RIC-LC

Ethernet Converter for Bonded PDH Circuits

Connects Fast Ethernet LANs transparently over TDM infrastructure

- Delivery of Ethernet traffic over up to 16 bonded E1 ports using Ethernet over NG-PDH protocols
- VLAN tagging and stacking for full separation of Ethernet user traffic from management data
- Monitoring and diagnostic tools for quick fault isolation on TDM and Ethernet ports
- TDM to Ethernet fault propagation
- Extensive management capabilities including local and remote (inband and out-of-band) options

RIC-LC is a Fast Ethernet over E1 converter that provides simple, efficient and cost-effective Fast Ethernet connectivity over one, four, eight or sixteen bonded E1 circuits. The device enables service providers to supply high-capacity Ethernet services to remote locations and transparently connect corporate LANs over existing E1 links.

RIC-LC supports standard Next Generation Ethernet over PDH protocols including GFP ITU-T G.8040, VCAT ITU-T G.7043 and LCAS ITU-T G.7042. These protocols allow service providers to dynamically allocate bandwidth to their customers by mere changing the number of links bonded to the virtual group, without stopping the service.

The device can be used in a point-to-point application or in a hub-and-spoke topology, operating with RAD's Egate-100, Egate-2000 and RICi-16 or third-party gateways.

Typical applications include:

- Ethernet private Line/LAN services
- IP DSLAM, cellular IP, and WiMAX base station backhauling
- Interoffice or enterprise LAN connection.

Using interface bonding, RIC-LC creates a scalable, large virtual pipe comprised of up to four, eight or sixteen E1 lines. The bonding is performed at the E1 level, providing flexible bandwidth for different applications.

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TRAFFIC SEPARATION

VLAN tagging and stacking at ingress and egress enable transporting user traffic transparently, keeping all the user VLAN settings intact. Management traffic and user Ethernet traffic are sent together on the same Ethernet flow and can be separated by different VLANs, thus ensuring high traffic security.

QUALITY OF SERVICE (QoS)

RIC-LC supports VLAN-aware and VLAN unaware bridging, as well as VLAN stacking (Q-in-Q). It maps Ethernet frames into four priority queues based on user port, VLAN priority (802.1p) or DSCP marking, to enable differentiation between various user applications. It uses both Strict Priority and WFQ (weighted fair queuing), as well as per port rate limitation.

INTERNAL BRIDGE

The internal bridge can be configured to filter or transparent mode. In filter mode, the bridge learns MAC addresses and filters local traffic accordingly. In transparent mode it forwards the received packets, ignoring the MAC addresses.

MANAGEMENT

RIC-LC can be managed locally via an ASCII terminal connected to RS-232.

Remote inband management is performed via the E1 ports using Telnet, Web browser or RADview, RAD's SNMP-based management system that ensure safe and secure access control.

Out-of-band management is performed via one of the user Ethernet ports.

LOOP DETECTION

E1 loops are immediately detected when they occur, avoiding the resulting Ethernet loops and Ethernet storms. The unit automatically recovers when the TDM loop clears.

FAULT PROPAGATION

If a failure is detected on the E1 port, the fault propagation mechanism deactivates the Fast Ethernet links, enabling routers and switches on both ends of the link to reroute the traffic.

DIAGNOSTICS

RIC-LC diagnostic capabilities include:

- Ping test for checking IP connectivity
- User-activated diagnostic loopback tests on VCG or individual E1 generated using management software or rear-panel DIP switch.
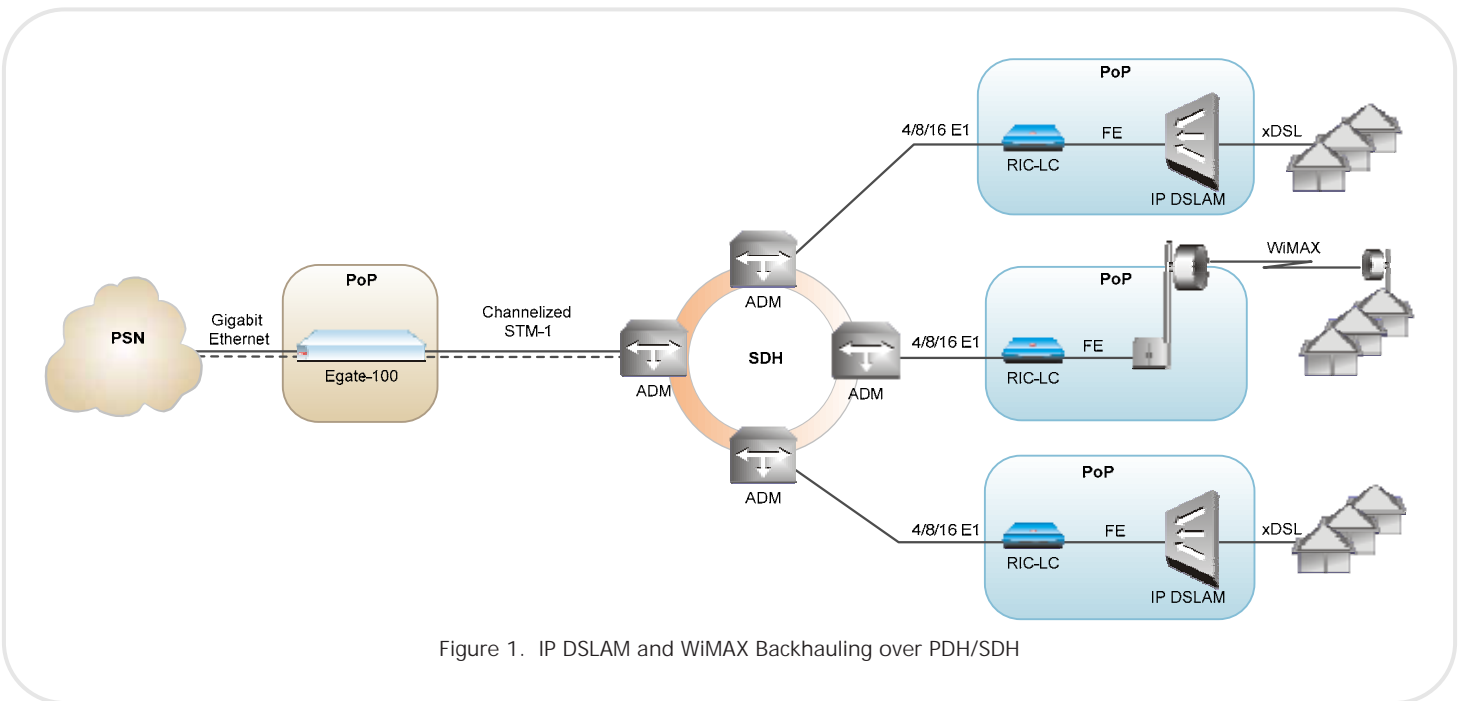

Figure 1. IP DSLAM and WiMAX Backhauling over PDH/SDH

Specifications

E1 INTERFACE

Number of Ports
1, 4, 8 or 16

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

Data Rate
2.048 Mbps, framed

Line Code
HDB3

Line Impedance
120Ω, balanced

75Ω, unbalanced

System Clock
Internal or loopback timing

Connector
RJ-45, balanced

BNC, unbalanced (1-, 4- or 8-port options only; 16-port units are supplied with RJ-45 to BNC adapter cable)

VIRTUAL CONCATENATION GROUP

Number of VCGs
1

ETHERNET INTERFACE

Number of Ports
4

Port Combinations
4 built-in electrical
2 built-in electrical + 2 fiber optic (SFP)

SFPs
For full details, see the SFP Transceivers data sheet at www.rad.com

*Note: It is strongly recommended to order this device with **original** RAD SFPs **installed**. This will ensure that prior to shipping, RAD has performed comprehensive functional quality tests on the entire assembled unit, including the SFP devices. RAD cannot guarantee full compliance to product specifications for units using non-RAD SFPs.*

Type
10/100 Mbps, full/half duplex

Connector
RJ-45 for electrical (100BaseTx)
LC (SFP-based) for optical (100BaseFx)

Max Frame Size
2036 bytes

Compliance
Relevant sections of IEEE 802.3, 802.3u and 802.1p&q

INTERNAL BRIDGE

Operation Mode
VLAN-aware, VLAN-unaware

MAC Table Size
1024

Filtering and Forwarding
Transparent or filtered

Port-Based VLAN
Untagged, tagged

Number of VLANs
64

VLAN Range
1–4094

L2CP Handling
Transparent

TERMINAL CONTROL PORT

Type
RS-232C/V.24 (DCE asynchronous)

Data Rate
115.2 kbps

Connector
Mini USB, female

GENERAL

Diagnostics
Loopbacks on VCG or E1, ping

Indicators
PWR (green) – Power status
TST (green) – Self test status
ALM (red) – Alarm status

Power
Wide-range power supply:
AC/DC: 100 to 240 VAC or 48 to 60 VDC

Power Consumption
AC: 6W
DC: 5W

Physical
Height: 43.7 mm (1.7 in)
Width: 220 mm (8.6 in)
Depth: 170 mm (6.7 in)
Weight: 0.5 kg (1.1 lb)

Environment
Temperature: 0 to 50°C (32 to 122°F)
Humidity: Up to 90%, non–condensing

Figure 2. Extending Ethernet Services over Multiple E1 Circuits

RIC-LC

Ethernet Converter for Bonded PDH Circuits

Ordering

STANDARD CONFIGURATIONS

RIC-LC/E1/4UTP
RIC-LC/4E1/4UTP
RIC-LC/8E1/4UTP
RIC-LC/16E1/4UTP

SPECIAL CONFIGURATIONS

RIC-LC/!/$/@

Legend

!   PDH ports:
  E1   1×E1 port
  4E1   4×E1 ports
  8E1   8×E1 ports
  16E1   16×E1 ports

$ **E1 interface** (Default=balanced):
  U   Unbalanced

Note: 1-, 4- or 8-port options are supplied with BNC ports; 16-port units have RJ-45 ports and are shipped with RJ-45 to BNC cable adapter.

@   **Ethernet ports**:
  4UTP   4×10/100BaseT Ethernet ports
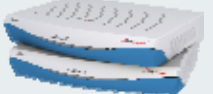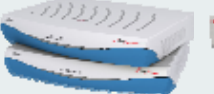 **2NULL2UTP** 2×10/100BaseT and 2×SFP (100Fx) ports

SUPPLIED ACCESSORIES

AC power cord

CBL-MUSB-DB9F
Mini USB control port cable

OPTIONAL ACCESSORIES

DC connection kit

RM-33-2
Hardware kit for mounting one or two units in a 19-inch rack

CBL-RJ45/2BNC/E1
RJ-45 to BNC adapter cable (if a 16-E1 port unit with unbalanced interfaces is ordered)

Table 1. RICi Family Product Comparison Table

Feature	RIC-LC (Ver. 1.0)	RICi-E1, RICi-T1 (Ver. 2.1)	RICi-E3, RICi-T3 (Ver. 1.1)	RICi-4/8 E1/T1 (Ver. 2.0)	RICi-16 (Ver. 2.5)
Protocol Type	GFP (G.7041), GFPoPDH (G.8040) VCAT (G.7043) LCAS (G.7042)	RAD HDLC HDLC IS GFP (G.7041) GFPoPDH (G.8040)	RAD HDLC X.86 (LAPS)	MLPPP (BCP)	GFP (G.7041), GFPoPDH (G.8040) VCAT (G.7043) LCAS (G.7042)
Fault Propagation	Yes	Yes	Yes	Yes	Yes
MAC Address Table	1024	512	512	2048	1024
QoS	Per port DSCP VLAN Priority (802.1p)	VLAN Priority (802.1p) IP Precedence	VLAN Priority (802.1p)	VLAN Priority (802.1p) DSCP Per port	VLAN Priority (802.1p) DSCP Per port
QoS Mechanism	Strict/WFQ	Strict	Strict	Strict	Strict/WFQ
Host VLAN	Yes	Yes	Yes	Yes	Yes
VLAN Stacking	Yes	Yes	Yes	Yes	Yes

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