

# LA-130

## DSL Cell-Site Gateway



Reduces cellular backhaul OPEX by efficiently transporting 2G, 3G and HSDPA services over IP or ATM-based DSLAM infrastructure



- Equipped with 4 E1 ports towards the cell site, individually software configurable as TDM, ATM UNI or ATM IMA
- Supports IMA or physical-layer bonding of SHDSL.bis up to 20 Mbps
- Ideal solution for HSDPA offload over ADSL2+
- Standard pseudowire encapsulation techniques: ATMoPSN, CESoPSN and SAToP
- High precision clock recovery via ACR (Adaptive Clock Recovery) or NTR (Network Time Reference)

LA-130 delivers TDM and ATM services over ATM and packet-switched networks. It aggregates and optimizes TDM and ATM traffic over DSL link in 2G and 3G cellular backhaul applications.

### PSEUDOWIRE CAPABILITIES

LA-130 converts the data stream from its ATM UNI, ATM IMA or TDM ports into packets with an MPLS frame format. These packets are transmitted over the PSN network via LA-130's DSL port. A remote pseudowire device converts the packets back to their native format.

### PSEUDOWIRE FUNCTIONALITY

A proper balance between PSN throughput and delay is achieved via a configurable packet size.

A jitter buffer compensates for packet delay variation (jitter) of up to 60 milliseconds in the network.

### ATM OVER PSN CAPABILITIES

LA-130 utilizes up to four pseudowire (PW) connections to emulate 3G ATM services over packet-switched networks.

The following encapsulation methods are supported according to draft-ietf-pwe3-atm-encap:

- 1:1 VP – Each VP is mapped to a single PW connection
- N:1 VP – Several VPs are mapped to a single PW connection.

LA-130 allows single or multiple cells to be encapsulated per frame.



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### TDM OVER PSN CAPABILITIES

LA-130 allows 2G cellular traffic to be carried over packet switched networks.

To compensate for the jitter caused by the packet-switched network, each TDM stream has a jitter buffer of up to 60 milliseconds.

The following encapsulation techniques are employed:

- CESoPSN
- SAToP
- TDMoIP

### TIMEOUT MECHANISM

A built-in timer determines the time to forward a PW frame regardless whether the max number of cells per frame has been reached or not.

### PACKET REORDERING

LA-130 features a mechanism that reorders packets when they arrive in an incorrect order.

### PSEUDOWIRE QoS/CoS

Ethernet networks – outgoing pseudowire packets are assigned a dedicated VLAN ID according to 802.1Q and marked for priority using 802.1p bits. Pseudowire traffic can be classified into 3 different classes (queues), which are then transmitted towards the network based

on the WFQ (weighted fair queuing) algorithm MPLS networks – outgoing pseudowire packets are assigned to a specific MPLS tunnel and marked for priority using EXP bits MPLS networks – outgoing pseudowire packets are assigned to a specific MPLS tunnel and marked for priority using EXP bits.

### PSEUDOWIRE OAM

Pseudowire connectivity is verified using the Virtual Circuit Connection Verification BFD (VCCV-BFD) mechanism. It provides low-overhead, low-latency detection of faults even on physical media that do not support failure detection of any kind.

### ATM CAPABILITIES

Four ATM cross-connections link the user interfaces to the network.

Using LA-130, operators can assign each virtual connection (VC) or virtual path (VP) to a service class, define the QoS parameters and shape the ATM egress traffic accordingly.

LA-130 performs traffic scheduling according to CBR, VBR, UBR and UBR+.

### ATM OAM

OAM is provided according to ITU I.610 requirements:

- F4 and F5 OAM
- AIS and RDI cell detection and

generation upon physical layer and ATM layer failures

- CC cell generation and LOC state detection per VP/VC
- Periodic loopbacks.

### NETWORK INTERFACE

The network port uses the IMA or multipair bonding technologies. The data is sent over 4 x 2-wire SHDSL/SHDSL.bis lines at a combined data rate of up to 9.2 Mbps (Annex A, B) or 20 Mbps (Annex F, G). Table 1 and Table 2 detail typical SHDSL ranges.

LA-130 is also available with the ADSL interface (Annex A/B, ADSL2 or ADSL2+). Table 3 and Table 4 detail typical ADSL ranges.

### E1 INTERFACE

LA-130 features four E1 ports with balanced or unbalanced (via an adapter cable) interfaces.

The E1 interfaces operate in ATM UNI, IMA, or TDM modes:

- Using structured CES in TDM mode, LA-130 transmits each E1 bundle over a separate PVC or PW. Up to 4 E1 TDM ports are supported.
- LA-130 transparently transfers the ATM-based E1 UNI services at the rate of 1984 kbps.

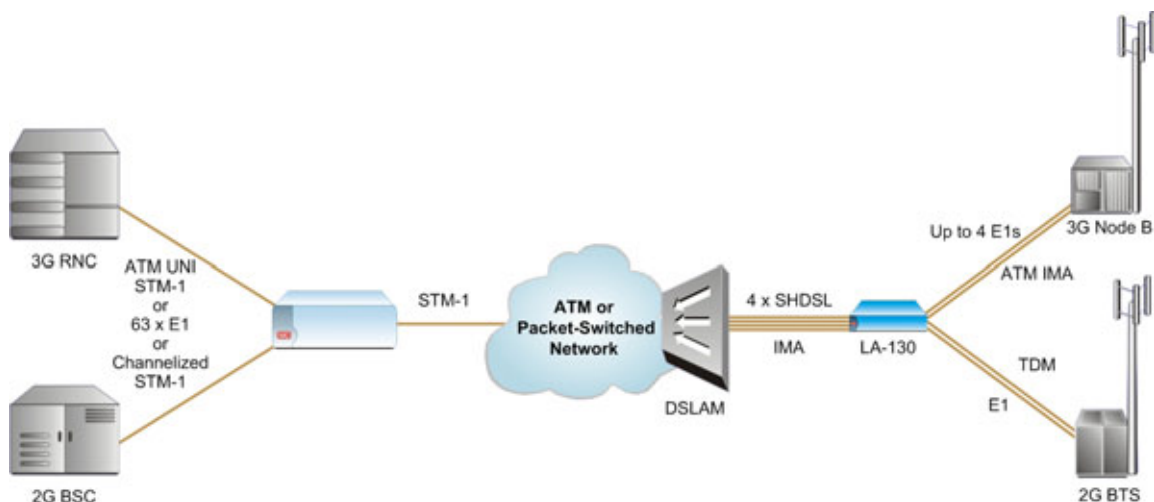


Figure 1. Backhauling 2G/3G Cellular Traffic over an ATM or Packet-Switched Network

- Up to 4 E1 UNI links can be bonded using IMA technology.

### ETHERNET INTERFACE

LA-130 includes one or four Ethernet 10/100BaseT interface with autonegotiation support.

The LA-130 Ethernet interface operates as a self-learning media access bridge.

The Ethernet traffic can be classified according 802.1p, IP precedence, ToS or DSCP. The traffic classes are mapped, using the ATM CoS or WFQ mechanism. LA-130 supports up to 8 QoS rules.

### ENVIRONMENT

LA-130/H is a temperature-hardened version intended for industrial installations.

### SYSTEM TIMING

LA-130 supports flexible timing modes for hierarchical timing distribution in the network.

The LA-130 master clock can be locked to the following sources:

- Internal – Provided by the internal oscillator
- Received – Locked to the Rx clock of an E1 CES port or an IMA group. The IMA group, providing clock reference consists of the user E1 UNI links or network SHDSL link (NTR clock).
- Recovered – Derived from the network via a bundle (MS over ATM mode) or a PW (MS over PSN mode).

### MANAGEMENT

LA-130 can be configured and monitored locally via an ASCII terminal, or remotely via Telnet, Web browser or RADview.

Management traffic can run over a dedicated VLAN or dedicated ATM VCC.

Software download is performed via the local terminal, using XMODEM, or remotely, using TFTP.

Different stations can manage LA-130 simultaneously, enabling monitoring of the network status from different locations.

### OAM AND DIAGNOSTICS

LA-130 collects performance monitoring statistics at the physical and ATM layers of the network and user interfaces. It also provides statistics for individual connections (AAL1, AAL5).

Comprehensive diagnostic capabilities include:

- Physical loopbacks on the network and user interfaces
- OAM loopback on a VCC
- Ping for IP connectivity checks.

LA-130 stores up to 200 alarms detected during its operation in a buffer.

## Specifications

### ATM INTERFACE

#### Type

UNI per ATM User-Network Interface (UNI) Specification (Version 3.1) for PVCs only

#### AAL Support

- AAL1 (CES)
- AAL5

#### Traffic Shaping

Per VC

#### ATM Service Categories

CBR, VBR, UBR+, UBR

#### F5 OAM Cells

Per ITU-T Rec. I.610

#### VPI Range

0–31

#### VCI Range

0–255

#### Maximum Number of XCs

4

### ATMoPSN FUNCTIONALITY

#### Standard Compliance

RFC 4717

#### PW Types

1:1 VP, N:1 VP

#### Number of PW Connections

4

#### Jitter Buffer Size

1–60 msec with 1 msec granularity

### TDMoPSN FUNCTIONALITY

#### Standard Compliance

- IETF: RFC 4553 (SAToP), RFC 5086 (CESoPSN), RFC 5087 (TDMoIP)
- MFA: IA 4.0

#### PW Types

CESoPSN, SAToP, TDMoIP

#### Number of PW Connections

4

### SHDSL INTERFACE

#### Standard

G. 991.2 (SHDSL, SHDSL.bis)

#### Line Code

TC-PAM

#### Line Rate per Link

Up to 2312 kbps (Annex A, Annex B)  
Up to 5696 kbps (Annex F, Annex G)

#### Handshake Protocol

ITU-T Rec. G994.1

#### EOC Support

Mandatory

#### Connector

RJ-45

Table 1. Typical Ranges for SHDSL Annex A, B (4-Wire 26 AWG, per Port)

| Data Rate | Range |      |
|-----------|-------|------|
|           | [km]  | [mi] |
| [kbps]    |       |      |
| 384–512   | 5.2   | 3.2  |
| 576–832   | 4.9   | 3.0  |
| 896–1152  | 4.6   | 2.8  |
| 1216–1344 | 4.5   | 2.7  |
| 1408–1856 | 4.0   | 2.4  |
| 1920–2176 | 3.7   | 2.2  |
| 2304      | 3.5   | 2.1  |
| 2312      | 3.8   | 2.3  |

Table 2. Typical Ranges for SHDSL Annex F, G (2-Wire 26 AWG)

| Data Rate<br>[kbps] | Range |      |
|---------------------|-------|------|
|                     | [km]  | [mi] |
| 768-1024            | 5.5   | 3.4  |
| 2048                | 5.0   | 3.1  |
| 2560                | 4.7   | 2.9  |
| 3072                | 4.4   | 2.7  |
| 2584                | 4.1   | 2.5  |
| 3818                | 4.0   | 2.4  |
| 4096                | 3.9   | 2.4  |
| 4608                | 3.5   | 2.1  |
| 5120                | 3.4   | 2.1  |
| 5696                | 3.1   | 1.9  |

**Note:** The values in Table 1 and Table 2 represent the data rates of a single pair.

## IMA BONDING

### Type

IMA over 4 × 2-wire, per ATM Forum 1.0 (AF-PHY-0086.000) or ATM Forum 1.1 (AF-PHY-0086.001)

### Data Rate

Up to 9.2 Mbps (Annex A, B)  
Up to 20 Mbps (Annex F, G)

## M-PAIR BONDING (PHYSICAL)

### Number of Pairs

2, 3 or 4

### Data Rate

Up to 9.2 Mbps (Annex A, B)  
Up to 20 Mbps (Annex F, G)

## ADSL INTERFACE

### Type

- ADSL: ITU-T Rec. G.992.1 Annex A and B
- ADSL2: ITU-T Rec. G.992.3 Annex A and B
- ADSL2+: ITU-T Rec. G.992.5 Annex A and B

### Line Code

DMT

### Data Rate

ADSL:

- Downstream: up to 8 Mbps

- Upstream: 1 Mbps

ADSL2:

- Downstream: 12 Mbps

- Upstream: 1 Mbps

ADSL2+:

- Downstream: 24 Mbps

- Upstream: 1 Mbps

### Connector

RJ-45

Table 3. Typical Ranges for ADSL2+ Annex A (2-Wire 26 AWG)

| Data Rate<br>[kbps] |            | Range |      |
|---------------------|------------|-------|------|
| Upstream            | Downstream | [km]  | [mi] |
| 1140                | 24720      | 0.2   | 0.1  |
| 1145                | 20500      | 1.2   | 0.7  |
| 1130                | 16565      | 1.7   | 1.0  |
| 1110                | 10595      | 2.5   | 1.5  |
| 970                 | 5935       | 3.2   | 2.0  |
| 765                 | 4070       | 3.7   | 2.3  |

Table 4. Typical Ranges for ADSL2+ Annex B (2-Wire 26 AWG)

| Data Rate<br>[kbps] |            | Range |      |
|---------------------|------------|-------|------|
| Upstream            | Downstream | [km]  | [mi] |
| 1160                | 24240      | 0.05  | 0.03 |
| 1160                | 22770      | 0.5   | 0.3  |
| 1045                | 21050      | 1.0   | 0.6  |
| 915                 | 17605      | 1.5   | 0.9  |
| 900                 | 13560      | 2.0   | 1.2  |
| 745                 | 9230       | 2.5   | 1.5  |
| 585                 | 5990       | 3.0   | 1.8  |
| 395                 | 3795       | 3.5   | 2.1  |

## E1 INTERFACE

### Number of Ports

4

### Data Rate

2.048 Mbps ±32 ppm

### Compliance

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

### Operation Mode

CES, ATM UNI, ATM IMA

### Receive Input Level

0 to -43 dB  
0 to -12 dB

### Transmit Output Level

±3V ±10%, balanced  
±2.37V ±10%, unbalanced

### Line Code

HDB3, AMI

### Framing

Unframed  
G732N with or without CRC-4  
G732S with or without CRC-4  
UNI (multiframe or non-multiframe)

### Line Impedance

120Ω, balanced  
75Ω, unbalanced

### Receive Input Level

0 to -43 dB  
0 to -12 dB

### Transmit Output Level

±3V ±10%, balanced  
±2.37V ±10%, unbalanced

### Jitter

ITU-T Rec. G.823

### Connectors

RJ-45, balanced  
BNC, unbalanced (via adapter cable)

## GENERAL

### Timing

Locked to the Rx clock of an E1 port or an IMA group TRL

Recovered from the network  
(ordering option)

Internal

### Management

SNMPv1  
Telnet  
RADview  
ASCII terminal via V.24 (RS-232) DCE port

### Terminal Control Port

Type: V.24 (RS-232) async DCE

Baud rate: 0.3- 115.2 kbps

Connector: 9-pin D-type female

# LA-130

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### LED Indicators

- PWR (green) – Power status
- ALM (red) – Alarm status
- SYNC SHDSL 1, 2, 3, 4 (red/green) – SHDSL interface synchronization status
- E1 1, 2, 3, 4 LOC (red) – Local loss of E1 synchronization
- E1 1, 2, 3, 4 REM (red) – Remote loss of E1 synchronization
- ETH LINK (green) – Ethernet link status
- ETH ACT (yellow) – Ethernet activity status

### Power

Wide range power supply:  
100–240 VAC, 48/60 VDC nominal (40 to 72 VDC)

### Power Consumption

8W max

### Physical

Height: 47 mm (1.8 in)  
Width: 215 mm (8.4 in)  
Depth: 300 mm (11.8 in)  
Weight: 2.4 kg (5.3 lb)

### Environment

Temperature:  
LA-130: 0 to 50°C (32 to 122°F)  
LA-130/H: -20 to 65°C (-4 to 149°F)  
Humidity: Up to 90%, non-condensing

Cell-Site Gateway Comparison Table

|                                 | LA-130<br>(Ver. 4.5)               | ACE-3100<br>(Ver. 5.0)                     | ACE-3200<br>(Ver. 5.0)                     |
|---------------------------------|------------------------------------|--|--|
| STM-1/OC-3c traffic aggregation | –                                  | ✓  | ✓  |
| E1 ports                        | 4                                  | 0 or 4, built-in                           | 8 or 16, built-in                          |
| T1 ports                        | –                                  | 0 or 4, built-in                           | 8 or 16, built-in                          |
| ATM-155 ports                   | –                                  | 1 or 2, built-in                           | 0 or 2, built-in                           |
| SFPs for ATM-155 ports          | –                                  | ✓  | ✓  |
| DSL ports                       | SHDSL/SHDSL.bis, ADSL/ADSL2/ADSL2+ | –  | –  |
| NTR clock recovery              | ✓                                  |  |  |
| Fast Ethernet ports             | 1 or 4                             | 2 for PSN traffic and/or inband management | 2 for PSN traffic and/or inband management |
| SFPs for FE ports               | –                                  | ✓ (optional)                               | ✓ (optional)                               |
| PSN clock distribution          | –                                  | ✓  | ✓  |
| PSN clock recovery              | ✓                                  | ✓  | ✓  |
| APS on ATM-155 ports            | –                                  | ✓  | ✓  |
| Max. ATM VCCs                   | 4                                  | 128  | 128  |
| Max. remote PSN peers           | 4                                  | 32   | 32   |
| Power supply                    | Single, fixed                      | Single, fixed                              | Single/dual, fixed                         |
| Physical width                  | 8.5"                               | 8.5"                                       | 17.3"                                      |
| Physical height                 | 1U                                 | 1U   | 1U   |

## LA-130

## DSL Cell-Site Gateway

## Ordering

LA-130/\$/E1/#/@/\*/!

## Legend

\$ Network interface type:

**SHDSL** SHDSL**1+A** One ADSL2+ Annex A port**1+B** One ADSL2+ Annex B port

# Number of Ethernet ports:

**ETH** One 10/100BaseT**4ETH** Four 10/100BaseT

@ Functionality type:

**BASIC** Non-upgradeable to PW functionality unit with 4 UNI/IMA E1 ports**PACK1** Software upgrade for enabling pseudowire functionality

*Note: If no functionality type is specified, LA-130 is supplied as an ATM-only unit. It can be upgraded to the pseudowire functionality by ordering the PACK1 software package.*

\* Recovered clock capability:

**A** Advanced adaptive clock for the PACK1-type units

*Note: Adaptive clock functionality is not available for units with ADSL2+ interface.*

! Unit type:

**H** Temperature-hardened unit

## SUPPLIED ACCESSORIES

Power cord

DC adapter plug

## OPTIONAL ACCESSORIES

**CBL-RJ45/2BNC/E1**

RJ-45 to BNC adapter cable

**CBL-DB9F-DB9M-STR**

Control port cable

**WM-35**

Hardware kit for mounting one LA-130 unit on a wall

**RM-35/@**

Hardware kit for mounting one or two LA-130 units into a 19-inch rack

@ Rack mounting kit type:

**P1** Mounting one unit**P2** Mounting two units**LA-130-SW/PACK1**

Software upgrade pack for enabling pseudowire functionality

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data communications

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