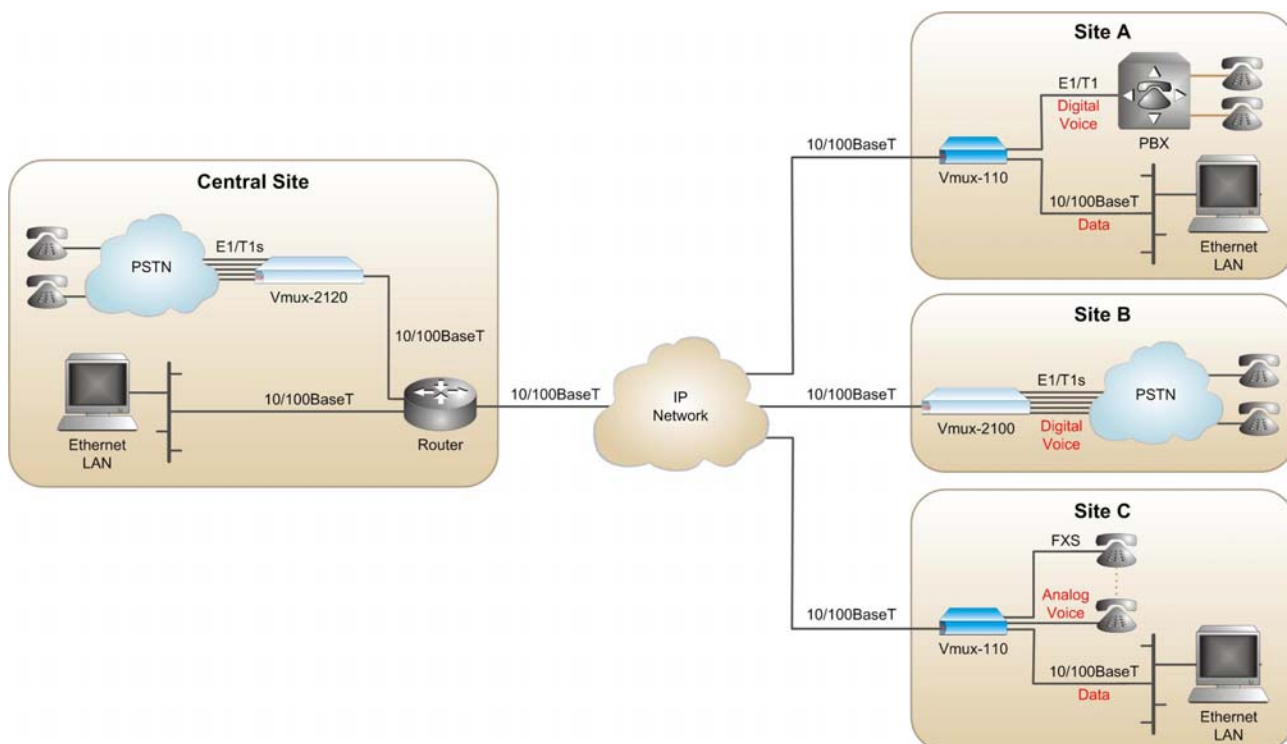


Figure 1. Data and Compressed Digital/Analog Voice over IP Network

**PRIORITY MECHANISM**

Vmux-110 includes an internal mechanism for identifying and assigning priority to packets containing voice, over those containing other LAN traffic. This ensures that voice packets are not delayed and a high voice service quality is maintained.

**QoS SUPPORT**

The IP uplink complies with all relevant Ethernet LAN standards, such as IEEE 802.3 and 802.3u. It provides reliable, high Quality of Service (QoS), by optional VLAN tagging and priority labeling according to IEEE 802.1D&Q.

The user can configure the Type of Service (ToS) of the outgoing IP packets. This allows an en-route Layer 3 router or switch, which supports ToS (or Diffserv), to give higher priority to Vmux-110's IP traffic for delay-sensitive applications.

Assigned, IANA-registered UDP socket number for TDMoIP simplifies flow classification through switches and routers.

**VLAN TABLE**

Vmux-110 includes a VLAN table that contains up to 64 entries. Each entry defines the egress and tagging policies for packets with a specific VLAN ID, for each port. Packets with a particular VLAN ID can be blocked.

**MANAGEMENT**

All Vmux-110 operating parameters are configured using simple, menu-based software. For upgrades or backup, software upload and download can be performed via TFTP.

Vmux-110 can be configured and monitored via a local ASCII terminal, Telnet or RADview-SC/Vmux (RAD's network management system). A DB-9 Control port is provided to connect a local terminal used for monitoring and control.

For system security, Vmux-110 offers four different user levels: Monitor, Technician, Operator and Administrator. Up to 20 different usernames with passwords can be defined.

**Specifications**

**NETWORK INTERFACE – ETHERNET**

**Compliance**

IEEE 802.3, 802.3u, Ethernet, 802.1D&Q

**Data Rate**

10 or 100 Mbps, half-duplex or full-duplex, autonegotiation

**Ingress Data Rate Limit**

Can be independently set for each Ethernet port: 128 kbps, 256 kbps, 512 kbps, 1 Mbps, 2 Mbps, 4 Mbps, 8 Mbps, or unlimited

**Statistics**

According to RFC 2819, RMON-MIB

**Copper UTP Interface**

Range: up to 100m on UTP Cat.5 cable  
Connector: RJ-45 (per port)

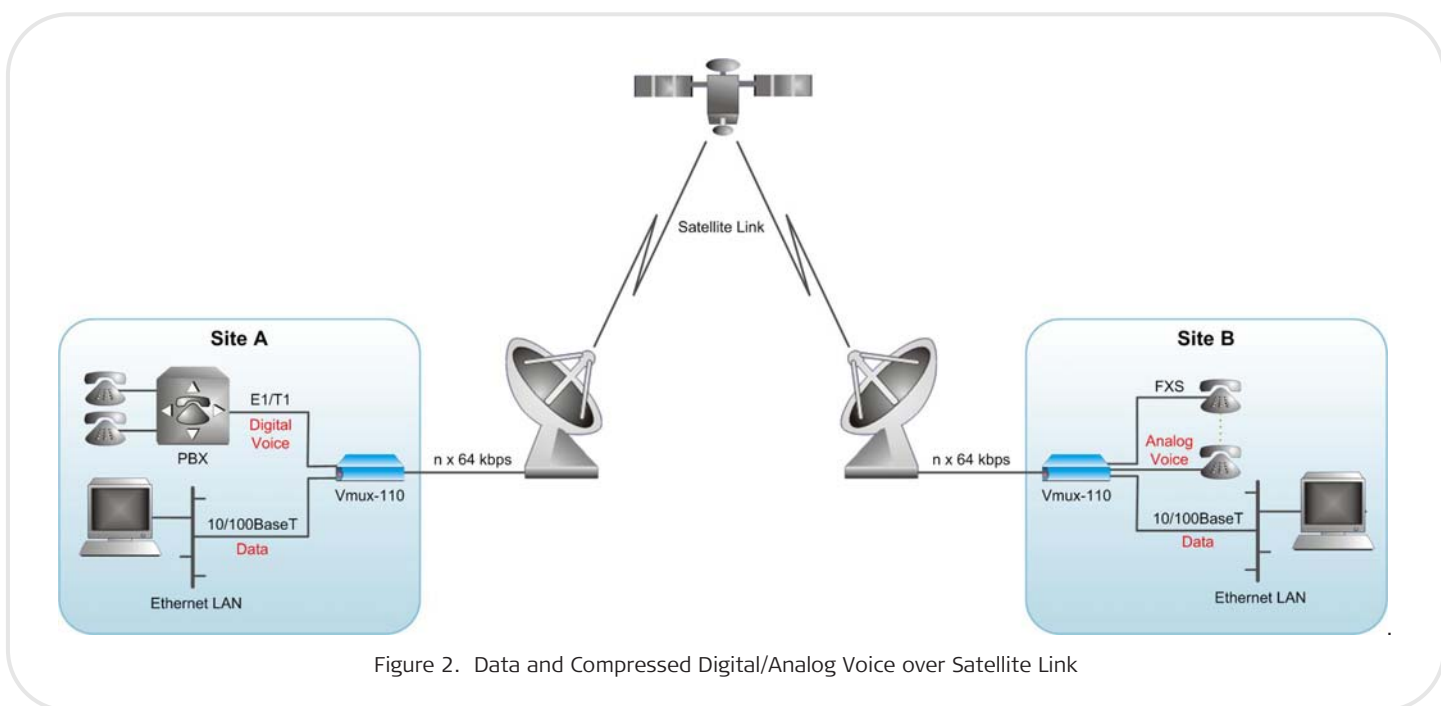


Figure 2. Data and Compressed Digital/Analog Voice over Satellite Link

# Vmux-110

## Voice Trunking Gateway for Remote Sites

### NETWORK INTERFACE – SERIAL

**Data Rate**

n x 64 kbps, up to 2048 kbps

**Interface**

Selectable for RS-530, V.35 or X.21

**Connector**

DB-25, female

*Note: For V.35 or X.21 interface, an adapter cable is required (see Ordering).*

**Clock Modes**

DCE: Vmux-110 provides the clock to connected equipment  
 DTE: Vmux-110 accepts the clock from connected equipment (requires adapter cable)

### NETWORK INTERFACE – E1

**Nominal Data Rate**

2.048 Mbps

**Compliance**

ITU-T Rec. G.703, G.704, G.706, G.732, G.823

**Framing**

G.732N, with or without CRC-4

**Line Code**

HDB3

**Receive Signal Level**

With LTU: 0 to -43 dB  
 Without LTU: 0 to -12 dB

**Transmit Signal Level**

Balanced: ±3V (±10%)

**Timing**

Internal or loopback

**Jitter Performance**

Per ITU-T G.823

**Line Type**






120Ω: 4-wire balanced  
 75Ω: unbalanced (via adapter cable)

**Connector**

RJ-45 for balanced interface

*Note: CBL-RJ45/2BNC/E1 adapter cable is available for converting the balanced E1 port RJ-45 connector into a pair of BNC connectors for unbalanced coax interface (see Ordering).*

Table 1. Vmux/Gmux Family Comparison

Feature	Vmux-110 (Ver. 4.2)	Vmux-210 (Ver. 1.2)	Vmux-2100 (Ver. 4.1)	Vmux-2120 (Ver. 1.1)	Gmux-2000 (Ver. 3.6)
					
Maximum compression ratio	16:1	16:1	16:1	16:1	16:1
Maximum number of compressed voice channels	30	30	496/384	496/384	3,472
Voice Interface	E1/T1/FXS/FXO/E&M	FXS	E1/T1	E1/T1	E1/T1/STM-1/OC-3
Network Interface	E1/T1, Serial, Fast Ethernet	E1/T1, Serial, Fast Ethernet	E1/T1, Fast Ethernet	E1/T1, Fast Ethernet	E1/T1/STM-1/OC-3, GbE, GbE/2
Signaling	Any	CAS only	Any	Any	Any
Fax/Modem/DTMF Relay	✓	✓	✓	✓	✓

## NETWORK INTERFACE – T1

### Nominal Data Rate

1.544 Mbps

### Compliance

ANSI T1.403, AT&T TR-62411,  
ITU-T Rec. G.703

### Framing

SF, ESF

### Line Code

AMI

### Zero Suppression

B8ZS

### Timing

Internal or loopback

### Receive Signal Level

With CSU: 0 to -36 dB  
Without CSU: 0 to -15 dB

### Transmit Signal Level

With CSU: 0, -7.5, -15, or -22.5 dB  
Without CSU:  $\pm 2.7V$  ( $\pm 10\%$ ) at 0-655 ft

### Jitter Performance

Per AT&T TR-62411

### Line Type

4-wire balanced, 100 $\Omega$

## USER ETHERNET PORT

The specifications are identical to those of the Network Ethernet port above.

## USER INTERFACE – VOICE

*Note: Vmux-110 is available with a choice of a single E1 or T1 voice ports, or 4/8 FXS, FXO, or E&M analog voice ports.*

### Compression Algorithms

G.723.1 (5.3 or 6.4 kbps), G.729A  
(8 kbps), G.711

### Silence Suppression

G.723.1A, G.729B

### Echo Cancellation

32 ms per channel as per G.168

### Fax Relay

Group III: 4.8, 9.6, 14.4 kbps

### Modem Relay

V.22/V.22 bis  
V.32/V.32 bis  
V.34 up to 21.6 kbps

### Voice Band Data

Transparent support for modems

### Signaling

Transparent CAS, including R2 and E&M  
Transparent CCS, including ISDN, QSIG and  
SS7

Clear channel

### MF Signaling

DTMF, MFR2, MFC detection, generation  
and relay

### Caller ID Relay

According to U.S. (Bellcore type 1) or  
European (V.23) standards,  
user-selectable

## USER INTERFACE – E1 DIGITAL VOICE

### Nominal Data Rate

2.048 Mbps

### Compliance

ITU-T Rec. G.703, G.704, G.706, G.732,  
G.823

### Framing

G.732N or G.732S, with or without CRC-4

### Line Code

HDB3

### Receive Signal Level

With LTU: 0 to -43 dB  
Without LTU: 0 to -12 dB

### Transmit Signal Level

Balanced:  $\pm 3V$  ( $\pm 10\%$ )

### Timing

Internal or loopback

### Jitter Performance

Per ITU-T G.823

### Line Type

120 $\Omega$ : 4-wire balanced  
75 $\Omega$ : unbalanced (via adapter cable)

### Connector

RJ-45

*Note: CBL-RJ45/2BNC/E1 adapter cable is available for converting the balanced E1 port RJ-45 connector into a pair of BNC connectors for unbalanced coax interface (see Ordering).*

## Vmux-110

### Voice Trunking Gateway for Remote Sites

#### USER INTERFACE – T1 DIGITAL VOICE

##### Nominal Data Rate

1.544 Mbps

##### Compliance

ANSI T1.403, AT&T TR-62411,  
ITU-T Rec. G.703

##### Framing

SF, ESF

##### Line Code

AMI

##### Zero Suppression

B8ZS

##### Timing

Internal or loopback

##### Receive Signal Level

With CSU: 0 to -36 dB  
Without CSU: 0 to -15 dB

##### Transmit Signal Level

With CSU: 0, -7.5, -15, or -22.5 dB  
Without CSU:  $\pm 2.7V$  ( $\pm 10\%$ ) at 0-655 ft

##### Jitter Performance

Per AT&T TR-62411

##### Line Type

4-wire balanced, 100 $\Omega$

##### Connector

RJ-45

#### USER INTERFACE – FXS ANALOG VOICE

##### Number of Ports

4 or 8

##### Analog Parameters

ITU-T standards: G.712, 2-wire for voice  
and signaling

Nominal level: 0 dBm

Nominal impedance: 600 $\Omega$

Return loss (300 to 3400 Hz): Better than  
20 dB

Frequency response (Ref: 1020 Hz):

- 300 to 3000 Hz:  $\pm 0.5$  dB
- 250 to 3400 Hz:  $\pm 1.1$  dB

Level adjustment, soft selectable:

- TX: +5 dBm to -4 dBm
  - RX: +5 dBm to -10 dBm
- Steps: 1 dB ( $\pm 0.1$  dB), nominal

Signal to total distortion, G.712:

- 0 to -30 dBm0: Better than 33 dB
- +3 to -45 dBm0: Better than 22 dB

Idle channel noise: Better than -70 dBm0  
(+20 dBnc)

##### Signaling

Method: EIA RS-464 Loop-start

On-hook/Off-hook threshold:

- On-hook: Higher than 25V between Tip  
and Ring
- Off-hook: 3V to 24V between Tip and  
Ring

Feed Current: 24 mA  $\pm 10\%$

Ringer:

- Voltage: 50 VRMS ( $\pm 10\%$ ),  
overload-protected
- Frequency: 25 Hz ( $\pm 10\%$ )
- Cadence: 1 sec ON/3 sec OFF (default),  
user-configurable

##### Connectors

4-port version: RJ-12 per channel

8-port version: DB-25 connector  
convertible to 8 x RJ-12 connectors via  
adapter cable (see *Ordering*)

#### USER INTERFACE – FXO ANALOG VOICE

##### Number of Ports

4 or 8

##### Analog Parameters

ITU-T standards: G.712, 2-wire for voice  
and signaling

Nominal level: 0 dBm

Nominal impedance: 600 $\Omega$

Return loss (300 to 3400 Hz): Better than  
20 dB

Frequency response (Ref: 1020 Hz):

- 300 to 3000 Hz:  $\pm 0.5$  dB
- 250 to 3400 Hz:  $\pm 1.1$  dB

Level adjustment, soft selectable:

- TX: +5 dBm to -4 dBm
  - RX: +2 dBm to -17 dBm
- Steps: 1 dB ( $\pm 0.1$  dB), nominal

Signal to total distortion, G.712:

- 0 to -30 dBm0: Better than 33 dB
- +3 to -45 dBm0: Better than 22 dB

Idle channel noise: Better than -70 dBm0  
(+20 dBnc)

##### Signaling

Method: EIA RS-464 loop start

DC impedance:

- Off-hook:  
100 $\Omega$  at 100 mA feed  
230 $\Omega$  at 25 mA feed
- On-hook: Above 1 M $\Omega$

Ring detector:

- Impedance: 20 k $\Omega$  @ 20 Hz, 70 VRMS
- Detection: >20 VRMS, 17–25 Hz
- No detection: <5 VRMS
- Dialing: DTMF or pulse

##### Connectors

4-port version: RJ-12 per channel

8-port version: DB-25 connector  
convertible to 8 x RJ-12 connectors via  
adapter cable (see *Ordering*)

## USER INTERFACE – E&M ANALOG VOICE

### Number of Ports

4 or 8

### Analog Parameters

ITU-T standards: G.712, 2-wire or 4-wire  
for voice and signaling

Nominal level: 0 dBm

Nominal impedance: 600Ω

Return loss (300 to 3400 Hz): better than  
20 dB

Frequency response (Ref: 1020 Hz):

- 300 to 3000 Hz: ±0.5 dB
- 250 to 3400 Hz: ±1.1 dB

Level adjustment, soft selectable:

- TX: +5 dBm to -7 dBm
  - RX: +2 dBm to -17 dBm
- Steps: 1 dB (±0.5 dB), nominal

Signal to total distortion, G.712:

- 0 to -30 dBm0: Better than 33 dB
- +3 to -45 dBm0: Better than 22 dB

Idle channel noise: better than -70 dBm0  
(+20 dBnc)

### Signaling

Method (software-selectable per channels  
1-4 and 5-8): EIA RS-464 Types I, II  
(with or without positive E&M  
signaling), III, and V (British Telecom  
SSDC5)

Signaling voltage: -12 to -60 VDC

Pulse dial distortion: ±2 ms max

### Connectors

4-port version: RJ-45 per channel

8-port version: 68-pin SCSI connector  
convertible to 8 x RJ-45 connectors via  
adapter cable (*see Ordering*)

## CONTROL PORT

### Standards

RS-232/V.24 (DCE)

### Data Rate

9.6, 19.2, 38.4, 57.6, or 115.2 kbps

### Connector

DB-9

## INDICATORS

### Front Panel

PWR (green): On when power is on

ETH (green): On when Ethernet line is OK

ALM (red): On when alarm is present in  
the system

### Ethernet Network and User Ports

LINK (green): On when the link is active

ACT (yellow): Blinking during LAN traffic  
activity

## GENERAL

### Diagnostics

E1/T1 uplink: Remote loops on entire  
E1/T1

Ethernet ports:

- Performance monitoring
- LAN statistics
- Ping

E1/T1 voice ports:

- Local and remote loops on entire  
E1/T1
- Tone injection per timeslot towards  
local side

FXS/FXO/E&M voice ports:

- Remote loops per channel
- Tone injection per channel towards  
local and remote side
- Statistics
- Ping

## Physical

Height: 4.3 cm (1.7 in)

Width: 21.5 cm (8.5 in)

Depth: 23.7 cm (9.3 in)

Weight: 2.0 kg (4.4 lb)

## Power

AC: 100 to 240 VAC, 50/60 Hz

48 VDC: -40 to -72 VDC

24 VDC: 20 to 32 VDC

## Power Consumption

4FXS: AC: 19 VA

DC: 18W

8FXS: AC: 28 VA

DC: 27W

4FXO: AC: 9 VA

DC: 8W

8FXO: AC: 9.5 VA

DC: 8.5W

4E&M: AC: 11 VA

DC: 10W

4E&M/POS: AC: 10 VA

DC: 9W

8E&M: AC: 12.5 VA

DC: 11.5W

8E&M/POS: AC: 11 VA

DC: 10.5W

E1/T1: AC: 10.2 VA

DC: 9W

## Environment

Operating temperature: 0 to 50°C  
(32 to 122°F)

Storage temperature: -20 to 70°C  
(-4 to 158°F)

Humidity: Up to 90%, non-condensing

## Vmux-110

### Voice Trunking Gateway for Remote Sites

## Ordering

### STANDARD CONFIGURATIONS

Vmux-110/AC/E1/30/ETH-UTP

Vmux-110/AC/T1/24/ETH-UTP

Vmux-110/AC/4FXS/ETH-UTP

Vmux-110/AC/8E&M/ETH-UTP

Vmux-110/AC/4E&M/ETH-UTP

Vmux-110/48/8E&M/ETH-UTP

### SPECIAL CONFIGURATIONS

Vmux-110/\*/+/%/&

#### Legend

- \* Power supply type:
  - AC 100 to 240 VAC
  - 48 -36 to -72 VDC
  - 24 Temperature-hardened, 20 to 32 VDC
- + Voice port type:
  - E1/30 Full E1 digital voice port
  - T1/24 Full T1 digital voice port
  - 4FXS 4 analog FXS ports
  - 8FXS 8 analog FXS ports
  - 4FXO 4 analog FXO ports
  - 8FXO 8 analog FXO ports
  - 4E&M 4 analog E&M ports
  - 8E&M 8 analog E&M ports
- % Ethernet port type (mandatory):
  - ETH-UTP Ethernet User and Network 10/100BaseT ports
- & Positive E&M signaling (Default=no positive E&M signaling)
  - POS With positive E&M signaling

### SUPPLIED ACCESSORIES

AC power cord (when AC power supply is ordered)

DC adapter plug (when DC power supply is ordered)

### OPTIONAL ACCESSORIES

CBL-DB9F-DB9M-STR

CBL-VM110/?

Serial link adapter cable, 40 cm long

#### Legend

? Interface type and clock mode:

- V35/DCE V.35, DCE mode
- V35/DTE V.35, DTE mode
- X21/DCE X.21, DCE mode
- X21/DTE X.21, DTE mode
- 530/DTE RS-530, DTE mode

*Note: An adapter cable is not required for connecting to RS-530 equipment when Vmux-110 operates in DCE clock mode.*

### CBL-KVF8/FXOS

Adapter cable for converting the FXO/FXS interface D-25 connector to 8 x RJ-12 connectors

### CBL-KVF8/E&M

Adapter cable for converting the E&M interface 68-pin SCSI connector to 8 x RJ-45 connectors

### CBL-RJ45/2BNC/E1

Interface adapter cable for converting the balanced E1 port RJ-45 connector into a pair of BNC connectors for unbalanced coax interface

### RM-35/@

Hardware kit for mounting one or two metal Vmux-110 units into a 19-inch rack

@ Rack mount kit:

- P1 Mounting one unit
- P2 Mounting two units

To order both P1 and P2 kits, define RM-35 only.

### RM-35-23

Hardware kit for mounting one Vmux-110 unit in a 23-inch rack

### RM-35-ETSI

Hardware kit for mounting one Vmux-110 unit in an ETSI rack

### WM-35-TYPE4

Hardware kit for mounting one Vmux-110 unit on the wall.

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