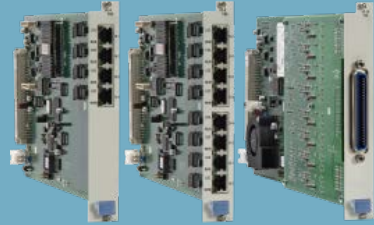


Megaplex-4, Megaplex-2100/2104 VC-4/4A, VC-8/8A, VC-16

4/8/16-Channel PCM and ADPCM Voice Modules



- E&M, FXS or FXO interface options
- Caller ID
- A-law or μ -law companding
- Optional inband signaling with A-law encoded channels
- PCM (64 kbps) and ADPCM (24 or 32 kbps) encoding

The VC-4, VC-8 and VC-16 modules provide 4, 8 or 16 toll-quality analog voice channels. Voice signals are digitized using PCM, in compliance with ITU-T G.711 and AT&T Pub. 43801 standards, for transmitting up to 30 voice channels over an E1 link, or 24 voice channels over a T1 link.

In addition to 64-kbps PCM encoding, VC-4A and VC-8A modules employ toll-quality 24- or 32-kbps ADPCM voice encoding.

Note: Unless otherwise specified, "VC modules" in this datasheet refer to all 5 modules.

The maximum number of voice channels in one Megaplex-2100/2104 unit depends on the chassis, main link modules, number of VC modules, and encoding used. For example, a MP-2100 unit equipped with 8 VC-16 modules, in conjunction with 4 channels of ML-8E1 or ML-8T1, can provide up to 120 voice channels.

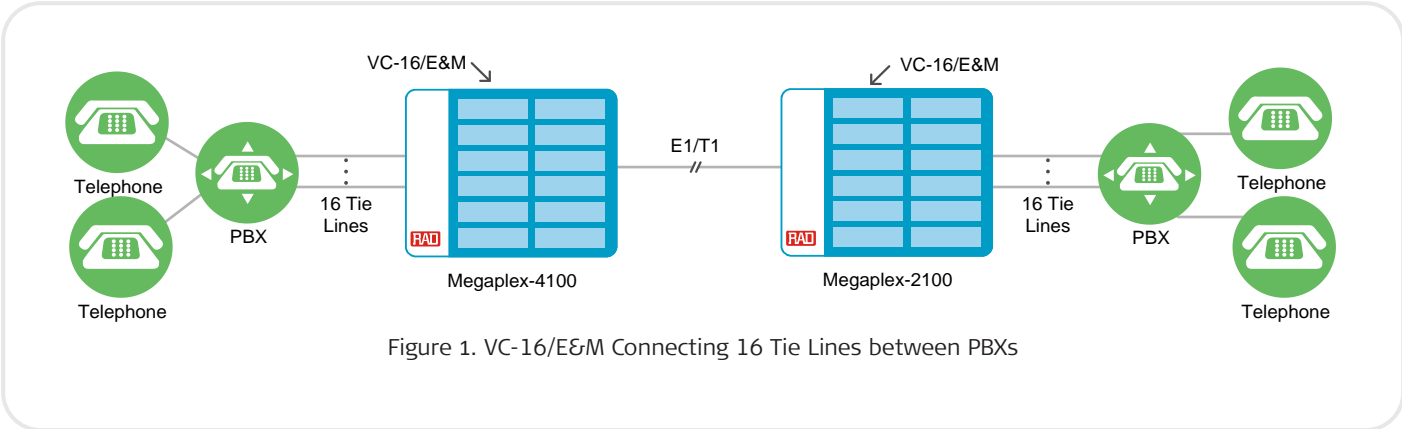


Figure 1. VC-16/E&M Connecting 16 Tie Lines between PBXs

VC-4/4A, VC-8/8A, VC-16

A Megaplex-4100 unit equipped with 10 VC-16 modules transmits 160 channels over SONET/SDH. For operation in E1/T1 environment, 9 VC-16 modules, in conjunction with M8E1 or M8T1, can provide up to 144 voice channels.

Encoding and decoding are in full compliance with ITU-T requirements G.712, G.713 and G.714. Voice channel companding is selectable for A-law or μ -law.

Each 64-kbps PCM voice channel is allocated a timeslot on a link in a DS0-compatible format, permitting voice channel switching in systems based on digital cross-connect (DACs). Each channel can be independently routed to any link.

Each ADPCM voice channel (32 or 24 kbps) is allocated half a timeslot on a link in a DS0-compatible format.

Each VC channel features Caller ID by transparently transferring the FSK modem tones between the incoming rings. Thus, a customer subscribed to a Caller ID service can see the Caller ID of an incoming or waiting call with any Caller ID display equipment.

VC channels transfer SMS messages between the telephones using DECT protocol.

The modules are available with E&M, FXO and FXS interface types.

The **E&M** interface operates with different types of E&M signaling: EIA RS-464 Types I, II, III and V (British Telecom SSDC5). Both 2-wire and 4-wire lines are supported (user-selectable). This interface is typically used for connection of tie lines between PBXs (see *Figure 1*).

The E&M modules provide 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 SSDC5) standards, a -48 VDC power source is required. An **E&M/EXT** version can be ordered for working with the standard E&M (-48 VDC) voltage.

A special **E&M/POS** version of VC-8 and VC-16 and **E&M/RJ/POS/24** version of VC-8 with positive signaling are available for use in applications that require positive signaling voltage (for example, radio transmitters). **E&M/POS** enables signaling at +5V or +12V. **E&M/RJ/POS/24** enables signaling at +24V and performs fault propagation. This version requires a -48 VDC power source. A special **E&M/DS** version of VC-8 with two 68-pin SCSI connectors can be ordered for working with double signaling, providing two signaling bits per each voice channel, so that each signaling bit can be changed independently.

Figure 2 illustrates a typical air traffic control (ATC) system, where the **E&M/POS** modules enable maintaining constant contact between the ATC center and remote airport radio stations. In this application, Megaplex enables communications between air traffic controllers and pilots and provides a broad range of ATC equipment connections, including intercom, telephone services and radar monitoring.

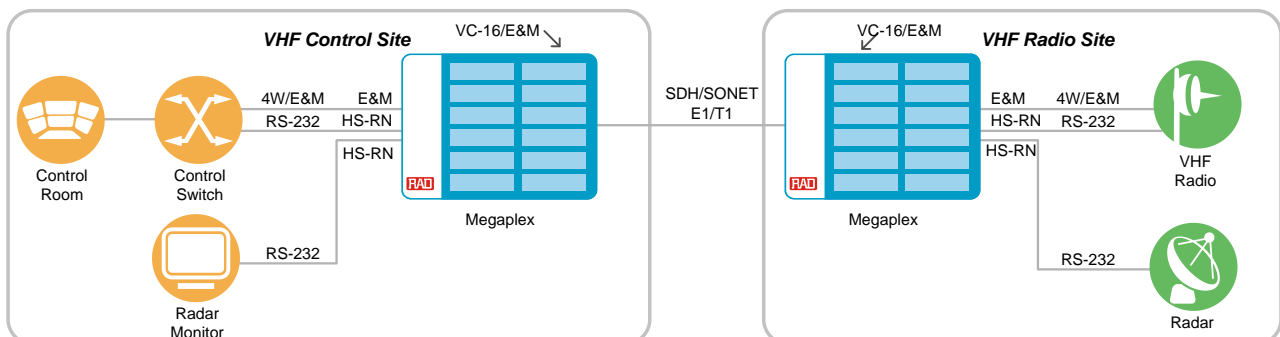


Figure 2. Air Traffic Control using E&M/POS Modules

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 (see *Figure 3*);
- 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.

Special ordering options of FXS VC modules generate 12/16 kHz metering pulse for connection to public payphones (see *Figure 4*).

The **FXO** interface employs both loop-start and wink-start signaling methods. It can be used for connection to PBX extension lines in point-to-point, loop-start applications, with a corresponding FXS VC module at the remote Megaplex connecting to the remote extension. When operating in PCM mode, battery polarity is reversed for wink-start signaling.

Special ordering options of FXO VC modules detect 12/16 kHz metering pulse for connection to public payphones (see *Figure 4*).

The following signaling transfer modes are selectable in VC-4, VC-8 and VC-16 modules:

- Channel Associated Signaling (CAS) transmitted in Timeslot 16, compatible with ITU-T Rec. G.704 (available with E1 links only);
- Inband "Robbed Bit Multiframe" (RBMF) (available with T1 links only). This method is compatible with ITU-T Rec. G.704 and AT&T Pub. 43801, and is generally used with μ -law companding;
- Inband "Robbed Bit Frame" (RBF). This method is applicable for VC-4A and VC-8A modules, and is useful for networks not supporting signaling switching
- No signaling – channel signaling is not transferred.

To provide feed and ringing signal generation voltages, FXS modules require a nominal -48 VDC (-20 to -54 VDC) source. This power can be provided either by an appropriate DC-powered chassis, or by an external standalone Ringer power supply unit or module for AC-powered chassis, in accordance with the number of ports. (For more information, refer to *Ordering* and to the *RAD Ringers data sheet*). The feed and ring generation voltages are distributed to the modules via the internal voltage bus of the chassis.

Gain control is user-selectable for both the receive and transmit directions, enabling easy installation in all environments. A special 4-wire version with enhanced gain control is available for the VC-16/E&M, VC-8/E&M and VC-4/E&M modules (see *Ordering*).

Note: 4-wire E&M module versions with enhanced gain control do not operate in 2-wire mode.

All operating parameters are configurable via the management system for both the local and remote modules.

Diagnostic features include loopbacks towards the local user equipment and towards the remote user equipment. Test tone injection of 1 kHz, 0 dBm0 towards the remote or local equipment is also available.

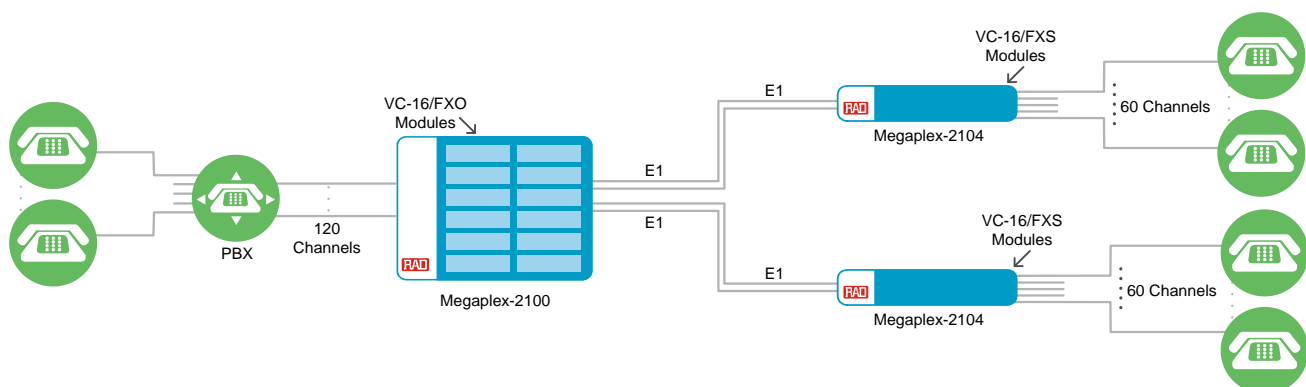


Figure 3. Multipoint, Off-Premises Extension of 120 PCM Voice Channels Using 4 E1 Links

Specifications

Number of Voice Channels

VC-16: 16
 VC-8, VC-8A: 8
 VC-4, VC-4A: 4

Voice Encoding Technique

PCM: per ITU-T G.711 and AT&T
 Pub. 43801, μ -law or A-law
 ADPCM: per ITU-T G.726 and G.727,
 μ -law or A-law

Bandwidth Requirement

PCM: 64 kbps (one timeslot) per enabled channel
 ADPCM:
 32 kbps per enabled channel (one timeslot per pair of channels) as per G.726 and G.727
 24 kbps per enabled channel (one timeslot per pair of channels) as per G.727 (when using RBF or RBMF inband signaling)

Analog Interface

Line type:
 E&M: 4-wire or 2-wire (soft-selectable)
 FXS, FXO: 2-wire
 ITU-T standard: G.712

Connectors: see *Table 3*

Analog Parameters

Nominal level: 0 dBm
 Nominal impedance: 600 Ω
 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 (± 0.15 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)
 Transformer isolation: 1500 VRMS
 Far-end cross-talk (2W&4W) : -65dBm0
 max
 Go-to-return cross-talk (4W): -60dBm0
 max
Adaptive Echo Canceller
 Delays of up to 4 msec per channel, as per G.168 (VC-4A, VC-8A only)

Power Consumption

See *Table 2*

E&M INTERFACE

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

FXS INTERFACE

Signaling Methods

PCM: EIA RS-464 loop-start or wink-start
 ADPCM: EIA RS-464 loop-start

On-Hook/Off-Hook Threshold

(where V_{in} = -20 to -54 VDC)
 3V to 80% V_{in} between Tip and Ring at
 Off-Hook state,
 Higher than 83% V_{in} between Tip and Ring
 at On-Hook state

Table 1. Transmit and Receive Levels for Voice Interfaces

Interface	Transmit [dbm]		Receive [dbm]	
	min	max	min	max
E&M regular	-8	+5	-17	+3.5
E&M 4W enhanced	-17	+5	-17	+9
FXS	-5	+5	-17	+1
FXO	-3.5	+5	-17	+1

Loop Resistance

Min: 300Ω
Max: 1600Ω

Feed Current

23 mA (±10%) per active channel

Ringer

54 VRMS, 22 Hz (±10%); Overload protected,
1 second ON, 3 seconds OFF

Metering Pulse Generation

Output frequency: 12 or 16 kHz (±2 Hz),
selectable

Output level: 1.7 VRMS

*Note: Metering pulse generation is not available in
the ADPCM mode.*

Reverse Polarity Pulse Distortion

6 msec max

-48 VDC (nominal) Current Consumption

30 mA (±10%) per active channel
(a full VC-16/FXS module consumes 480
mA; a full VC-8/FXS consumes 240 mA)

Number of Channels

Ringer-2100R: up to 40
Ringer-2000: up to 100
Ringer-2200N: up to 200

FXO INTERFACE

Signaling Methods

PCM: EIA RS-464 loop-start or wink-start
ADPCM: EIA RS-464 loop-start

DC Impedance

Off-Hook:
100Ω at 100 mA feed,
230Ω at 25 mA feed
On-Hook: above 1 MΩ

Ring Detector

20 kΩ @ 20 Hz, 70 VRMS
Detection: >20 VRMS, 17–25 Hz
No detection: <5 VRMS

Metering Pulse Detection Frequency

12 or 16 kHz (±200 Hz), soft-selectable

*Note: Metering pulse detection is not available in
the ADPCM mode.*

Reverse Polarity Pulse Distortion

6 msec max

GENERAL

End-to-End Signaling

T1 links:

RBMF: 667 samples per second with
D4; 333 samples per second with ESF
RBF

E1 links:

CAS per ITU-T G.704 para. 3.3.3.2

Table 2. Power Consumption for Various interfaces

Module	Power Consumption [W]		
	FXS	FXO	E&M
VC-4	2.5	1.9	2.8
VC-4A	3.3	2.7	3.6
VC-8	2.8	2.0	3.4
VC-8A	3.7	2.8	4.2
VC-16	4.7	2.5	5.2

Diagnostics

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

Note: In ADPCM mode, the local digital loopback towards the local user equipment is performed for each pair of consecutive channels (1-2, 3-4, etc.)

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

Environment

Operating temperature: -10°C to +55°C
(-14°F to 131°F)

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

Humidity: up to 95%, non-condensing

Table 3. VC Module Connectors

Module	E&M Interface	FXO/FXS Interface
VC-4, VC-4A	RJ-45 connector per channel	RJ-12 connector per channel
VC-8, VC-8A	68-pin female SCSI connector for all channels	1 x 50-pin female TELCO connector for all channels
VC-8/DS	2 x 68-pin female SCSI connectors, - one per group of 4 channels	-
VC-8/RJ/POS/24	RJ-45 connector per channel	RJ-12 connector per channel
VC-16	2 x 68-pin female SCSI connectors, - one per group of 8 channels	1 x 50-pin female TELCO connector for all channels

VC-4/4A, VC-8/8A, VC-16

Ordering

RECOMMENDED CONFIGURATIONS

MP-2100M-VC-4/E&M

4-Channel PCM voice module with E&M interface

MP-2100M-VC-4/FXO

4-Channel PCM voice module with FXO interface

MP-2100M-VC-4/FXS

4-Channel PCM voice module with FXS interface

MP-2100M-VC-8/E&M

8-Channel PCM voice module with E&M interface

MP-2100M-VC-8/FXO

8-Channel PCM voice module with FXO interface

MP-2100M-VC-8/FXS

8-Channel PCM voice module with FXS interface

MP-2100M-VC-16/E&M

16-Channel PCM voice module with E&M interface

MP-2100M-VC-16/E&M/4WIRE

16-Channel PCM voice module with E&M interface and enhanced gain levels

MP-2100M-VC-16/FXO

16-Channel PCM voice module with FXO interface

MP-2100M-VC-16/FXS

16-Channel PCM voice module with FXS interface

SPECIAL CONFIGURATIONS

Please contact your local RAD partner for additional configuration options.

OPTIONAL ACCESSORIES

Octopus cables for splitting the high-density module (VC-8 and VC-16) connector(s) into separate channels with RJ-12/RJ-45 connectors, for direct connection to user equipment. Default cable length is 2m (6 ft).

CBL-VC16/FXS0

Cable with 16 x RJ-12 connectors, for splitting the VC-16/FXS or VC-16/FXO single 50-pin Telco connector

CBL-VC8/FXS0

Cable with 8 x RJ-12 connectors, for splitting the VC-8/FXS or VC-8/FXO single 50-pin Telco connector

CBL-KVF8/E&M

Cable with 8 x RJ-45 connectors, for splitting a single VC-8/E&M or VC-16/E&M 68-pin SCSI connector, 2m long

CBL-KVF8/E&M/4METER

Cable with 8 x RJ-45 connectors, for splitting a single VC-8/E&M or VC-16/E&M 68-pin SCSI connector, 4m long

CBL-KVF8/E&M/10METER

Cable with 8 x RJ-45 connectors, for splitting a single VC-8/E&M or VC-16/E&M 68-pin SCSI connector, 10m long

CBL-KVF8/E&M/12METER

Cable with 8 x RJ-45 connectors, for splitting a single VC-8/E&M or VC-16/E&M 68-pin SCSI connector, 12m long

CBL-KVF8/E&M/25METER

Cable with 8 x RJ-45 connectors, for splitting a single VC-8/E&M or VC-16/E&M

68-pin SCSI connector, 25m long

CBL-KVF8/E&M/OPEN

Open-end cable with stranded core, for splitting a single VC-8/E&M or VC-16/E&M 68-pin SCSI connector, 2m long

CBL-KVF8/E&M/OPEN/4METER

Open-end cable with stranded core, for splitting a single VC-8/E&M or VC-16/E&M 68-pin SCSI connector, 4m long

CBL-KVF8/E&M/OPEN/10METER

Open-end cable with stranded core, for splitting a single VC-8/E&M or VC-16/E&M 68-pin SCSI connector, 10m long

CBL-KVF8/E&M/OPEN/12METER

Open-end cable with stranded core, for splitting a single VC-8/E&M or VC-16/E&M 68-pin SCSI connector, 12m long

CBL-KVF8/E&M/OPEN/25METER

Open-end cable with stranded core, for splitting a single VC-8/E&M or VC-16/E&M 68-pin SCSI connector, 25m long

CBL-KVF8/E&M/OPEN/SOLID/12METER

Open-end cable with solid core, for splitting a single VC-8/E&M or VC-16/E&M 68-pin SCSI connector, 12m long

Note: Order these cables only for applications that do not need "Signaling Battery" and "Signaling Ground" functionality.

When ordering FXS or E&M modules, a **RINGER** may be required (see *Ringer data sheet* for ordering)

Note: FXS modules require a -48 VDC (nominal) source for feed and ring voltages. This power can be provided by a Ringer-2000/2200N unit or Ringer-2100R module. E&M applications may also require -48 VDC. -48 VDC-powered chassis, or AC-powered MP-2104 chassis with built-in ringer option, do not require an additional Ringer.

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