

RICi-16

Ethernet over Bonded PDH Network Termination Unit



- Connects Ethernet traffic over up to 16 bonded E1 or T1 ports or up to two clear channel T3 ports using GFP, VCAT, and LCAS encapsulation and bonding protocols
- Connects Ethernet traffic over bonded T1s and legacy TDM T1s, over single channelized T3 interface
- Supports up to 16 GFP VCAT groups
- VLAN tagging, stacking, and stripping fully separate Ethernet user traffic from management data
- Fault propagation mechanism, initiating traffic to be rerouted upon error report
- Monitoring and diagnostic tools for quick fault isolation on TDM and Ethernet ports

Connect Fast Ethernet
LANs transparently to
a TDM infrastructure

EtherAccess

RICi-16 is a state-of-the-art network termination unit (NTU) connecting Fast Ethernet LANs over up to two bonded clear-channel T3 circuits. If only E1/T1 circuits are available, RICi-16 can connect Fast Ethernet LANs over up to 16 bonded E1/T1 circuits. Alternatively, RICi-16 can connect Ethernet over bonded T1s and TDM T1s using a single channelized T3 as uplink.

RICi-16 enables service providers to supply high-capacity Ethernet services to remote locations, and can be used to transparently connect corporate LANs over existing E1/T1 lines.

RICi-16 complies with RAD's unique set of EtherAccess™ features. This feature set provides services and carrier backhaul

applications over low and high-speed SDH/SONET and PDH circuits from fractional and full E1/T1, E3/T3 over STM-1/OC-3, STM-4/OC-12 to Ethernet networks.

ENCAPSULATION AND BONDING

The device's bonding function creates a scalable, virtual pipe comprised of up to 16 E1/T1 lines and up to two clear channel T3 lines.

RICi-16 uses the Ethernet over NG-PDH standards and applies the Generic Framing Procedure (GFP) to encapsulate the packet data, thus enabling efficient bandwidth



data communications

The Access Company

RICi-16

Ethernet over Bonded PDH Network Termination Unit

utilization and improving the latency for delay-sensitive applications. Virtual Concatenation (VCAT) is used to bond the required PDH connections for transmitting data, providing flexible bandwidth for different applications and using the Link Capacity Adjustment Scheme (LCAS) to ensure seamless PDH capacity changes without affecting traffic and error handling on individual E1/T1 links.

RICi-16 supports up to 16 GFP VCAT groups (VCG), allowing the connection of up to 16 different customers per site.

Standard bonding and encapsulation protocols make RICi-16 interoperable with third-party devices.

Typical applications include:

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

TRAFFIC SEPARATION

VLAN stacking and stripping option at ingress and egress enables transporting user traffic transparently, keeping the user VLAN settings intact. In addition, the management traffic can be tagged with a different VLAN, fully separating user traffic from management data.

QUALITY OF SERVICE - QOS

The VLAN priority bits (802.1p), DSCP, and per port priority schemes enable users to

define four QoS levels according to application requirements, providing high priority to real-time applications such as voice and video.

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

The device is managed inband from the Fast Ethernet user ports or remotely through the TDM port. Access is available using Telnet, Web browser, and SNMP (RADview-EMS). Management traffic and user Ethernet traffic are transported together on the same Ethernet flow, separated by different VLANs. Local management is performed via an ASCII terminal.

DELAY COMPENSATION

The device compensates for a differential delay of up to 250 ms on E1/T1 links and 217 ms on T3 links.

LOOP DETECTION

E1/T1 loops are immediately detected, and the E1/T1 link is not added to the VCAT LCAS group, avoiding the resulting Ethernet loops and Ethernet storms. RICi-16 automatically recovers when the loop clears.

FAULT PROPAGATION

The fault propagation mechanism enables routers and switches connected to both ends of the link to reroute the traffic to alternative paths.

If a failure is detected on the first GFP port, the fault propagation mechanism deactivates the Fast Ethernet link and reports the error to the Ethernet network.

ENVIRONMENT

The RICi-16 unit is available as a temperature-hardened device, extending the permitted operating temperature range to -22° to 65°C (-7.6° to 149°F).

Specifications

E1 INTERFACE

Number of Ports

4, 8, or 16

Compliance

G.703

G.704

Data Rate

2.048 Mbps

Line Code

HDB3, AMI

Framing

Framed (G732N with CRC)

Line Impedance

120Ω, balanced

75Ω, unbalanced (via adapter cable)

Connector

RJ-45, balanced

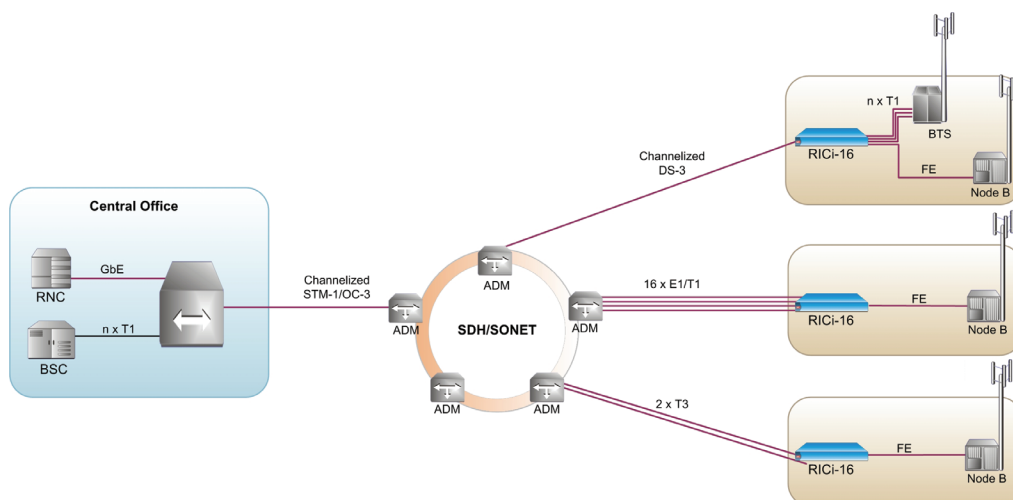


Figure 1. -Ethernet Cellular backhauling over PDH/SONET/SDH

System Clock

Internal or loopback timing

T1 INTERFACE

Number of Ports

4, 8, or 16

Compliance

T1.403

Data Rate

1.544 Mbps

Line Code

B8ZS, AMI

Framing

ESF

Line Impedance

100Ω, balanced

System Clock

Internal or loopback timing

Connector

RJ-45

T3 INTERFACE

Number of Ports

1 (channelized)
2 (clear channel)

Compliance

T1.102, T1.107

Data Rate

44.736 Mbps

Line Code

B3ZS

Framing

M23 or C-bit parity

Line Impedance

75Ω, unbalanced

System Clock

Internal or loopback timing

Connector

BNC

WAN PROTOCOL

Encapsulation

GFP (G.7041)
GFPoPDH (G.8040)

Bonding

VCAT (G.7043) – Up to 16 VCAT groups
LCAS (G.7042)

Delay Compensation

Up to 250 ms for E1/T1 ports
Up to 217 ms for clear channel T3 ports

ETHERNET INTERFACE

Number of Ports

3 or 4, according to port combination

Port Combinations

4 built-in electrical
2 built-in electrical + 1 fiber optic (SFP)

Type

10/100 Mbps, autonegotiation, full/half duplex, flow control

Max Frame Size

1700 bytes

Compliance

IEEE 802.3 and 802.3u, relevant sections

INTERNAL BRIDGE

LAN Table

Up to 2018 MAC addresses (learned) and 30 static addresses

Operation Mode

VLAN-aware, VLAN-unaware

Filtering and Forwarding

Transparent or filtered

TERMINAL CONTROL PORT

Type

RS-232/V.24 (DCE asynchronous)

Data Rate

9.6, 19.2, 115.2 kbps

Connector

9-pin, D-type, female

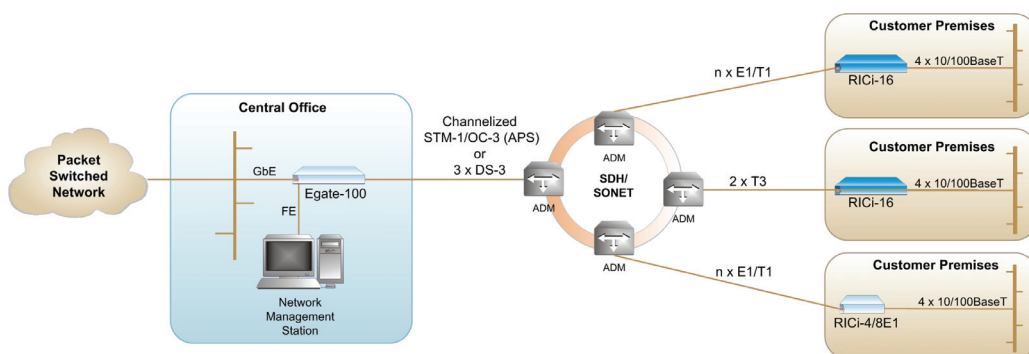


Figure 2. Ethernet Services over PDH/SONET/SDH Using Egate-100

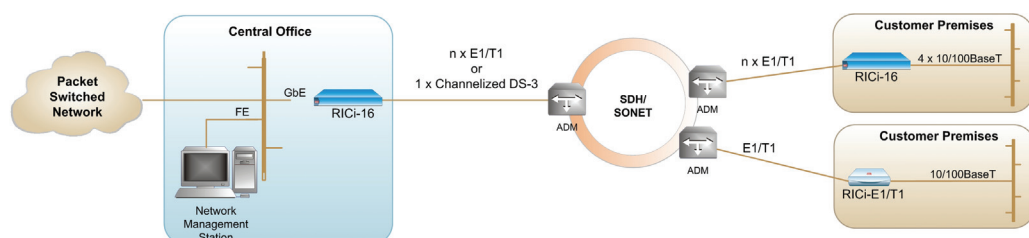


Figure 3. Ethernet Services over PDH/SONET/SDH Using RICI-16 as Aggregator

RICi-16

Ethernet over Bonded PDH Network Termination Unit

GENERAL

Diagnostics

Remote loopbacks on E1, T1, T3 interfaces

Indicators

PWR (green, per power supply) – Power status

TST (yellow) – Self test status

ALM (red) – Alarm status

Power

Wide-range AC/DC:

100–240 VAC, 50/60 Hz or
48/60 VDC nominal (40–72 VDC)

Power Consumption

13W max

Physical

Height: 43.7 mm (1.7 in) 1U

Width: 440.0 mm (17.3 in)

Depth: 240.0 mm (9.4 in)

Weight: 3.0 kg (6.6 lb)

Environment

Temperature:

Standard enclosure:
0 to 50°C (32 to 122°F)

Temperature-hardened enclosure:
-22° to 65°C (-7.6° to 149°F)

Humidity: Up to 90%, non-condensing

Ordering

RICi-16E1/B//\$/?

RICi-16T1+/B//?

Legend

+ T3 interface (Default=No T3 ports):

T3 Two T3 ports

Note: If T3 interface is ordered, the unit is supplied with 16 T1 ports.

B Number of E1/T1 ports (Default=16 ports):

4 Four E1/T1 ports

8 Eight E1/T1 ports

| Number of power supplies (Default=Single power supply):

R Dual power supplies

\$ E1 Interface type (Default=Balanced):

U Unbalanced E1 interface via RJ-45 to BNC adapter cable

? Temperature range (Default=Normal temperature range, not NEBS compliant):

H Temperature-hardened, compliant with NEBS level 3, types 2, 3, and 4

SUPPLIED ACCESSORIES

AC power cord

DC power connection kit

CBL-RJ45/2BNC/E1

RJ-45 to BNC adapter cable (if unbalanced E1 interface is ordered)

RM-34

Hardware kit for mounting one RICi-16 unit in a 19-inch rack

OPTIONAL ACCESSORIES

CBL-DB9F-DB9M-STR

Control port cable

WM-34

Hardware kit for mounting one RICi-16 unit on a wall

OP-34-PS

Spare wide-range power supply module (100–240 VAC/ –48 VDC)

RICi Family Product Comparison Table

Feature	RICi-E1, RICi-T1 (Ver. 2.1)	RICi-E3, RICi-T3 (Ver. 1.1)	RICi-4E1, RICi-4T1 RICi-8E1, RICi-8T1 (Ver. 2.0B)	RICi-16 (Ver. 2.1)
Protocol Type	RAD HDLC HDLC IS GFP (G.8040, G.7041/Y.1303)	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
MAC Address Table	512	512	2048	2048
QoS	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	Strict	Strict	Strict
Host VLAN	Yes	Yes	Yes	Yes
VLAN Stacking Support	Yes	Yes	Yes	Yes

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 America Headquarters

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

www.rad.com



data communications

The Access Company