

LA-110

Advanced Integrated Access Device



Provide voice, data and LAN services over ATM or packet-switched networks, with DSL interfaces

- Offers multiple services over ATM or PSN
- Supports standard-compliant pseudowire (PW) with TDMoIP, CEsPSN, SAToP, ATMoPSN and HDLCoPSN encapsulation
- ADSL/SHDSL/SHDSL IMA/E1 network interfaces
- Four analog FXS or four digital ISDN user interfaces
- Corrects network errors such as jitter buffer on the fly and compensates for lost packets



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.

MULTISERVICE OVER ATM

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).

LA-110

Advanced Integrated Access Device

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.

MULTISERVICE OVER PSN

LA-110 provides legacy services over packet networks. The device converts the data stream from its user E1/T1 or data ports into packets for transmission over the network. The frame format of these packets is IP or MPLS. These packets are transmitted via the LA-110 network port to the PSN. A remote pseudowire device converts the packets back to the original user traffic format.

The unit supports various legacy over packet transport types, including TDMoIP, CESoPSN, SAToP, HDLCoPSN, FRoPSN.

Proper balance between PSN throughput and delay is achieved via configurable packet size.

A jitter buffer compensates for packet delay variation (jitter) of up to 40 msec in the network.

PW 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.

IP networks – outgoing pseudowire packets are marked for priority using DSCP, ToS, or Diffserv bits.

MPLS networks – outgoing pseudowire packets are assigned to a specific MPLS tunnel and marked for priority using EXP bits.

PW PERFORMANCE MONITORING

Fault propagation initiates user port alarms, such as E1/T1 LOS, to reflect packet network fault conditions. Alarms detected at user ports are propagated to the remote pseudowire device via the packet network.

Performance monitoring is provided by Ethernet and IP-layer network condition statistics, such as packet sequence errors (loss or misorder) and packet delay variation (jitter), which are monitored and stored by the device.

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 r 2-wire SHDSL for a combined data rate of up to 9.2 Mbps and extended range
- ADSL interface (Annex A)
- E1 interface.

ETHERNET INTERFACE

The Ethernet 10/100BaseT port supports autonegotiation and flow control.

The Ethernet interface can be configured to operate as a MAC bridge or an IP router.

In bridge mode the LA-110 Ethernet interface operates as a self-learning media access bridge. The MAC bridge is user-configurable to VLAN-aware and VLAN-unaware modes.

In bridge mode, 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-110 supports up to eight QoS rules.

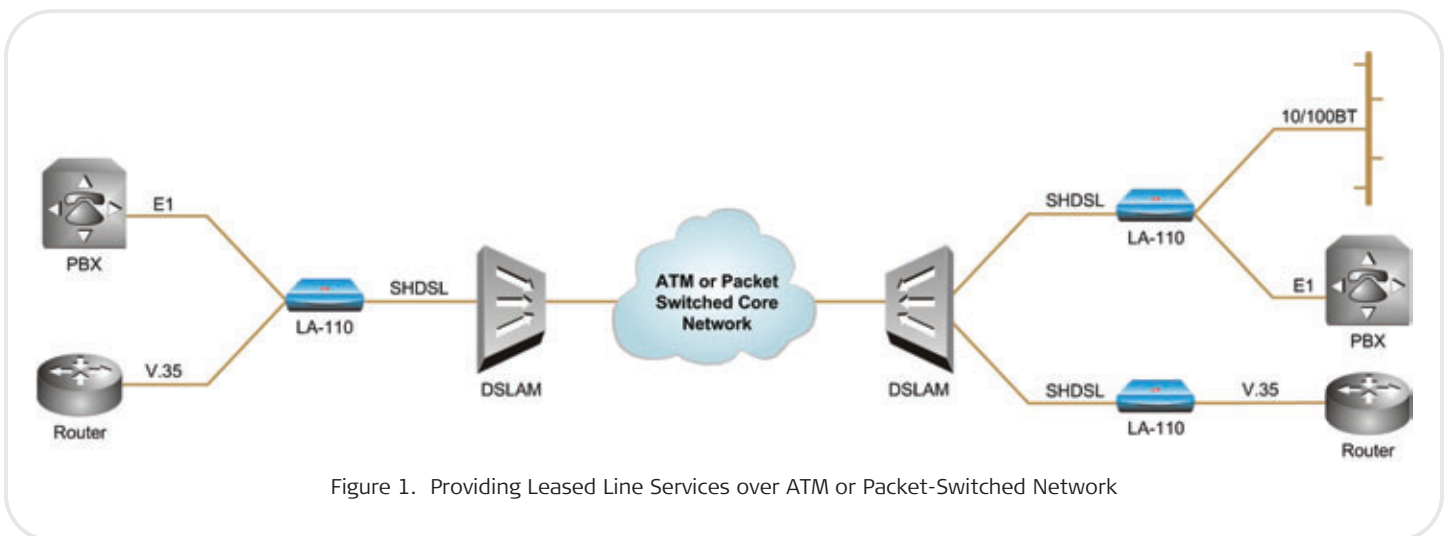


Figure 1. Providing Leased Line Services over ATM or Packet-Switched Network

When configured to operate as an IP router, LA-110 supports:

- 1–2 IP networks (sharing the same physical Ethernet 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.

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.

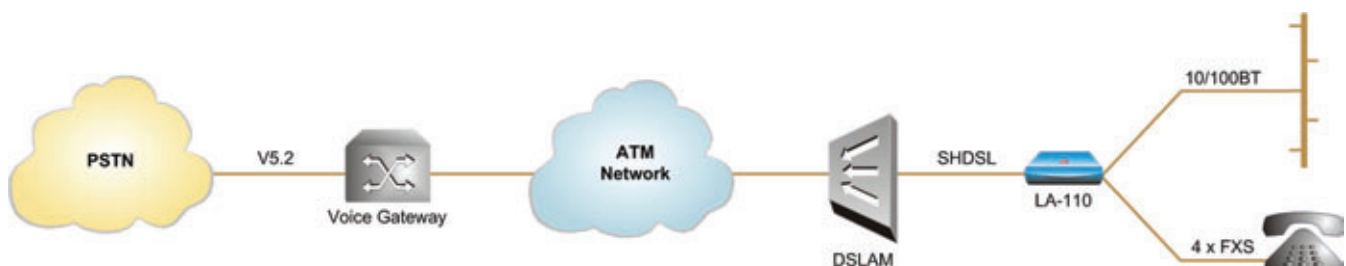


Figure 2. Providing VoDSL Using LES over AAL2

LA-110

Advanced Integrated Access Device

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.

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 – Timing reference is locked to the DSLAM clock
- Received – Clock is received from the E1 equipment
- Adaptive – Clock is locked to an average arrival rate of the ATM cells

carrying voice channels

- Internal –Clock is generated by the 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.

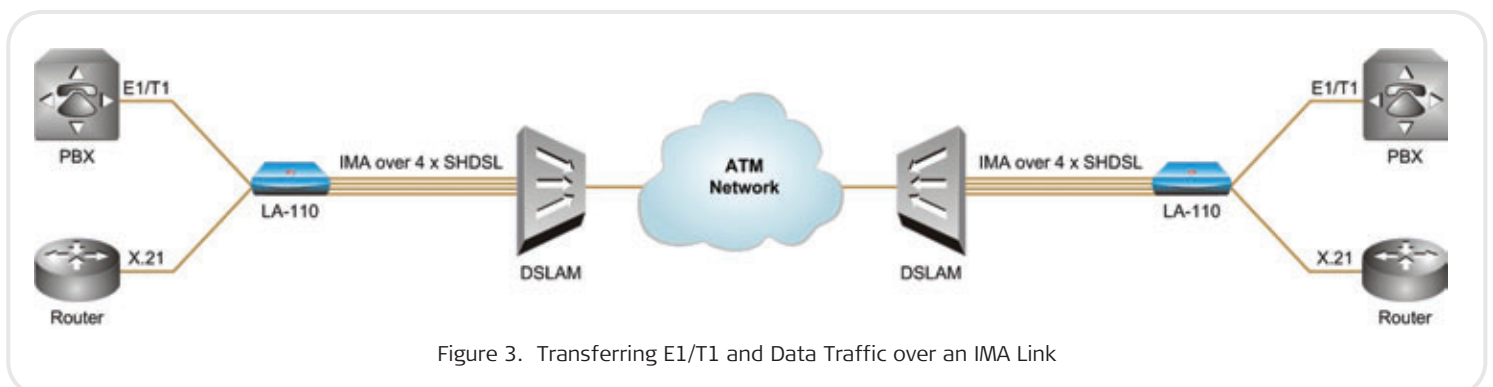


Figure 3. Transferring E1/T1 and Data Traffic over an IMA Link

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

PSEUDOWIRE FUNCTIONALITY

Standard Compliance

ATM:

- IETF: RFC 4717

TDM:

- IETF: RFC 4553 (SAToP), PWE3 Internet drafts for TDMoIP, CESoPSN
- ITU-T: Y.1413 (TDMoIP)
- MFA: IA 4.0

HDLC:

- IETF: PWE3 Internet draft for HDLCoPSN

Number of PW Connections

8

Jitter Buffer Size

- 0.5–200 msec (unframed) with 0.1 msec granularity
- 2.5–200 msec (framed) with 0.5 msec granularity.

SHDSL INTERFACE

Type

- Single 2-wire or 2/4-wire per ITU T Rec. G.991.2, Annex A and Annex B
- IMA over 4 r 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 (26 AWG)

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*.

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 × 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 ± 32 ppm

Line Code

HDB3

Line Interface

- 120W, balanced
- 75W, unbalanced

Receive Input Level

0 to -43 dB or 0 to -12 dB, user-configurable

Transmit Output Level

- ±3V ±10%, balanced
- ±2.37V ±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 × 64 kbps (64–2048 kbps)

LA-110

Advanced Integrated Access Device

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

ETHERNET INTERFACE

Type

- 10/100BaseT
- IMA over 4 r 2-wire, per ATM Forum 1.0 (AF-PHY-0086.000) or ATM Forum 1.1 (AF-PHY-0086.001)

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 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 interfaces

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

100Ω

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

600Ω

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 dBnc)

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 \pm 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)

Line Impedance

- 120Ω, balanced
- 75Ω, 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

100Ω, balanced

Receive Input Level

- 0 to -36 dB (normal sensitivity)
- 0 to -30 dB (low sensitivity)

Transmit Output Level

- ±3V ±10%; 0 dB, -7.5 dB, -15 dB, -22.5 dB (CSU)
- ±3V ±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

LA-110

Advanced Integrated Access Device

Ordering

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

Legend

- ~ Power supply type (Default=AC):
DC -48 VDC (-40/-60 VDC)
- \$ Network interface type:
SHDSL 2-wire SHDSL
SHDSL/4W 4-wire SHDSL
SHDSL/IMA IMA over 4x2-wire SHDSL
ADSLA ADSL Annex A
E1 balanced E1
- * ADPCM compression type
(Default=None)
VC4 ADPCM FXS, 4 TS
VC8 ADPCM ISDN, 8 TS
VC30 ADPCM E1, 30 TS

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

- # Voice interface type
E1 E1
T1 T1
FXS 4-port FXS
ISDN 4-port ISDN

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

FXS and ISDN interfaces are available for units with single ADSL or SHDSL network interfaces only.

- @ Serial data interface type
V35 V.35
X21 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