FastLink
the Multiservice Access System
for Telephony, Data and Broadband Services
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In today’s climate establishing their own access networks is the key to profitability in the fixed network business for every network operator. With the Siemens FastLink product users are offered DLC and FITL solutions which make the business of arranging such networks simple, flexible and economical.

Even today, the most important sources of income remain the telephone services (POTS, ISDN). Starting with a simple telephone connection and progressing through a second line for internet and fax to ISDN access, FastLink supports these services and puts the network operator in a position to make high profits. For servicing business and high-end private customers FastLink also makes it possible to provide leased lines (voice and data) as well as broadband data services, via DSL for example.

Its modularity and open architecture make FastLink quick and easy to integrate into any network environment. Additional services such as broadband data services via DSL can be provided through integration of broadband components and powerful upgrade kits. Connection to any type of exchange via standardized V5 interfaces has long been normal practice for many network operators with FastLink. Preconfigured outdoor technology proven on the world market makes it unnecessary to use special air-conditioned operating rooms and significantly shortens the time between delivery and operational deployment.

The telephony, data and broadband services are based on: The Optical Network Unit (ONU) as a compact unit for subscriber access, protocol, routing and transport. The following modules are available for the ONU:

- Access Multiplexer AMXC
- Access Multiplexer AMX or Multiplexer FMX2R3.1 (only for ONU 20 FTTO and ONU 30 FTTB)
- ATM Multiplexer Mini-DSLAM or Micro-DSLAM
- Synchronous Multiplexer SMX1/4c or SMA1K-CP
- Optical Multiplexer OMX16
- 2-Mbit/s Line Equipment LE2
- Terminal panels and distributors
- Power supply with/without battery backup
- Double-walled shelter without active cooling for the outdoor operation
- ETS racks with side panel and front doors (optional) for the indoor operation

The Optical Line Termination (OLT) as a central access to the local exchange, the data networks and ATM/IP networks. The following modules are available for the OLT:

- Crossconnect Multiplexer CMXII-V5.x/CAS as gateway to V5.1/V5.2 exchanges, for routing data channels and for CAS/V5.x conversion
- IP router or ATM switch XP140 for inclusion of broadband
- Synchronous Multiplexer SMX1/4c or SMA1/4c
- Optical Multiplexer OMX16
- 2-Mbit/s Line Equipment LE2
- Terminal panels and distributors

The Network Termination (NT) as a compact desktop unit complementing the ONUs for leased lines, online services, multimedia and broadband applications.

The user-friendly management system AccessIntegrator (ACI) for central operation and monitoring is used for all FastLink components. The AccessIntegrator administers, monitors and manages the entire access network, which significantly reduces both the service and implementation costs as well as the ongoing operating costs. A tool for the mass provisioning of subscribers (MASSPROVI) considerably eases the task of creating large numbers of subscribers. The major advantage of such an arrangement is the reduced outlay needed for commissioning. The ACI with its client-server architecture can be used not only as a multi-station or standalone system but also as a local craft terminal (LCT).
FastLink’s telephony, data and broadband services can be linked into a wide range of network structures, as it supports point-to-point, point-to-multipoint, tree and ring architectures. This provides the network operator with maximum flexibility in selecting a suitable structure for his network.

There are powerful upgrade kits available for both setting up new networks and safeguarding current and future investments, ensuring the provision of broadband services with the aid of xDSL-technology.

Using existing twin copper cables in the subscriber access area, ADSL can be employed to transfer data at up to 8 Mbit/s (downstream) and 800 kbit/s (upstream) between subscriber and Internet Service Provider.

With high-speed Internet access via SHDSL data and voice is transported using ATM at speeds of up to 2.3 Mbit/s.

The integration of ADSL and/or SHDSL components into FastLink networks will supplement the TDM-based narrowband signals by ATM-based broadband signals. This means that ATM-based broadband transmission over the entire transmission link, from the ISP interface in the OLT up to the DSL modem (broadband NT or NIC) at the subscriber is possible.
The Optical Network Unit (ONU), as the central system component for telephony, data and broadband services, combines multiplexer and transport facilities for optimum configuration of telecommunication, city or corporate networks. The network operator has a choice of different ONU types for connecting up to 2048 narrowband and up to 80 broadband subscribers; FTTC variants for outdoor use or FTTO/FTTB variants for indoor operation.

A number of ONU variants provide the option of ODT functionality, so that the ONU can also be used as an active hybrid distribution unit and thereby making a significant contribution to reducing costs. The number of multiplexers and the number of interfaces can be expanded as required, ranging from the small starter system through to the comprehensive network.

A wide range of the latest transmission technologies is employed to ensure that the ONU can be used in all network areas. Transmission with wavelength division multiplexing (WDM) on an optical glass fiber can span up to 50 km (without repeaters) and whereas transmission with HDSL on e.g. 0.8-mm copper cable can span up to 8 km (dependent on cable type).

The Optical Line Termination (OLT) is the FastLink component which terminates the glass fiber and/or copper cable network and implements the interfaces to the exchange, to the data network and the ATM network. The connection to the exchange is made directly via digital 2-Mbit/s interfaces, with signaling complying with the international V5.1/V5.2 standards. If these interfaces are not available, the OLT is connected using voice frequency (VF) or 2-Mbit/s interfaces with Channel Associated Signaling (CAS).

The broadband connection to the Internet Service Provider (ISP) is made using IP routers or an ATM switch function either via an Ethernet interface or via an optical STM-1 point-to-point connection. In addition the OLT is the central access point for the AccessIntegrator network management system both via a QD2 interface and via an SNMP interface.

FastLink’s Network Terminations (NTs) provide subscribers directly with both high-speed digital interfaces for online services and multimedia applications, such as video-on-demand, fast Internet or tele-learning, and also for all other standard bit rates.

The NTs are compact desktop units that connect via copper or fiber-optic cable to the ONU or the OLT cover a wide range of attractive subscriber services. Thus e.g. the ADSL NTs provide an Ethernet interface for high-speed Internet connections and simultaneous S0 or a/b interfaces for voice transmission.

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... and Network Structures

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FastLink’s Optimized Telephony, Data and Broadband Services

Compact ONUs

- **Compact shelves**
  - Up to 32 POTS or 8 ISDN interfaces per line card (LC)
  - Up to 512 POTS or 128 ISDN interfaces per shelf

- **Integrated broadband application with Mini-DSLAM or Micro-DSLAM**
  - Up to 32 ADSL or 16 SHDSL interfaces per LC
  - Up to 64 ADSL or 80 SHDSL interfaces per shelf

- **Complete infrastructure**
  - Outdoor shelter for operation in the open air
  - Rack-mounted or special desktop or wall-mounted housing for operation within buildings
  - Internal or external power supply with and without battery backup
  - Intelligent temperature and battery management
  - Flexible solutions for system and subscriber interfaces (MDF) and 2-Mbit/s-distribution frames (DDF)
  - Integrated feeders (STM-1, STM-4, 34 Mbit/s, 2 Mbit/s)

- **Optimized outdoor shelter**
  - Does not require air conditioning
  - Guarantees optimum security and functionality and a defined range of operating temperatures
  - Side doors and front doors offer easy access to the distribution units for cabling as well as for operation and maintenance of the components

- **Small size**
  - Small footprint
  - Easy installation through pre-mounted shelter and rack
Various Concentration Concepts

- **Single-step concentration**
  - ONU
  - AMXC
  - V5.2
  - OLT
  - V5.2
- V5.2 direct at the ONU
- Single-stage voice concentration
- Minimum number of network elements

- **Two-step concentration**
  - ONU
  - AMXC
  - V5C
  - OLT
  - CMXII
  - V5.2
- V5C at the ONU, V5.2 at the OLT
- Two-step voice concentration
- Consolidation of leased lines (LL) and thereby reduction of the transport capacity needed
- Internal control channel ECC to monitor the ONU and thus use of available transport infrastructures
- Reduction in the number of V5.2 interfaces to the exchange

Integrated Line Test for POTS and ISDN (ILTF/PAT)

- POTS: Line test integrated on the line cards (LCs)
- ISDN: Line test with Test Probe Unit (TPU)
- All necessary measurements performed (voltages, resistances, capacitances,...)
- On-demand measurements supported
- Periodic line testing (PAT)
- High performance due to line test running in parallel
- High customer satisfaction due to better service
With FastLink’s “medium to large” Optical Network Units, the
ONU 250 FTTB/FTTC and
ONU 1000 FTTB/FTTC, up to 2048
narrowband and up to 80 broad-
band subscriber lines can be pro-
vided.

The ONUs are available for both
indoor operation (FTTB) and out-
door operation (FTTC) and contains
all the infrastructure components
such as shelter/rack, internal or
external power supply with and
without battery backup, terminal
panels for system and subscriber
interfaces (MDF), 2-Mbit/s distri-
bution frames (DDF) and optical dis-
tributor (ODF).

The enclosures for outdoor deploy-
ment offer optimum security, oper-
ating temperature and operability.
The enclosed, double-walled shel-
ter keeps out e.g. moisture and
small animals, as well as maintain-
ing a predetermined operating
temperature range.
Side doors and front doors provide easy access to the distributors for the cabling as well as for operating and maintaining the components. For indoor operation the ONUs are installed in racks. The racks comply with the ETS standard and can mount up to five subracks as required.

Multiplexers and transport systems of the ONUs consist of one or more plug-in units in double Eurocard format. These units are mounted in 19" or ETS shelves. The shelves (beside UMX2S2 and UMXLS) are equipped with terminal panels, which significantly reduces the work of installation.

The central management, measuring and power supply functions are realized in the COMPS2 (ONU 250 FTTB/FTTC) or COMPS (ONU 1000 FTTB/FTTC) shelves.
With FastLink’s “smallest” ONUs, the ONU 20 FTTO and the ONU 30 FTTB, up to 20 or 30 subscriber lines can be provided. The compact unit in a desktop housing (ONU 20 FTTO) or in a wall housing (ONU 30 FTTB) for use within buildings with a strongly distributed subscriber structure guarantees fast connection of new subscribers and is particularly suitable of use by business customers.

These ONUs are constructed from the following components:
- Access Multiplexer AMX with max. 2 LCs (ONU20 FTTO) or max. 3 LCs (ONU 30 FTTB)
- Flexible Multiplexer FMX2R3.1 of the system FMX2R3.1 with max. 2 LCs (only ONU 20 FTTO)
- 2-Mbit/s Line Equipment LE2
- Supervision unit COSU (only ONU 20 FTTO)
- Measurement and supervision unit MSUE (only ONU 30 FTTB)

**Access Multiplexer AMX**

As an access multiplexer with V5.1 signaling the AMX provides up to 30 subscriber interfaces with each 64 kbit/s for a wide range of services. Subscriber channels and V5.1 signaling channel, multiplexed to form a 2-Mbit/s signal, are transmitted to the exchange via fiber-optic or copper cable. The AMX can be connected directly via the 2-Mbit/s interface to a digital exchange.

The following units are part of the AMX:
- Central unit CUA
- Line cards (LCs) for narrowband applications
- Terminal panels for system and subscriber interfaces
- AC connecting unit and splice cassette (only ONU 30 FTTB)

The ONU 20 FTTO is supplied with power via an external power adapter or by a backup battery. Direct power supply with –48 V is also possible.

The ONU 30 FTTB is supplied with the required operating voltage via the local power grid. The internal power supply module with backup battery converts the operating voltage into the necessary direct current supply.

**Subscriber Interfaces**

The subscriber interfaces are implemented by the LC of the multiplexer and the 2-Mbit/s line equipment.

**Line Interfaces**

Depending on requirements:
- 1 x optical 2 x 2 Mbit/s
- Max. 2 x 2 Mbit/s SHDSL/Uk2/G.703 optical (Ug2)
- 1 x 2 Mbit/s HDSL

Each interface type is implemented by a special line card:

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<tr>
<th>Interfaces, Services</th>
<th>IF per LC</th>
<th>LC</th>
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<tbody>
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<td>ISDN-BA, U_{10} for 2B1Q</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>ISDN-BA, U_{40} for 4B3T</td>
<td>8</td>
</tr>
<tr>
<td>POTS</td>
<td>POTS, a/b</td>
<td>10</td>
</tr>
<tr>
<td>Digital LL</td>
<td>G.703, n x 64 kbit/s, n ≤ 31</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>X.21, n x 64 kbit/s, n ≤ 30</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>V.35, n x 64 kbit/s, n ≤ 30</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>V.36, n x 64 kbit/s, n ≤ 30</td>
<td>2</td>
</tr>
<tr>
<td>Analog LL</td>
<td>2/4wire</td>
<td>10</td>
</tr>
</tbody>
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ONU 20 FTTO

ONU 30 FTTB

Subscriber Interfaces

Line Interfaces
The **OLT**, as a central access to the local exchange, the data networks and ATM/IP networks, is physically installed in one or more ETS racks which are set up within buildings on the exchange site. The racks can be equipped with up to four shelves. In addition each rack contains a terminal panel for power supply, QD2 and clock distribution.

For connecting glass fiber cables, depending on the number of connections required and the local circumstances, a splice box or an optical distribution frame (ODF) can be mounted in the rack.

For broadband connection to the Internet Service Provider an IP router with ATM switch function is installed in the OLT rack.

The number of racks concerned and how they are equipped, as well as the rack cabling are project-dependent.

The units are connected via the backplane of the shelf, on which the terminal panel with its connectors for external and internal cabling is also mounted. The intern connections typically include connections between the individual shelves and connections between the shelf and the rack terminal panel. All other connections, to the exchange, the data network, the Internet or to the ONU, are external connections.

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### Shelves and Modules
- CMXII-CS + 1 x CMXII-2S with 1 x CMXII (2-shelf variant)
- CMXII-CS + 2 x CMXII-2S with 1 x CMXII (3-shelf variant)
- CMXII-LS with 1 x CMXII-Light (1-Shelf-Variante)
- CMXII-LS + 1 x CMXII-2S with 1 x CMXII-Light (2-shelf variant)
- OMX2S2 with LE2
- OMX16S with OMX16, LE2
- SMXCS with SMX1
- SM/SMc with SMA1/4 R2 or SMA1/4c R2
- IP router or ATM switch (optional)
Network Terminations

The Network Terminations (NT) are deployed on the subscriber side, but can also be used on the network side as Line Terminations (LT). The NTs are linked to either a line card of the corresponding multiplexer or to a line termination unit of the 2-Mbit/s line equipment via copper or fiber optic cable.

**Network Terminations Unit NTU**

Up to two data terminals with interfaces in accordance to ITU-T recommendations can be connected via the NTU at a Uo interface with 2B10-encoding. The Uo interface can be implemented e.g. by the IUL82 line card of the multiplexer AMXC.

The NTU can be equipped with up to two (also different) interface modules which each implement one of the following interfaces:
- **V.24, V.35, V.36, X.21** with subrates up to 64 kbit/s
- **V.35, V.36, X.21** for 64 kbit/s or 128 kbit/s
- **G.703 codirectional** for 64 kbit/s

Power is supplied locally to the NTU via an AC adapter, with the option of 230 V or 115 V.

**Data Network Unit DNU01SD**

The DNU01SD is used for synchronous data transmission with high data rates of n x 64 kbit/s (maximum 512 kbit/s) via copper cable. Following interfaces are realized:
- **X.21**
- **V.35 or V.36**

The DNU01SD is equipped as standard with the X.21 interface. Data interfaces V.35 or V.36 are implemented by additional interface modules.

The network interface is provided by a transmission module which must also be included in the line card CPF2 of the AMXC. Following modules are available:

- **EDSL transmission with 64, 128, 192, 256, 384 or 512 kbit/s**
- **Baseband transmission with 2 x 64 kbit/s or 128 kbit/s**

Power is supplied locally to the DNU01SD via an AC adapter suitable for either 230 V or 115 V supply, depending on the version.

**Network Termination NT22OV**

Digital leased lines n x 64 kbit/s (n = 1 to 31) via a glass fiber can be set up with the NT22OV for the following interfaces:
- **V.35**
- **V.36**
- **X.21**

The NT22OV can be equipped with up to two (possibly differing) interface modules.

The V.35 and V.36 interfaces operate either in transparent or in protocol mode. In protocol mode point-to-multipoint connections can also be set up.

In addition transparent transmission of 2 Mbit/s acc. to ITU-T.V.35 is possible.

On the network side the unit is connected to an optical line termination unit LTO/LT via 2 x 2 Mbit/s. For this connection the NT22OV uses a wavelength of 1300 nm.

Power is supplied to the NT22OV via an external AC adapter either with 115 V or with 230 V AC or directly with 24 V DC.

**Network Terminations NT12C and NT220**

This NTs each contain one 2-Mbit/s line termination units:
- **NT12C: 1 x LTOH**
- **NT220: 1 x LTO/NT**

Both NTs are used for transparent 2-Mbit/s transmission.

Power is supplied via an external AC adapter either with 115 V or with 230 V AC.
Each interface type is implemented by a special service unit:

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<th>Interfaces, Services</th>
<th>Interfaces per LC</th>
<th>LC</th>
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<tbody>
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<tr>
<td>ADSL to splitter unit POSU32:I</td>
<td>32</td>
<td>SU_ADSL32I</td>
</tr>
<tr>
<td>ADSL over ISDN to subscriber</td>
<td>32</td>
<td>POSU32:I</td>
</tr>
<tr>
<td>ADSL over POTS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ADSL to splitter unit POSU32:P</td>
<td>32</td>
<td>SU_ADSL32P</td>
</tr>
<tr>
<td>ADSL over POTS to subscriber</td>
<td>32</td>
<td>POSU32:P</td>
</tr>
<tr>
<td>SHDSL</td>
<td></td>
<td></td>
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<tr>
<td>SHDSL with PAM16</td>
<td>16</td>
<td>SU_SHDSL16</td>
</tr>
</tbody>
</table>

**Advantages of the Mini-/Micro-DSLAM**

- ATM-based broadband transmission over the entire transmission link, from the ISP interface in the OLT to the DSL modem (broadband NT, NIC or IAD)
- Broadband and telephony services (ISDN/POTS) are transmitted via the ADSL interface on a shared twin copper wire between ONU and subscriber. The telephony and data signals are split and merged using the splitter units.
- Data and voice are transmitted symmetrically as SHDSL multiplex signals via a twin copper wire between the Mini-/Micro-DSLAM in the ONU and IADs installed at the subscribers. No splitter units are necessary.
- Transmission of n x E1 (n ≤ 8) by inverse multiplexing over ATM (IMA).
- Interoperability with Voice over DSL (VoDSL) since the same components and interfaces are used on the CPE and OLT side.
- Capacity increase to max. 160 SHDSL interfaces in the Mini-DSLAM and max. 32 SHDSL interfaces in the Micro-DSLAM (SU_SHDSL32) and expandable by additional VDSL services (SU_VDSL8) (on request)

**ATM Multiplexer Mini-DSLAM or Micro-DSLAM**

The ATM multiplexers Mini- and Micro-DSLAM are a cost-optimized variant of the broadband equipment of FastLink and offer an ATM-based network solution combining both broadband and narrowband services. All services are transmitted in end-to-end connections with the aid of ATM cells from the ATM network to the subscriber and back again.

For simultaneous transmission of voice and for example Internet data on a shared twin copper wire different xDSL techniques are used:

- ADSL with bit rates up to 8 Mbit/s for the transport of data in the direction of the subscriber (downstream) and 800 kbit/s in the opposite direction (upstream)
- SHDSL with bit rates of 2.3 Mbit/s in both directions
- The Mini-/Micro-DSLAM terminates the subscriber network, concentrates all the broadband and narrowband traffic and directs it via STM-1, E3 or IMA interfaces to the ATM network.
- The Mini-/Micro-DSLAM is monitored, supplied and controlled via the 10BaseT interface which is on a central unit.
- The following units are part of the Mini-/Micro-DSLAM:
  - Central Unit CLU
  - Service Units (SUs) for broadband applications
  - Splitter units

**Diagram**

- Subscriber
- ADSL over ISDN
- ADSL over POTS
- SHDSL/ATM
- CU
- SU_ADSL32
- SU_ADSL32
- POSU32:I
- POSU32:P
- SU_SHDSL32
- ISDN
- POTS
- AMXC
- E3 electr. or STM-1 opt. or IMA electr.

1) Equipped with max. 2 x SU_ADSL32 + Splitter or max. 5 x SU_SHDSL16
2) Equipped with 1 x SU_ADSL32 + Splitter or 1 x SU_SHDSL16
Access Multiplexer AMXC

Access multiplexer AMXC is a further development of the AMX and a cost-optimized implementation of the subscriber-side access to FastLink, which, by concentrating subscriber interfaces, makes it possible to connect large numbers of subscribers using the same transmission capacity.

The AMXC provides on the exchange side both the open V5.2 or V5.1 interface and an FastLink-internal concentrating V5C interface in conjunction with crossconnect multiplexer CMXI-I-V5.x. Thus, concentration rates of e.g. 4 : 1 are possible within the ONU itself.

Monitoring, supply and control of the AMXC is performed over the QD2-slave interface by the central measurement and power supply module COMPS or COMPS2.

The following units are part of the AMXC:
- Central unit CUAII
- Line cards (LCs) for narrowband applications
- Power supply unit PSU

Advantages of the AMXC

- Increase in subscriber concentration per multiplexer: A CUAII serves up to 16 LCs. For each LC up to 8 ISDN or 32 POTS interfaces are available. This means that for each AMXC up to 512 subscribers (POTS) can be connected.
- Saving transmission capacity on the systems side through the proprietary V5C interface between AMXC and CMXII. For each CUAII up to four 2-Mbit/s signals are transmitted from the AMXC to the CMXII. When the full concentrator function is utilized the capacity of max. four 2-Mbit/s signals can be transmitted over one 2-Mbit/s link (feeder).
- Saving the CMXII and transmission capacity on the system side by direct connection of the AMXC to the exchange via 2-Mbit/s interfaces with V5.2 protocol. When the full concentrator function is utilized the capacity of max. four 2-Mbit/s signals can be transmitted over one 2-Mbit/s link (feeder). In the standard variant two 2-Mbit/s links are provided (protection mode).
- AMXC concept for individual 2-Mbit/s signals allows different transport paths in the direction of the OLT. If, for example, an individual 2-Mbit/s transport channel fails, the AMXC traffic load can be routed via the remaining transport channels. To minimize the number of subscribers who are affected by the failure of a module or a transport channel, two CUAII units can be used. Both CUAII units divide up the traffic load and each serve eight LCs.

1) The number of subscriber interfaces depends on the LC type
2) Eight LCs per CUAII it two CUAII are equipped per shelf
3) Active when more than eight ISDN LCs are equipped
Each interface type is implemented by a special line card:

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<tbody>
<tr>
<td><strong>ISDN</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ISDN-BA, $U_{k0}$ for 2B1Q</td>
<td>8</td>
<td>IUL82</td>
</tr>
<tr>
<td>ISDN-BA, $U_{k0}$ for 4B3I</td>
<td>8</td>
<td>IUL84</td>
</tr>
<tr>
<td>ISDN-BA, $S_0$</td>
<td>8</td>
<td>I8S0P</td>
</tr>
<tr>
<td><strong>POTS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>POTS, a/b</td>
<td>16</td>
<td>SUB162</td>
</tr>
<tr>
<td>POTS, a/b</td>
<td>32</td>
<td>SUB322</td>
</tr>
<tr>
<td><strong>Digital LL</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G.703, $n \times 64$ kbit/s, $n \leq 31$</td>
<td>4</td>
<td>DSC6-nx64G</td>
</tr>
<tr>
<td>EDSL to DNU01SD, $n \times 64$ kbit/s, $n=1, 2, 3, 4, 6$ or $8$ $U_{k0}$-baseband with 4B3T to DNU01SD, $n \times 64$ kbit/s, $n \leq 2$ V.24/V.28, subrates to 64 kbit/s V.35, subrates to $n \times 64$ kbit/s, $n \leq 31$ V.36, subrates to $n \times 64$ kbit/s, $n \leq 31$ X.21/V.11, subrates to $n \times 64$ kbit/s, $n \leq 31$</td>
<td>4</td>
<td>CPF2</td>
</tr>
<tr>
<td><strong>Analog LL</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2/4wire with E&amp;M signaling</td>
<td>6</td>
<td>UAC68</td>
</tr>
</tbody>
</table>
Crossconnect Multiplexer
CMXII-V5.x

As a gateway for POTS and ISDN services between the dedicated network and the public network, the crossconnect multiplexer converts CMXII-V5.x channel-associated signaling (CAS) either into V5.1 or into V5.2 switching protocols. Through connections of leased lines or of CAS are also possible. The CMXII-V5.x consists of the following units:
- Central unit CCU
- Frame Relay unit V52FR
- 2-Mbit/s interface unit PUCAS and/or PU2+
- SISA interface unit PUSISA (optional)
- Supervision unit MCU
- Power supply PSC

The CCU, V52FR and PSC can be duplicated if module redundancy is required.

With the PU2+ on the subscriber side, 2-Mbit/s signals with V5.1 protocol can be switched or also concentrated in accordance with V5.2. In addition, via FastLink-internal signaling protocol (V5C) a concentration of the subscribers can additionally be undertaken.

Interfaces
- 2 Mbit/s as per ITU-T G.703
- Clock interfaces T3in and T3out for external synchronization
- QD2 interface for connection to a management system
- F interface for local management access (with LCT)
- Alarm interface as floating relay contacts

PUCAS and PU2+ each possesses 4 x 2-Mbit/s interfaces. If the shelves are fully equipped on the subscriber side with PUCAS and on the network side with PU2+, the resulting switching capacities are per magin:

Simultaneous operation of V5.1 and V5.2 in the direction of the exchange is not possible.

The CMXII-V5.x is available in four different capacity stages:
- Single shelf (CMXII-LS)
- Combination of two shelves (CMXII-LS and CMXII-2S or CMXII-CS and CMXII-2S)
- Combination of three shelves (CMXII-CS and 2 x CMXII-2S)

This means that its overall capacity can be adapted very variably to the requirements of the network.

Power supply to the CMXII-V5.x is –48 V/–60 V.

Operating Modes
- Connection types:
  - 64 kbit/s
  - 2 Mbit/s structured as per ITU-T G.704
  - LL n x 64 kbit/s
- Connections either bidirectional, unidirectional or also broadcast
- Conversion of CAS into V5 protocols
- Through connection of CAS
- Switching of V5 signaling information
- V5.2 concentration in the direction of the exchange
- Implementation of timer jobs
- 2-Mbit/s path protection

**CAS-V5 conversion with V5.1 interfaces in the direction of the exchange**

<table>
<thead>
<tr>
<th>Shelves</th>
<th>1 shelf</th>
<th>2 shelves</th>
<th>2 shelves</th>
<th>2 shelves</th>
<th>3 shelves</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMXII-LS</td>
<td>CMXII-LS + CMXII-2S</td>
<td>CMXII-LS + CMXII-2S</td>
<td>CMXII-LS + 2 x CMXII-2S</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Mbit/s</td>
<td>64k ch.</td>
<td>64k ch.</td>
<td>64k ch.</td>
<td>64k ch.</td>
<td></td>
</tr>
<tr>
<td>24/24</td>
<td>720</td>
<td>36/56</td>
<td>1080</td>
<td>72/68</td>
<td>2040</td>
</tr>
</tbody>
</table>

**CAS-V5 conversion with V5.1 interfaces in the direction of the exchange**

<table>
<thead>
<tr>
<th>Shelves</th>
<th>1 shelf</th>
<th>2 shelves</th>
<th>2 shelves</th>
<th>3 shelves</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMXII-LS</td>
<td>CMXII-CS + CMXII-2S</td>
<td>CMXII-CS + CMXII-2S</td>
<td>CMXII-CS + 2 x CMXII-2S</td>
<td></td>
</tr>
<tr>
<td>2 Mbit/s</td>
<td>64k ch.</td>
<td>64k ch.</td>
<td>64k ch.</td>
<td>64k ch.</td>
</tr>
<tr>
<td>32/16</td>
<td>960</td>
<td>36/32</td>
<td>1080</td>
<td>124/16</td>
</tr>
</tbody>
</table>
Crossconnect Multiplexer CMXII-CAS

For routing the services via a larger network node crossconnect multiplexer CMXII-CAS is used. The non-blocking switching is undertaken at the 64-kbit/s level.

The CMXII-CAS consists of the following units:
- Central unit CCU
- CAS unit CASU
- 2-Mbit/s interface units PU2+
- SISA interface unit PUSISA (optional)
- Supervision unit MCU
- Power supply PSC

The PUSISA is used if remote equipment (up to 128) is to be controlled via 64-kbit/s channels (ECC).

The CCU, CASU and PSC can be duplicated if module redundancy is required.

Interfaces
- 2 Mbit/s as per ITU-T G.703
- Clock interfaces T3in and T3out for external synchronization
- QD2 interface for connection to a management system
- F interface for local management access (with LCT)
- Alarm interface as floating relay contacts

The CMXII-CAS is available in four different capacity stages:
- Single shelf (CMXII-LS)
- Combination of two shelves (CMXII-LS and CMXII-2S or CMXII-CS and CMXII-2S)
- Combination of three shelves (CMXII-CS and 2 x CMXII-2S)

This means that its overall capacity can be adapted very variably to the requirements of the network.

Power supply to the CMXII-CAS is −48 V /−60 V.

Operation Modes
- Connection types:
  - 64 kbit/s
  - 2 Mbit/s as per ITU-T G.703, transparent
  - 2 Mbit/s structured as per ITU-T G.704
  - LL n x 64 kbit/s
- Connections either bidirectional, unidirectional or also broadcast
- Cross connection of channel-associated signaling (CAS)
- Digital conference circuits for up to 128 x 64-kbit/s subscribers
- Implementation of timer jobs
- Path protection at 2-Mbit/s level

Port unit PU2+ possesses 4 x 2-Mbit/s interfaces. If the shelves are fully equipped, the switching capacities are as shown in the table below:

<table>
<thead>
<tr>
<th>Shelves</th>
<th>1 shelf</th>
<th>2 shelves</th>
<th>2 shelves</th>
<th>3 shelves</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMXII-LS</td>
<td>CMXII-2S + CMXII-2S</td>
<td>CMXII-LS + CMXII-2S</td>
<td>CMXII-CS + 2xCMXII-2S</td>
<td></td>
</tr>
<tr>
<td>2 Mbit/s</td>
<td>2 Mbit/s</td>
<td>2 Mbit/s</td>
<td>2 Mbit/s</td>
<td></td>
</tr>
<tr>
<td>64 k ch.</td>
<td>64 k ch.</td>
<td>64 k ch.</td>
<td>64 k ch.</td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>92</td>
<td>1380</td>
<td>140</td>
<td>184</td>
</tr>
</tbody>
</table>
The central measurement and power supply modules COMPS or COMPS2 handle the central management and measurement functions in the ONUs as well as power distribution and for the COMPS2 the AC/DC conversion as well. Whereas the COMPS is primarily used in large ONUs (ONU 1000 FTTB/FTTC), the COMPS2 is used in smaller ONUs (ONU 250 FTTB/FTTC).

**Functions**

- Central operation and supervision of the ONU via the supervision unit OSU
- Centralized measurement function for ISDN line cards IUL82 and IUL84 via test probe unit TPU
- DC/DC power supply for auxiliary ringing voltage of POTS via power supply unit PSR
- AC/DC conversion and thereby direct access to the 230-V AC network via the GR60/6 unit (COMPS2 only)
- Control of battery backup via the supervision unit of battery backup TPA
- Power distribution and fusing of –48 V and –33 V battery voltages (only for COMPS with external AC/DC converter) via power distribution unit:
  - PDU for 230-V AC power supply of the ONU or
  - PDU2 for external supply of the ONU with –48 V
- Control signals for power supply
- Fan control

Supervision Unit OSU forms the access for the operations system to the ONU and implements functions to operate and supervise the individual functions within each ONU and to control measurement sequences between the TPU and the analog LCs.

The OSU has interfaces for connecting a TMN system and an F interface for connecting a local craft terminal (LCT).
Synchronous Multiplexer SMX1/4c

Plesiochronous 2-Mbit/s, 34-Mbit/s and/or electrical STM-1 signals to a synchronous network via an optical or electrical STM-1, or an optical STM-4 interface are connected with synchronous multiplexer SMX1/4c. Depending on the configuration of the SMX1/4c with optical or electrical add/drop multiplexer units ADM1o, ADM1e or ADM4 and expansion units TC21E1, TC21E1R, TC1E3 and TC1STM1e the interfaces and operating modes listed below are implemented.

**Interfaces**
- Up to 63 x 2 Mbit/s
- 1 x 34 Mbit/s
- 1 x STM-1 electrical
- 2 x STM-1 or 2 x STM-4 optical or 2 x STM-1 electrical
- Clock interfaces T3in and T4out for external synchronization
- QD2 interface as access for the management system
- Interfaces to overhead control channels as per V.11

**Operating Modes**
- Synchronous multiplexer level 1 or level 4
- Operation in both line and ring structures
- Add/drop function for filling up the STM-1/STM-4 signal in ring structures
- STM-1 with max. 63 x 2 Mbit/s
- STM-4 with max. 252 x 2 Mbit/s
- SNC/I protection switching as per ETS 300 417

Operating voltages +5 V and -5 V for the units of the SMX1/4c are provided by the power supply unit PSX or PSD.

Alternatively to the SMX1/4c Synchronous Multiplexer SMA1K-CP can also be used for linkage to a synchronous network with optical STM-1 interface.

Optical Multiplexer OMX16

The optical multiplexer OMX16 comprising multiplexer unit DSMX34, optical transceiver unit OTRU36 and supervision unit OTSU2M combines sixteen 2-Mbit/s signals into one 34-Mbit/s signal and conditions them for transmission over one single-mode optical fiber.

2-Mbit/s Line Equipment LE2

2 Mbit/s are prepared by the 2-Mbit/s line equipment for transmission on copper cable or optical cable.

The line equipment consists of units, which can be used on both the network side and the subscriber side.

**Line Termination Unit LTCOH**

As HDSL line equipment the LTCOH is used for transparent transmission of 1 x 2 Mbit/s on copper cables. Connections between two LTCOH or between LTCOH and network termination unit NT12C are possible.

**Line Termination Unit LT2ME1**

Line termination unit LT2ME1 can be equipped with up to two plug-in modules. This means that up to two line interfaces (including different ones) from the following assortment are available:

- 2 Mbit/s, U₉₂ as per FTZ 1TR221
- 2 Mbit/s, G.703 (short haul)
- 2 Mbit/s optical, U₉₂ as per FTZ 1TR222
- 2.3 Mbit/s SHDSL

Module Uk2mp also possesses a remote feed unit and can thus supply intermediate regenerators.

**Line Termination Unit LTO**

The optical line termination unit LTO uses a single mode glass fiber for transmission of 2 x 2 Mbit/s in send and receive direction. Using the 1550 nm optical window for the LTO/LT and the 1300 nm window for the LTO/NT separates the directions.

Management access for both units (LT and NT) is via the network-side unit. The management data are transmitted in the overhead channel.
The AccessIntegrator (ACI), Siemens’ network management solution for access products, supports the entire scope of FastLink’s telephony, data and broadband services and provides control of the entire network with all its services, transport functions and network elements from the topography level, the ONU view, down to the plug-in unit view.

With their IP interface to the Data Communication Network (DCN) the network elements can be controlled via QD2 and also via SNMP. The management channels are routed inband or outband. A higher ranking operation and maintenance system can use the CORBA or SNMP interface to conduct alarm supervision, service creation and service activation as well as line tests via the ACI.

In this way it is possible to control the entire network centrally from one operator terminal with complete path management.

Features of the ACI
- Graphical user interface based on Windows NT® including support for various languages
- Client-server architecture with distributed tasks
- Optimum scalability for networks small and large
- Fully object-oriented application software
- Standard interfaces for integration into superordinate networking or management systems (CORBA, SNMP)

The ACI runs with the Windows operating system and can be configured from single user up to multi-user including high-availability as warm standby.

Network Management
The entire network is displayed and can be adapted to the real network topology with the network editor.

Configuration Management
Special software is loaded to each plug-in unit. The element and path parameters can be configured for operational as well as for test purposes.

Performance Management
Performance data can be displayed on screen or be recorded in log files.

Fault Management
The entire network and every fault are displayed down to the smallest element. In the case of permanent faults the relevant functional unit is disconnected and an alarm is sent over the Telecommunications Management Network (TMN).

Security Management
Access control with subdivided authentication classes conforms to today’s security requirements.
Technical Specifications

Access Multiplexer AMXC

**CUAII**
- Number of 2-Mbit/s interfaces: 4 (G.703/6)
- Bit rate: 2048 kbit/s
- Operating voltage: +5 V
- Power consumption: 6 W

**CPF2**
- Interface modules: 4
- Number of interfaces per module: 1
- Operating voltage: +5 V
- Power consumption (without module): 2.5 W

**Interface module UEB128-04E**
- Transmission method: U0 baseband with 4B3T
- Bit rate: n x 64 kbit/s (n = 1 to 8)
- Reach with 512 kbit/s and 0.6-mm conductor diameter: 8 km

**Interface module EDLS**
- Transmission method: pseudo-ternary baseband
- Bit rate: n x 64 kbit/s (n = 1 to 8)
- Reach with 512 kbit/s and 0.6-mm conductor diameter: 3.8 km

**Interface module CIM-V.24**
- Electrical characteristics: V.28
- Bit rate:
  - asynchronous: 0.3 to 38.4 kbit/s, 115.2 kbit/s
  - synchronous: 0.6 to 64 kbit/s, 128 kbit/s
- Reach with 19.2 kbit/s and 0.6-mm conductor diameter: 15 km

**Interface module CIM-V.35**
- Electrical characteristics: V.28/V.35 All
- Bit rate:
  - asynchronous: 0.3 to 38.4 kbit/s, 115.2 kbit/s
  - synchronous: 0.6 to 48 kbit/s, 56 kbit/s
  - n x 64 kbit/s (n = 1 to 31)
- Reach with 64 kbit/s (V.35 All), 1000 m
- Reach with 19.2 kbit/s (V.28) and 0.6-mm conductor diameter: 15 m

**Interface module CIM-V.36/RS530**
- Electrical characteristics: V.10/V.11
- Bit rate:
  - asynchronous: 0.3 to 38.4 kbit/s, 115.2 kbit/s
  - synchronous: 0.6 to 56 kbit/s, n x 64 kbit/s (n = 1 to 31)
- Reach with 64 kbit/s (V.11), 1 kbit/s (V.10), and 0.6-mm conductor diameter: 1000 m

**Interface module CIM-X.21**
- Electrical characteristics: X.21/V.11

**Technical Specifications**

- **Bit rate**
  - asynchronous: 0.3 to 38.4 kbit/s, 115.2 kbit/s
  - synchronous: 0.6 to 56 kbit/s, n x 64 kbit/s (n = 1 to 31)
- Reach with 64 kbit/s and 0.6-mm conductor diameter: 1000 m

**DSC6-nx64G**
- **Codirectional mode**
  - Number of interfaces: 6
  - Electrical characteristics: G.703, 2w
  - Bit rate: n x 64 kbit/s (n = 1 to 8)
  - Reach with 0.6-mm conductor diameter:
    - 64 kbit/s: 300 m
    - 512 kbit/s: 50 m

- **Contradirectional mode**
  - Number of interfaces: 2
  - Electrical characteristics: G.703, 4w
  - Bit rate: n x 64 kbit/s (n = 1 to 31)
  - Reach with 0.6-mm conductor diameter:
    - 64 kbit/s: 400 m
    - 2048 kbit/s: 50 m

- **Centralized clock mode**
  - Number of interfaces: 6
  - Electrical characteristics: G.703, 2w
  - Bit rate: 64 kbit/s
  - Reach with 64 kbit/s and 0.6-mm conductor diameter: 400 m
  - Operating voltages: +5 V
  - Power consumption: 1.75 W

**I8S0P**
- **Number of interfaces**: 8 (S0)
- **Point-to-point connection**
  - Subscriber count: 1
  - Reach: 1000 m

- **Point-to-multipoint connection**
  - Short passive bus
    - Subscriber count: ≤ 8
    - Reach: 150 m
  - Extended passive bus
    - Subscriber count: ≤ 4
    - Reach: 500 m
  - Operating voltages: –48 V, +5 V, –5 V
  - Power consumption (without feeding at S0): 1.8 W

**IUL82/IUL84**
- **Number of interfaces**
  - IUL82: 8 (U0 with 2B1Q)
  - IUL84: 8 (U0 with 4B3T)
  - **Function**
    - IUL82: subscriber access via NTBA, NTU
    - IUL84: subscriber access via NTBA

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Transmission method ........ bit transparent, duplex
Reach with 0.6-mm conductor diameter .......... max. 8 km
Power-feeding voltage .................. –95 V
Operating voltages .............. –48 V, +5 V, –5 V
Power consumption .............. 5 W

SUB162/322
Number of interfaces ........ 16/32 (POTS, VF, 2w)
Operating voltages ........ +5 V, –5 V
Operating voltage for ringing signal generation . . . . . . . . +71 V (+66 V to +72 V)
Input voltage for Subscriber loopbacks ........ –48 V (~36 V to –72 V)
Power consumption with 0.25 Erl
SUB162 ..................................... ≤ 9.5 W
SUB322 ..................................... ≤ 15 W

UAC68
Number of interfaces ........ 6 (2w/4w; VF, 6 (signal wires S21, S22)
Operating voltages ........ +48 V/~60 V, +5 V, –5 V
Power consumption ........ ≤ 4.7 W

PSU
Input voltages .................. −36 V to –72 V
Output voltages for 2 x CUAII ........ +5 V
for LCs ................................ +5 V, –5 V
Max. output power .............. 18 W

SU ADSL32
Number of ASDL interfaces .......... 32
Standards ........ according to ITU-T G.992.1
Max. bit rate
Upstream .................. 800 kbit/s
Downstream .............. 8160 kbit/s
Frequency range ADSL over ISDN
Upstream .................. 140 kHz to 257 kHz
Downstream .............. 257 kHz to 1104 kHz
Frequency range ADSL over POTS
Upstream .................. 24 kHz to 132 kHz
Downstream .............. 136 kHz to 550 kHz
Transmission method ........ DMT
Operating voltage .............. –48 V/~60 V
Power consumption .......... 70 W

SU SHDSL16
Number of SHDSL interfaces .......... 16
Standards ........ according to ITU-T G.991.2
Line connection ........ twisted pair (Cu)
Bit rate .................. 200 kbit/s to 2320 kbit/s
Frequency range .................. 0 to 400 kHz
Coding .................. PAM16 according to ITU-T G.991.2
Operating voltage .............. –48 V/~60 V
Power consumption .......... 34 W

FCU
Power consumption
Active .................. 10 W
Standby .................. 2 W

FUMS
Power consumption .............. 11 W

Access Multiplexer AMX

CUA
Number of 2-Mbit/s interfaces .......... 1 (G.703/6)
Bit rate .................. 2048 kbit/s
Input voltage .................. –36 V to –72 V
Operating voltages internal and for LCs .................. +5 V, –5 V

BEC
Input voltage .................. –36 V to –72 V
Operating voltage internal and for LCs .................. +5 V, –5 V
Power consumption (without LC feeding) ........ ≤ 0.1 W

DSC2-nx64V35
Number of interfaces .......... 2
Electrical characteristics ........ according to ITU-T35/28
### DSC2-nx64V36
- Number of interfaces: 2
- Electrical characteristics: according to ITU-T V.111/10
- Operation mode: synchronous (duplex)
- Bit rate: \( n \times 64 \text{ kbit/s} \) (\( n = 1 \) to 30)
- Operating voltage: \(+5 \text{ V}, -5 \text{ V}\)
- Power consumption: 2.25 W

### DSC2-nx64X
- Number of interfaces: 2
- Electrical characteristics: according to ITU-T V.21/V.11 and V.24/V.28
- Operation mode: synchronous/asynchronous
- Bit rate: \( n \times 64 \text{ kbit/s} \) (\( n = 1 \) to 30)
- Operating voltage: \(+5 \text{ V}, -5 \text{ V}\)
- Power consumption: 2.5 W

### DSC6-nx64G
- See AMXC

### I4UK2V5
- Number of interfaces: 4 (\( \Omega_0 \) with 2B1Q)
- Transmission method: bit transparent, duplex
- Power-feeding voltage: \( 48 \text{ V}, 60 \text{ V}, 95 \text{ V} \)
- Reach with 0.6-mm conductor diameter: max. 8 km
- Operating voltages: \(-48 \text{ V} / -60 \text{ V}, +5 \text{ V}, -5 \text{ V}\)
- Power consumption: 1.1 W

### IUL84
- See AMXC

### LLA102/104
- Number of interfaces: 10 (2w/4w, VF, switchable)
  - **2wire operation**
    - Impedance: 600Ω
    - Input level: \(-8 \text{ dB} \) to \(+9 \text{ dB} \)
    - Output level: \(-14 \text{ dB} \) to \(+4 \text{ dB} \)
  - **4wire operation**
    - Impedance: 600Ω
    - Input level: \(-14 \text{ dB} \) to \(+4 \text{ dB} \)

### SUB102
- Number of interfaces: 10 (POTS, VF, 2w)
- Operating voltages: \(-48 \text{ V} / -60 \text{ V}, +5 \text{ V}, -5 \text{ V}\)
- Power consumption with 0.5 Erl: \( \leq 7.5 \text{ W} \)
- Dissipation power (typ.) with 0.5 Erl: \( \leq 4.5 \text{ W} \)

### Crossconnectmultiplexer CMXII

#### CCU
- Clock interface: G.703/10
- Operating voltage: \(-48 \text{ V} / -60 \text{ V}\)
- Power consumption: \( \leq 12.5 \text{ W} \)

#### CASU
- Operating voltage: \(-48 \text{ V} / -60 \text{ V}\)
- Power consumption: \( \leq 6.25 \text{ W} \)

#### PUCAS/PU2+
- Number of 2-Mbit/s interfaces: 4 (G.703/6)
- Bit rate: 2048 kbit/s
- Operating voltage: \(+5.4 \text{ V}\)
- Power consumption: \( \leq 2.5 \text{ W} \)

#### PUSISA
- Operating voltage: \(+5.4 \text{ V} \pm 3 \%\)
- Power consumption: \( \leq 1.5 \text{ W} \)

#### V52FR
- Operating voltage: \(-48 \text{ V} / -60 \text{ V}\)
- Power consumption: \( \leq 6.25 \text{ W} \)

#### MCU
- F interface (point-to-point): V.24/V.28
- Input voltage: \(-36 \text{ V} \) to \(-72 \text{ V}\)
- Power consumption: \( \leq 4.5 \text{ W} \)

#### PSC
- Input voltage: \(-36 \text{ V} \) to \(-72 \text{ V}\)
- Output voltage: \(+5.4 \text{ V}\)
- Max. output power: \( 68 \text{ W} \)
**COMPS/COMPS2**

**GR60/6**
- Input voltage: \(230 \text{V}_\text{AC}\)
- Output voltage: \(48 \text{V}_\text{DC}\)
- Max. output power: \(370 \text{ W}\)

**OSU**
- F interface (point-to-point): \(28 \text{ V}\)
- Alarm inputs: \(22 \text{ V}\)
- Operating voltage: \(+5 \text{ V}\)
- Power consumption: \(5 \text{ W}\)

**PDU/PDU2+**
- Input voltages: \(-30 \text{ V} \text{ to } -72 \text{ V}\)
- Output voltages: \(-30 \text{ V} \text{ to } -72 \text{ V}\)
- Max. dissipation power of the unit:
  - (with 4 times \(I_N = 6.3 \text{ A}\)): \(0.5 \text{ W}\)

**PSR**
- Input voltage: \(-36 \text{ V} \text{ to } -72 \text{ V}\)
- Output voltages:
  - for LCs and TPU: \(+70 \text{ V} \text{ to } +72.3 \text{ V}\)
- Max. output power: \(72 \text{ W}\)
- Max. dissipation power: \(13 \text{ W}\)

**TPA**
- Battery and power supply connection:
  - Voltage: \(-41 \text{ V} \text{ to } -59 \text{ V}\)
  - Max. current loading: \(64 \text{ A}\)
- Power supply:
  - Input voltage: \(-36 \text{ V} \text{ to } -72 \text{ V}\)
  - Power consumption: \(<5 \text{ W}\)

**TPU**
- Measurement accuracy for all measurements: \(\pm 10 \%\)
- Permissible test voltage: \(<100 \text{ V}\)
- Permissible test current: \(<100 \text{ mA}\)
- Max. permissible foreign voltages:
  - according to ITU-T K.20:
    - atmospheric discharges: \(1.5 \text{ kV} \text{, } 10/700 \text{ µs}\)
    - mains voltage: \(230 \text{ V}_\text{ef}/50 \text{ Hz} (60 \text{ Hz})\)
- Input voltage: \(-36 \text{ V} \text{ to } -72 \text{ V}\)
- Power consumption: \(<3 \text{ W}\)

**ADM1o/ADM1e**
- Optical STM1 interface (only ADM1o):
  - Bit rate: \(155.520 \text{ Mbit/s}\)
  - Electr. characteristics: according to ITU-T G.707
  - Line code: \(\text{NRZ}\)
  - Optical fiber (bidirectional): single mode \(10/125 \mu \text{m}\)
- Electrical STM-1 interface (only ADM1e):
  - Bit rate: \(155.520 \text{ Mbit/s} \pm 20 \text{ ppm}\)
  - Electr. characteristics: according to ITU-T G.707
  - Coding: \(\text{NRZ}\)
- 2-Mbit/s interface:
  - Bit rate: \(21 \times 2.048 \text{ Mbit/s} \pm 50 \text{ ppm}\)
  - Electr. characteristics: according to ITU-T G.703
  - Coding: \(\text{CMI}\)
- Operating voltages:
  - +5 V, –5 V
- Power consumption ADM1o: \(15.5 \text{ W}\)
- Power consumption ADM1e: \(15 \text{ W}\)

**ADM4**
- Optical STM4 interface:
  - Bit rate: \(622.080 \text{ Mbit/s}\)
  - Electr. characteristics: according to ITU-T G.707
  - Line code: \(\text{NRZ}\)
  - Optical fiber (bidirectional): single mode \(10/125 \mu \text{m}\)
- 2-Mbit/s interface:
  - Bit rate: \(21 \times 2.048 \text{ Mbit/s} \pm 50 \text{ ppm}\)
  - Electr. characteristics: according to ITU-T G.703
  - Coding: \(\text{NRZ}\)
- Operating voltages:
  - +5 V, –5 V
- Power consumption: \(18.5 \text{ W}\)

**TC1E3**
- 34-Mbit/s interface:
  - Bit rate: \(1 \times 34.368 \text{ Mbit/s} \pm 50 \text{ ppm}\)
  - Coding: \(\text{NRZ}\)
- Operating voltages:
  - +5 V, –5 V
- Power consumption: \(5 \text{ W}\)

**TC2E1/TC2E1R**
- 2-Mbit/s interface:
  - Bit rate: \(21 \times 2.048 \text{ Mbit/s} \pm 50 \text{ ppm}\)
  - Coding: \(\text{NRZ}\)
- Operating voltages:
  - +5 V, –5 V
- Power consumption TC2E1: \(8 \text{ W}\)
- Power consumption TC2E1R: \(9 \text{ W}\)
TC1STM1e

Electrical STM-1 interface

- Bit rate: 1 × 155.520 Mbit/s ±20 ppm
- Coding: CMI
- Operating voltages: +5 V, -5 V
- Power consumption: 8 W

PSD

- Input voltage: -36 V to -72 V
- Output voltages: +5 V, -5 V
- Max. output power with +5 V: 15 W
- Max. output power with 5 V: 10 W

PSX

- Input voltage: -36 V to -72 V
- Min. voltage: -36 V
- Max. voltage: -75 V
- Output voltages: +5 V, -5 V
- Max. output power: 50 W

Synchronous Multiplexer SMA1K-CP

Optical STM-1 interface

- Bit rate: 155.520 Mbit/s
- Coding: NRZ
- Wave length: 1280 nm to 1335 nm

2-Mbit/s interface

- Bit rate: 12 × 2.048 Mbit/s
- Electr. characteristics: according to ETS 300 166
- Coding: HDB3

34-Mbit/s interface

- Bit rate: 1 × 34.368 Mbit/s
- Electr. characteristics: according to ETS 300 166
- Coding: HDB3

45-Mbit/s interface

- Bit rate: 1 × 44.736 Mbit/s
- Electr. characteristics: according to ETS 300 166
- Coding: B3ZS

Power supply

- Operating voltage: -48 V to -60 V
- Power consumption: < 25 W

Optical Multiplexer OMX16

DSMX34

- Number of F1 interfaces: 1 (HDB3)
- Bit rate: 34368 kbit/s
- Number of F2 interfaces: 16 (HDB3)
- Bit rate: 2048 kbit/s
- Input voltage: -36 V to -72 V

Operating voltage (internal): +5 V
Power consumption: 9.3 W

OTRU36

- Number of F1 interfaces (optical): 1 (NRZ)
- Bit rate: 3864 kbit/s
- Optical fiber (bidirectional): SM 10/125 µm
- Number of F2 interfaces: 1 (HDB3)
- Bit rate: 34384 kbit/s
- V.11 interfaces
- Bit rates: 512 kbit/s, 256 kbit/s, 64 kbit/s
- Input voltage: -36 V to -72 V
- Operating voltage (internal): +5 V
- Power consumption: 7.1 W

OTSU2M

- QD2-F interface: RS232 (LCT)
- QD2-Q interface: RS485 & G.703 (ACI)
- Functionality: SISA concentration
- Input voltage: -36 V to -72 V
- Power consumption: < 5 W

2-Mbit/s Line Equipment LE2

LTCOH

- 2-Mbit/s interface G.703: 1
- Bit rate: 2.048 Mbit/s ±50 ppm
- Impedance (switchable): 75 Ω/120 Ω
- HDSL interface
- Bit rate: 1.168 Mbit/s per wire pair
- Frame structure: according to ETSI RTR/00306
- Line code: 2B1Q, scrambled
- Impedance: 135 Ω

LT2ME1

- 2-Mbit/s interfaces G.703: 2
- Bit rate: 2.048 Mbit/s ±50 ppm
- Impedance (switchable): 75 Ω/120 Ω
- Module Uk2mp
- Line interface: Uk2 according to FTZ 1 TR221
- Bit rate: 2.048 Mbit/s ±50 ppm
- Pulse shape: sine half wave
- Impedance, symmetrical: 130 Ω
- Remote feed voltage: 114 V
- Remote feed current: 59 mA ±1 mA
- Module G703sh
- Interface: G.703, short-haul
- Bit rate: 2.048 Mbit/s ±50 ppm
- Pulse shape: approaching rectangular
- Impedance, symmetrical: 120 Ω
- Module Ug2
- Optical line interface: Ug2
- According to FTZ 1 TR 222
Bit rate .......................... 2.048 Mbit/s
Optical fiber per direction .......... single mode
Wave length ........................ 1300 nm
Optical fiber connector ............. D/N
Max. bridgeable attenuation ........ 15 dB

Module SHDSL
Transmission method ............... PAM16
Symmetrical wire pair .............. 1
Bit rate .......................... 2.32 Mbit/s
User rate .......................... 2.048 Mbit/s
Management channel ............... 64 kbit/s
Typical reach with
0.4-mm conductor diameter ........ 3.9 km

LTO
2-Mbit/s interfaces G.703 .......... 2
Bit rate .......................... 2.048 Mbit/s ±50 ppm
Impedance (switchable) .......... 75 Ω/120 Ω

Optical interface
Bit rate total ..................... 8.704 Mbit/s ±30 ppm
Optical fiber, bidirectional single mode 10/125 μm
Fiber optic connector .......... FC/PC
Max. bridgeable attenuation ....... 15 dB

ONU 20 FTTO

COSU
OD2 interface, intern. switchable. according to RS485
F interface ........................ V.24/V.28

Power supply
Via external AC adapter .......... 230 V
Backup battery .................... 48 V
Power consumption (with 0.5 Erl) ....... 56 W

Data Network Unit DNU01SD

Number of line interfaces .......... 1
EDSL
Transmission method ................. pseudoternary baseband with echo compensation
Bit rates .......................... n x 64 kbit/s (n ≤ 8)
Impedance ........................ 135 Ω
Max. bridgeable line attenuation .... 27 dB
U₀ baseband
Transmission method .............. baseband with 4B3T
Bit rates .......................... 1.5/3.6/6.12/24/48/64 or 120 kbit/s
Impedance ........................ 150 Ω
Max. bridgeable line attenuation .... 32 dB

Number of subscriber interfaces .... 1
Data interface X.21
Electr. characteristics ............. X.21/V.11

Operating mode .................... synchronous
Bit rates .......................... n x 64 kbit/s (n ≤ 8)

Data interface V.35
Electr. characteristics ............. V.28/V.35 All
Operating mode .................... synchronous
Bit rates .......................... n x 64 kbit/s (n ≤ 8)

Data interface V.36
Electr. characteristics ............. V.10/V.11
Operating mode .................... synchronous
Bit rates .......................... n x 64 kbit/s (n ≤ 8)

Power feeding (local) .............. 5.2 V ±1 %
Power consumption ................ ≤ 12 W

Network Termination Unit NTU

Number of line interfaces .......... 1
Line interface U₀
Coding ............................. 2B1Q
Medium ............................ 1 copper pair
Reach with 0.6-mm conductor diameter .... max. 8 km

Number of subscriber interfaces ...... 2
Subscriber interface G.703
Operating mode ................. synchronous, codirectional
Bit rate .......................... 64 kbit/s

Subscriber interface V.24
Electr. characteristics ............. V.28
Bit rates
asynchronous ................... 0.3 to 19.2 kbit/s
synchronous .................... 0.6 to 64 kbit/s, 128 kbit/s
Frame structure for subrates ......... V.110
Reach with 19.2 kbit/s and
0.6-mm conductor diameter .......... 15 m

Subscriber interface V.35
Electr. characteristics ............. V.28/V.35 All
Operating mode .................... synchronous
Bit rate .......................... 0.6 to 64 kbit/s, 128 kbit/s
Frame structure for subrates ......... V.110
Reach with 64 kbit/s (V.35 All) and
0.6-mm conductor diameter .......... 500 m
Reach with 19.2 kbit/s (V.28) and
0.6-mm conductor diameter .......... 15 m

Subscriber interface V.36
Electr. characteristics ............. V.10/V.11
Operating mode .................... synchronous
Bit rate .......................... 0.6 to 64 kbit/s, 128 kbit/s
Frame structure for subrates ......... V.110
Reach with 64 kbit/s (V.11) and
0.6-mm conductor diameter without 113 timing ........ 500 m
with 113 timing .................. 1000 m

Subscriber interface X.21
Electr. characteristics ............. X.21/V.11
Operating mode .................... synchronous
ONU FTTO/FTTB

Environmental conditions

- Reach with 64 kbit/s and 0.6-mm conductor diameter
  - without X timing: 500 m
  - with X timing: 1000 m

Power supply

- Via external AC adapter: 115 V/230 V
- Max. power consumption: 3.5 W

Network Termination NT220V

Number of line interfaces: 1

- Bit rate total: 8.704 Mbit/s ±30 ppm
- Optical fiber, bidirectional: single mode 10/125 µm
- Fiberoptic connector: DIN, optional FC/PC
- Max. bridgeable attenuation: 15 dB
- Wave length: 1300 nm/1550 nm

Number of subscriber interfaces: 2

- Subscriber interface V.36
  - Electrical characteristics: V.10/V.11
  - Operation mode: synchronous
  - Bit rate: n x 64 kbit/s (n = 1 to 31)
  - Reach at V.10 with 1 kbit/s: max. 1000 m
  - at V.11 with 64 kbit/s: max. 1000 m

- Subscriber interface V.35
  - Electrical characteristics: V.28/V.35 All
  - Operating mode: synchronous
  - Bit rates: n x 64 kbit/s (n = 1 to 31)
  - Reach: max. 15 m

- Subscriber interface X.21
  - Electrical characteristics: X.21 V.11
  - Operating mode: synchronous
  - Bit rates: n x 64 kbit/s (n = 1 to 31)
  - Reach with 64 kbit/s: max. 1000 m

Power supply

- Via external AC adapter: 120 V/230 V
- Max. power consumption: 8 W

Environmental Conditions

ONU FTTC

- Environmental class: ETS 300 019-1-4.1
- Temperature range: -33 °C to +40 °C
- Product safety: EN/IEC 60950
- EMC: ETS 300 386-1, Tab. 4

OLT

- Environmental class: ETS 300 019-1-3.1
- Temperature range: +5 °C to +45 °C
- Product safety: EN/IEC 60950
- EMC: ETS 300 386-1, Tab. 2 or 4

Construction (B x H x T)

- ONU 20 FTTO: 370 x 165 x 247 mm
- ONU 30 FTTB: 440 x 535 x 260 mm
- ONU 250 FTTB: 600 x 2200 x 300 mm
- ONU 250 FTTC: 900 x 1700 x 400 mm
- ONU 1000 FTTB (per rack): 600 x 2200 x 300 mm
- ONU 1000 FTTC: 1500 x 1600 x 400 mm
- OLT: 1200 x 2200 x 300 mm

Shelves (B x H x T)

- ASMXS2: 535 x 400 x 240 mm
- CMXII-2S: 535 x 400 x 240 mm
- CMXII-CS: 535 x 400 x 240 mm
- CMXII-LS: 535 x 400 x 240 mm
- COMP: 535 x 175 x 196 mm
- COMP S2: 535 x 175 x 196 mm
- Micro-DSLAM: 535 x 100 x 280 mm
- OMX2S2: 535 x 400 x 240 mm
- OMX16S: 535 x 450 x 240 mm
- SMA1K-CP: 535 x 108 x 223 mm
- SMXCS: 535 x 450 x 240 mm
- SMXLS2: 535 x 450 x 240 mm
- SNUS: 535 x 400 x 240 mm
- UMX2S2: 535 x 300 x 240 mm
- UMX4MS: 535 x 375 x 280 mm
- UMXLS: 535 x 300 x 240 mm
### Product Overview

#### ONU types

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<th>Description</th>
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<td>Table/wall-mounted enclosure for max. 20 NB subscriber</td>
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<td><strong>ONU 30 FTTB</strong></td>
<td>Wall-mounted enclosure for max. 30 NB subscriber</td>
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<td><strong>ONU 250 FTTB</strong></td>
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<tr>
<td>with Mini-DSLAM</td>
<td>ETS rack for max. 256 NB and max. 80 BB subscriber</td>
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<td>with Micro-DSLAM</td>
<td>ETS rack for max. 256 NB and max. 32 BB subscriber</td>
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<tr>
<td><strong>ONU 250 FTTC</strong></td>
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<tr>
<td>with Mini-DSLAM</td>
<td>Shelter for max. 256 NB and max. 80 BB subscriber</td>
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<td>with Micro-DSLAM</td>
<td>Shelter for max. 256 NB and max. 32 BB subscriber</td>
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<td><strong>ONU 1000 FTTB</strong></td>
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<td>ETS and MDF racks for max. 2048 NB and max. 160 BB subscriber</td>
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<td>with Micro-DSLAM</td>
<td>ETS and MDF racks for max. 2048 NB and max. 32 BB subscriber</td>
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<td>Shelter (small or large) for max. 1024 NB and max. 160 BB subscriber</td>
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<td>Shelter (small or large) for max. 1024 NB and max. 32 BB subscriber</td>
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#### Shelves

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<td>ASMXS2</td>
<td>AMXC shelf (AMXC, SMX1/4c, OMX16, LE2)</td>
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<tr>
<td>CMXII-2S</td>
<td>CMXII shelf (2-Mbit/s interfaces)</td>
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<tr>
<td>CMXII-CS</td>
<td>Central CMXII shelf</td>
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<tr>
<td>CMXII-LS</td>
<td>Compact CMXII shelf</td>
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<tr>
<td>COMPS</td>
<td>COMPS shelf</td>
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<tr>
<td>COMPS2</td>
<td>COMPS2 shelf</td>
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<tr>
<td>Micro-DSLAM</td>
<td>Micro-DSLAM shelf</td>
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<tr>
<td>OMX16S</td>
<td>Feeder shelf (OTSU2M, OMX16, LE2)</td>
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<td>OMX2S2</td>
<td>Feeder shelf (OTSU2M, LE2)</td>
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<td>SMA1K-CP</td>
<td>Feeder shelf</td>
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<td>SMXCS</td>
<td>Feeder shelf (OTSU2M, SMX1/4c)</td>
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<td>SMXL2S</td>
<td>Feeder shelf (OTSU2M, SMX1/4c, OMX16, LE2)</td>
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<td>SNUS</td>
<td>Feeder shelf (OTSU2M, SMX1/4c, OMX16, LE2)</td>
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<td>UMX2S2</td>
<td>AMXC shelf (AMXC, LE2)</td>
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<td>Mini-DSLAM shelf (Mini-DSLAM, FCU, FUMS)</td>
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<td>UMXLS</td>
<td>Feeder shelf (OTSU2M, SUE, LE2)</td>
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### Plug-in units AMX

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<td>Line card for data</td>
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<td>UEB128-E04</td>
<td>Transmission module U_{k0} baseband</td>
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<td>EDSL-01</td>
<td>Transmission module EDSL</td>
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<td>CIM-V.24</td>
<td>Interface module for V.24</td>
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<td>CIM-V.35</td>
<td>Interface module for V.35</td>
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<td>CIM-V.36</td>
<td>Interface module for V.36</td>
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### Plug-in units MINI-DLAM/MICRO-DLAM

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<td>CLU_E3</td>
<td>Central unit for E3</td>
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<tr>
<td>CLUIMA</td>
<td>Central unit for IMA</td>
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<td>POSU32I</td>
<td>Combination splitter for ADSL over ISDN</td>
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<tr>
<td>POSU32P</td>
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<td>Fan unit in MINI-DLAM</td>
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<td>MCU</td>
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<td>2-Mbit/s interface unit for CAS/V5.x conversion (in CMXII-V5.x only)</td>
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<td>Add/drop multiplexer unit (STM-4 optical), short-haul and long-haul</td>
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<td>TC1E3</td>
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<td>TC21E1R</td>
<td>Tributary extender unit with retiming function (21 x 2 Mbit/s)</td>
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<td>1 x 2 Mbit/s, Ug2 module optical fiber</td>
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<td>LTO</td>
<td>Line termination unit (2 x 2 Mbit/s, optical fiber)</td>
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</tbody>
</table>
### Plug-in units COMPS/COMPS2

<table>
<thead>
<tr>
<th>Unit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GR60</td>
<td>AC/DC module (in COMPS2 only)</td>
</tr>
<tr>
<td>OSU</td>
<td>Supervision unit</td>
</tr>
<tr>
<td>PDU/PDU2</td>
<td>Power distribution unit</td>
</tr>
<tr>
<td>PSR</td>
<td>Power supply unit for aux. ringing voltage</td>
</tr>
<tr>
<td>TPA</td>
<td>Supervision unit of battery backup</td>
</tr>
<tr>
<td>TPU</td>
<td>Measurement unit for ISDN line cards</td>
</tr>
</tbody>
</table>

### Network Terminations

<table>
<thead>
<tr>
<th>NT12C</th>
<th>Network termination unit (with LTCOH)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NT22OV</td>
<td>Network termination unit (base unit for max. 2 interface modules)</td>
</tr>
<tr>
<td>NTOV36</td>
<td>DATA module V.36</td>
</tr>
<tr>
<td>NTOV35</td>
<td>DATA module V.35</td>
</tr>
<tr>
<td>NTOX21</td>
<td>DATA module X.21</td>
</tr>
<tr>
<td>NT22O</td>
<td>Network termination unit (with LTO/NT)</td>
</tr>
<tr>
<td>NTU</td>
<td>Network termination unit (base unit for max. 2 interface modules)</td>
</tr>
<tr>
<td>NTUV24</td>
<td>Module V.24</td>
</tr>
<tr>
<td>NTUV35</td>
<td>Module V.35</td>
</tr>
<tr>
<td>NTUV36</td>
<td>Module V.36</td>
</tr>
<tr>
<td>NTUX21</td>
<td>Module X.21</td>
</tr>
<tr>
<td>NTU64kCO</td>
<td>Module 64k-codirectional</td>
</tr>
<tr>
<td>DNU01SD</td>
<td>Data network unit (base unit)</td>
</tr>
<tr>
<td>EDSL01</td>
<td>Module EDSL</td>
</tr>
<tr>
<td>UEB128-04E</td>
<td>Module U&lt;sub&gt;10&lt;/sub&gt; baseband</td>
</tr>
<tr>
<td>IF-V.35/V.36</td>
<td>Module V.35/V.36</td>
</tr>
<tr>
<td>i210</td>
<td>Integrated Access Device (SHDSL, 4 x S&lt;sub&gt;b&lt;/sub&gt; 10BaseT)</td>
</tr>
<tr>
<td>Twin NT4500</td>
<td>ADSL network termination unit (POTS or ISDN, 10BaseT)</td>
</tr>
<tr>
<td>POSU-R</td>
<td>ADSL/POTS splitter remote</td>
</tr>
</tbody>
</table>

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### Our contribution to environmental protection – ICN AS AN environmental declaration

The objective of the environmental declaration which comes with each system is to give you the most important environmentally-relevant information for the product concerned. You can thus be certain that you have chosen a supplier who develops, produces, packs and dispatches their products in an environmentally friendly way. All specifications are supplied unsolicited and far exceed legal requirements.
<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC</td>
<td>Alternating Current</td>
</tr>
<tr>
<td>ACI</td>
<td>Access Integrator</td>
</tr>
<tr>
<td>ADSL</td>
<td>Asymmetrical Digital Subscriber Line</td>
</tr>
<tr>
<td>ATM</td>
<td>Asynchronous Transfer Mode</td>
</tr>
<tr>
<td>BA</td>
<td>Basic Access</td>
</tr>
<tr>
<td>BB/NB</td>
<td>Broadband/Narrowband</td>
</tr>
<tr>
<td>CAS</td>
<td>Channel Associated Signaling</td>
</tr>
<tr>
<td>CMI</td>
<td>Code Mark Inversion</td>
</tr>
<tr>
<td>CPE</td>
<td>Customer Premises Equipment</td>
</tr>
<tr>
<td>DC</td>
<td>Direct Current</td>
</tr>
<tr>
<td>DDF</td>
<td>Digital Distribution Frame</td>
</tr>
<tr>
<td>DLC</td>
<td>Digital Loop Carrier</td>
</tr>
<tr>
<td>DNU</td>
<td>Data Network Unit</td>
</tr>
<tr>
<td>DSL</td>
<td>Digital Subscriber Line</td>
</tr>
<tr>
<td>ECC</td>
<td>Embedded Control Channel</td>
</tr>
<tr>
<td>EDSL</td>
<td>Enhanced Digital Subscriber Line</td>
</tr>
<tr>
<td>EIA</td>
<td>Electronics Industries Association</td>
</tr>
<tr>
<td>EMC</td>
<td>Electromagnetic Compatibility</td>
</tr>
<tr>
<td>E&amp;M</td>
<td>Earth &amp; Minus</td>
</tr>
<tr>
<td>ETS</td>
<td>European Telecommunications Standard</td>
</tr>
<tr>
<td>ETSI</td>
<td>European Telecommunications Standard Institute</td>
</tr>
<tr>
<td>FITL</td>
<td>Fiber in the Loop</td>
</tr>
<tr>
<td>FTTB</td>
<td>Fiber to the Building</td>
</tr>
<tr>
<td>FTTC</td>
<td>Fiber to the Curb</td>
</tr>
<tr>
<td>FTTO</td>
<td>Fiber to the Office</td>
</tr>
<tr>
<td>GbE</td>
<td>Gigabit Ethernet</td>
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<tr>
<td>HDB3</td>
<td>High Density Bipolar of Order 3</td>
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<tr>
<td>HDSL</td>
<td>High Bitrate Digital Subscriber Line</td>
</tr>
<tr>
<td>IAD</td>
<td>Integrated Access Device</td>
</tr>
<tr>
<td>IEC</td>
<td>International Electrotechnical Commision</td>
</tr>
<tr>
<td>IF</td>
<td>Interface</td>
</tr>
<tr>
<td>ILTF</td>
<td>Integrated Line Test Function</td>
</tr>
<tr>
<td>IMA</td>
<td>Inverse Multiplexing over ATM</td>
</tr>
<tr>
<td>IP</td>
<td>Internet Protocol</td>
</tr>
<tr>
<td>ISDN</td>
<td>Integrated Services Digital Network</td>
</tr>
<tr>
<td>ISP</td>
<td>Internet Service Provider</td>
</tr>
<tr>
<td>ITU-T</td>
<td>International Telecommunications Union, International Standardization Sector</td>
</tr>
<tr>
<td>LC</td>
<td>Line Card</td>
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<tr>
<td>LCT</td>
<td>Local Craft Terminal</td>
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<tr>
<td>LL</td>
<td>Leased Line</td>
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<tr>
<td>LT</td>
<td>Line Termination</td>
</tr>
<tr>
<td>MDF</td>
<td>Main Distribution Frame</td>
</tr>
<tr>
<td>MTA</td>
<td>Metallic Test Access</td>
</tr>
<tr>
<td>NIC</td>
<td>Network Interface Card</td>
</tr>
<tr>
<td>NRZ</td>
<td>Non Return to Zero</td>
</tr>
<tr>
<td>NT</td>
<td>Network Termination</td>
</tr>
<tr>
<td>NTBA</td>
<td>Network Termination Basic Access</td>
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<tr>
<td>NTU</td>
<td>Network Termination Unit</td>
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<tr>
<td>ODF</td>
<td>Optical Distribution Frame</td>
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<tr>
<td>ODT</td>
<td>Optical Distant Termination</td>
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<tr>
<td>OLT</td>
<td>Optical Line Termination</td>
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<tr>
<td>ONU</td>
<td>Optical Network Unit</td>
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<tr>
<td>PAM</td>
<td>Pulse Amplitude Modulation</td>
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<tr>
<td>PAT</td>
<td>Periodic Access Test</td>
</tr>
<tr>
<td>PBX</td>
<td>Private Branch Exchange</td>
</tr>
<tr>
<td>PDH</td>
<td>Plesiochronous Digital Hierarchy</td>
</tr>
<tr>
<td>POTS</td>
<td>Plain Old Telephone Service</td>
</tr>
<tr>
<td>QD2</td>
<td>Standard Interface to TMN</td>
</tr>
<tr>
<td>SDH</td>
<td>Synchronous Digital Hierarchy</td>
</tr>
<tr>
<td>SHDSL</td>
<td>Symmetric High-Bitrate Digital Subscriber Line</td>
</tr>
<tr>
<td>SISA</td>
<td>Supervisory and Information System for Local and Remote Area</td>
</tr>
<tr>
<td>SM</td>
<td>Single Mode</td>
</tr>
<tr>
<td>SNC/I</td>
<td>Inherently Monitored Sub-Network Connection Protection</td>
</tr>
<tr>
<td>SNMP</td>
<td>Simple Network Management Protocol</td>
</tr>
<tr>
<td>STM-1</td>
<td>Synchronous Transport Module Level 1 (155 Mbit/s)</td>
</tr>
<tr>
<td>STM-4</td>
<td>Synchronous Transport Module Level 4 (622 Mbit/s)</td>
</tr>
<tr>
<td>SU</td>
<td>Service Unit</td>
</tr>
<tr>
<td>TDM</td>
<td>Time Division Multiplex</td>
</tr>
<tr>
<td>TMN</td>
<td>Telecommunications Management Network</td>
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<tr>
<td>V5.x</td>
<td>Signaling Protocols for Access Networks</td>
</tr>
<tr>
<td>VDSL</td>
<td>Very High Bitrate DSL</td>
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<tr>
<td>VF</td>
<td>Voice Frequency</td>
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<td>VoDSL</td>
<td>Voice over DSL</td>
</tr>
<tr>
<td>2B1Q/4B3T</td>
<td>ISDN Transmission Codes</td>
</tr>
<tr>
<td>2w/4w</td>
<td>2wire/4wire</td>
</tr>
<tr>
<td>64k ch.</td>
<td>64-kbit/s channels</td>
</tr>
</tbody>
</table>
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