

LA-110



Advanced Integrated Access Device



Link
Access

FEATURES

- Advanced Integrated Access Device providing voice, data and LAN services over ATM and packet-switched networks (PSN)
- Wide range of services:
 - Leased lines
 - Pseudowire (CESoPSN)
 - E1 (CES, PRI, UNI)
 - High-speed data (serial and Frame Relay)
 - Ethernet with MAC bridge and IP router
 - Voice, such as ISDN BRI, PRI or FXS
 - 2G and 3G cellular backhaul
- Network interface:
 - ADSL
 - Single 2-/4-wire SHDSL
 - IMA (Inverse Multiplexing over ATM) over 4 × 2-wire SHDSL
 - E1
- Emulated services over PSN
- Traffic shaping for reliable service and optimal ATM uplink utilization
- AAL1, AAL2 and AAL5 adaptation layers
- Up to 8 connections on the ATM side
- LAN port providing bridge (VLAN-aware/unaware, QoS) or IP router (DHCP server/relay, different address translation services, DNS relay, firewall and PBR) functionality
- RADIUS client for secured access
- Data port with V.35 or X.21 physical interface supporting transparent or Frame Relay services
- Voice ports with four FXS or ISDN S0 BRI interfaces employing toll-quality 64-kbps PCM modulation or 32-kbps ADPCM encoding
- E1 user port supporting AAL1 (CES, DB-CES, UNI) or AAL2 (LES) operation
- Flexible system timing:
 - NTR
 - Received from the E1 uplink or user port
 - Adaptive
 - Internal
- Extended management capabilities:
 - Local out-of-band management via an ASCII terminal connected to the RS-232 port
 - Remote out-of-band management via the LAN port
 - Remote inband management via the ATM uplink
- Plug & Play installation
- Comprehensive diagnostics:
 - Collection of application layer performance statistics
 - ATM layer performance statistics and control (OAM support)
 - Physical layer diagnostics: loopback tests and performance statistics
- Compact 8.5-inch wide enclosure

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DESCRIPTION

- LA-110 is an advanced Integrated Access Device (IAD) offering voice, data and LAN services extension over ATM or packet-switched networks.
- The services supported by LA-110 include:
 - High-quality leased lines over E1 or serial data links
 - E1 (CES, PRI, UNI)
 - Cellular backhaul
 - High-speed data (transparent and Frame Relay)
 - Ethernet with MAC bridge and IP router
 - Voice, such as ISDN BRI, PRI or FXS.

NETWORK INTERFACE

- LA-110 has one network port, that can be ordered with one of the following interfaces:
 - Single 2- or 4-wire SHDSL interface
 - IMA over 4 × 2-wire SHDSL for a combined data rate of up to 9.2 Mbps and extended range
 - ADSL interface (Annex A)
 - E1 interface.

- The UNI network interface supports the following ATM adaptation layers:
 - AAL1 – for transparent transport of serial data streams, and for circuit emulation services (CES)
 - AAL2 – for providing ATM Forum Loop Emulation Services (LES) that support PSTN and ISDN BRI and PRI access
 - AAL5 – for packet traffic (Frame Relay, Ethernet, IP).
- The network interface supports the following classes of service: CBR, VBR, UBR and UBR+.
- Per-connection user-configurable traffic shaping and traffic contract enforcing ensure improved QoS and efficient utilization of the ATM uplink bandwidth.

LAN INTERFACE

- The LAN interface is an Ethernet 10/100BaseT port with autonegotiation support.
- The LAN interface can be configured to operate as a MAC bridge or an IP router.
- In bridge mode the LA-110 LAN interface operates as a self-learning media access bridge. The MAC bridge is user-configurable to VLAN-aware and VLAN-unaware modes with flow control according to IEEE 802.3x requirements.
- In bridge mode, the LAN 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-110 supports up to eight QoS rules.

- When configured to operate as an IP router, LA-110 supports:
 - 1–2 IP networks (sharing the same physical LAN interface)
 - 1–8 WAN ports, each using its own PVC
 - An optional host interface for router management.
- The router uses static routing entries or RIP I/II for routing decisions. It can also use policy-based routing (PBR) for defining user-specific routing rules, overriding the routing table settings.
- In IP router mode, LA-110 performs encapsulation per RFC2684, or transfers the traffic using PPPoA (with PAP and CHAP authentication).
- LA-110 serves as a DNS relay, exchanging DNS requests and replies between its hosts and the DNS server.
- A firewall can be set on each one of the router interfaces (WAN, LAN) for filtering inbound or outbound traffic.
- LA-110 can be configured as a DHCP server or to DHCP relay mode.
- When operating opposite a RADIUS server, LA-110 performs client authentication.
- The IP router provides up to 20 NAT/NAPT translations. Each translation can be applied to a WAN or LAN port.

APPLICATIONS

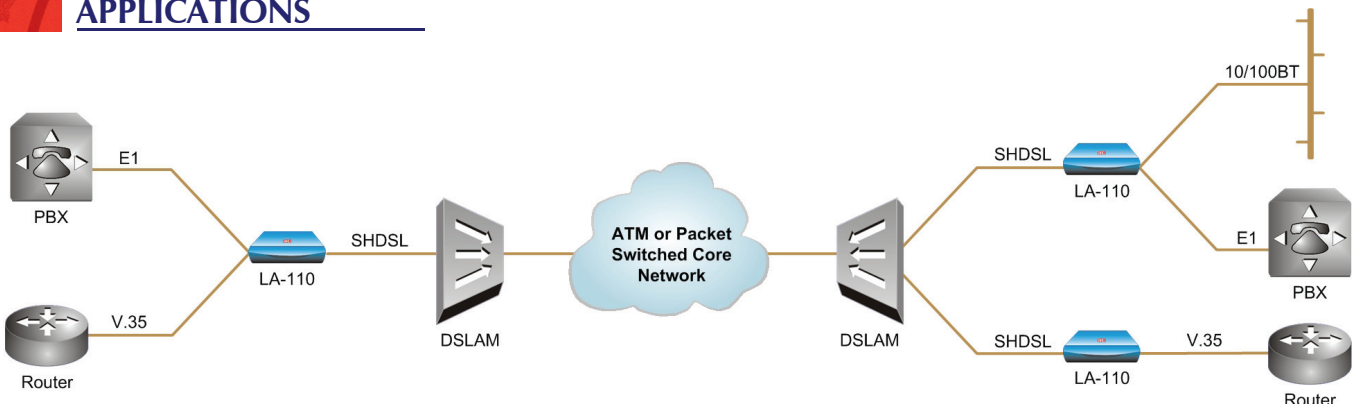


Figure 1. Providing Leased Line Services over ATM or Packet-Switched Network

DATA INTERFACE

- The LA-110 data port is a synchronous serial DCE port, supporting V.35 and X.21 interfaces. The data port operates at the rates of $N \times 64$ kbps in the range of 64 to 2048 kbps.
- The data payload is processed in accordance with the user-selectable application mode: AAL1 or Frame Relay.
- In AAL1 mode, the data stream is transferred transparently at the CBR service category. The AAL1 stream mode supports any Layer 2 protocol.
- When the LA-110 data port operates in Frame Relay mode, the traffic is carried over AAL5, at the user-configurable ATM service category.
- LA-110 supports up to 8 DLCIs.
- The Frame Relay interworking mode can be configured to:
 - Service interworking per FRF.8
 - Network interworking per FRF.5.

FXS INTERFACE

- LA-110 can be ordered with four independent FXS analog voice interfaces, for direct connection to subscriber POTS phone, fax or voiceband modem equipment. Each port provides power feed and ringing to the subscriber equipment.

- The input and output audio levels of each channel are user-selectable. The signals are encoded by a PCM codec, using 64-kbps PCM encoding per ITU-T Rec. G.711, enabling transparent transfer of DTMF signaling, Group III fax signals and voiceband modem signals.
- Each channel includes a near-end echo canceller. The echo canceller can be disabled when processing fax or modem signals.
- For compatibility with national implementations, the PSTN signaling characteristics are user-selectable.
- The transport of analog voice requires LES over AAL2, which allows several voice connections to share the same VC. The ELCP can also be used.

ISDN INTERFACE

- Four independent ISDN BRI S0 interfaces comply with ETSI 300012 and ITU-T Rec. I.430. The interface characteristics are compatible with many types of ISDN switches, including NTT, 5ESS, DMS-100 and NI1.
- The ISDN interface operates in NT (Network Termination) mode, enabling direct connection of ISDN terminal equipment to "S" ports.
- The ISDN ports require use of LES over AAL2, allowing several connections to share the same VC. The ELCP can also be used. The signaling information carried by the multiplexed 64-kbps D channel is transported transparently to the voice gateway.

E1 AND T1 USER INTERFACE

- LA-110 can be ordered with one user E1 or T1 port with balanced or unbalanced (E1) interfaces.
- The E1 interface supports the following framing modes:
 - G732S
 - G732N
 - Unframed
 - ISDN PRI (AAL2 only)
 - E1 ATM UNI.
- In AAL1 mode, LA-110 uses the following transmission methods:
 - Structured CES, transmitting each E1 bundle over a separate PVC
 - Dynamic bandwidth allocation (DB-CES) for detecting voice channel activity and allocating uplink bandwidth accordingly.
- In AAL2 mode, LES is used for voice support, with or without ELCP. Application identifiers determine the signaling methods:
 - CAS
 - PSTN signaling
 - DSS1 for ISDN BRI and PRI
 - ISDN PRI remote access with ELCP.
- LA-110 transparently transfers the ATM-based E1 UNI services at the rate of 1984 kbps.
- The balanced T1 user interface offers the same transmission and signaling methods as the E1 user interface.

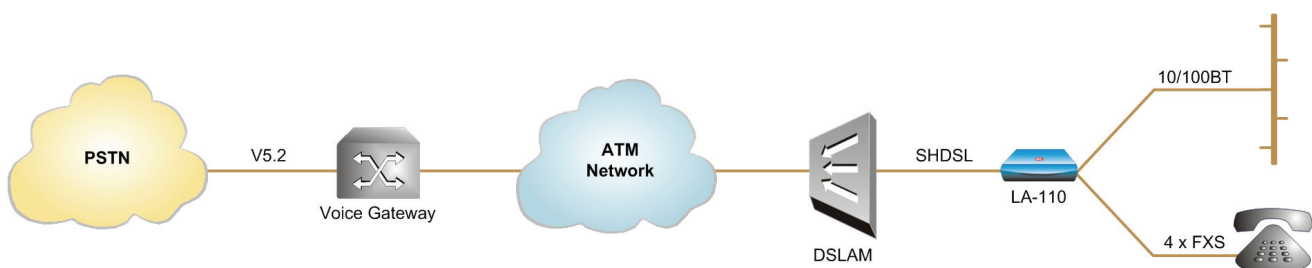


Figure 2. Providing VoDSL Using LES over AAL2

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TIMING MODES

- LA-110 supports flexible timing modes for hierarchical timing distribution in the network.
- The LA-110 system timing can be locked to the following sources:
 - NTR – LA-110 locks its timing reference to the DSLAM clock
 - Received – LA-110 receives the clock from the E1 equipment
 - Adaptive – the LA-110 clock is locked to an average arrival rate of the ATM cells carrying voice channels
 - Internal – LA-110 uses the clock generated by its internal oscillator.

MANAGEMENT CAPABILITIES

- The unit can be managed using different ports and applications:
 - Local out-of-band management via an ASCII terminal connected to the RS-232 port
 - Remote out-of-band management via the LAN port
 - Remote inband management via the ATM uplink. Remote management is performed using Telnet, Web browser or RADview-Lite, RAD's SNMP-based management access system.
- Different stations can manage LA-110 simultaneously, enabling monitoring the network status from different locations.

PLUG & PLAY

- LA-110 supports automatic configuration from a remote location. Once the unit is installed, it needs only to be powered up. It then automatically receives its management IP address, and all the configuration procedures can be performed from the remote location.

DIAGNOSTICS

- LA-110 collects performance monitoring statistics at the physical and ATM layers for 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-110 stores alarms detected during its operation in a buffer holding up to 200 alarms.

SPECIFICATIONS

NETWORK SIDE

ATM INTERFACE

- **Type**
UNI per ATM User-Network Interface (UNI) Specification (Version 3.1) for PVCs only
- **AAL Support**
 - AAL1 (CES and DB-CES)
 - AAL2 (LES and ELCP)
 - 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 VCs**
8

SHDSL INTERFACE

- **Type**
 - Single 2-wire or 2/4-wire per ITU-T Rec. G.991.2, Annex A
 - IMA over 4 × 2-wire, per ATM Forum 1.0 (AF-PHY-0086.000) or ATM Forum 1.1 (AF-PHY-0086.001)
- **Line Code**
TC-PAM
- **Range**
See Table 1
- **Line Rate**
 - 200–2320 kbps (2-wire)
 - 200–4620 kbps (4-wire)
 - 800–9280 kbps (4 × 2-wire IMA)
- **Handshake Protocol**
ITU-T Rec. G994.1
- **EOC Support**
Mandatory
- **Connector**
RJ-45

Table 1. Typical SHDSL Ranges

Data Rate [kbps]	2-wire		4-wire		4 × 2-wire IMA	
	[km]	[mi]	[km]	[mi]	[km]	[mi]
384–512	5.5	3.4	6.3	3.9	5.2	3.2
576–832	5.0	3.1	5.4	3.3	4.9	3.0
896–1152	4.5	2.7	5.1	3.1	4.6	2.8
1216–1344	4.2	2.6	5.1	3.1	4.5	2.7
1408–1856	3.9	2.4	4.5	2.7	4.0	2.4
1920–2176	3.5	2.1	4.5	2.7	3.7	2.2
2304	3.3	2.0	4.5	2.7	3.5	2.1
2432–3072	–	–	3.9	2.4	–	–
3200–4624	–	–	3.3	2.0	–	–

Note: For 4 × 2-wire IMA interface data rates represent the value of a single pair. Typical ranges of the IMA interface are also relevant for data rates above 2304 kbps. To obtain a typical range for a data rate between 2304–9216 kbps, divide the data rate by four and then consult Table 1.

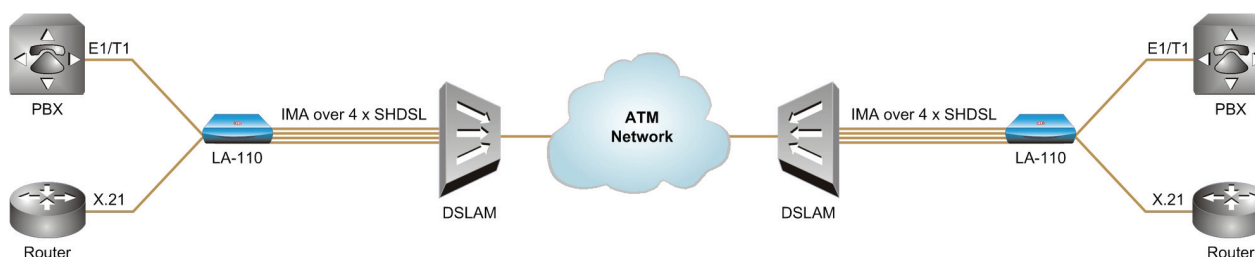


Figure 3. Transferring E1/T1 and Data Traffic over an IMA Link

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ADSL INTERFACE

- **Type**
Per ITU-T Rec. G.992.1 Annex A
- **Line Code**
Full DMT
- **Data Rate**
 - Downstream: up to 8 Mbps
 - Upstream: 1 Mbps
- **Connector**
RJ-45

E1 INTERFACE

- **Payload Rate**
 $N \times 64$ kbps ($N = 1-26$)
- **Compliance**
ITU-T Rec. G.704, G.706, G.732, G.823
- **Framing**
G732N or G732S, with or without CRC-4
- **Line Rate**
2.048 Mbps \pm 32 ppm
- **Line Code**
HDB3
- **Line Interface**
 - 120 Ω , balanced
 - 75 Ω , unbalanced
- **Receive Input Level**
0 to -43 dB or 0 to -12 dB, user-configurable
- **Transmit Output Level**
 - $\pm 3V \pm 10\%$, balanced
 - $\pm 2.37V \pm 10\%$, unbalanced
- **Jitter**
ITU-T Rec. G.823
- **Connectors**
 - RJ-45, balanced
 - Two BNC, unbalanced (via RJ-45 to BNC adapter cable)

USER SIDE

SERIAL INTERFACE

- **Data Link Protocol**
 - Frame Relay using AAL5
 - Transparent using AAL1
- **Data Rate**
 $N \times 64$ kbps in the range of 64 to 2048 kbps
- **Frame Relay Interworking**
 - Network interworking per FRF.5
 - Service interworking per FRF.8

- **Frame Relay Connections**
Up to 8 DLCIs
- **Timing**
DCE
- **Type**
 - V.35 via 34-pin connector
 - X.21 15-pin D-type female connector

LAN INTERFACE

- **Type**
10/100BaseT
- **Functionality**
 - Ethernet MAC bridge
 - IP router
- **MAC Bridge**
 - Number of ports: 1 LAN, 1-8 WAN
 - VLAN: aware or unaware mode
- **IP Router**
 - Routing: static, RIP I, RIP II, RIPv1 and RIPv2, policy-based
 - Number of ports: 1-2 IP networks (sharing the same physical LAN interface), 1-8 WAN, host (optional)
 - DHCP services: DHCP server (up to 10 address pools), DHCP relay
 - NAT, PAT services
- **Maximum Frame Size**
1536 bytes
- **Connector**
RJ-45

ISDN INTERFACES

- **Number of Ports**
4
- **Type**
"S"
- **Compliance**
ETS 300012, ITU-T Rec. I.430, compatible with NTT, 5ESS, DMS-100 and NI1 switches
- **Bit Rate**
192 kbps
- **Line Coding**
Pseudo-ternary
- **Mode**
NT with phantom feed
- **Line Impedance**
100 Ω
- **Connector**
RJ-45

ANALOG FXS VOICE INTERFACES

- **Number of Ports**
4
- **Type**
FXS, for direct connection to a 2-wire telephone, RS-464 loop start
- **Nominal Impedance**
600 Ω
- **Return Loss (ERL)**
Better than 20 dB
- **Encoding**
 - 64-kbps PCM per ITU-T Rec. G.711 and AT&T PUB-43801, μ -Law or A-Law
 - 32-kbps ADPCM per ITU-T Rec. G.726 (see *Ordering*)
- **Frequency Response (Ref: 1020 Hz)**
 ± 0.5 dB: 300 to 3000 Hz
 ± 1.1 dB: 250 to 3400 Hz
- **Signal/Total Distortion (ITU-T Rec. G.712, G.713 Method 2)**
0 to -30 dBm0: better than 33 dB
+3 to -45 dBm0: better than 22 dB
- **Idle Channel Noise**
Better than -70 dBm0 (+20 dBBrnc)
- **Transformer Isolation**
1500 VRMS
- **Echo Cancellation**
In accordance with ITU-T Rec. G.168, tail end, maximum 4 msec
- **Connector**
RJ-11

E1 INTERFACE

- **Compliance**
ITU-T Rec. G.703, G.704, G.706, G.732, G.823
- **Line Rate**
2.048 Mbps ± 32 ppm
- **Line Code**
HDB3, AMI
- **Framing**
 - Unframed
 - G732N with or without CRC-4
 - G732S with or without CRC-4
 - ISDN PRI
 - UNI (multiframe or non-multiframe)

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- **Line Impedance**
 - 120 Ω , balanced
 - 75 Ω , unbalanced
- **Receive Input Level**
 - 0 to -43 dB
 - 0 to -12 dB
- **Transmit Output Level**
 - $\pm 3V \pm 10\%$, balanced
 - $\pm 2.37V \pm 10\%$, unbalanced
- **Jitter**
ITU-T Rec. G.823
- **Connectors**
 - RJ-45, balanced
 - Two BNC, unbalanced
(via RJ-45 to BNC adapter cable)

T1 INTERFACE

- **Compliance**
AT&T TR-62411, ANSI T1.403,
ITU-T Rec. G.703, G.704, G.706
- **Line Rate**
1.544 Mbps ± 32 ppm
- **Line Code**
B8ZS
- **Framing**
 - Unframed
 - ESF
 - SF
- **Line Impedance**
100 Ω , balanced
- **Receive Input Level**
 - 0 to -36 dB (normal sensitivity)
 - 0 to -30 dB (low sensitivity)
- **Transmit Output Level**
 - $\pm 3V \pm 10\%$; 0 dB, -7.5 dB,
-15 dB, -22.5 dB (CSU)
 - $\pm 3V \pm 10\%$, 0 to 655 feet, (DSU)
- **Jitter**
ITU-T Rec. G.824
- **Connectors**
RJ-45, balanced

GENERAL

- **Timing**
 - Recovered from xDSL interface (NTR)
 - Recovered from E1 interface
 - Adaptive
 - Internal

- **Management**
 - Inband: SNMP, Telnet, Web
 - Out-of-band: LAN port, serial V.24 (RS-232) port
- **Terminal Control Interface**
 - Type: V.24 (RS-232) async DCE
 - Baud rate: 0.3–115.2 kbps
 - Connector: 9-pin D-type female
- **Indicators**
PWR (green) – Power status
WAN (red/green) – WAN interface synchronization status
LAN (green) – LAN transmit/receive activity status
- **Power**
AC: 100–240 VAC
DC: -48 VDC (-40/-60 VDC)
Note: The DC option is not available for the units with ISDN, FXS user or E1 network interfaces.
- **Power Consumption**
7.5W max
- **Physical**
Height: 43.7 mm (1.7 in)
Width: 217 mm (8.5 in)
Depth: 170 mm (6.7 in)
Weight: 0.5 kg (1.1 lb)
- **Environment**
Temperature: 0–50°C (32–122°F)
Humidity: Up to 90%,
non-condensing

ORDERING

LA-110/~/\$/*/#/@

Advanced Integrated Access Device

~ Specify **DC** for a DC power supply
Default is an AC power supply

\$ Specify network interface type:
SHDSL for 2-wire SHDSL
SHDSL/4W for 4-wire SHDSL
SHDSL/IMA for IMA over
4 \times 2-wire SHDSL
ADSLA for ADSL Annex A
E1 for balanced E1

* Specify optional ADPCM
compression type:
VC4 for ADPCM FXS, 4 TS
VC8 for ADPCM ISDN, 8 TS
VC30 for ADPCM E1, 30 TS

Note: ADPCM compression is not available for units with IMA over SHDSL network interfaces.

Specify voice interface type:

E1 for E1

T1 for T1

FXS for 4-port FXS

(units with single SHDSL or
ADSL network interfaces only)

ISDN for 4-port ISDN

(units with single SHDSL or
ADSL network interfaces only)

Note: E1 and T1 user ports are not available for units with ADSL network interfaces.

@ Specify serial data interface type:

V35 for V.35

X21 for X.21

Note: V.35 and X.21 serial data ports are not available for units with ISDN, FXS user or ADSL network interfaces.

SUPPLIED ACCESSORIES

Power cord

AC/DC adapter plug (if a DC option is ordered)

OPTIONAL ACCESSORIES

RM-33-2

Hardware kit for mounting one or two LA-110 units into a 19-inch rack

CBL-RJ45/2BNC/E1

RJ-45 to BNC adapter cable for unbalanced E1 network or user interface

CBL-DB9F-DB9M-STR

Control port cable



data communications

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