

# 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, together with various voice compression algorithms, provides up to 16:1 compression for efficient bandwidth utilization
- 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

**TDMoIP®**  
**Driven**

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.



**data communications**

Innovative Access Solutions

# Vmux-110

## Voice Trunking Gateway for Remote Sites

A second 10/100BaseT port is provided for connecting a user Ethernet LAN to the unit. Together with Vmux-110's 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.

An integrated router supports IP routing, Firewall, NAT, DHCP Server/Relay and static routing. The IP routing can be performed between the network, user, and serial ports.

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 to one of several values 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.

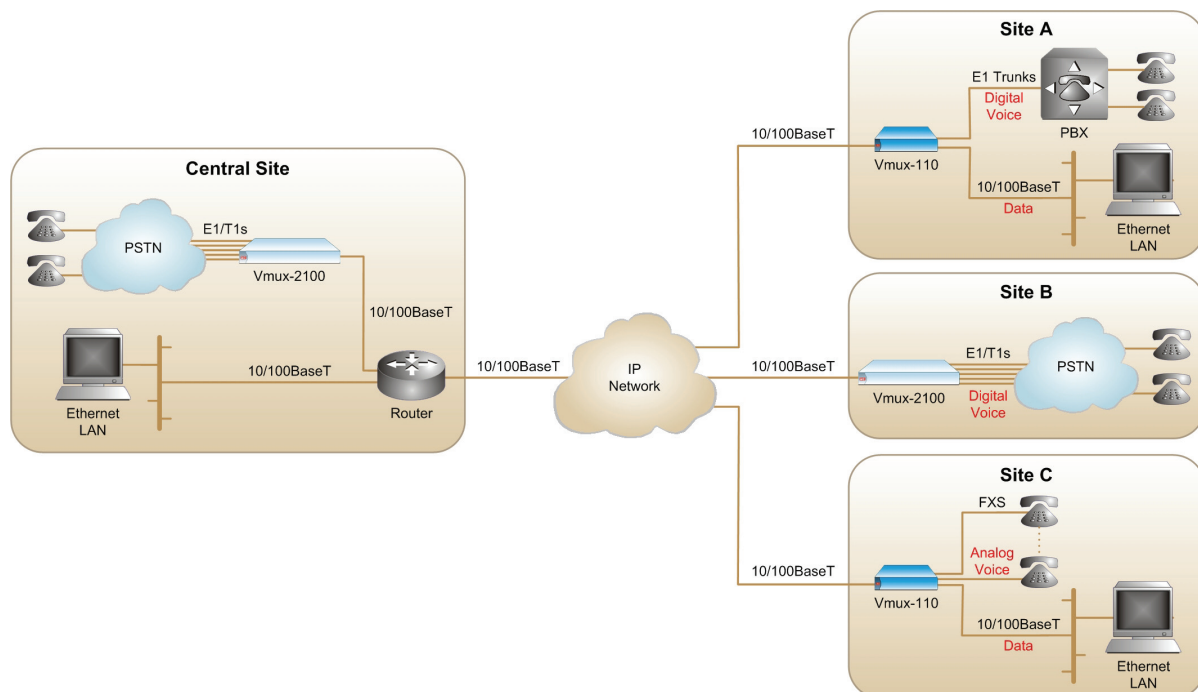


Figure 1. Data and Compressed Digital/Analog Voice over IP Network

### 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, ConfiguRAD (RAD's Web-based remote access terminal) or RADview (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 OR USER INTERFACE – ETHERNET

**Note:** Vmux-110 features two 10/100BaseT Ethernet ports (one network and one user), one  $n \times 64$  kbps serial link, and one E1/T1 link.

### Standards

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

### Data Rate

10 or 100 Mbps, half duplex or full duplex, auto-negotiation

### Ingress Data Rate Limit

Can be independently set for each Ethernet port: 128, 256, 512 kbps, 1, 2, 4, 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)

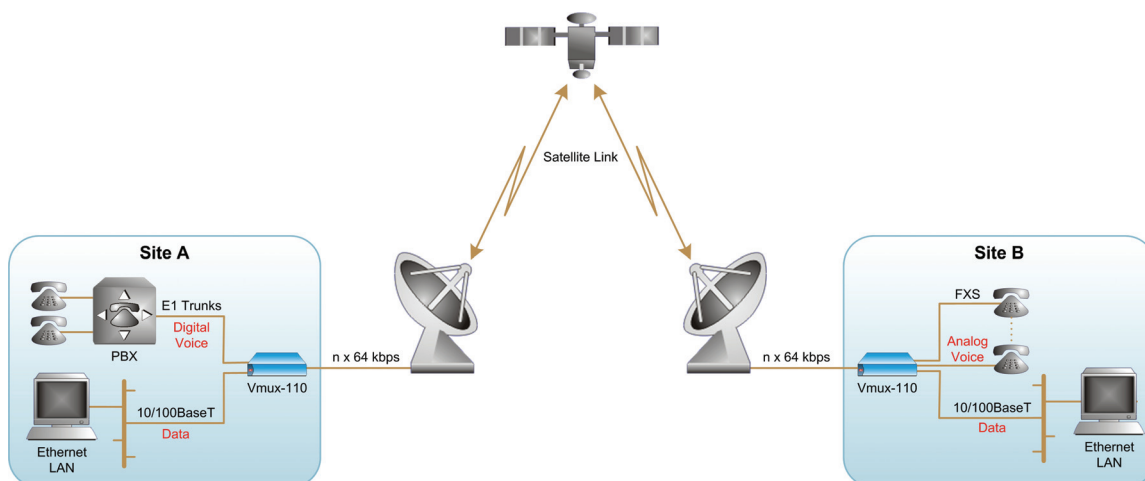


Figure 2. Data and Compressed Digital/Analog Voice over Satellite Link

# 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

#### Standards

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

#### Timing

Internal or loopback

#### Jitter Performance

Per ITU-T G.823

#### Line Type

4-wire balanced, 120W

#### 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-2100                                     | Vmux-110                                     | Vmux-210                                     | Gmux-2000                                     |
|---|---|--|--|---|
| Maximum compression ratio                   | 16:1  | 16:1   | 16:1   | 16:1  |
| Maximum number of compressed voice channels | 496   | 30   | 30   | 3,472   |
| Voice Interface                             | E1/T1   | E1/T1/FXS/FXO/E&M                            | FXS  | E1/STM-1                                      |
| Network Interface                           | E1/T1, Serial, Fast Ethernet                  | E1/T1, Serial, Fast Ethernet                 | E1/T1, Serial, Fast Ethernet                 | E1, STM-1, GBE                                |
| Modularity                                  | ✓   |  |  | ✓   |
| Signaling                                   | Any   | Any  | CAS only                                     | Any   |
| Fax/Modem/DTMF Relay                        | ✓   | ✓  | ✓  | ✓   |
| Management                                  | ASCII terminal, Telnet, Web*, RADview-SC/Vmux | ASCII terminal, Telnet, Web, RADview-SC/Vmux | ASCII terminal, Telnet, Web, RADview-SC/Vmux | ASCII terminal, Telnet, Web, RADview-SC/Vmux* |

\* - Unavailable yet

**NETWORK INTERFACE – T1****Nominal Data Rate**

1.544 Mbps

**Standards**

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

**USER INTERFACE – VOICE**

*Note: Vmux-110 is available with a choice of single  
E1 or T1 voice port, 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 msec 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

**Standards**

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**

4-wire balanced, 120W

**Connector**

RJ-45

# Vmux-110

## Voice Trunking Gateway for Remote Sites

### USER INTERFACE – T1 DIGITAL VOICE

#### Nominal Data Rate

1.544 Mbps

#### Standards

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, 120W

#### 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 dBrnc)

#### 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

#### 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*)

#### 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 dBrnc)

#### 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

**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): EIA RS-464 Types I, II, III, and V (British Telecom SSDC5) software selectable per 4 channels

Signaling voltage: -12 to -60 VDC

Pulse dial distortion: ±2 msec 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

**GENERAL****Diagnostics**

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

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

**Indicators**

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

**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**

(according to ordering)

AC: 100 to 240 VAC, 50/60 Hz

DC: -40 to -72 VDC

**Power Consumption**

4FXS: AC: 19.0 VA

DC: 18.0W

8FXS: AC: 28.0 VA

DC: 27.0W

4FXO: AC: 9.0 VA

DC: 8.0W

8FXO: AC: 9.5 VA

DC: 8.5W

4E&M: AC: 11.0 VA

DC: 10.0W

8E&M: AC: 12.5 VA

DC: 11.5W

E1/T1: AC: 10.2 VA

DC: 9.0W

**Environment**

Temperature:

Operating: 0 to 50°C (32 to 122°F)

Storage: -20 to 70°C (-4 to 158°F)

Humidity: Up to 90%, non-condensing

## Vmux-110

## Voice Trunking Gateway for Remote Sites

## Ordering

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

Voice Trunking Gateway for Remote Sites

## Legend

- \* Power supply type:
  - AC** single 100 to 240 VAC
  - 48** single -36 to -72 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:
  - ETH-UTP** Ethernet 10/100BaseT port

## SUPPLIED ACCESSORIES

AC power cord (with AC power supply only)

DC adapter plug (with DC power supply only)

## OPTIONAL ACCESSORIES

## CBL-VM110/?

Serial link adapter cable

## 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&amp;M

Adapter cable for converting the E&amp;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 for mounting one or two Vmux-110 units in a 19-inch rack

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