S-Access

SA A 155

STM1/4

EBER	Excessive Bit Error Rate
ECC	Embedded Communication Channel
EMC	Electromagnetic Compatibility
ERO	Optical Transceiver
ESD	Electrostatic discharge
FTTB	Fiber To The Building
FTTC/Ca	Fiber To The Curb/Cabinet
HDB3	High Density Bipolar 3
ITU-T	International Telecommunication Union - Telecommunications
LOF	Loss Of Frame
LOS	Loss Of Signal
LT (LCT)	Local (Craft) Terminal
MMI	Man-Machine Interface
MS-AIS	Multiplexer Section - Alarm Indication Signal
MXA	Add-drop SDH access multiplexer
PABX	Private Automatic Branch exchange
POH	Path Overhead
RMX	S-ACCESS Remote Multiplexer
Rx	Receiver
SD	Signal Degrade
SDH	Synchronous Digital Hierarchy
SF	Signal Fail
SOH	Section Overhead
STM-1	Synchronous Transport Module Level 1
TSIG	Remote signaling input
TUG	Tributary Unit Groups
Tx	Transmitter
VC	Virtual Container

S-Access GmbH **tel: +41 1 700 3111**
Oberhausenstrasse 47 **fax: +41 1 700 3103**
8907 Wettswil a/A
Switzerland **email: s-access@dplanet.ch**

2nd edition – January 2002

S-Access GmbH
Oberhausenstrasse 47
8907 Wettswil a/A
Switzerland

tel: +41 1 700 3111
fax: +41 1 700 3103
email: s-access@dplanet.ch

1 INTRODUCTION

S-ACCESS is providing a **global SDH Solution** to its customers at STM-1, STM-4 and STM-16 capacities, enabling to offer all different services from E1 up to 2,5 Gbps.

S-ACCESS solution is particularly **compact, scalable and easy to operate**; it is made of SA A 155, SA A 2500, SA T 155 and ACCESS GAIN VIEW NMS.

SA A 155 is an STM-1/4 Add-drop Multiplexer that can also be used as an STM-1/4 Terminal, STM1/4 regenerator or a local cross connect.

It has the following special features:

- the capacity to integrate not only the usual TDM signals, but also data flows from LANs or the Internet;
- its high capacity, which makes it one of the most comprehensively integrated equipment currently available;
- its flexibility of configuration. In particular its modularity and the possibility of supervision using the SNMP protocol from a remote manager such as ACCESS GAIN VIEW NMS or a workstation connected to the Internet.

This equipment is SNMP native. It has an embedded HTTP server. SA A 155 is managed by Network Management System, ACCESS GAIN VIEW NMS (which also manages SA A 2500 and SA T 155).

2 SDH OPTICAL MULTIPLEXERS

S-ACCESS continues to develop its range of compact SDH multiplexers designed for mixed Voice and Data access networks.

SA A 155 is an 'add-drop' STM1/STM4 multiplexer that can be used for creating ring networks at 63xE1 or 3xE3/DS3 with Ethernet 10/100 and V.11 data interfaces.

A common feature of all this equipment is the compatibility with the SDH networks (open to public operator networks).

The PDH tributaries are E1, E3 and DS3.

The SDH tributaries are STM1 optical or electrical.

The SDH aggregates are STM1 (155 Mbit/s) or STM4 (620 Mbit/s).

The STM1 tributary or aggregate is provided by the same card.

The data access (tributary) is X21/V11 and Ethernet10/100. The advantages of this solution are the use of optical fiber giving high quality performance for transport voice and LAN connection.

SA T 155 is a terminal multiplexer offering single fiber optic links of 16xE1(G.703 and X.21/V.11).

SA A 2500 is an add-drop multiplexer that allows making rings or point-to-point STM16 networks with STM-1, STM4/STM-4c, STM-16/STM-16c and Gigabit Ethernet tributaries.

These three products are designed for complete operational compatibility.

Equipment has been made to perform complex ring or meshed networks mixing voice and data and benefiting from high quality fibber optic performance and compatibility with public networks.

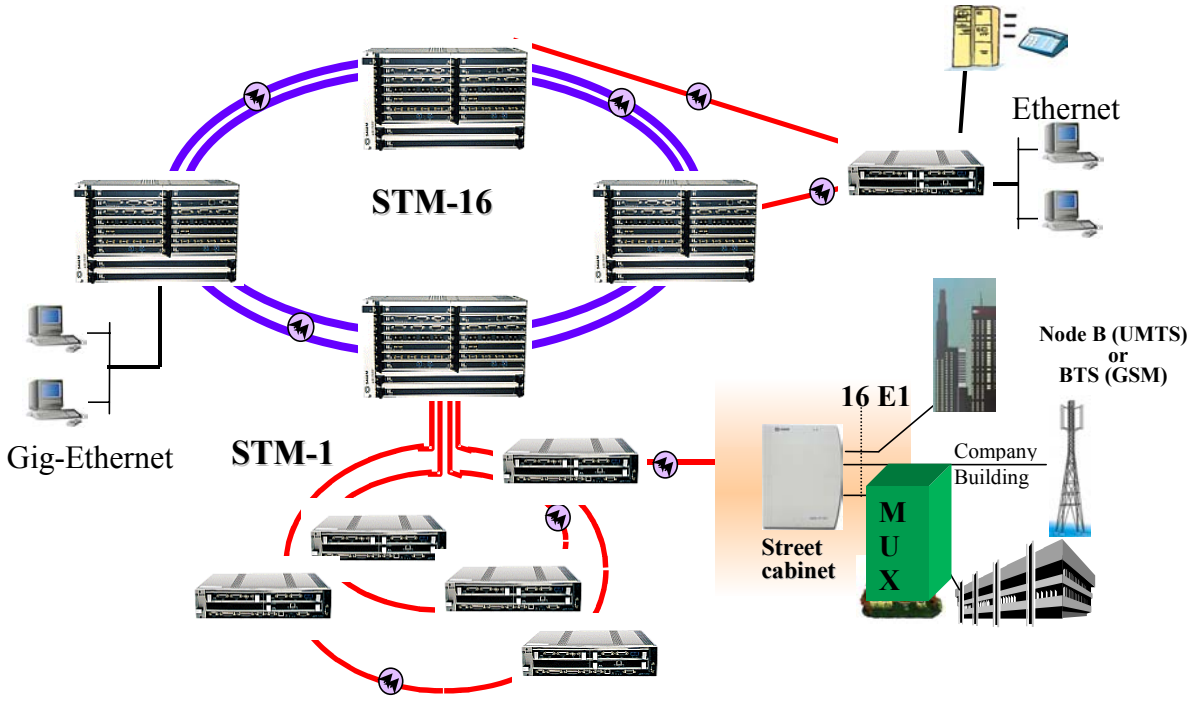


Figure 1: Mixed Voice/Data Network

S-Access GmbH
Oberhausenstrasse 47
8907 Wettswil a/A
Switzerland
tel: +41 1 700 3111
fax: +41 1 700 3103
email: s-access@dplanet.ch

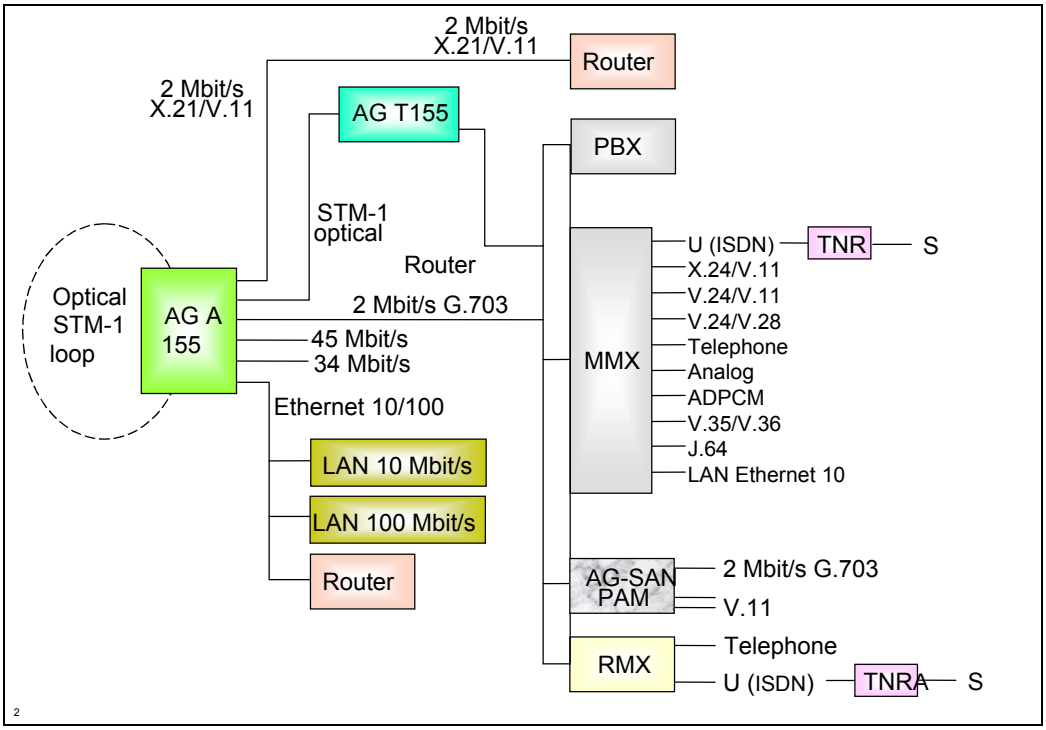


Figure 2: The different access network interfaces

S-Access GmbH
Oberhausenstrasse 47
8907 Wettswil a/A
Switzerland
tel: +41 1 700 3111
fax: +41 1 700 3103
email: s-access@dplanet.ch

3 APPLICATIONS

3.1 ADVANTAGES

3.1.1 TRUE VOICE/DATA INTEGRATION

The SA A 155 is conform to SDH standard transmission norm. It is a versatile add-drop multiplexer with a diversity of access (including E1, E3/DS3 and LAN Ethernet 10/100).

3.1.2 PROTECTED EQUIPMENT

SDH design of SA A 155 gives the benefit of standard traffic protection (SNCP and MSP protections).

3.1.3 COMPACT, SIMPLE, RELIABLE, LOW POWER EQUIPMENT

Designed for the access network, the SA A 155 is very compact: dimensions are 422 x 91 x 225 (ETSI/19 inch compatibility).

Its high level of integration means it is also reliable and low consumption equipment.

And last, but not least, it is very simple to install and to commission (default configuration flexibility and self-adaptative behavior)

3.1.4 MODULARITY

The SA A 155 is a versatile platform. It can be configured as an add-drop, a terminal multiplexer, a regenerator or a cross connect.

The SA A 155 features 4 undedicated slots for aggregate or tributary.

The heart of system is made on 5 x 5 VC4 non-blocking switch with VC4/VC3/VC12 granularity.

3.1.5 SNMP MANAGEMENT SYSTEM

The SA A 155 implements an HTTP server. This enables monitoring of alarms or events and configuration of any equipment in the network. It is possible to use any browsers web (IE, Netscape). This application is a friendly graphical windows-type man-machine interface.

The ACCESS GAIN VIEW NMS (Access Network Manager) is an SNMP management platform that includes a provisioning feature. This software is adaptable to the size of the network, runs on a Windows NT or UNIX workstation; it features multi-users and differentiated services with access security.

3.1.6 A SDH COST-EFFECTIVE SOLUTION

Money saving is a leading goal of the S-ACCESS SDH family. Generally speaking, SDH/SONET has proven to be one of the most widespread worldwide.

This very important advantage is the result of a three dimensional concept.

First, ADR takes advantages of S-ACCESS experience in designing second generation cost-effective and highly integrated equipment.

The second point is it very easy to install and commission: the shelf is available with 19 inch and ETSI mounting kit. Commissioning is time saving.

The third point is the management and maintenance: the management is very simple with the centralised ACCESS GAIN VIEW NMS system. Maintenance is reduced due to the high reliability of the equipment. No special training is required for operators. Moreover, new firmware can be downloaded to equipment from ACCESS GAIN VIEW NMS without going to every site.

3.2 FIBER OPTIC ACCESS NETWORK

The SA A 155 and SA T155 are used in access networks to create local loops connected to the public network, with direct PDH interfaces and Ethernet or V.11 interfaces for local networks. These loops can be implanted in any areas served by fiber optic cable, such as industrial areas, suburban areas and residential areas.

3.3 PRIVATE NETWORK

Business districts typically feature a very high demand for both tributary capacity and a wide variety of services (telephony, leased lines, ISDN terminals, fax, etc.). When used in conjunction with low rate multiplexers (S-ACCESS- DLC product range: DLC1100, MMX, etc.), the SA A 155 meets this demand by offering a single collection point for all types of signals (voice, data, video) for connection to a Central Office switch that may be located many tens of kilometers away (up to 100 km in a single optical hop).

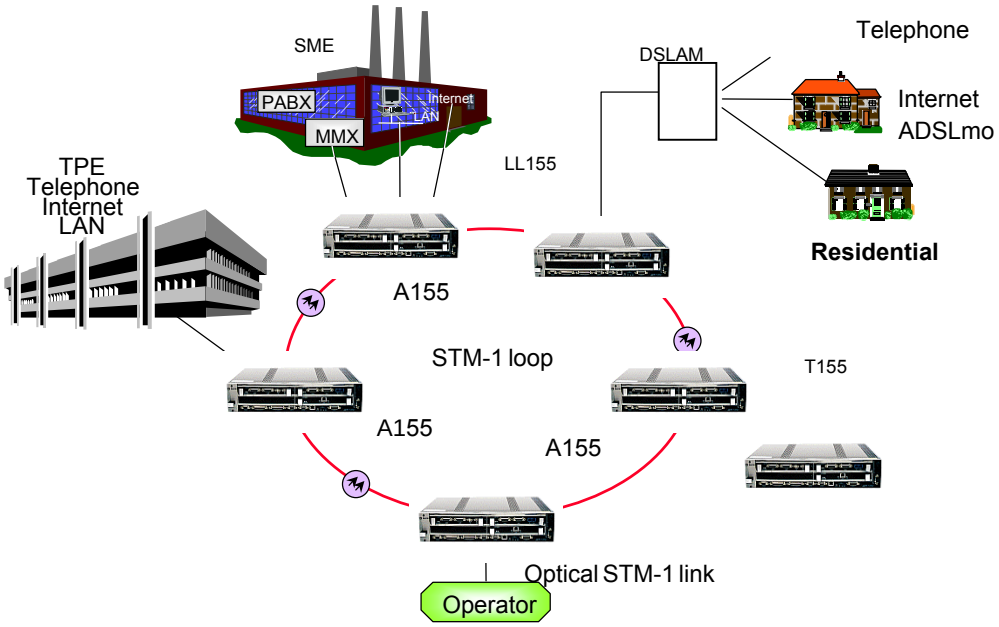


Figure 3: Urban area networking

S-Access GmbH
Oberhausenstrasse 47
8907 Wettswil a/A
Switzerland
tel: +41 1 700 3111
fax: +41 1 700 3103
email: s-access@dplanet.ch

3.4 CAMPUS NETWORK AND PRIVATE NETWORK

The SA A 155 is ideal for constructing private networks that cover wide areas: e.g., industrial sites with multiple buildings, extended campuses.

The SA A 155 offers the benefits of fiber optics and SDH technology (security, management).

For these applications, voice (inter-PABX links) and data (LAN interconnection) compatibility is very important; open access to the public network is also of major benefit for linking remote sites.

3.4.1 LAN EXTENSION / LAN INTERCONNECTION

The Ethernet bridging function of the SA A 155 makes it possible to construct very simply a LAN to cover several remote sites (LAN interconnection) without the need for leased line rental.

This architecture is perfect for single-company use (a single LAN = no need for inter-site access protection), although it is possible to overlay 2 or even 3 distinct LANs on the same SA A 155 loop. The 2 Mbit/s interfaces also enable connection of private exchanges (PBXs) and 2 Mbit/s multiplexers.

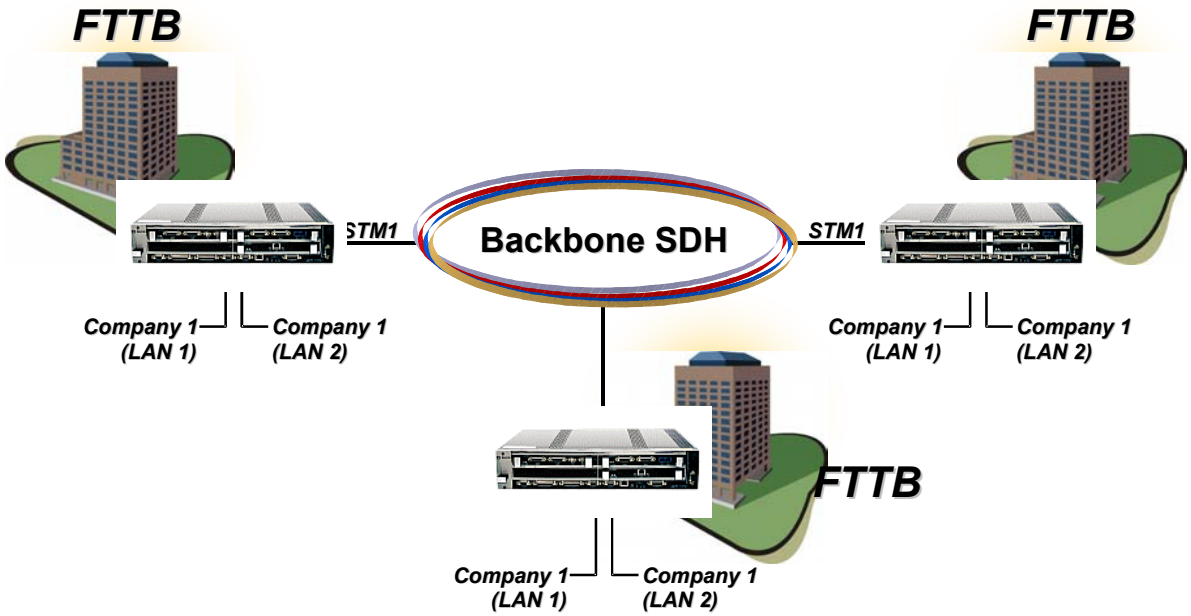


Figure 4: LAN extension

S-Access GmbH
Oberhausenstrasse 47
8907 Wettswil a/A
Switzerland
tel: +41 1 700 3111
fax: +41 1 700 3103
email: s-access@dplanet.ch

3.4.2 LAN / MULTI-LAN EXTENSION

Linked to a router or a switch, the SA A 155 makes it possible to construct very simply a MAN/WAN to cover several remote sites to constitute a multi-LAN structure without the need for leased line rental between routers/switches.

This architecture is particularly aimed at multi-company uses (access protection by router).

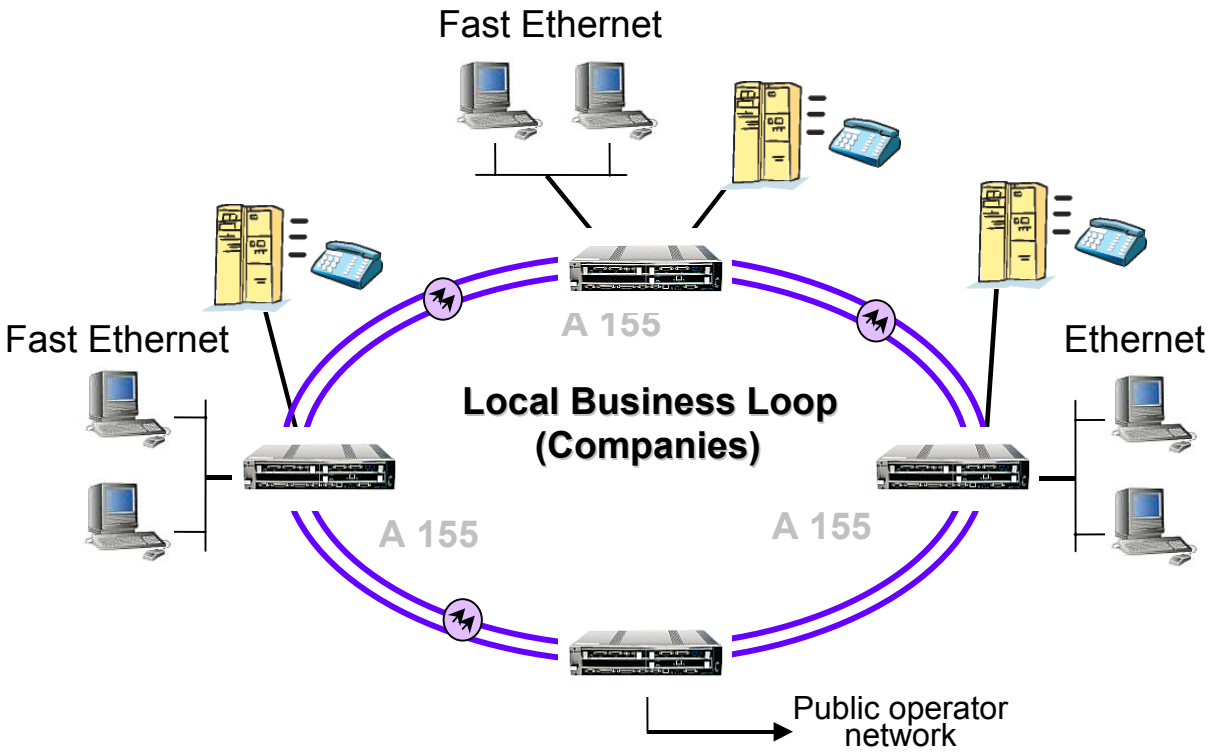


Figure 5: Multi-LAN

S-Access GmbH
Oberhausenstrasse 47
8907 Wettswil a/A
Switzerland
tel: +41 1 700 3111
fax: +41 1 700 3103
email: s-access@dplanet.ch

3.5 PUBLIC UTILITY COMPANY NETWORKS

The S-ACCESS range can be used for the construction of large linear networks, such as pipeline, railways, motorway or tunnel networks.

When used in conjunction with the SA T155, the SA A 155 allows the construction of large linear networks for STM-1/4 flows, with intermediate stations providing add-and-drop for up to 63 E1 (Fig.6).

Intermediate stations provide add and drop for up to 63 E1. Protection is therefore achieved with flat loops.

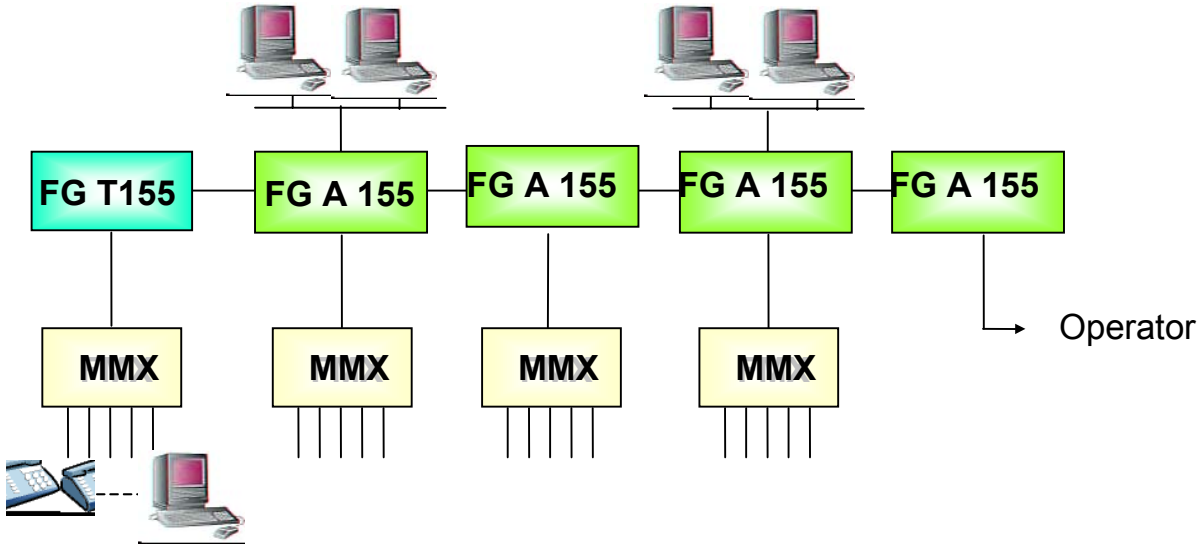


Figure 6: Typical Linear Network of a public utilities company

S-Access GmbH
Oberhausenstrasse 47
8907 Wettswil a/A
Switzerland
tel: +41 1 700 3111
fax: +41 1 700 3103
email: s-access@dplanet.ch

3.6 SDH ACCESS LINKS

SDH distribution networks in high-density urban areas generally feature a protected ring structure, and they carry very high bit rates (155 Mbit/s, 620 Mbit/s, 2.4 Gbit/s, 10 Gbit/s).

The SA A 155 provides direct connection of PDH signals to STM-1 interfaces on the SA A 2500.

The SA A 155 is a useful tool in the expansion of SDH networks. As a complement to an existing STM-N network, it offers a very cost-effective solution to STM-1/4 expansion links.

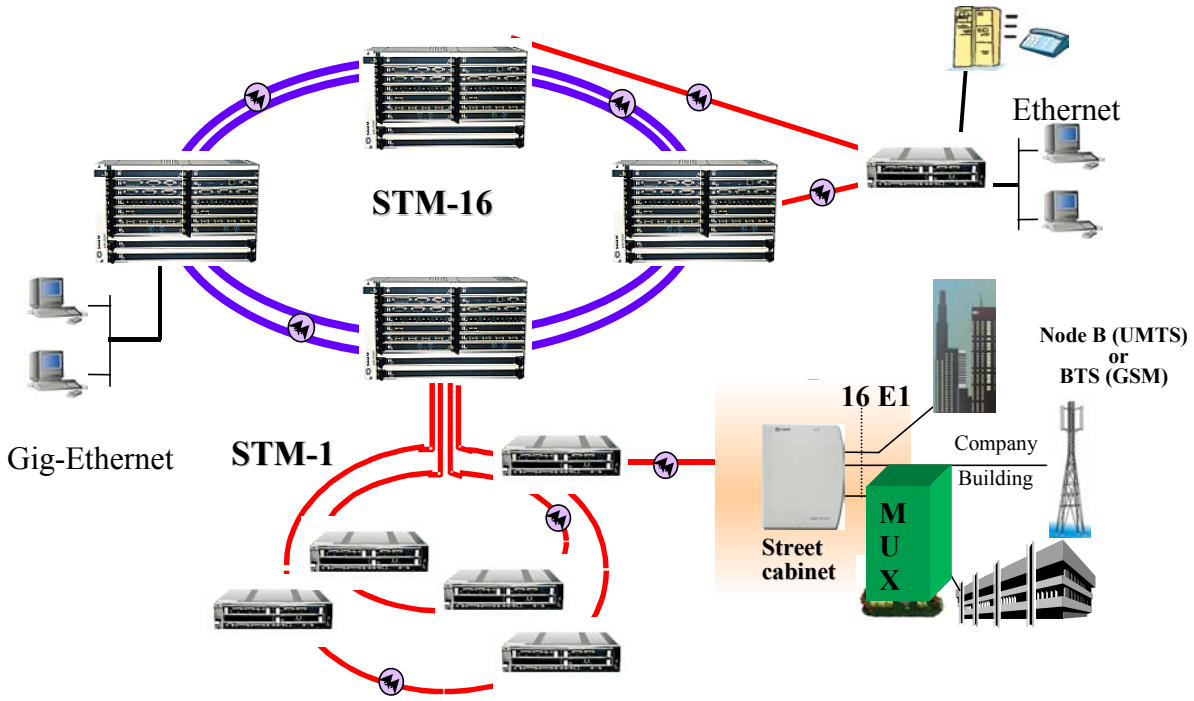


Figure 7: Typical Use of SA A 155 for expanding an existing SDH Network

S-Access GmbH
Oberhausenstrasse 47
8907 Wettswil a/A
Switzerland
tel: +41 1 700 3111
fax: +41 1 700 3103
email: s-access@dplanet.ch

4 FUNCTIONAL DESCRIPTION

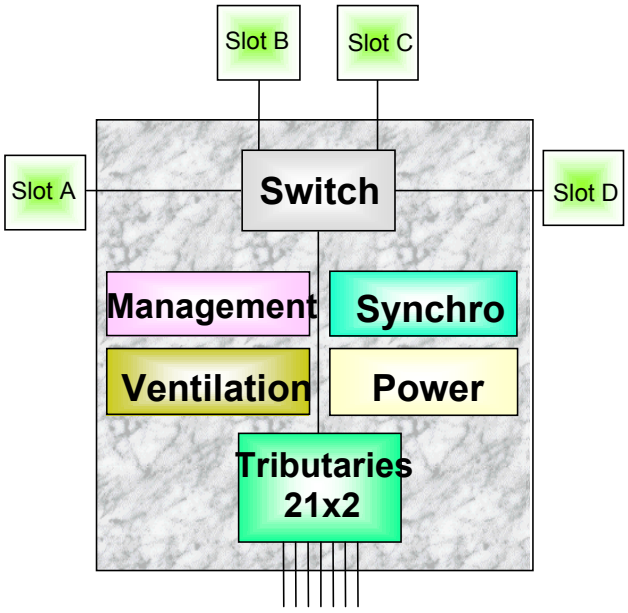
4.1 ARCHITECTURE

The SA A 155 is in the form of a sub-rack equipped with a board comprising the main unit functions (power, management, cross-connect, synchronization and 21 x 2 Mbit/s access).

The unit contains 4 slots meant to receive the different types of PDH (2, 34 and 45 Mbit/s), SDH (STM1/STM4) or data (2 Mbit/s V.11, Ethernet 10/100) type interface.

Figure 8: SA A 155 sub-rack

The S-ACCESS- SA A 155 sub-rack may be table or wall mounted, or installed in a 19" or ETSI rack.



S-Access GmbH
Oberhausenstrasse 47
8907 Wettswil a/A
Switzerland
tel: +41 1 700 3111
fax: +41 1 700 3103
email: s-access@dplanet.ch

Figure 9: Block diagram

S-Access GmbH
Oberhausenstrasse 47
8907 Wettswil a/A
Switzerland
tel: +41 1 700 3111
fax: +41 1 700 3103
email: s-access@dplanet.ch

4.2 STANDARD CONFIGURATIONS

Here are a few examples of the standard configurations:

Configuration	Slot A	Slot B	Slot C	Slot D
Terminal				
Terminal (1+1) 63xE1/21x E1 or E3/DS3	21 x E1 or E3/DS3 tributary	STM1 optical (1+1)	21 x E1 or E3/DS3 tributary	STM1 optical (1+0)
Add-drop STM1				
Add-drop 63xE1	21x2 tributary	STM1 optical (West)	21x2 tributary	STM1 optical (East)
Add-drop 21xE1 & Ethernet 10/100		STM1 optical (West)	ADR-LAN	STM1 optical (East)
Add-drop STM4		STM1 optical (West)	ADR-LAN	STM1 optical (East)
Add-drop 63xE1	21x2 tributary	STM4 optical (West)	21x2 tributary	STM4 optical (East)
Add-drop 21xE1 & Ethernet 10/100 & E3/DS3	E3/DS3	STM4 optical (West)	ADR-LAN or ADRIMA	STM4 optical (East)
Cross-connect				
Cross-connect 4x STM1	STM1 optical or electrical	STM1 optical or electrical	STM1 optical or electrical	STM1 optical or electrical

All configurations are possible up to the limit of 4 slots.

4.3 BASIC MODULE

The basic module features the following functions:

- Power supply: 48V power converter
- Equipment operation (SEMF and MCF functions)
- Cross-connect core
- 21 x E1 interface
- Synchronisation

4.3.1 POWER SUPPLY

The power supply features two -48 V inputs (normal and backup) protected by diodes and filtered against electromagnetic surges.

4.3.2 VENTILATION

The sub-rack includes a ventilation module.

The ventilation module is removable, and can be changed without dismantling the sub-rack.

4.3.3 OPERATION

The operation module is used for supervising and configuring all equipment functions.

The operation interfaces are the DCC channels of the STM1/4 interfaces, an Ethernet 10baseT interface with the central management system (ACCESS GAIN VIEW-ANM) and an RS232C interface with a VT100 type terminal.

4.3.4 CROSS-CONNECT AND SWITCHING CORE

The core is a 1/3/4 cross-connect (VC-12, VC-3 and VC-4 cross-connect) that has the capacity to process one VC-4 per tributary slot and one VC-4 on the motherboard, i.e. a total of 5 VC-4s.

4.3.5 ADDITIONAL FUNCTIONS 1+1 PROTECTION

All the main protection modes are possible with the SA A 155:

STM1 or STM4 optical line protection (MSP 1+1)

VC-12 and VC-3 path protection (SNC-P)

4.3.5.1 MSP 1+1 Protection

STM-1/4 line protection is obtained by doubling the fiber optic cable and the STM1/STM4 interface module (ADRIC) (1+1):

- transmission over two channels

(main and backup)

- receiving-end selection from either channel.

There is automatic switchover to the protection link in accordance with the criteria described in ITU-T recommendation G.823. There is no interruption to the order-wire and data flows with MSP 1+1 protection.

Protection switching is initiated upon:

- a line fault,
- STM1/4 interface module fault,
- an operator command.

When detected on the main channel, the following fault conditions initiates MSP protection:

- SF (Signal Fail): logic ORing of :
  - STM-1/4 incoming signal loss (LOS STM-1)
  - STM-1/4 loss of frame alignment (LOF STM-1/4)
  - STM-1/4 multiplex section AIS detection (MS-AIS)
  - Byte B2 excessive bit error rate (EBER-B2)
  - STM1/4 (ADRIC) interface module absence.
- SD (Signal Degrade): B2 bit error rate greater than configurable threshold.

The SF and SD indications are processed and filtered (fault persistency filter with configurable time persistency). This activates the K1/K2 protocol described in ITU-T recommendation G.783 to initiate the protection mechanism.

4.3.5.2 (SNC-P) 1+1 path protection

SNC-P path protection is used in ring topologies and consists in using the two sides of the ring: one for the normal path, the other for the backup path.

When detected on the main channel, the following fault conditions initiate a switch:

SF (Signal Fail): « OR » logic of:

- AIS detection at path termination (LP-AIS)
- Byte B3 or V5 excessive bit error rate (EBER-B3/V5)

SD (Signal Degrade):

B3 or V5 bit error rate greater than configurable threshold.

The SF and SD indications are processed and filtered (fault persistency filter with configurable time persistency).

The switching process lasts less than 50 ms after confirmation of the originating fault, and the switch status is maintained until tributary signal restoration.

4.3.6 21 X E1 INTERFACE

The interface module provides the following functions:

- HDB3 conversion,
- 2 Mbit/s signal multiplexing,
- formation of TUG-3 tributary unit groups,
- formation of AU-4 administrative units.

4.3.7 SYNCHRONISATION

The SA A 155 :

- uses its own timing source to synchronise transmission via the STM1 (ADRIC) interface module,
- can provide the synchronisation for other equipment,
- can be synchronised to an internal or an external source.

4.3.7.1 Synchronisation sources

The SA A 155 may be synchronised to the following alternative timing sources :

- the East, West, main or standby STM-1/4 aggregate signal,
- one of the 2 Mbit/s tributaries,
- ITU-T G.703-compliant 2048 kHz external clock signal,
- the internal local oscillator.

4.3.7.2 Automatic mode

In the event of a failure of the active sync source, synchronisation switches automatically to one of various prioritised standby sync sources. This switching mechanism can be reversible.

4.3.7.3 Manual mode

It is possible to force-switch to one of the available sources.

4.4 OPTICAL OR ELECTRICAL STM1/4 INTERFACE

4.4.1 STM1/4 INTERFACE

The STM1 interface module includes STM1 multiplexing functions, VC-4 processing, insertion of the EOW and auxiliary channels overhead and optical or electrical interface :

- IC1.1 interface (1310 nm)
- IC1.2 interface (1550 nm
- S1.1 Interface (1310 nm
- L1.1 Interface (1310 nm
- MM1 interface (1310 nm)
- S4.1 Interface (1310 nm)
- L4.1 Interface (1310 nm)
- L4.2 Interface (1550 nm)
- coaxial G.703 155 Mbit/s interface

The use of two STM1 or STM4 optical interfaces makes it possible to constitute a 1+1 terminal multiplexer or a 1+0 "add-drop" multiplexer.

The SDH functions carried out are as compliant to G.783.

4.4.1.1 Overhead Byte Processor

Path overhead (POH) and section overhead (SOH) bytes, which are added to and dropped from the SDH frame, carry various items of supervisory information relative to the STM-1/4 links :

- frame alignment bytes,
- parity check data,
- engineering order-wires and digital service channels interchanged by both ends of a network.

4.4.1.1.1 Engineering Order-wires and Digital Service Channels

A digital channel (E1 or E2 overhead byte) in the SDH frame is reserved for transport of a digital engineering order-wire (EOW). Digital service channel protection is as with 1+1 line protection. The E1 or E2 and F1 bytes are available over a SubD/HE5 connector on the module front panel. To have a voice signal EOW, it is necessary to have an external mechanism (SAGEM-EOW300), which adapts the 64 kbit/s digital signal of the E1/E2 and F1 interfaces.

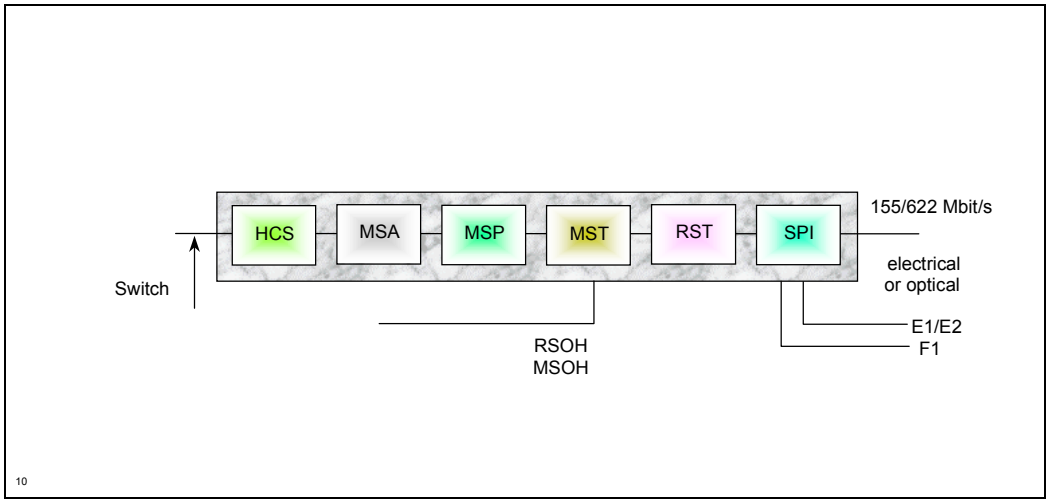


Figure 10: STM1 Interface

4.4.2 STM4 INTERFACE

The A 155 has a capacity of Add-Drop of one VC4. In one site, it is possible to have access to 63 E1.

The shelf can be upgraded from STM-1 to STM-4. In this shelf, the STM-4 boards must be inserted in slot B and D ; other boards can be plugged in any 4 slots.

This upgrade is an in-service upgrade in case of a ring topology.

The impact on existing traffic is limited to a protection switch-hit for each SA A 155 upgraded in the ring.

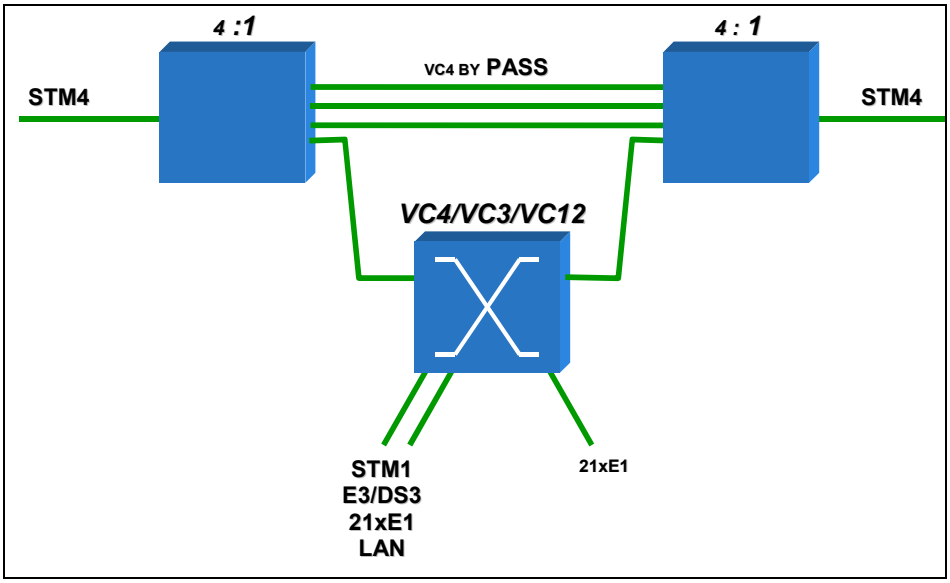


Figure 11 : STM4 interface

S-Access GmbH
Oberhausenstrasse 47
8907 Wettswil a/A
Switzerland
tel: +41 1 700 3111
fax: +41 1 700 3103
email: s-access@dplanet.ch

4.5 LAN INTERFACE

4.5.1 ADRLAN

The ADRLAN function acts as a three-way Ethernet bridge :

- external Ethernet interface
- VC3 East backbone
- VC3 West backbone

Operation is as follows : a frame received at the external interface is processed in the same way as in a filtering bridge, i.e. it is accepted as long as it is correct (CRC okay) and its address corresponds to the list of addresses accepted by the filter (MAC address of the equipment linked to the bridge). According to a dynamic routing table, this frame is sent either over the VC3 East or the VC3 West. A local frame is ignored and a frame with an unknown destination address is broadcast.

The optical fiber, VC3 backbone, is a collision-free bus whose access is regulated by queuing system.

Congestion of the data VC3 which is shared between all the interfaces is avoided by a statistical mechanism which locally rejects frames according to the replenishment of the queue; the rejection statistic increases with this replenishment until it is no longer possible to ensure a throughput corresponding to the maximum capacity of the VC3 channel (50 Mbit/s).

In point to point application, the maximum capacity is up to 100 Mbit/s (2 VC3).

The optical data VC3 links are point-to-point links, and the frames are processed at each node in queues, to be dropped at the external interface when the MAC address corresponds to the local sub-network or to be re-transited otherwise.

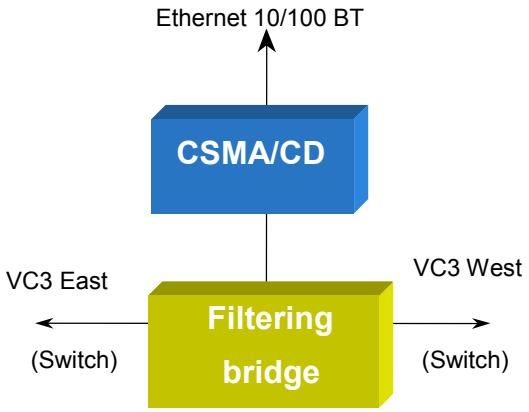


Figure 12: ADRLAN function

4.5.2 ADRIMA

4.5.2.1 version 1

The ADRIMA is providing a point to point or a point to multi-point LAN connection. The Throughput of the connections is in the range of 2 to 16 Mbit/s.

The bridge interfaces are :

- One 10/100 base T interface
- One to 8 WAN (VC12 in SDH frame) access

Operation is as follows : a frame received at the external interface is processed in the same way as in a filtering bridge, i.e. it is accepted as long as it is correct (CRC okay) and its address corresponds to the list of addresses accepted by the filter (MAC address of the equipment linked to the bridge).

According to a dynamic routing table, this frame is sent over IMA/VC12. A local frame is ignored and a frame with an unknown destination address is broadcast.

Congestion of the data VC12 is avoided by a statistical mechanism, which locally rejects frames according to the replenishment of the queue.

The VC12 connection could be protected by SDH protection (SNCP or MSP protections).

4.5.2.2 version 2 (hardware different from version 1)

The ADRIMA is providing a point to point or a point to multi-point LAN connection. The Throughput of the connections is in the range of 2 to 100 Mbit/s.

The bridge interfaces are :

- One 10/100 base T interface
- One to 63 (VC12 in SDH frame) WAN access
- One STM1 ATM access (VC4)

Each WAN access can be composed by several VC12 (1 to 63). In this case, a multiplexing function is used (ATM/IMA).

The ADRIMA offers possibility to connect SDH network to ATM network.

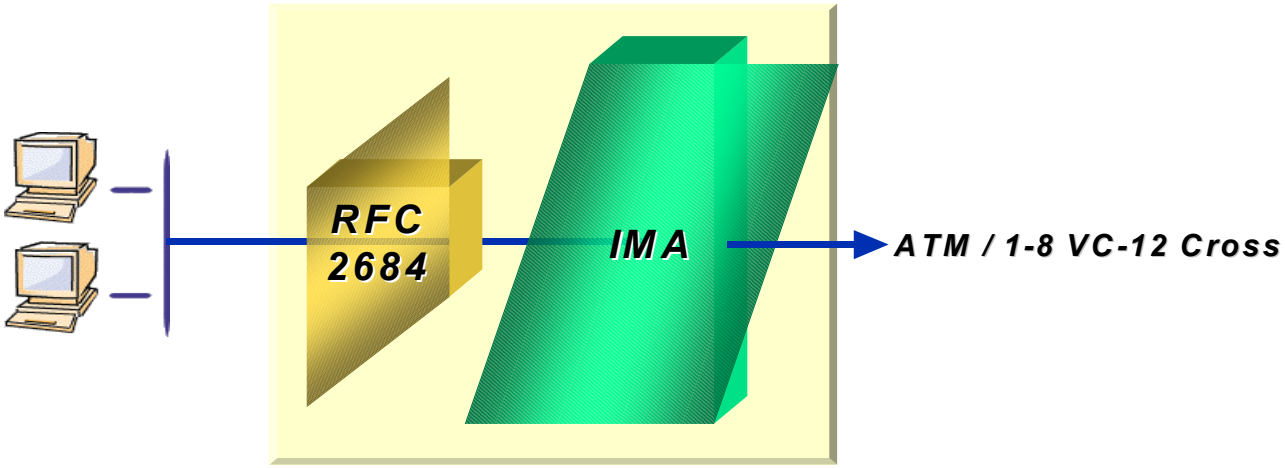


Figure 13 ADRIMA function (version 1)^

S-Access GmbH
Oberhausenstrasse 47
8907 Wettswil a/A
Switzerland
tel: +41 1 700 3111
fax: +41 1 700 3103
email: s-access@dplanet.ch

4.5.3 FRAME SWITCHING

At each network node, the frames are routed according to their MAC address ("level 2 switching"); this is the function of the filtering bridge.

This mechanism enables automatic reconfiguration of the network when the topology or configuration is modified.

4.5.4 DATA PROTECTION

The transmitted data benefits from SDH architecture protections, with very short switching times (50 ms); in addition, the "spanning tree" offers adaptation of the logical structure of the network to its physical structure.

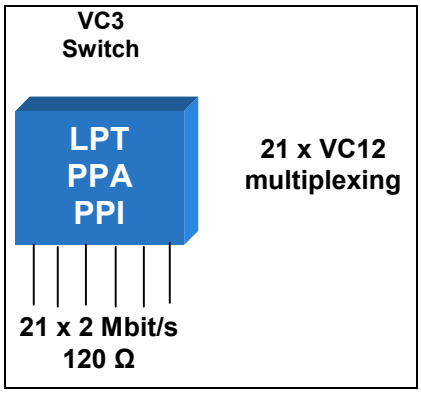


Figure 14: 21x2 Interface

4.7 1 X E3/DS3 ACCESS

The interface module provides the following functions:

electrical conversion,

E3/DS3 Mbit/s signal multiplexing,

TUG-3 Tributary Unit Group generator.

4.6 21 X E1 ACCESS

The interface module provides the following functions:

HDB3 converter,

2 Mbit/s signal multiplexing (Fig.10),

formation of TUG-3 tributary unit groups,

The 21x2 Mbit/s interface is of the 120 ohm G.703 type over 2 SubD/HE5 connectors, one for the 21 inputs, and the other for the 21 outputs. For 75-ohm interfaces, a 75-ohm 21x2 Mbit/s connection panel is used, fitted with a 120/75 impedance adapter and BNC coaxial connectors.

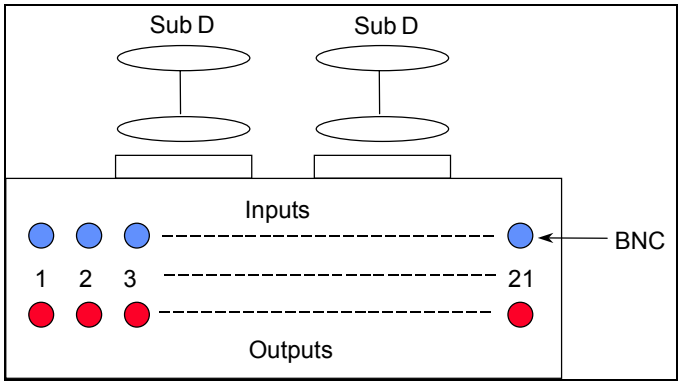


Figure 15: 75 ohm 21xE1 Mbit/s panel

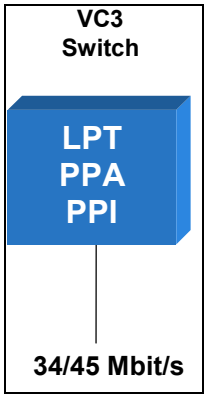


Figure 16: 1x34/45 Interface

S-Access GmbH
Oberhausenstrasse 47
8907 Wettswil a/A
Switzerland
tel: +41 1 700 3111
fax: +41 1 700 3103
email: s-access@dplanet.ch

5 OPTICAL ENGINEERING

5.1 OPTICAL LINK BUDGET

The equipment (or system) power budget is expressed as dB available between the S and R interfaces of the system, i.e. the difference between average transmitter output power and the optical input power necessary to obtain a BER value equal to or less than 10^{-10}.

In SDH networks, the system penalty does not affect optical output power parameters because the latter include temperature variations (5°C/45°C) and above all ageing.

System budget (guaranteed values)

	ADRIC1.1	**ADRIC1.2**	**ADRS1.1**	**ADRL1.1**	**ADRMM1**
Standard	G.957 et G.958	G.957 et G.958	G.958	G.957 et G.958	ANSI T1.646
Working mode	Mono mode	Mono mode	Mono mode	Mono mode	Multi mode
Wavelength (nm)	1310	1550	1550	1310	1310
Data rate (Mbit/s)	155,52 ±20 ppm	155,52 ±20 ppm	155,52 ±20 ppm	155,52 ±20 ppm	155,52 ±20 ppm
Code	No coding NRZ	No coding NRZ	No coding NRZ	No coding NRZ	No coding NRZ
Output power (S point)	-5 to 0 dBm	-5 to 0 dBm	-15 to -8 dBm	-5 to 0 dBm	-20 to –14 dBm
Sensitivity (R point)	-34 dBm	-34 dBm	-28 dBm	-34 dBm	-30 dBm
Max level (R point)	0 dBm	0 dBm	-8 dBm	-10 dBm	-14 dBm
Connector	FC/PC	FC/PC	SC/PC	SC/PC	SC/PC

	ADRIC S4.1	**ADRIC L4.1**	**ADRIC L4.2**
Standard	G.957 et G.958	G.957 et G.958	G.958
Working mode	Mono mode	Mono mode	Mono mode
Wavelength (nm)	1310	1310	1550
Data rate (Mbit/s)	622,08 ±20 ppm	622,08 ±20 ppm	622,08 ±20 ppm
Code	No coding NRZ	No coding NRZ	No coding NRZ
Output power (S point)	-15 to –8 dBm	-3 to +2 dBm	-3 to +2 dBm
Sensitivity (R point)	-28 dBm	-28 dBm	-28 dBm
Max level (R point)	-8 dBm	-8 dBm	-8 dBm
Connector	SC/PC	SC/PC	SC/PC

All this data is valid for G.652 mono-mode fibers.

The optical cards used are also compatible with multimode optical fibers. In this case the cable length is limited to around 15 km.

6 INSTALLATION

6.1 MECHANICAL INSTALLATION

The same SA A 155 unit can be used either installed on a table, wall-mounted, or mounted in a 19'' or ETSI rack, 300 mm deep.

A maximum of 6 SA A 155 per rack is suggested for consumption.

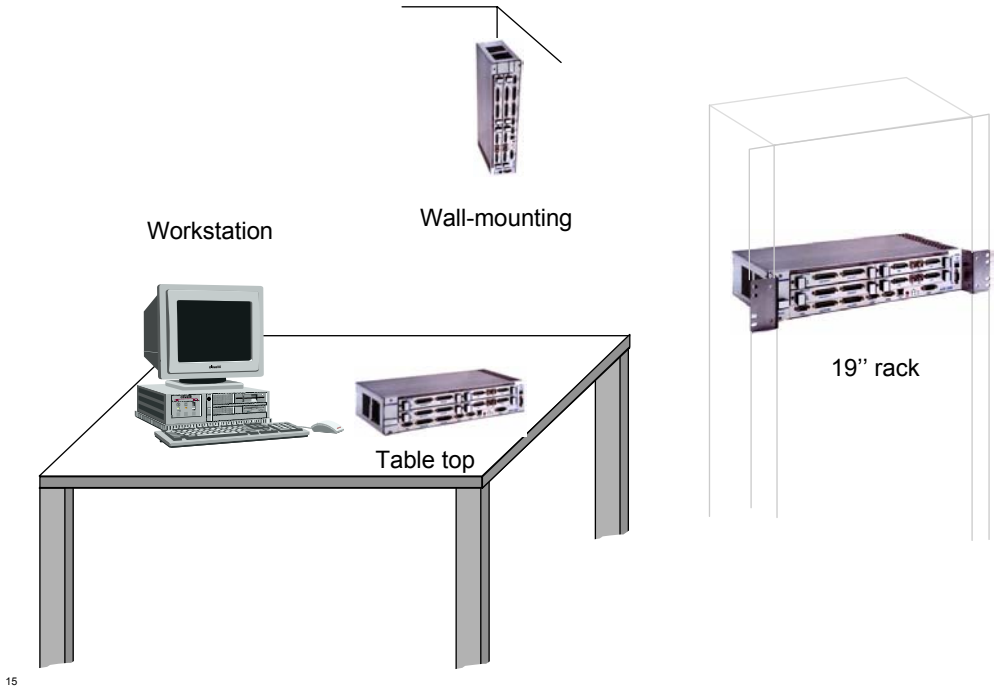


Figure 17: Table, wall or rack installation

S-Access GmbH
Oberhausenstrasse 47
8907 Wettswil a/A
Switzerland
tel: +41 1 700 3111
fax: +41 1 700 3103
email: s-access@dplanet.ch

6.2 WIRING

All wiring accesses are on the front panel of the sub-rack.

The various connectors are as follows:

External interfaces	Location	Connector
Power supply:	Sub-rack	9-pin female HE5/subD
Synchronization:	Sub-rack	9-pin female HE5/subD
Remote signaling alarm loops:	Sub-rack	15-pin female HE5/subD
VT100 local operating terminal: V.24/V.28 interface	Sub-rack	9-pin female HE5/subD
Manager: Ethernet 10	Sub-rack	RJ45 (10baseT)
V.11 Manager or X.21/V.11 1 x 2 Mbit/s interface:	Sub-rack	HE5/subD
120 ohm 21 x 2 Mbit/s interface:	Sub-rack and 21x 2 Mbit/s module	HE5/subD
75 ohm 21 x 2 Mbit/s interface:	external panel	BNC
75 ohm 1 x 34/45 Mbit/s interface:	1x 34/45 Mbit/s module	BNC (or 1.6/5.6: BNC - 1.6/5.6 adapter)
Ethernet interface: (10BaseT or 100BaseT)	ADRLAN module	RJ45
EOW and AUX channel interface:	155 Mbit/s electrical or optical interface	15-pin female HE5/subD
G.703 1 x 155 Mbit/s interface: electrical	Electrical 155 Mbit/s module	BNC (or 1.6/5.6: BNC - 1.6/5.6 adapter)
Optical 1 x 155 Mbit/s interface	Optical 155 Mbit/s module IC1.1 or IC1.2	FC/PC
Optical 1 x 155 Mbit/s interface	Optical 155 Mbit/s module S1.1 or L1.1	SC/PC
Optical 1 x 620 Mbit/s interface	Optical 620 Mbit/s module S4.1 or L4.1 or L4.2	SC/PC

7 SUPERVISION/MAINTENANCE

7.1 SUPERVISION

7.1.1 LOCAL SUPERVISION

SA A 155 owns HTTP server enabling any PC with an Internet browser to be used as a Local Craft Terminal.

Local Management is done with traditional alarms, performances, configuration and Fault features.

A VT100 console is connected to the RS232 (F) interface which enters the IP address.

The interface is the serial asynchronous type - 8 bits without parity - supporting 19200-baud data interchanges.

7.1.1.1 INFORMATION CONTENT

The screens are in English. The user has access via a screen menu to sections relating to :

- hardware and software inventory,
- configuration of basic functions,
- basic functions alarms report,
- performance monitoring.

7.1.1.2 Downloading

The SA A 155 can be downloaded locally and from the centralized management system. This function is particularly useful when software modifications are required, e.g., the addition of new functions.

TBD

Figure 18 : SA A 155 local supervision through an Internet browser

S-Access GmbH
Oberhausenstrasse 47
8907 Wettswil a/A
Switzerland
tel: +41 1 700 3111
fax: +41 1 700 3103
email: s-access@dplanet.ch

7.1.2 CENTRALIZED MANAGEMENT (ACCESS GAIN VIEW NMS)

NETWORK MANAGEMENT SYSTEM ACCESS GAIN VIEW NMS manages networks with SA A 155, SA T155 and SA A 2500.

The management network is composed of an Ethernet LAN, which includes a workstation supporting ACCESS GAIN VIEW NMS (PC or SUN Server). At least one of the SA A 155, SA T 155 or SA A 2500 in the network is linked to the SNMP manager. The DCC channel relays supervision information to the SNMP manager.

DCC channel communications are protected in the same way as the STM-1/4 line.

There are two possible centralized management levels:

- network view:
- showing all network links,
- equipment view:
  showing modules in a particular equipment unit.

The functions available are identical to those offered at local operating level.

NETWORK MANAGEMENT SYSTEM
for SA A 155 SA T155 and SA A 2500

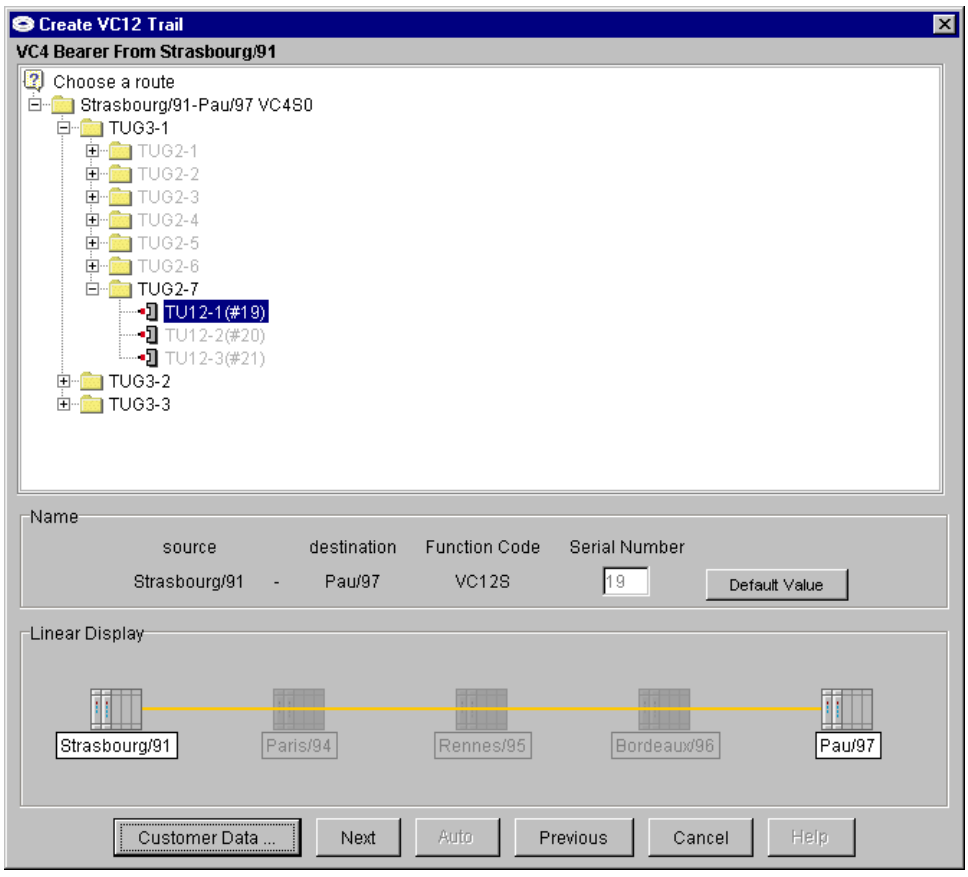


Figure 19: Provisioning Window from ACCESS GAIN VIEW NMS

S-Access GmbH tel: +41 1 700 3111
Oberhausenstrasse 47 fax: +41 1 700 3103
8907 Wettswil a/A
Switzerland email: s-access@dplanet.ch

7.1.3 MANAGEMENT SA A 155 OVER SDH NETWORK

The A 155 has the possibility to transport management of SA A 155 over VC12. In this case, the SA A 155 can be connected to all SDH vendors. It needs one SA A 155 as a “gateway” which routes the management packets. The VC12 transports the management protocol over the backbone.

The three main advantages of this solution are :

- compatibility with all SDH backbone,
- this solution uses only 2 VC12,
- and do not require additional environment equipment.

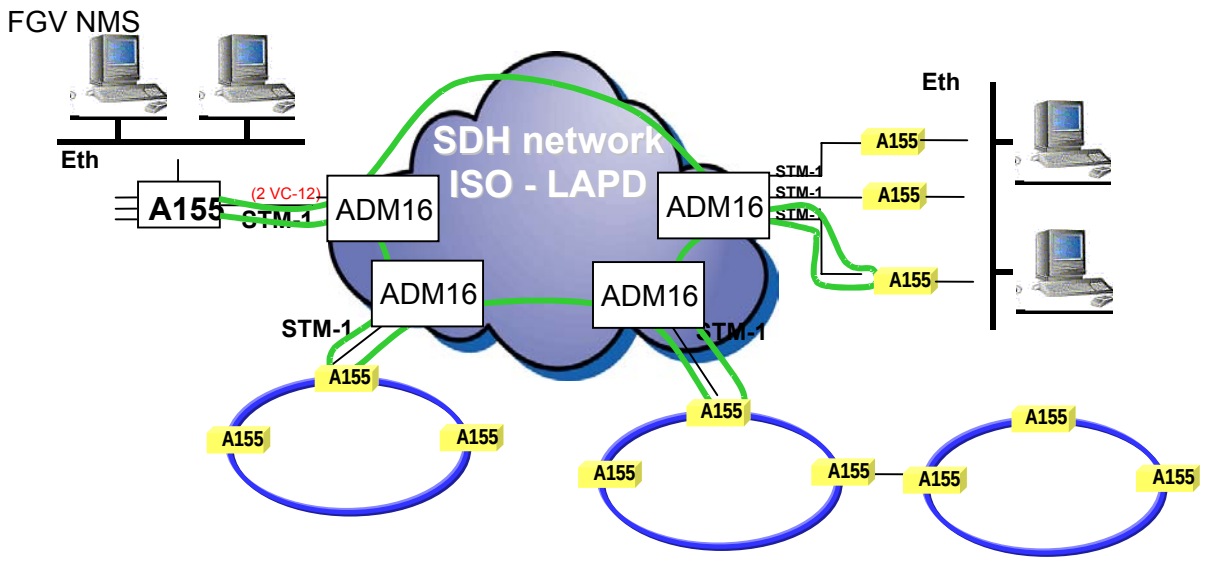


Figure 20 : Management carrier in the backbone network

S-Access GmbH
Oberhausenstrasse 47
8907 Wettswil a/A
Switzerland
tel: +41 1 700 3111
fax: +41 1 700 3103
email: s-access@dplanet.ch

7.2 MAINTENANCE

7.2.1 ALARMS

The SA A 155 System provides operators with various fault detection and faulty card isolation facilities for maintenance purposes.

On the SA A 155 equipment :

- LEDs on each card,
- two network management relay contact alarms.
- Via the workstation :
- current alarms status,
- alarm and performance event logs.
- network, link or equipment level view.

The SA A 155 has four remote signaling inputs ("TSIG") for external equipment alarm notification.

7.2.2 SELF-TESTS

The SA A 155 software carries out software self-tests:

- at start-up,
- periodically,
- upon insertion of a new module.

These routines are transparent to operations and do not affect service.

7.2.3 LOOPBACKS

The SA A 155 has integrated loop back functions to aid the operator in diagnosing local multiplexer or network faults.

7.2.3.1 STM-1/4 Line Loop back

Equipment loop back applied to the main or standby STM-1/4 line is used for testing the equipment. Line loop back applied to far-end equipment via the main or standby STM-1/4 line is used for testing the transmission path.

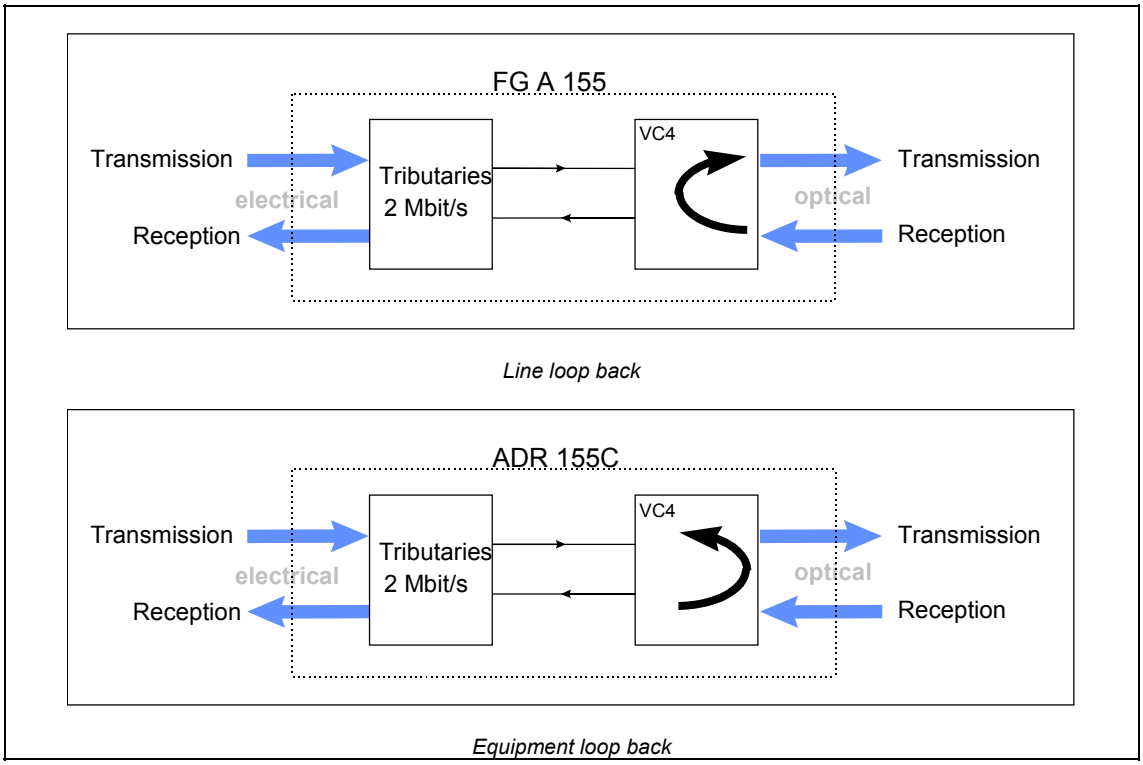


Figure 21: Line loop back

7.2.3.2 E1/E3/DS3 Tributary Loop back

Tributary loop back is used specifically to loop back one or more E1/E3/DS3 tributaries in order to test the interface circuits.

Equipment loop back is used specifically to loop back one or more E1/E3/DS3 tributaries, to test the transmission from this/these tributaries.

It is possible to carry out loop back of all equipment and of all tributaries at once.

All above loop back facilities can be configured over the Network Management System.

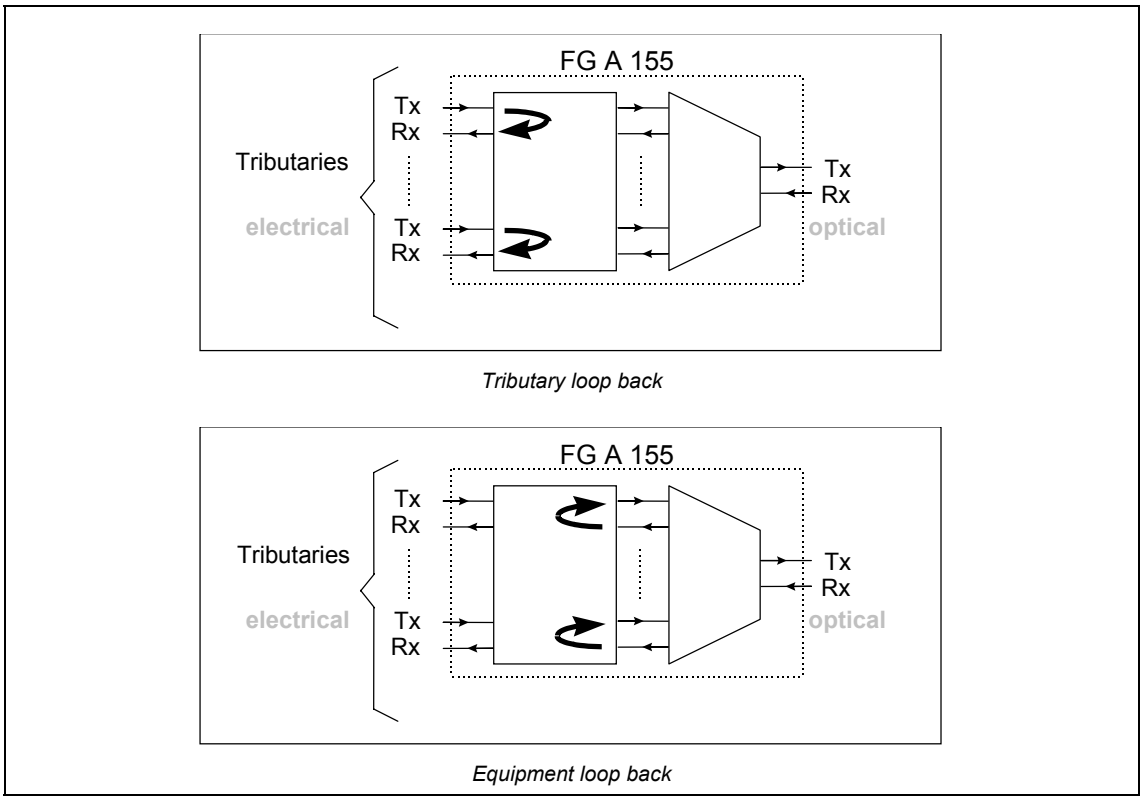


Figure 22: Tributary loop back

S-Access GmbH
Oberhausenstrasse 47
8907 Wettswil a/A
Switzerland
tel: +41 1 700 3111
fax: +41 1 700 3103
email: s-access@dplanet.ch

8 SPECIFICATIONS

8.1 ELECTRICAL AND OPTICAL SPECIFICATIONS

8.1.1 AFFLUENT SIGNALS

	45 Mbit/s G.703	34 Mbit/s G.703	2 Mbit/s G.703	2 Mbit/s V.11	10/100 Mit/s
Bitrate	45 Mbit/s	34 Mbit/s	2,048 Mbit/s	2,048 Mbit/s	10 or 100 Mbit/s (configurable)
Access	UIT-T G.703 G.824	UIT-T G.703 G.823	UIT-T G.703 and G.823	X.21/V.11	IEEE 802.3
Code	B3ZS	HDB3	HDB3		Ethernet standard (CSMA-CD)
Impedance	75Ω	75Ω	120 Ω or 75 Ω		
Connector	BNC	BNC	SubD/HE5 or BNC	SubD/HE5	RJ 45

	G.703 155 Mbit/s	155 Mbit/s optical
Bitrate	155.520 Mbit/s	155.520 Mbit/s
Standard	G.703	1310 or 1550 nm : ITU-T G.957
Code	CMI	NRZ
Connector	BNC	FC/PC or SC/PC
Optical safety		yes

8.1.2 AGGREGATE SIGNALS

	G.703 155 Mbit/s	155 Mbit/s optical	622 Mbit/s optical
Bitrate	155.520 Mbit/s	155.520 Mbit/s	622.080 Mbit/s
Standard	G.703	1310 or 1550 nm : ITU-T G.957	1310 nm or 1550 nm : ITU-T G.957
Code	CMI	NRZ	NRZ
Connector	BNC	FC/PC or SC/PC	SC/PC
Optical safety		yes	yes

S-Access GmbH
Oberhausenstrasse 47
8907 Wettswil a/A
Switzerland
tel: +41 1 700 3111
fax: +41 1 700 3103
email: s-access@dplanet.ch

8.2 SUPERVISORY INTERFACES

TMN interface	10 base T Ethernet (RJ45)
F Interface (VT100):	V.24/V.28 (SubD/HE5)
EOW and AUX channel	64 kbit/s V.11 (SubD/HE5)

8.3 MECHANICAL SPECIFICATIONS

19" subrack external dimensions (L x H x D)	19" x 2U x 300 mm
Unit external dimensions (L x H x D)	422 x 91 x 225 mm
Subrack weight	3 kg

8.4 POWER SUPPLY

Input voltage:	-48 VDC
With adapter:	110VAC/240VAC (50-60 Hz)
Input voltage range	-36V to -72 VDC

8.5 POWER CONSUMPTION

S-ACCESS- SA A 155	typical 35 W

8.6 ENVIRONMENTAL CONDITIONS

Operating temperature normal	-5°C to +45°C
Packaged/transport temperature	-40°C to +70°C
Relative humidity	less than 85 %
Wall unit protection index	IP52
EMC	NF EN 300 386
Security	EN 60 950

8.7 GUARANTEED ATTENUATION (*)

	Type	Operating Wavelength (nm)	Guaranteed Attenuation Budget (dB)	Typical Range (km)
Optical aggregate signals	IC-1.1	1300	0 - 28	0 - 68
	IC-1.2	1550	0 - 28	0- 100
	S-1.1	1300	0 - 12	0 - 28
	L-1.1	1300	10-28	22 – 68
	MM1	?	0-9	0-2
	S4.1	1300	0-12	0-25
	L4.1	1300	10-24	22-60
	L4.2	1550	10-24	40-90

(*) Available between S (Tx) and R (Rx) interfaces as defined in ITU-T Rec. G.957 (10-10 BER)

S-Access GmbH
Oberhausenstrasse 47
8907 Wettswil a/A
Switzerland
tel: +41 1 700 3111
fax: +41 1 700 3103
email: s-access@dplanet.ch