IRITEL committed to digital communications

CATALOGUE

OTN/DWDM Systems
Next Generation SDH Systems
Access Systems
Network Management System
VoIP Devices
Radio Communications
Power Electronics
IRITEL was founded in 1967.

Today, with 160 highly educated and skilled employees, IRITEL represents the leading company in the fields of communications and electronics in South-East Europe.

IRITEL has accreditation at Ministry of Science and Technological Development as research and development institute.


The main areas of activity in communications and electronics:

- Transmission systems
- Switching systems
- Radio communications
- Power Electronics
- Engineering
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**NOTE:** reserves the right to make technical changes without notice.
OTP100G
Optical Transport Platform OTN/DWDM up to 8 Tbit/s

- Multiservice OTN/DWDM Platform
- Line Side Coherent Tunable CFP 100G DWDM Transceiver with Integrated CD Compensation
- Universal Ports - Plugable Interfaces
  Any service – Any rate – Any port – Any λ
- Universal Unit
  Single Unit Solution =>
  Muxponder, Transponder,
  ODUk Cross connect, 3R Regeneration
- Unified Platform for 80 Optical Channels
  DWDM multiplexers, optical amplifiers, dispersion compensation modules

- Integrated Optical Transport Solution
  OTN    SDH/SONET     point-to-point
  DWDM   Ethernet      chain
          Fibre Channel  ring
          Video         mesh
          CPRI
MAIN FEATURES

- 100G client/line interfaces are implemented using CFP modules:
  - OTN OTU4
  - Ethernet 100GE

- 10G client/line interfaces support
  Any service – Any rate – Any port – Any λ using XFP modules:
  - OTN OTU2/OTU2e
  - Ethernet 10G LAN, 10G WAN
  - SDH STM-64 SONET OC-192
  - Fibre Channel 8GFC, 10GFC
  - CPRI Option 7

- Client/line interfaces for bitrates up to 5 Gb/s are implemented using SFP modules as
  Any service – Any rate – Any port – Any λ:
  - OTN OTU1
  - Ethernet GE, FE
  - SDH STM-16/4/1, SONET OC-48/12/3
  - SAN: ESCON, FICON, Fibre Channel FC-12/25/50/100/200/400
  - Video DVB-ASI, SD-SDI, HD-SDI
  - CPRI Option 1, 2, 3, 4, 5
  - Bit-transparent protocol-independent client services

- All SFP, SFP+, XFP and CFP interfaces are universal and software configurable with fixed (1310nm, 1550nm, CWDM, DWDM) or tunable (DWDM) lasers

- Support for client signals mapping into
  OTN ODU0, ODUflex, ODU1, ODU2, ODU2e, ODU3, ODU4 structures

- Multistage multiplexing

- Mapping into ODU1/OPU1 tributary slots of n x 155.52 Mb/s capacity for efficient mapping of client signals at sub-ODU0 granularity

- OTN client signal mapping procedures
  - AMP – Asynchronous Mapping Procedure
  - BMP – Bit-synchronous Mapping Procedure
  - GMP – Generic Mapping Procedure
  - GFP – Generic Framing Procedure: Framed and Transparent

- Traffic grooming based on client signal requirements by using ODUflex, OTN VCAT (Virtual Concatenation) (OPUk-xv, k=0, 1, 2), and/or n x 155Mb/s tributary slots

- OTN non-blocking ODUk cross connect supports arbitrary mix of ODUk traffic for each muxponder/transponder unit, down to ODU0 granularity

- FEC (Forward Error Correction) functionality for detecting and correcting transmission errors, supports: ITU-T G.709 FEC, ITU-T G.975.1 I.4 FEC and ITU-T G.975.1 I.7 FEC, SD-FEC (for coherent DWDM 100G line interfaces)

- Transparent transfer of timing information for all client signals

- Synchronization support
  - SyncE
  - PTP1588v2

- Carrier class traffic protection is implemented at multiple levels and protocols on optical and electrical levels

- DWDM multiplexing supports up to 80 channels of C-band wavelengths (192THz – 196THz) with 50GHz spacing

- DWDM filters with low attenuation upgrade ports allow DWDM multiplex configuration in steps of 4, 8 or 40 wavelengths, up to 80 wavelengths

- The system can utilize active and/or passive optical filters. Active multiplexers are implemented using software configurable variable optical attenuators (VOA)

- Use of EDFA and RAMAN optical amplifiers extends the maximum length of optical sections

- Module for chromatic dispersion compensation is based on FBG (Fiber Bragg Gratings)

- Up to 8 degrees ROADM connectivity

- DCN is implemented using GCC and OSC channels

- Support for in-system optical parameters monitoring

- External monitoring points provide access for OSA instrument measurements

- Performance monitoring

- Power supply DC power supply -48V DC or -60V DC

EMS/NMS Software

- SUNCE+ Module OTN

- Based on client-server architecture

- SNMPv3 based

Network Management System (NMS) Element Management System (EMS)
**BASIC CONFIGURATION**

- **OTP100Gs** is a compact 1U system
  - **Applications**: Implementing OTN networks at different hierarchy levels, inter-connecting networks based on different technologies, regeneration systems and local ODUk cross connect

- **OTP100G-C4** is a four-slot subrack (shelf) module
  - **Applications**: In building OTN at different hierarchy levels, inter-connecting networks based on different technologies, regeneration systems, local ODUk cross connect and building passive DWDM optical networks with local wavelength switching

- **OTP100G-C15** is an 15-slot subrack (shelf) with the basic application in building OTN/DWDM networks with the maximum traffic capacity of the device is up to **80 wavelengths** per pair of optical fibers, and with several hundreds of client interfaces

- **OTP100G-C14** is a 14-slot subrack (shelf) with the basic application in building OTN/DWDM networks with the maximum traffic capacity of the device is up to **80 wavelengths** per pair of optical fibers, and with several hundreds of client interfaces. This subrack has possibility for hardware protection of control and monitoring unit.

  **Applications OTP100G-C14/C15**: Implementing all network configurations with all interface types, at different hierarchy levels, inter-connecting networks based on different technologies, regeneration systems, local ODUk cross connect, building DWDM optical networks and local wavelength switching

**MECHANICAL DESIGN**

- **OTP100G-C15/C14 subrack**: 586.2 mm x 437 mm x 298 mm
- **OTP100G-C4 subrack**: 225 mm x 485.5 mm x 298.6 mm
- **OTP100Gs system**: 44,4 mm x 437 mm x 280 mm

**UNITS**

- **OT-CMU** unit is the system control-management unit
- **OT10G-3** unit has the following universal software-configurable client/line interfaces: 16 SFP and 3 10G XFP interfaces. **OT10G-3** features muxponder, transponder, cross connect, synchronization and traffic protection functionalities
- **OT10G-4** is a transponder unit with 4 software-configurable client/line XFP interfaces. **OT10G-4** features transponder, cross connect, synchronization and traffic protection functionalities
- **OT10G-8** is a high density transponder unit with 8 software-configurable client/line XFP interfaces. **OT10G-8** features transponder, cross connect, synchronization and traffic protection functionalities
- **OT10G-1** is a high density muxponder unit with 10 software-configurable client SFP+ interfaces and one line CFP 100G interfaces. **OT10G-1** features muxponder, cross connect, synchronization and traffic protection functionalities
- **OT10G-2** is a high density transponder unit with 2 CFP 100G interfaces (one client and one line). **OT10G-2** features transponder, cross connect, synchronization and traffic protection functionalities
- **pDWDM-4Cx** and **pDWDM-8Cx** are passive units for DWDM multiplexing and demultiplexing of 4 or 8 optical signals. The upgrade ports enable capacity increase

**CWDM-x** are units for DWDM multiplexing and demultiplexing of 4 (CWDM-4Cx) or 8 (CWDM-8Cx) or 40 (CWDM-40CM, CWDM-40CD, CWDM-40HM, CWDM-40HD) optical signals with variable optical attenuator and photo detector for optical signal level adjustment. The upgrade ports enable capacity increase. Using interleaver unit DWDM-IL can be created multiplex of 80 wavelengths. **DWDM-IL** is used to combine and separate odd and even wavelengths to create a 50GHz system.

- **OMA-xy** unit performs the function of amplification optical signal using EDFA and RAMAN amplifiers with **Booster, Preamplifier and Inline** applications
- **DCM-DxDy** unit performs chromatic dispersion compensation based on FBG
- **OTVOA-x** unit has 4 or 8 variable optical attenuators and photo detectors for optical signal level adjustments
- **OPS-x** unit implements of 1+1 on optical level protection of up to 4 or 8 optical signals

**CFP INTERFACES**

- **Ol.100G-CT** coherent tunable DWDM 50GHz GRID
- **Ol.100G-4x28** tunable DWDM 4x28Gb/s 50GHz GRID
- **Ol.100G-ER4** 40km
- **Ol.100G-LR4** 10km
- **Ol.100G-SR10** 100m
APPLICATIONS IN TRANSPORT NETWORKS

The optical transport platform OTP100G is line of IRITEL’s devices for digital signal transmission over optical fibers, based on OTN and DWDM technologies, designed for implementation of local, metropolitan and regional networks of various configurations:

- Point-to-point connections
- Linear add/drop networks
- Ring networks at different hierarchy levels

- For inter-connecting networks based on different technologies
- Mesh networks
- Regeneration systems
- For local switching at ODUk level
- For implementation of passive and active optical networks
- For local switching at optical wavelength level

The OTP100G enables inter-connecting networks based on different technologies: OTN, SDH, Ethernet, SAN (ESCON, FICON, Fibre Channel), video, CPRI, bit-transparent protocol-independent client services, etc.

The OTP100G platform is designed and manufactured with modern modular technology, making it a very flexible solution for building, expanding and upgrading networks. It enables efficient and profitable delivery of telecommunications services.
OTP10G
Optical Transport Platform OTN/DWDM up to 800 Gbit/s

- Multiservice OTN/DWDM Platform
- Universal Ports
  *Any service – Any rate – Any port – Any λ*
- Universal Unit
  *Single Unit Solution => Muxponder, Transponder, ODUk Cross connect, 3R Regeneration*
- Unified Platform for 80 Optical Channels
  *DWDM multiplexers, optical amplifiers, dispersion compensation modules*

- Integrated Optical Transport Solution
  - OTN SDH/SONET point-to-point
  - DWDM Ethernet chain
  - Fibre Channel ring
  - Video mesh
MAIN FEATURES

- 10G client/line interfaces support
  - Any service – Any rate – Any port – Any λ using XFP modules:
    - OTN OTU2/OTU2e/OTU1e/OTU2f/OTU1f
    - Ethernet 10GE LAN, 10GE WAN
    - SDH STM-64 SONET OC-192
    - Fibre Channel 8GFC, 10GFC
- Client/line interfaces for bitrates up to 5 Gb/s are implemented using SFP modules as
  - Any service – Any rate – Any port – Any λ:
    - OTN OTU1
    - Ethernet GE, FE
    - SDH STM-16/4/1, SONET OC-48/12/3
    - SAN: ESCON, FICON, Fibre Channel FC-12/25/50/100/200/400
    - Video DVB-ASI, SD-SDI, HD-SDI
    - Bit-transparent protocol-independent client services

- All SFP and XFP interfaces are universal and software configurable with fixed (1310nm, 1550nm, CWDM, DWDM) or tunable (DWDM) lasers
- Support for client signals mapping into OTN ODU0, ODUflex, ODU1, ODU2, ODU2e structures
- Mapping into ODU1/OPU1 tributary slots of n x 155.52 Mb/s capacity for efficient mapping of client signals at sub-ODU0 granularity
- OTN client signal mapping procedures
  - AMP – Asynchronous Mapping Procedure
  - BMP – Bit-synchronous Mapping Procedure
  - GMP – Generic Mapping Procedure
  - GFP – Generic Framing Procedure: Framed and Transparent
- Traffic grooming based on client signal requirements by using ODUflex, OTN VCAT (Virtual Concatenation) (OPUk-Xv, k=0, 1, 2), and/or n x 155Mb/s tributary slots
- OTN non-blocking ODUk cross connect supports arbitrary mix of ODUk traffic for each muxponder/transponder unit, down to ODU0 granularity
- FEC (Forward Error Correction) functionality for detecting and correcting transmission errors, supports: ITU-T G.709 FEC, ITU-T G.975.1 I.4 FEC and ITU-T G.975.1 I.7 FEC
- Transparent transfer of timing information for all client signals
- Synchronization support
  - SyncE
  - PTP1588v2
- Carrier class traffic protection is implemented at multiple levels and protocols on optical and electrical levels
- DWDM multiplexing supports up to 80 channels of C-band wavelengths (192THz – 196THz) with 50GHz spacing
- DWDM filters with low attenuation upgrade ports allow DWDM multiplex configuration in steps of 4 or 8 wavelengths, up to 80 wavelengths
- The system can utilize active and/or passive optical filters. Active multiplexers are implemented using software configurable variable optical attenuators (VOA)
- Use of EDFA and RAMAN optical amplifiers extends the maximum length of optical sections
- Module for chromatic dispersion compensation is based on FBG (Fiber Bragg Gratings)
- Up to 8 degrees ROADM connectivity
- DCN is implemented using GCC and OSC channels
- Support for in-system optical parameters monitoring
- External monitoring points provide access for OSA instrument measurements
- Performance monitoring
- 100G ready platform

EMS/NMS Software

- SUNCE+ Module OTN
- Based on client-server architecture
- SNMPv3 based Network Management System (NMS) Element Management System (EMS)
**OTP10Gs** is compact 1U system with:
- up to 2 OTN OTU2/2e/1e/2f/1f,
- up to 8 OTN OTU1,
- up to 2 universal 10G clients,
- up to 16 universal clients with bitrates from 16Mb/s to 5Gb/s each

**Applications:** Implementing OTN networks at different hierarchy levels, inter-connecting networks based on different technologies, regeneration systems and local ODUk cross connect

**OTP10G-C4** is four-slot subrack (shelf) module with:
- up to 12 OTN OTU2/2e/1e/2f/1f,
- up to 16 OTN OTU1,
- up to 12 universal 10G clients,
- up to 32 universal clients with bitrates from 16Mb/s to 5Gb/s each,
- up to 16 DWDM channels add/drop in two directions

**Applications:** In building OTN at different hierarchy levels, inter-connecting networks based on different technologies, regeneration systems, local ODUk cross connect and building passive DWDM optical networks with local wavelength switching

**OTP10G-C15** is 15-slot subrack (shelf) with the basic application in building OTN/DWDM networks with the maximum traffic capacity of the device is **up to 80 wavelengths** per pair of optical fibers, and with several hundreds of client interfaces

**Applications:** Implementing all network configurations with all interface types, at different hierarchy levels, inter-connecting networks based on different technologies, regeneration systems, local ODUk cross connect, building DWDM optical networks and local wavelength switching

**MECHANICAL DESIGN**

**OTP10G-C15 subrack:**
Dimensions (H x W x D)  586.2 mm x 437 mm x 298 mm

**OTP10G-C4 subrack:**
Dimensions (H x W x D)  225 mm x 485.5 mm x 298.6 mm

**OTP10Gs system:**
Dimensions (H x W x D)  44.4 mm x 437 mm x 280 mm

**UNITS**

- **OT-CMU** unit is the system control-management unit
- **OT10G-3** unit has the following interfaces: 16 universal software-configurable client/line SFP interfaces and 3 universal software-configurable client/line 10G XFP interfaces. **OT10G-3** features muxponder, transponder, cross connect, synchronization and traffic protection functionalities
- **OT10G-4** is a transponder unit with 4 software-configurable client/line XFP interfaces. **OT10G-4** features transponder, cross connect, synchronization and traffic protection functionalities
- **OT10G-8** is high density transponder unit with 8 software-configurable client/line XFP interfaces. **OT10G-8** features transponder, cross connect, synchronization and traffic protection functionalities
- **pDWDM-4Cx** and **pDWDM-8Cx** are passive units for DWDM multiplexing and demultiplexing of 4 or 8 optical signals. The upgrade ports enable capacity increase
- **OMA-xy** unit performs the function of amplification optical signal using EDFA and RAMAN amplifiers with **Booster, Preamplifier** and **Inline** applications
- **DCM-Dx Dy** unit performs chromatic dispersion compensation based on FBG
- **OTVOA-x** unit has 4 or 8 variable optical attenuators and photo detectors for optical signal level adjustments
- **OPS-x** unit implements of 1+1 protection of up to 4 or 8 optical signals

**XFP INTERFACES**

- **OI.10G-x 1310nm, 1550nm 10-80km**
- **OI.D10G-x-CHx DWDM band 40-88km**
- **OI.D10G-x-CHT tunable DWDM 40-80km**

**POWER SUPPLY**

DC power supply -48V DC or -60V DC
APPLICATIONS IN TRANSPORT NETWORKS

The optical transport platform OTP10G is line of Iritel's devices for digital signal transmission over optical fibers, based on OTN and DWDM technologies, designed for implementation of local, metropolitan and regional networks of various configurations:

- Point-to-point connections
- Linear add/drop networks
- Ring networks at different hierarchy levels
- For inter-connecting networks based on different technologies
- Mesh networks
- Regeneration systems
- For local switching at ODUk level
- For implementation of passive and active optical networks
- For local switching at optical wavelength level

The OTP10G enables inter-connecting networks based on different technologies: OTN, SDH, Ethernet, SAN (ESCON, FICON, Fibre Channel), video, bit-transparent protocol-independent client services, etc.

The OTP10G platform is designed and manufactured with modern modular technology, making it a very flexible solution for building, expanding and upgrading networks. It enables efficient and profitable delivery of telecommunications services.
ODS2G5
SDH/SONET Multiservice Optical Digital Systems

- Next generation SDH Optical Digital Systems for STM-16/4/1, E1, E3, 10/100 BaseTx, 100 BaseFx, 1000 BaseX, 1000 BaseT services
- Add/drop, cross-connect and terminal multiplexer
- Ethernet over SDH, GFP/VCAT/LCAS technologies
- Compact and flexible SDH equipment, easily expandable from small to full capacity, for metro and access network applications
- Network management system SUNCE-M or SNMP-based management
Basic configuration

- **ODS2G5C3** configuration for 3 units:
  - up to: 4 x STM-16, 18 x STM-4/1, 21 x 2 Mbit/s, 3 x 34 Mbit/s and 4 x 10/100 BaseTx, 1 x 100 BaseFx, 9 x 1000 BaseT/1000 BaseX

- **ODS2G5C8** configuration for 8 units:
  - up to: 4 x STM-16, 20 x STM-4/1, 273 x 2 Mbit/s, 3 x 34 Mbit/s and 13 x 10/100 BaseTx, 2 x 100 BaseFx, 10 x 1000 BaseT/1000 BaseX

- **ODS2G5C12** configuration for 12 units:
  - up to: 6 x STM-16, 30 x STM-4/1, 273 x 2 Mbit/s, 3 x 34 Mbit/s and 20 x 10/100 BaseTx, 3 x 100 BaseFx, 15 x 1000 BaseT/1000 BaseX (cross connect card protection, sync module protection, E1 line protection)

Applications

- Point-to-point fiber optic links
- Linear fiber optic networks, providing add-and-drop capability
- All types of fiber rings and complex network structure at STM-16, STM-4 and STM-1 level
- Local cross-connect at VC12 (2 Mbit/s), VC3 (34 Mbit/s) and VC4 levels

Main features

- Multiservice SDH optical digital system for voice and data transmission of up to STM-16 (2.5 Gbit/s)
- Optical line interface 2.5 Gbit/s, 622 Mbit/s and 155 Mbit/s provides transmission over single-mode optical fiber at 1310 nm for section length of up to 50 km, or at 1550 nm for section length of up to 120 km
- Plug-in SFP optical or electrical transceivers, provide STM-16, STM-4 or STM-1 interface configuration on the same unit
- WDM option - two way single fiber transmission (1310 and 1550 nm), passive optical filter
- CWD option - wavelength division multiplexing (1471, 1491, 1511, 1531, 1551, 1571, 1591, 1611 nm +1310 nm), passive optical filters
- PDH tributary interfaces for 2 Mbit/s and 34 Mbit/s
- Full non blocking cross-connect matrix, capacity 24.88 Gbit/s (160 x 160 VC4) up to VC12 level, S4ADM-2 unit or 44.78 Gbit/s (288 x 288 VC4) up to VC12 level, S16ADM-2 unit
- Ethernet over SDH via GFP/VCAT/LCAS technologies
- Static and dynamic Ethernet traffic capacity adjustment, LCAS procedure
- Line protection at multiplex section, 1+1 MSP, higher order path or lower order path protection (VC12, VC3, VC4), subnetwork protection SNCP
- Advanced fault diagnosis (integrated BER tester, etc)
- Protection configurations (working and reserve modules or units) are possible for cross-connect matrix, synchronization modules, STM-16, STM-4 and STM-1 interfaces and tributary units STI2-63 (1:N 2 Mbit/s tributary protection)
- Unit’s configuration parameters are stored in backplane memory, that enable “plug & play” change of units
- SONET option (OC-48/OC-12/OC-3, T1, T3) is software configurable
- ODS2G5 has been designed in compliance with new ITU-T recommendation and ETSI standards

![ODS2G5 functional block diagram](image-url)
Control and monitoring
- Integrated network management system SUNCE-M provides continuous management of ODS2G5 and all other IRITEL's SDH and PDH equipment (OTS622, ODS155, FM-MSAN, ...)
- The computer (PC) in management operations centre is connected to one network element (ODS2G5) using Ethernet 10/100BaseTx or RS232 interface (F interface)
- NMS interconnections of collocated IRITEL's devices using Q2 (RS485) or Q2Et (10/100BaseTx) interfaces
- NMS interconnection of remote IRITEL's SDH equipment using DCC channels (192 kbit/s, 576 kbit/s)
- Additional G.703 2 Mbit/s interfaces used for connections of independent subnetworks to one centralized management system SUNCE-M
- SNMP northbound and southbound interfaces
- SNMP MIB
- Control and monitoring using standard SNMP viewer

Power supply
- DC power supply –48 V DC or –60 V DC

Mechanical design
- Unit's dimension: 277 x 175 mm
- Module's dimension
  - ODS2G5C3 (3 units): 150 x 436.6 x 238 mm
  - ODS2G5C8 (8 units): 400 x 436.6 x 238 mm
  - ODS2G5C12 (12 units): 482 x 436.6 x 238 mm
- ETSI or 19" cabinet's dimension: 2200 x 600 x 300 mm
**TECHNICAL DATA**

**OTS main unit**
- TMN interface: RS232/V.24, 10/100 BaseTX, Q2 (RS485), Q2Et (10/100 BaseTX), 2 Mbit/s / G.703
- EOW telephone interface: Z (2-wire)
- DCC (F1 or E2) interface: 64 kbit/s, V11
- Performance management: G.826, G.783
- 21 x 2 Mbit/s interface: G.703 (120/75 Q)
- 3 x 34 Mbit/s interface: G.703 (75 Q)
- Ethernet interface: 4 x 10/100 BaseTx (IEEE 802.3), 1 x 100 BaseFx (IEEE 802.3)
- Mapping: GFP-F G.7041 (n x VC12, n x VC3 or VC4)
- Capacity adjustment, LCAS: static, dynamic
- Jitter and wander
- Power consumption: max 30 W

**OTS-G main unit**
- Same as OTS except:
  - Ethernet interface: 1 x 1000 BaseT/BaseX (IEEE 802.3)

**S4ADM-2 unit**
- Cross-connect: non blocking matrix
- Capacity adjustment: 160 x 160 VC4 (up to VC12 level)
- Synchronization: according to G.813
- 2 x 155/622 Mbit/s interface: G.957, G.703
- Jitter and wander: G.825
- Ethernet interface: 5 x 10/100 BaseTx (IEEE 802.3), 1 x 100 BaseFx (IEEE 802.3), 1 x 1000 BaseT/1000 BaseX (IEEE 802.3)
- Power consumption: max 30 W

**S4LI-4 unit**
- 4 x 155/622 Mbit/s interface: G.957, G.703
- Jitter and wander: G.825
- Ethernet interface: 2 x 10/100 BaseTx (IEEE 802.3), 2 x 1000 BaseT/1000 BaseX (IEEE 802.3)
- Power consumption: max 27 W

**S16LI-8 unit**
- up to 2 x 2.5 Gbit/s interface: G.957, G.703
- up to 8 x 155/622 Mbit/s interface: G.957, G.703
- Jitter and wander: G.825
- Power consumption: max 28 W

**S16LE-2 unit**
- up to 2 x 2.5 Gbit/s interface: G.957, G.703
- up to 4 x 155/622 Mbit/s interface: G.957, G.703
- Jitter and wander: G.825
- Ethernet interface: 4 x 1000 BaseT/1000 BaseX (IEEE 802.3)
- Power consumption: max 30 W

**ST12-63 tributary unit**
- 63 x E1 interface: G.703 (120/75 Q)
- Jitter and wander: G.823
- Power consumption: max 25 W

**STM-4**
- OL.S4A: LC/FPLD 1310 nm/15 km
- OL.L4A: LC/DFBLD 1310 nm/48 km
- OL.L4B: LC/DFBLD 1550 nm/80 km
- OL.L4B1: LC/DFBLD 1550 nm/120 km

**STM-1**
- OL.S1A1: LC/FPLD 1310 nm/15 km
- OL.S1A: LC/FPLD 1310 nm/40 km
- OL.S1B: LC/DFBLD 1550 nm/93 km
- OL.S1 electrical: CMI/12.7 dB at 78 MHz

**FE**
- OL.S1A1: IEEE 802.3
- OL.S1A: LC/FPLD 1310 nm/15 km
- OL.S1B: LC/DFBLD 1550 nm/93 km

**GbE**
- OL.Gbe-E5: LC/MQW FPLD 1310 nm/10 km
- OL.Gbe-E: LC/DFBLD 1310 nm/40 km
- OL.Gbe-ZX: LC/DFBLD 1550 nm/60 km
- EI.Gbe-RJ45: RJ45/CAT5/CATe/CAT6/100 m

**Traffic protection**
- Line protection: 1+1 MSP
- Path protection: VC12, VC3, VC4
- Subnetwork protection: SNCP

**Plug-in SFP transceivers**
- **STM-16**
  - OL.S16A: LC/FPLD 1310 nm/15 km
  - OL.L16A: LC/FPLD 1310 nm/48 km
  - OL.S16B: LC/FPLD 1550 nm/15 km
  - OL.L16B: LC/DFBLD 1550 nm/80 km
  - ITU-T G.957

**ODS2G5**
- SDH/SONET Multiservice Optical Digital Systems
OTS622
SDH/SONET Multiservice Optical Transport Systems

- Next generation SDH Optical Transport Systems for STM-4/1, E1, E3, 10/100BaseTx, 100BaseFx, 1000BaseX, 1000BaseT services
- Add/drop, terminal multiplexer and cross-connect
- Ethernet over SDH, GFP/VCAT/GFP/LCAS technologies
- Compact, flexible and cost-effective SDH equipment for metro and access network applications
- Network management system SUNCE-M or SNMP-based management
Basic configurations

- **OTS622s** compact 1U system, options:
  - **OTS622s-21E1**: 2 x STM-4/1, 21 x 2 Mbit/s
  - **OTS622s-21E1/E3**: 2 x STM-4/1, 21 x 2 Mbit/s, 3 x 34 Mbit/s
- **FE-5** module for OTS622s-21E1 or OTS622s-21E1/E3: 4 x 10/100BaseTx, 1 x 100BaseFx
- **GbE-2** module for OTS622s-21E1 or OTS622s-21E1/E3: 1 x 1000BaseX/BaseT

**OTS622-21E1** “two slots - two OTS/OTSG units”:
- 2 x (2 x STM-4/1), 2 x (21 x 2 Mbit/s), 2 x (3 x 34 Mbit/s), 2 x [(4 x 10/100BaseTx, 1 x 100BaseFx) or (1 x 1000BaseX/T)]

**OTS622-84E1** “two slots system”:
- 2 x STM-4/1, 84 x 2 Mbit/s (OTS/OTSG unit 21 x 2 Mbit/s and one tributary unit 63 x 2 Mbit/s), 3 x 34 Mbit/s, (4 x 10/100BaseTx, 1 x 100BaseFx) or (1 x 1000BaseX/T)

Applications

- Point-to-point fiber optic transmission
- Linear fiber optic networks, providing add-and-drop capability
- Add-drop fiber ring at STM-1 or STM-4 level
- Connecting to the same or higher order SDH networks
- Local cross-connect at VC12, VC3 and VC4 levels

Main features

- Multiservice SDH optical transport system for voice and data transmission at STM-1 (155 Mbit/s) and STM-4 (622 Mbit/s) level
- Optical line interfaces 622 Mbit/s and 155 Mbit/s provide transmission over single-mode optical fiber at 1310 nm for section length of up to 50 km, or at 1550 nm for section length of up to 120 km
- Plug-in SFP optical or electrical tranceivers, provide STM-1 or STM-4 interfaces configurations on the same unit
- WDM option-single fiber transmission (1310 and 1550 nm), passive optical filter
- CWD M option - wavelength division multiplexing (1471, 1491, 1511, 1531, 1551, 1571, 1591, 1611 nm +1310 nm), passive optical filter
- Full non blocking cross-connect matrix, capacity 16x16 VC4 (2.5 Gb/s) up to VC12 level
- PDH tributary interfaces for 2 Mbit/s and 34 Mbit/s
- Ethernet over SDH via GFP/VCAT/LCAS technologies
- Static and dynamic Ethernet traffic capacity adjustment, LCAS procedure
- Line protection at multiplex section, 1+1 MSP, higher order path or lower order path protection (VC12, VC3, VC4), subnetwork protection SNCP
- Advanced fault diagnosis (integrated BER tester, etc)
- Unit’s configuration parameters are stored in backplane memory, which enables “plug & play” change of units
- SONET option (OC-12/OC-3, T1, T3) is software configurable
- OTS622 has been designed in compliance with new ITU-T recommendation and ETSI standards
Control and monitoring

- Integrated network management system SUNCE-M provides continuous management of OTS622 and all other IRITEL’s SDH and PDH equipment (ODS2G5, ODS155, FM-MSAN ...).
- The computer (PC) in management operations centre is connected to one network element (OTS622) using Ethernet 10/100BaseTx or RS232 interface (F interface).
- NMS interconnections of collocated IRITEL’s devices using Q2 (RS485) or Q2Et (10/100BaseTx) interfaces
- NMS interconnection of remote IRITEL’s SDH equipment using DCC channels (192 kbit/s, 576 kbit/s)
- Additional G.703 / 2 Mbit/s interfaces used for connections of several independent subnetwork on one centralized management system SUNCE-M.
- SNMP northbound and southbound interfaces
  - SNMP MIB
  - Control and monitoring using standard SNMP viewer

Power supply

- DC power supply –48 V DC or –60 V DC
- Optional 230 V AC internal power supply for OTS622s systems

Mechanical design

- Unit: 20 x 277 x 175 mm (H x W x D)
- Mechanical modules
  - OTS622s: 44.5 x 436.6 x 238 mm
  - OTS622-21E1: 150 x 436.6 x 238 mm
  - OTS622-84E1: 150 x 436.6 x 238 mm
- ETSI or 19”cabinet: 2200 x 600 x 300 mm
## TECHNICAL DATA

### OTS main unit

**TMN interface**  RS232/V.24, 10/100 BaseTX, Q2 (RS485), Q2Et (10/100 BaseTX), 2 Mbit/s / G.703

**EOW telephone interface**  Z (2-wire)

**DCC (F1 or E2) interface**  64 kbit/s, V11

**Performance management**  G.826, G.783

**21 x 2 Mbit/s interface**  G.703 (120/75 Ω)

**Mapping/multiplexing**  G.707 at paths:


**3 x 34 Mbit/s interface**  G.703 (75 Ω)

**Mapping/multiplexing**  G.707 at paths:


**Ethernet interface**  4 x10/100 BaseTx (IEEE 802.3)  1 x100 BaseFx (IEEE 802.3)

**Mapping**  GFP-F G.7041 (n x VC12, n x VC3 or VC4)

**Capacity adjustment, LCAS**  static, dynamic

**2 x 155/622 Mbit/s interface**  G.957, G.703

**Jitter and wander**  G.825

**Power consumption**  max 30 W

### OTS-G main unit

Same as OTS except:

**Ethernet interface**  1x1000 BaseT/BaseX (IEEE 802.3)

### STI2-63 tributary unit

**63 x E1 interface**  G.703 (120/75 Ω)

**Jitter and wander**  G.823

**Mapping/multiplexing**  G.707 at paths:


**Power consumption**  max 25 W

### OTS622s-21E1

Compact 1U system  same functionalities as OTS unit, but without interfaces for 34 Mbit/s and Ethernet

### OTS622s-21E1/E3

Compact 1U system  same functionalities as OTS unit, but without interfaces for Ethernet

### FE-5

Fast Ethernet interfaces module for OTS622s systems

**Ethernet interface**  4 x10/100 BaseTx (IEEE 802.3)  1 x100 BaseFx (IEEE 802.3)

### GbE-2

Gigabit Ethernet interface module for OTS622s systems

**Ethernet interface**  1x1000 BaseT/BaseX (IEEE 802.3)

### Traffic protection

**Line protection**  1+1 MSP

**Path protection**  VC12, VC3, VC4

**Subnetwork protection**  SNCP

### Plug-in SFP transceivers

**STM-4:**

- OI.S4A  LC/FPLD 1310 nm/15 km
- OI.L4A  LC/DFBLD 1310 nm/48 km
- OI.L4B  LC/DFBLD 1550 nm/80 km
- OI.L4B1  LC/DFBLD 1550 nm/120 km

**STM-1:**

- OI.S1A1  LC/FPLD 1310 nm/15 km
- OI.S1A  LC/FPLD 1310 nm/40 km
- OI.S1B  LC/DFBLD 1550 nm/93 km
- OI.S1 electrical  CMI/12.7 dB at 78 MHz

**FE:**

- OI.S1A1  LC/FPLD 1310 nm/15 km
- OI.S1A  LC/FPLD 1310 nm/40 km
- OI.S1B  LC/DFBLD 1550 nm/93 km
- OI.GbE  IEEE 802.3

**GbE:**

- OI.GbE-AS  LC/MQW FPLD 1310 nm/10 km
- OI.GbE-A  LC/DFBLD 1310 nm/30 km
- OI.GbE-ZX  LC/DFBLD 1550 nm/60 km
- EI.GbE-RJ45  RJ45/CAT5/CATe/CAT6/100 m
Passive optical modules for increasing the capacity of a single optical fiber using wavelength-division multiplexing

Passive WDM multiplexers for increasing the capacity of a single optical fiber, for up to 2 wavelengths 1310/1550 nm

Passive CWDM Mux/Demux for increasing the capacity of a single optical fiber, for up to 4 or 8 wavelengths 1471/1491/1511/1531/1551/1571/1591/1611 nm

Passive optical add/drop multiplexer for one or two wavelengths
**TECHNICAL DATA**

**WDM**
- 2 wavelengths per one fiber [nm]: 1310, 1550
- Isolation: 25 dB/45* dB
  (*high isolation option*)
- Maximum insertion loss: 0.4 dB
- Optical connector: LC or FC/PC

**CWDM4 MUX/DEMUX modules**
- 4 wavelengths [nm]: 1511, 1531, 1551, 1571
- Optionally any combination from CWDM8
- Maximum insertion loss: 1.2* dB/1.8 dB
  (*ultra low insertion loss option*)
- Isolation: 30 dB adjacent, 50 dB non-adjacent channels
- Optical connector: LC

**CWDM4e MUX/DEMUX modules**
- 4+1 wavelengths [nm]: 1511, 1531, 1551, 1571 +1310
  Optionally any combination from CWDM8
- Maximum insertion loss: 1.8 dB, (0.8 dB for 1310)
- Isolation: 30 dB adjacent, 50 dB non-adjacent channels
- Optical connector: LC

**CWDM8 MUX/DEMUX modules**
- 8 wavelengths [nm]: 1471, 1491, 1511, 1531, 1551, 1571, 1591, 1611
- Maximum insertion loss: 1.8* dB/2.8 dB
  (*ultra low insertion loss option*)
- Isolation: 30 dB adjacent, 50 dB non-adjacent channels
- Optical connector: LC

**CWDM8e MUX/DEMUX modules**
- 8+1 wavelengths [nm]: 1471, 1491, 1511, 1531, 1551, 1571, 1591, 1611 +1310
- Maximum insertion loss: 2.8 dB, (0.8 dB for 1310)
- Isolation: 30 dB adjacent, 50 dB non-adjacent channels
- Optical connector: LC

**OADM-1 ADD/DROP module**
- Add and drop 1 selected wavelength from CWDM range 1417-1611 nm
  (*option add/drop 1310 channel - module OADM-1e*)
- Maximum insertion loss:
  - 1 dB for add/drop channel
  - 1.2 dB for pass through channel
- Isolation: 30 dB adjacent, 50 dB non-adjacent channels
- Optical connector: LC

**OADM-2 ADD/DROP module**
- Add and drop 2 selected wavelengths from CWDM range 1417-1611 nm
  (*option add/drop 1310 channel - module OADM-2e*)
- Maximum insertion loss:
  - 1.2 dB for add/drop channel
  - 1.6 dB for pass through channel
- Isolation: 30 dB adjacent, 50 dB non-adjacent channels
- Optical connector: LC

**WDM-8**
- Rack mechanical construction for up to eight WDM/CWDM/OADM modules
- 19"/ETSI/1U height
- Power supply: NO (passive modules)

**Mechanical dimensions**
- WDM-8: 44.5 x 436.6 x 200 mm
- WDM/CWDM/OADM modules: 17.3 x 90 x 140 mm
**FM-MSAN (FM8x2)**
**MULTISERVICE ACCESS MULTIPLEXER**

- Multiservice Access Node (MSAN)
- Universal access PSTN
- 8 to 72 external and 16 to 80 internal links 2 Mbit/s
- Digital channel cross-connect between all 88 links (non-blocking)
- Concentrator according to V5.2 up to 2400 subscribers, for remote multiplexers and/or V5.2 access nodes
- Protocol conversion V5.2-CAS
- Built in optical transmission, TDMoIP access, multiple conference and service channels available
Applications
FM-MSAN access multiplexer is designed to allow transmission of voice and data in access telecommunication networks. It can be configured as access multiplexer, drop/insert, cross-connect and fractional multiplexer and concentrator according to V5.2.

Features
- Supports over 15 different transmission and subscriber, analog and digital interfaces
- Redudant central unit
- Cross-connect non-blocking switching fabric for up to 88 E1 links, CAS signalling included
- Up to 21 universal unit slots per subracks
- Up to 20 channels per unit
- Advanced traffic protection mechanism for E1 links
- Line test access
- Concentrator according V5.1/V5.2 protocol for POTS and ISDN-BRI/PRI
- Intergarted Optical Transmission Unit
- Intergrated TDM over IP Line Card
- NMS based on client server application with data base replication
- SNMP based agent

Configurations
- FMV– multiplex, cross-connect, control and power supplay unit with V5.2 interface
- Various types of channel units with up to 20 user interfaces
- PE1 – 8xE1 interfaces unit, up to 8 units per FM-MSAN
- Rack configuration – 1 to 4 subracks, 21 (19, 12) universal unit slots, 2 special slots for central unit

User interfaces
- 2w/4w analog voice interface with E/M signaling
- 2w analog voice interface ATA – for direct connection to a phone
- 2w analog voice interface ATC – for direct connection to a exchange
- 2w analog voice interface LB – for direct connection to a phone with local battery supply
- 64 kbit/s digital interface, codirectional G.703
- n x 64 kbit/s digital interface with X.21 interface
- Asynhronous/synchronous digital interface V.24, up to 38.4 kbit/s
- ISDN basic rate access U interface
- SHDSL, nx64 kbit/s interface
- Ethernet 10/100 BaseT and 100 BaseFX interface
- Conference connection
**Channel units**

- **PEM10** – 10 channels 2w/4w with E/M signaling
- **PAT10** – 10 channels, ATA interface
- **PAT20** – 20 channels, ATA interface
- **PAC10** – 10 channels, ATC interface
- **PLB10** – 10 channels, LB interface
- **PCO** – 10 channels, 64 kbit/s digital interface, codirectional G.703
- **PN64** – 4 channels, nx64 kbit/s, V.11/X.21 interface
- **PN64A** – 8/4 channels, asynchronous/synchronous transmission from 2.4 up to 115.6 kbit/s, V24/V.28
- **PIU-LT** – 4 channels, ISDN U interface, 2B1Q for direct connection to a ISDN phone
- **PIU-NT** – 4 channels, ISDN U interface, 2B1Q for direct connection to a ISDN exchange
- **PSH** – 4 channels, SHDSL nx64 kbit/s interface or 2 Mbit/s or Ethernet over SHDSL
- **PET** – 3 channels, nx64 kbit/s Ethernet bridge with 10/100 BaseT or/and 100 Base FX interface
- **PIO** – 8 x digital I/O
- **PCF** – up to 5 conferences with up to 60 users
- **POT** – Integrated Optical Transmission unit with 1+1 APS and additional 2xE1
- **PTP** – TDM over IP Transmission Unit with additional 2xE1

**Control and monitoring**

Integrated network management system SUNCE-M provides continuous management of FM-MSAN and all other IRITEL’s SDH and PDH equipment (ODS155, OTS622 ...)

For NMS system integration we support standard interface based on SNMP protocol

**Synchronization**

- From internal built-in oscillator (± 25 ppm)
- From external 2 048 kHz clock
- From received clock on any external link
- From received clock on a chosen digital channel interface

**Mechanical design**

- Unit (233×160×20 mm) and (233×175×20mm)
- 19”/ETSI cabinet’s rack (300×483/533×230 mm)
- 19”/ETSI cabinet for 4 subracks (2200×600×300 mm)
- ETSI cabinet for 3 subracks (1200×600×400 mm)
- Wall mount cabinet for 17 or 14 units and uninterruptable power supply (650×600×300 mm)
TECHNICAL DATA

E1 Tributaries
2048 kbit/s according to ITU-T G.703, G.704 and G.706

2w/4w analog voice interface with E/M signaling
Impedance 600 Ω
Relative levels
2w/4w input and output levels −16 up to +4 dBref. in steps
E/M signaling
output (E) ≤ 50 mA/150 V
input (M) ≤ 500 Ω (2 mA)

2 wire analog voice interface ATC
Impedance 600 Ω
Relative levels
output −4 dB ± 3 dB (in 0.1 dB steps)
input −3 dB ± 3 dB (in 0.1 dB steps)
Loop current ≤ 60 mA
Loop resistance ≤ 350 Ω
Ringing load impedance > 1 kΩ + 0.47µF
Ringing detection level 15 up to 35 Veff /25 Hz
Maximum ringing voltage 90 Veff
Ringing frequency 16 up to 50 Hz
Metering
frequency (standard/option) 16/12 kHz ± 1%
sensitivity level 85 mV

2 wire analog voice interface ATA
Impedance ETSI/600 Ω
Relative levels
output −7 dB ± 3 dB (in 0.1 dB steps)
input 0 dB ± 3 dB (in 0.1 dB steps)
Loop feeding
48 V/2x400 Ω, loop resistance up to 1200 Ω,
Ringing signal from ring generator (GZV15) 50 do 75 Veff /25 Hz
Metering
frequency (standard/option) 16/12 kHz ± 1%

2 wire analog voice interface LB
Impedance 600 Ω
Relative levels
output −4 dB ± 3 dB (in 0.1 dB steps)
input −3 dB ± 3 dB (in 0.1 dB steps)
Ringing load impedance > 1 kΩ + 0.47µF
Ringing detection level 15 up to 35 Veff /25 Hz
Maximum ringing voltage 90 Veff
Ringing frequency 16 do 50 Hz
Ringing signal from ring generator (GZV15) 50 do 75 Veff /25 Hz

64 kbit/s digital interface
according to ITU-T G.703, codirectional

n x 64 kbit/s digital interface
according to ITU-T V.11/X.21 or V.35

Asynchronous/synchronous digital interface V.24/V.28
transparent transmission up to 115.6 kbit/s

ISDN interface
U interface channel structure: 2B+D
line code: 2B1Q
according to ETSI ETR 080

SHDSL interface
according to ETSI TS 101 524 and ITU-T G.991.2

Ethernet bridge interface
10/100 BaseT and 100 BaseFX according to IEEE 802.3

External clock reference
2048 kHz according to ITU-T G.703/10

TMN interface
SUNCE-M (proprietary)
F (RS232/V.24 or 10/100 BaseTX Ethernet),
Q2 (RS485), Q2Et (10/100 bT)
SNMP/V1/V2/V3
RFC 3895 (DS1/E1),
RFC 2494 (DS0), RFC 4316 (SHDSL)
Proprietary MIB extension for DS0

Operating temperature range
-5°C up to +45°C
(class 3.2)
PIU
4 ISDN tributaries with U interface

- Provides connection to ISDN exchange for 4 remote subscribers, via multiplexers FM2x2, FM-MSAN
- Single pair subscriber loop with 2B1Q line code
- PIU-LT (Line Termination) and PIU-NT (Network Termination) options
Applications

PIU unit, as tributary unit within multiplexers FM2x2 and FM-MSAN provides connection of remote customer to ISDN exchange. User NT1 equipment is NT (network termination), whereas U-interface at exchange side is LT. Therefore, PIU unit at customer side must be PIU-LT, and PIU unit at exchange side PIU-NT.

Remote subscriber can be connected with ISDN exchange via more than one PIU-LT/PIU-NT pair, but maximum number of regenerators is six (i.e. three LT/NT pairs). For test purposes ISDN exchange can send diagnostic commands through EOC channel to each PIU unit in chain. 3 bits are reserved for address. “0” is address of NT1 equipment, “1” to “6” are for PIU units in chain, and “7” is for all stations in chain (broadcast).

Basic functions

- 4 ISDN U interfaces on PIU unit
- One U-ISDN occupies 2.5 64kbit/s channels in FM2x2 and FM-MSAN multiplex
- Position of U-ISDN in multiplex is configurable by management software
- Transport via single pair is accomplished by use of 2B1Q line code with near-end echo cancellation
- PIU-LT is equipped with remote power feed source, which can provide power feeding of NT1 without local power supply
- Copper-pair interruption detection
- Short-circuited copper-pair detection
- Remote loopback control from ISDN exchange through EOC
- Performance monitoring

Control and monitoring

PIU unit within multiplexers FM2x2 and FM-MSAN can be controlled by PC software SUNCE-M (Network Manager):

- PIU unit configuration
- time slot assigning
- remote power feed control
- performance monitoring control
- alarm monitoring control
- Alarm monitoring

ISDN exchange has loopback control over PIU unit by means of EOC.

Activation and deactivation of U-interfaces is initiated from NT1 or exchange.

Technical Data

<table>
<thead>
<tr>
<th>ISDN U interface</th>
<th>ITU-T G.960, G.961 compliant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transport type</td>
<td>duplex</td>
</tr>
<tr>
<td>Transport medium</td>
<td>one twisted-pair</td>
</tr>
<tr>
<td>Line code</td>
<td>2B1Q</td>
</tr>
<tr>
<td>Line speed</td>
<td>80 kboud ± 100 ppm</td>
</tr>
<tr>
<td>64kbit/s channels per interface</td>
<td>2.5</td>
</tr>
<tr>
<td>Maximum line attenuation at 40 kHz</td>
<td>36 dBm</td>
</tr>
<tr>
<td>at 80 kHz</td>
<td>45 dBm</td>
</tr>
<tr>
<td>Maximum line resistance without repeaters</td>
<td>1048 Ω</td>
</tr>
<tr>
<td>with repeaters</td>
<td>1300 + 700 Ω</td>
</tr>
<tr>
<td>Synchronization frame</td>
<td>1.5 ms</td>
</tr>
<tr>
<td>multiframe</td>
<td>12 ms</td>
</tr>
<tr>
<td>Scrambling</td>
<td>$1 + X^{19} + X^{23}$</td>
</tr>
<tr>
<td>CRC12</td>
<td>$X^{12} + X^{11} + X^3 + X + 1$</td>
</tr>
<tr>
<td>Remote power</td>
<td>105 V</td>
</tr>
</tbody>
</table>

Technical Data

| PIU/FM2x2 regenerator chain between remote subscriber and ISDN exchange |

2B+D Transparency

Embedded Operations Channel (EOC)
**PET**

3 digital nx64 kbit/s Ethernet Bridge subscribers with 10/100 BaseT or 100 BaseFX interface

- Provides connection of remote LAN network with Ethernet 10/100Base-TX or 100Base-FX interface via telecommunication network with n x 64 kbit/s data rate.
- Programming the number (1 to 31) of 64 kbit/s channels for any of 3 digital subscribers.
Applications

PET unit, as tributary unit within multiplexers, is used when subscriber want to connect devices with Etherent 10/100 Base-T or 10/100 Base FX interfaces through the transport telecommunication network. Any of 3 ports realize the Switch function on level 2 (MAC level). PET unit can be programmed at nx64 kbit/s rate on Ethernet Bridge interface to the transport network.

Basic functions

- 3 independent Ethernet Switches on one unit, 10/100 Base T/100 Base FX interface and one internal WAN interface for nx64 kbit/s Ethernet Bridge function
- Electrical Ethernet interfaces (10/100 BaseT) support auto negotiation procedure which determine the type of interface (10 or 100 Mbit/s, full or half duplex)
- All three Ethernet Switches can be configured for VLAN
- Support for QoS priority choice according to the port or IEE802.1p
- LED diodes for links activity, full/half duplex transmission and data rate
- Integrated control and monitoring
- When autonegotiation is switched off it is possible to programme all three 10/100 BaseT ports independently
- Flow control for full duplex transmission according to IEE802.3x or back pressure flow control for half duplex transmission
- Automatic address learning for MAC frame switching

### TECHNICAL DATA

<table>
<thead>
<tr>
<th>Ethernet 10/100 BaseT</th>
<th>Ethernet 100 BaseFX</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Transport type</strong></td>
<td>duplex</td>
</tr>
<tr>
<td><strong>Electrical characteristics</strong></td>
<td>IEEE 802.3</td>
</tr>
<tr>
<td><strong>Transmission</strong></td>
<td>symmetrical</td>
</tr>
<tr>
<td><strong>Section length (UTP cable class 5)</strong></td>
<td>135 m</td>
</tr>
<tr>
<td><strong>Connector</strong></td>
<td>RJ45</td>
</tr>
</tbody>
</table>

**Ethernet 100 BaseFX**

- Transport type: duplex
- Optical characteristics: IEEE 802.3
- Transmission: singlemode optical fiber
- Section length: 2000 m
- Connector: SC
PN64
4 digital interfaces of X.21/V.11 type, n x 64 kbit/s

- Provides connection of terminal equipment (DTE) with n x 64kbit/s X.21/V.11 interface to telecommunication network via multiplexers FM2x2 and FM-MSAN (DCE)
- Independent selection of number (1 to 31) of 64 kbit/s channels for each interface
Applications
PN64 unit, as tributary unit within multiplexers FM2x2, PDH, and SDH in MSAN, provides network access to customer equipment based on X.21 interface. Bit rate n x 64 kbit/s on X.21 interface is programmable and not dependent on protocol type used for providing service to customer.

Basic functions
- 4 n x 64 kbit/s X.21 interfaces on one board
- Programmable position in multiplex for each n x 64 kbit/s channel, independent
- Number of 64 kbit/s channels, n per interface can be 1, 2,..., 31
- Independent selection of X.21 interface type: codirectional or contradirectional
- Byte Timing signal (B) is available for contradirectional interface type
- Selectable Byte Timing signal type: time slot (byte) or PCM frame of FM2x2 and FM-MSAN
- Codirectional interface type can be referent clock source for multiplexers FM2x2 and FM-MSAN
- Asymmetric capacity is possible for codirectional interface type
- Unused interfaces can be switched off for power saving
- States of near (DCE) and far (DTE) end are displayed by front LEDs

Control and monitoring
PN64 unit within multiplexers FM2x2 and FM-MSAN is controlled by PC software SUNCE-M (Network Manager):
- PN64 unit configuration:
  - activation/deactivation of interfaces
  - time slot assigning
  - contradirectional/codirectional selection
  - referent clock selection
  - Alarm monitoring

Technological data
X.21 interface
- ITU-T X.27, V.11 compliant
- Transport: duplex
- Transport medium: 6 twisted-pairs
- Connector: 15-pin SUBD, female
- No. of 64 kbit/s intervals per interface: 1 to 31
- Line rate: n x 64 kbit/s
- Maximum line length:
  - up to 128 kbit/s: 1300 m
  - up to 2048 kbit/s: 60 m
- Copper-pair termination:
  - Transmit (R, S, B and I signals): 120 Ω
  - Receive (T, X, C signals): 120 Ω
PCO
10 digital G.703 64 kbit/s codirectional interfaces

- Provides connection for 10 independent subscribers with G.703 64 kbit/s codirectional interfaces via multiplexers FM2x2 and FM-MSAN
Applications
PCO unit, as a tributary unit within multiplexers FM2x2 and FM-MSAN provides connection between remote customers having equipment based on ITU-T G.703 64 kbit/s codirectional interface though TDM based telecommunication network. Each interface is absolutely transparent regarding the protocol that gives particular service to the customer.

Basic characteristics
- 10 independent 64 kbit/s G.703 codirectional interfaces accessible from rear side
- Each channel could be programmed to occupy any time slot into any external E1 link
- Octet framing programming capability for each channel
- Power saving mode for the unused interfaces
- Each channel can be programmed to be synchronization source for multiplexers FM2x2 and FM-MSAN

Control and monitoring
PCO unit within multiplexers FM2x2 and FM-MSAN is controlled by PC software SUNCE-M (Network Manager):
- PCO unit configuration:
  - Interface activation and deactivation
  - Time slot allocation
  - Framing type definition
  - Alarm monitoring
  - Synchronization
- Centralized alarm monitoring and acquisition functions

### TECHNICAL DATA

#### G.703 64kbit/s codirectional

**Input**
- Impedance: 120 Ω
- Loss at 128 kHz: 0 to 3 dB
- Return loss:
  - 4 to 13 kHz: ≥12 dB
  - 13 to 256 kHz: ≥18 dB
  - 256 to 384 kHz: ≥14 dB

**Output**
- Impedance: 120 Ω
- Impulse level: 1 V ±0.1 V
- Impulse width:
  - single: 3900 ns
  - double: 7800 ns
- Impulse shape:
  - according to ITU-T G.703
  - single: 5a/G.703
  - double: 5b/G.703
- Section length:
  - 800m or better
- Connector:
  - 25-pin, D-type, female
  - jointed for 5 interfaces

**Transmission**
- full duplex

**Transmission medium**
- 2 pairs

**Line speed**
- 256 kbit/s ± 100 pmm

**Framing**
- unframed
- octet framing
PN64A
8 digital interfaces of V.24/V.28 type

- Asynchronous transmission independent from code and data rate
- Data rate in multiplex 64 kbit/s to 384 kbit/s
- Submultiplexing up to 8 channels in 64 kbit/s
- Interface data rate: 2400 bit/s up to 115.6 kbit/s
**Applications**

PN64A unit, as tributary unit within multiplexers FM2x2 and FM-MSAN, provides network access to customer equipment based on V.24/V.28 interface for transparent asynchronous data transmission. Used multiplex data rate for transmission is software programmed and can be 64 kbit/s up to 384 kbit/s and submultiplexing up to 8 channels in 64 kbit/s.

**Basic functions**

- 8 interfaces V.24/V.28 on one unit
- Programmable position of used channels in multiplex
- Selection of data rate in multiplex for transmission: 64 to 384 kbit/s
- Submultiplexing up to 8 channels in 64 kbit/s
- Asynchronous transmission independent from code and data rate

**Control and monitoring**

PN64A unit within multiplexers FM2x2 and FM-MSAN is controlled by PC software SUNCE-M (Network Manager):

- PN64A unit configuration:
  - activation/deactivation of interfaces
  - time slots assigning
  - submultiplex assigning
  - Alarm monitoring

**Technical data**

- Number of interfaces: 8
- Digital interface (TD, RD, RTS, DCD): ITU-T V.24/V.28
- Transmission method: asynchronous transparent (ITU-T R.111)
- Connector (EIA-561): RJ-45
- No. of 64kbit/s time slots: 1 to 6
- Interface data rate: 2400 bit/s up to 115.6 kbit/s
- Asynchronous distortion: <8%
FMOP
FLEXIBLE MULTIPLEXER OPTICAL PLATFORM

- Universal TDM narrowband and packet broadband optical transmission platform
- Up to 400 equivalent 64 kbit/s subscribers
- Wire speed broadband Ethernet Services
- Point to point leased line or switched TDM services over optical transmission medium
- 1+1 optical Automatic Protection Switch (APS)
Applications

FMOP is flexible multiplexer specially designed to allow transmission of TDM narrowband voice and data signals and broadband Ethernet packet data in point to point configurations over optical transmission medium.

Device enables reliable and high quality TDM voice and data services with low latency and guaranteed throughput. FMOP helps user to protect their existing investments in legacy TDM based CO and CPE equipment and at the same time enable smooth transition to a new broadband services. For the users who requires guaranteed quality of services FMOP represents unparallel solution compared to a VoIP technology.

Typically FMOP find application for:
- Connecting remote analog subscribers, FXS, FXO
- Connecting remote ISDN BRA subscribers
- Leased line access to Internet Service Providers (ISP)
- Leased line services over E1 for corporate PABX connections
- IP DSLAM connections to remote IP SWITCH

FMOP multiplexer is suitable to be used by:
- Public telecommunication networks operators
- Public utility companies
- Large and medium sized companies
- Government offices and agencies

Features

- Supports over 15 different transmission and subscriber, analog and digital interfaces. Shares the same channel units with other multiplexers from IRITEL.
- 4 E1 PDH tributary interfaces for 2 Mbit/s
- Full non-blocking cross-connect
- Up to 21 universal unit slots per subracks
- Up to 20 channels per unit
- Various synchronization sources are available, received clock from line, from a subchannel, from internal oscillator or from external reference
- Line test access
- Integrated network management system, SNMP and SUNCE support
- Supports fiber rings and complex network structure
- Plug-in SFP optical transceivers, provides different fiber type and section lengths
- Wire speed Ethernet bridge functionality
- Optical Line protection, 1+1
- Advanced fault diagnosis (integrated BER tester)

User interfaces

- Analog: 2w/4w with E/M signaling, 2w FXS, 2w FXO, Magnetic
- Digital 64 and nx64 kbit/s: X.21, asynchronous/synchronous V.24, ISDN U, SHDSL, Ethernet
FOP4/8/16
4/8/16xE1 + 2xFE over Fiber Multiplexer

- Simultaneously multiplexes 16 E1 and one 10/100 Mbit/s Ethernet tributaries
- Plug in optical transceivers supporting short, medium, long, dual or single fiber options
- Up to 120 km section length
- 1+1 optical Automatic Protection Switch (APS) option
- Ring topology support
- Control and monitoring over Embedded Web server and SNMP (MIB: RFC-2495, RFC 2233, RFC 2493) support for NMS
- Local displaying of remote device alarms
- Compact 1U, stand alone or 19”/ETSI mount options
- External office/environmental dry contact alarm inputs and orderwire option
- 220V AC and/or -48V DC options (dual power protection)
- Embedded BER Built In Self Test (BIST) on all E1 tributaries and Optical line
**Description**

FOP16 is optical transmission equipment that combines up to 16 TDM E1 signals and one packet oriented 100 Mbit/s Ethernet signal through the fiber link. Besides, optical multiplexer FOP16 provides many value-added functions and interfaces in order to meet different customers needs. It is a very flexible and efficient way to use the FOP16 in optical transmission network for voice, data, and wireless applications.

FOP16 provides network management system for local/remote maintenance purpose by a well known and friendly GUI based Web Server and standard SNMP. FOP16 also provide switch and LED indications for field application.

On optical transmission line, the FOP16 provide two fiber links for 1+1 protection or ring configuration.

**Application**

- Point-to-point fiber optic links
- Linear fiber optic networks, providing add-and drop capability
- Supports fiber rings and complex network structure
- Local cross-connect at E1 (2 Mbit/s) levels

**Main features**

- Plug-in SFP optical transceivers, provides different fiber type and section lengths
- 16 E1 PDH tributary interfaces for 2 Mbit/s
- Full non blocking cross-connect matrix at E1 level
- Wire speed Ethernet bridge functionality
- Optical Line protection, 1+1
- Advanced fault diagnosis (integrated BER tester)
- Integrated network management system
- SNMP northbound and southbound interfaces
- SNMP MIB
- Control and monitoring using standard SNMP viewer

**TECHNICAL DATA**

**Optical interface 155520 kbit/s**

<table>
<thead>
<tr>
<th>Number of interfaces</th>
<th>up to 2xSFP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frame</td>
<td>proprietary</td>
</tr>
<tr>
<td>Multiplexing method</td>
<td>ITU-T G.472 like</td>
</tr>
<tr>
<td>Optical characteristics</td>
<td>depends on plug in module characteristics</td>
</tr>
</tbody>
</table>

- **option -S1A**
  - light source: FPLD, 1310 nm
  - output power: –5 dBm
  - typical section length: 49 km

- **option -S1B**
  - light source: DFBLD, 1550 nm
  - output power: –5 dBm
  - typical section length: 100 km
  - sensitivity for 10⁻¹⁰ BER: –34 dBm
  - maximum input level: –10 dBm

**Interface G.703 2 Mbit/s**

<table>
<thead>
<tr>
<th>Type of signal</th>
<th>2048 kbit/s ±50 ppm HDB3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal impedance</td>
<td>75 Ω asymmetric</td>
</tr>
<tr>
<td></td>
<td>120 Ω symmetric</td>
</tr>
</tbody>
</table>

**Input**

- Max. cable attenuation: 0 - 6 dB at 1024 kHz
- Input jitter tolerance: ITU-T G.823
- Input return loss:
  - 12 dB in range: 50 kHz to 100 kHz
  - 18 dB in range: 100 kHz to 2 MHz
  - 14 dB above: 2 MHz

**Output**

- Nominal impulse amplitude: 2.37 V ± 0.237 V, 75 Ω
- Impulse shape according to: ITU-T 15/G.703
- Output jitter up to 100 kHz: 0.25 UI p-p
- in range 18 kHz to 100 kHz: 0.05 UI p-p

**Ethernet interface**

<table>
<thead>
<tr>
<th>2 x10/100 BaseT x</th>
</tr>
</thead>
<tbody>
<tr>
<td>(IEEE 802.3)</td>
</tr>
</tbody>
</table>

**Power supply**

<table>
<thead>
<tr>
<th>DC input voltage</th>
<th>–36 to –72 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power consumption</td>
<td>&lt;4 W</td>
</tr>
</tbody>
</table>

**Environmental conditions**

<table>
<thead>
<tr>
<th>Climatic conditions</th>
<th>class 3.1 ETSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>-5°C to +45°C</td>
</tr>
</tbody>
</table>

**Physical dimensions (H x W x D)**

<table>
<thead>
<tr>
<th>Unit</th>
<th>440 x 257 x 43.2 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>3.15 kg</td>
</tr>
<tr>
<td></td>
<td>rack-mountable hardware included</td>
</tr>
</tbody>
</table>
FMTP
FLEXIBLE MULTIPLEXER TDMoIP PLATFORM

- Universal TDM narrowband and packet broadband TDM over IP transmission platform
- Up to 400 equivalent 64 kbit/s subscribers
- High speed broadband Ethernet Services
- Point to point or point to multipoint leased line or switched TDM services over Ethernet packet based transmission network
- Various protection mechanisms
- SUNCE and SNMP based TMN support
### Applications

FMTP is flexible multiplexer specially designed to allow transmission of narrowband voice and data signals in point to point or point to multipoint configurations Ethernet packet core network.

Device enables reliable and high quality TDM voice and data services with low latency and guaranteed throughput. FMTP helps user to protect their existing investments in legacy TDM based CO and CPE equipment and to avoid costly E1 leased lines necessary for existing equipment operation. For the users who requires guaranteed quality of services FMTP represents unparallel solution compared to a VoIP technology. Typically FMTP find application for:

- Connecting remote analog subscribers, FXS, FXO
- Connecting remote ISDN BRA subscribers
- Leased line services over E1 for corporate PABX connections
- Wireless base station backhauling

FMTP multiplexer is suitable to be used by:

- Public telecommunication networks operators
- Public utility companies
- Large and medium sized companies
- Government offices and agencies

### Features

- Supports over 15 different transmission and subscriber, analog and digital interfaces. Shares the same channel units with other multiplexers from IRITEL.
- 2 E1 PDH tributary interfaces for 2 Mbit/s
- Full non-blocking cross-connect
- Up to 21 universal unit slots per subracks
- Up to 20 channels per unit
- Various synchronization sources are available, received clock from line, from a subchannel, from internal oscillator or from external reference
- Line test access
- Integrated network management system, SNMP and SUNCE support
- Plug-in SFP optical transceivers, provides different fiber type and section lengths
- Wire speed Ethernet bridge functionality
- Various protection mechanisms
- Advanced fault diagnosis (integrated BER tester)

### User interfaces

- Analog: 2w/4w with E/M signalling, 2w FXS, 2w FXO, Magnetic
- Digital 64 and nx64 kbit/s: X.21, asynchronous/synchronous V.24, ISDN U, SHDSL, Ethernet
Simultaneously performs TDM circuit emulation over enterprise or carrier packet-switched Ethernet L2/L3 networks for 4, 8 or 16 E1.

At the Ethernet line side supports both electrical Fast and optical 100 FX Ethernet interface.

Multiprotocol encapsulation supporting IPv4, IPv6, UDP, RTP, L2TPv3, MPLS and Metro Ethernet.


Lost/misordered packet compensation.

FTP4/816 provide traditional leased-line and TDM switched services transparently over IP with higher voice quality with much lower latency than VoIP and can support all applications that run over E1 circuits, not just voice.
Description
FTP4/8/16 is TDM circuit emulation over Ethernet packet switched network transmission unit. It combines 4, 8 or 16 TDM E1 signals over IP based network. FTP4/8/16 enables transparent services for E1 signals from central unit transmission over enterprise or carrier Ethernet network.

Besides TDM traffic transmission over IP based networks FTP4/8/16 provides many value-added functions in order to meet different customers needs including different network management capabilities, traffic protection, synchronization etc.

Applications
- In carrier network FTP4/8/16 typically finds applications for:
  - TDM services over Ethernet MAN, broadband wireless, CATV
  - 2G / 2.5G cellular backhaul over IP/MPLS
  - HDLC-based traffic (ex. Frame Relay) trunking over IP/MPLS
  - PSTN-IP network bridging
  - SS7 transport over IP
- In enterprise applications FTP4/8/16 is suitable to be used for:
  - Private line/toll bypass via Ethernet MAN
  - TDM PBX migration to Ethernet MAN
- In access networks FTP4/8/16 typically finds application as Multi Tenant Multi Dwelling Unit MTU/MDU

Basic features
- 4, 8 or 16 E1, framed or unframed, PDH tributary interfaces
- One 10/100 electrical and one 100 optical Ethernet interface
- Multiprotocol encapsulation supporting IPv4, IPv6, UDP, RTP, L2TPv3, MPLS and Metro Ethernet
- Recovered clock jitter and wander compliant to ITU-T G.823, G.824 synchronization interface
- Lost/misordered packet compensation
- Compliant with:
  - IETF PWE3 Internet drafts for SAToP, TDMoIP, CESoPSN, HDLC
  - MFA Forum Implementation Agreements 4.1, 5.1 and 8.0.0
  - Metro Ethernet Forum Technical Specification MEF8
- Supports adaptive clock recovery, differential clock (common clock) (using RTP), external clock and loopback timing modes
- Integrated network management system, SNMP and SUNCE support

TECHNICAL DATA

Ethernet interfaces
- Standards IEEE 802.3, IEEE 802.3u IEEE 802.1p, IEEE 802.1Q
- Maximum Frame size 1536 bytes
- 10/100 BaseTx
  - Number of interfaces 1
  - Data rate 10 or 100 Mbits Full/Half duplex
  - Connector RJ45

100 BaseFx
- Number of interfaces 1
- Data rate 100 Mbits Full duplex
- Connector SFP plug in module
  - option -S1A
    - light source FPLD, 1310 nm
    - output power –5 dBm
    - typical section length 49 km
  - option -S1B
    - light source DFBLD, 1550 nm
    - output power –5 dBm
    - typical section length 100 km
    - sensitivity for 10⁻¹⁰ BER –34 dBm
    - maximum input level –10 dBm

Interface G.703 2 Mbit/s
- Number of interfaces 4, 8, 16
- Type of signal 2048 kbit/s ±50 ppm HDB3
- Nominal impedance 75 Ω asymmetric 120 Ω symmetric

Input
- Max. cable attenuation 0 - 6 dB at 1024 kHz
- Input jitter tolerance ITU-T G.823
- Input return loss
  - 12 dB in range 50 kHz to 100 kHz
  - 18 dB in range 100 kHz to 2 MHz
  - 14 dB above 2 MHz

Output
- Nominal impulse amplitude 2.37 V ± 0.237 V 75 .
- Impulse shape according to ITU-T 15/G.703
- Output jitter up to 100 kHz
  - 0.25 UI p-p
  - in range 18 kHz to 100 kHz
  - 0.05 UI p-p

Power supply
- DC input voltage –36 to –72 V
- Power consumption <5 W

Environmental conditions
- Climatic conditions class 3.2 ETSI
- Temperature -5ºC to +45ºC
FMVP
FLEXIBLE MULTIPLEXER VoIP PLATFORM

- Universal VoIP Residential Gateway Solution
- Up to 400 POTS analog subscribers (simultaneous VoIP-POTS conversions)
- High speed broadband Ethernet Services
- Media engine supports various voice coders
- Enhanced voice processing and quality enhancement
- Signalling engine - SIP
- SUNCE and SNMP based TMN support
Applications

FMVP is flexible multiplexer specially designed to enable voice services to residential subscriber over packet switched Ethernet and IP based network. The main 4 function of FMVP multiplexer are: Media Engine works on voice coding, Signalization Engine deals with signalization, Application Engine controls software applications and TDM Engine deals with analog and digital subscribers.

Device enables premium voice quality utilizing versatile voice quality enhancement like voice detection, echo cancellation, packet loss concealment, comfort noise generation etc. FMVP helps user to protect their existing investments in subscribers CPE equipment and enables smooth transition to new packet voice services while keeping subscriber infrastructure intact. Besides of VoIP services FMVP offers high speed Ethernet connection suitable to be used for IP DSLAM connectivity thus making the FMVP ideal packet voice and data provisioning platform.

Typically FMVP find application for:
- Connecting residential subscribers to VoIP Soft Switch
- FMVP multiplexer is suitable to be used by:
  - Public telecommunication networks operators
  - Public utility companies
  - Large and medium sized companies
  - Government offices and agencies

Features

- Supports up to 400 subscribers
- Supports different voice coders: PCM, ADPCM, GSM, Fax Relay
- Echo cancellation: per ITU-T G.168-2000 ECAN 10 ms, 16 ms, 32 ms, 128 ms
- Voice detection: analyses voice activity to detect silence
- Packet Loss Concealment: per ITU-T G.711 Appendix 1
- Comfort Noise Generation: per ITU-T G.711 Appendix 2
- Adaptive Jitter Buffer Manager: fully adaptive or static; dejitter and packet reordering
- Audio Conferencing: support for 3 to N party audio conferences
- DTMF Detect and Generate: per Bellcore GR-506-CORE, TIA 464-B, ITU-T Q.23 and Q.24
- DTMF Relay: per RFC 2833
- Call Progress Tone Handling: per Bellcore GR-506-CORE, ITU-T Q.35
- Integrated network management system, SNMP and SUNCE support

User interfaces

- Subscriber: analog: 2w FXS, 2w FXO, ISDN U Line Termination side
- Auxiliary: Fast Ethernet
V5CAS
PROTOCOL CONVERTOR

- 1 to 8 E1 links (V5)
- Up to 24 E1 links (CAS)
- Digital channel cross-connect (non blocking)
- Remote multiplexers (CAS) connectivity to V5 interface (up to 660 subscribers)
- Concentrator according to V5.2 up to 2400 subscribers, for remote multiplexers and/or V5.2 access nodes
- Factory customerable CAS interface for non IRITEL multiplexers
Applications

V5CAS Protocol convertor provide connection of access multiplexers FM-MSAN and FM2x2 with CAS signalling to telephone exchange with V5 protocol (V5.1/V5.2).

V5CAS enable economic solution to use telephone exchange's V5.2 interfaces for connection access multiplexer with small number of subscribers (60 to 120).

V5CAS enable digital channel cross-connect (64 kbit/s) between all 24 E1 links.

Basic functions

- Connections of remote access nodes: FM2x2 (multiplexer), FM-MSAN (concentrator) to exchange V5.2 interface
- Digital channel cross-connect including corresponding signaling bits between all 24 links (2 Mbit/s) (non blocking)
- Control channel (20 kbit/s or 64 kbit/s) transmission via V5.2 interface

Configurations

- FMV– multiplex, cross-connect, control and power supply unit with V5.2 interface
- PE1 – 8xE1 interfaces unit
- PSH – 4 x SHDSL interface unit
Control and monitoring

Integrated network management system SUNCE-M provides continuous management of V5CAS and all other IRITEL’s SDH and PDH equipment (FM-MSAN, FM2x2, ODS155, OTS622 ...).

For NMS system integration we support standard interface based on SNMP protocol.

Synchronization

- From internal built-in oscillator (± 25 ppm)
- From external 2 048 kHz clock
- From received clock on any external link

Mechanical design

- Unit (233x175x20 mm and 233x100x20 mm)
- V5CAS module (120x437x205 mm)
- 19”/ETSI cabinet (2200x600x300 mm)
TECHNICAL DATA

E1 Tributaries
2048 kbit/s according to ITU-T G.703, G.704 and G.706

E1 Service alarms
according to E/M signalization standard

External clock reference
2048 kHz according to ITU-T G.703/10

TMN interface
SUNCE-M (proprietary)
F (RS232/V.24 or 10/100 BaseTX Ethernet),
Q2 (RS485), Q2Et (10/100 bT)
SNMP/V1/V2/V3
RFC 3895 (DS1/E1)

Operating temperature range
-5°C up to +45°C
class 3.2
**PSH - SHDSL modem**

*4 x SHDSL, 4 x E1, 1 x Ethernet*

- G.shdsl interface: fractional n x 64 kbit/s from cross-connect field or 2 Mbit/s G.703 – G.shdsl interface converter
- G.703 interface: unframed transparent mode or E1 framer mode
- Ethernet over 1 to 4 SHDSL
- Non-blocking 336 channels cross-connect field
- LTU or NTU mode of G.shdsl operation
- 1 or 2 pairs G.shdsl operation
- Multiplexers subscriber unit or standalone unit
Application
Each G.shdsl interface has two modes of operation.

First mode is n x 64 kbit/s fractional operation, with bit-rate in range from 144 to 2312 kbit/s (G.shdsl subscriber application). In this mode some number of 64kbit/s channels can be assigned to Ethernet (Ethernet-over-G.shdsl application).

Second mode is 2.048 Mbit G.703 (without E1 framer/deframer) to G.shdsl transparent interface converter, with fixed line rate of 2.056 Mbit/s (G.703 range extension application), when paired with one of four G.703 interfaces.

G.shdsl interfaces can be paired to operate in 4-wire mode with maximum total data rate of 2.320 Mbit/s (shared between two copper pairs, 1160 Mbit/s each), if longer loop is needed.

PSH unit can operate as separate unit without FM-MSAN if all four G.703 – G.shdsl pairs operate as interface converters.

Basic characteristics
- Four G.shdsl interfaces on board (ETSI SHDSL: ETSI TS 101 524, ITU-T G.shdsl: ITU-T G.991.2)
- High symmetric line rate of maximum 2320 kbit/s utilizes 16-level TC-PAM modulation, with near-end echo-cancellation
- LTU and NTU modes of G.shdsl
- Line rates from 152 to 2320 kbit/s (144 to 2312 kbit/s subscriber data rate)
- Flexible synchronization options
- Connector for external remote power feed
- LED alarm indication

Monitoring and management
PSH unit management is integrated in IRITEL network management system SUNCE-M, which incorporates:
- Configuration
- Alarm monitoring
- Performance monitoring

TECHNICAL DATA

G.703 (2 Mbit/s) ITU-T G.703/G.704
Input
Signal 2048 kbit/s ±50 ppm (HDB3)
Impedance 75 Ω/120 Ω Loss 0 to 6 dB at 1024 kbit/s
Jitter according to ITU-T G.823
Return loss according to ITU-T G.703/9.3

Output
Signal 2048 kbit/s ±50 ppm (HDB3)
Impedance 75 Ω/120 Ω
Impulse level 2.37 V ±0.237 V, 75 Ω
3 V ±0.3 V, 120 Ω
Impulse width 244 ns
Impulse shape according to ITU-T 15/G.703
Jitter according to ITU-T G.823

G.shdsl interface ETSI TS 101 524, ITU-T G.991.2
Transmission symmetrical duplex
Transmission medium one or two (4-wire mode)
twisted pairs
Modulation TC-PAM
Line rate 152 kbit/sto 2320 kbit/s
Maximum loop length
- 0.4 mm copper wire 152 kbit/s 6000 m
2320 kbit/s 2200 m
- 0.8 mm copper wire 152 kbit/s 17000 m
2320 kbit/s 6300 m
NTX
iDSL modem with X.21 interface

- NTX is ISDN NT1 modem with U interface (2B+D), 64, 128, 144 kbit/s
- Enables connectivity of distant DTE devices with X.21 interface to telecommunication network, using existing access multiplexers FM2x2 or FM-MSAN with PIU-LT or PN64 tributary units
- Point to point connection of devices based on X.21 interface using single twisted pair transmission medium (NTX LT and NT mode)
Basic features
- One ISDN BRI U Line Termination (LT) or Network Termination (NT) interface with maximum user throughput of 144 kbit/s
- Single copper pair transmission by using 2B1Q line code with near end echo cancellation
- Automatic or manual Embedded Operation Channel management
- Accepts remote power supply provided by LT side
- One X.21 interface, contradirectional, DCE or DTE type for 64, 128 or 144 kbit/s transmission
- In DCE mode synchronization is on internal reference
- In DTE mode synchronization on X.21 S timing signal
- Management thought the PC Graphical User Interface based application via RS232 interface
- Front panel LED alarm and basic configuration status display
- Testing and performance facility
  - Built In Self Test
  - Local and Remote test loops.
  - Far End and Near End Block Error monitoring
- Desktop mountable case
- External (220/110V AC/unregulated 5V DC) or (-48 V DC/5V DC) adapter options

Applications
NTX is basic ISDN NT1 modem with U interface (2B+D). In modem version NTX enables connectivity of distant DTE devices with X.21 interface by using the existing telecommunication network. Access to the existing network could be realized by using Flexible Multiplexer FM2x2 or FM-MSAN through the proper tributary units like PIU-LT or PN64. In this particular application NTX is Network Terminating (NT) device while tributary unit performs ISDN BRA Line termination (LT). Line Termination side, PIU-LT cards, besides of all other LT functionality provides remote power for NTX devices.

Another typical NTX devices application is bidirectional point to point connection by using single twisted pair transmission medium. Typically this configuration is suitable for direct routers connection in campus or other similar inter-building applications. In order to connect distant routers it is necessary to configure NTX device in one, for instance central or corporate site, in X.21 DCE and ISDN U LT mode. The other NTX, remote device, have to be configured as, X.21 DCE and ISDN U NT. In this case synchronization is obtained from internal reference at the ISDN U LT side; NT side is always synchronized to the peering LT device. Also by adding Remote Power Supply (RPS) device it is possible to power both NTX devices.

TECHNICAL DATA

<table>
<thead>
<tr>
<th>ISDN U interface</th>
<th>ITU-T G.960, G.961</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transport type</td>
<td>duplex</td>
</tr>
<tr>
<td>Transport medium</td>
<td>one twisted-pair</td>
</tr>
<tr>
<td>Line code</td>
<td>2B1Q</td>
</tr>
<tr>
<td>Line speed</td>
<td>80 kiboud ± 100 ppm</td>
</tr>
<tr>
<td>64kbit/s channels per interface</td>
<td>2.5</td>
</tr>
<tr>
<td>Maximum line attenuation</td>
<td></td>
</tr>
<tr>
<td>at 40 kHz</td>
<td>36 dBm</td>
</tr>
<tr>
<td>at 80 kHz</td>
<td>45 dBm</td>
</tr>
<tr>
<td>Maximum line resistance</td>
<td></td>
</tr>
<tr>
<td>without repeaters</td>
<td>1048 Ω</td>
</tr>
<tr>
<td>with repeaters</td>
<td>1300 + 700 Ω</td>
</tr>
<tr>
<td>Synchronization</td>
<td></td>
</tr>
<tr>
<td>frame</td>
<td>1.5 ms</td>
</tr>
<tr>
<td>multiframe</td>
<td>12 ms</td>
</tr>
<tr>
<td>Scrambling</td>
<td></td>
</tr>
<tr>
<td>CRC12</td>
<td>X^{12} + X^{11} + X^3 + X + 1</td>
</tr>
<tr>
<td>Remote power</td>
<td>105 V</td>
</tr>
<tr>
<td>RS232 interface</td>
<td>ITU-T V.24, V.28</td>
</tr>
<tr>
<td>X.21 interface</td>
<td>ITU-T X.21/27, V.11</td>
</tr>
<tr>
<td>Transport type</td>
<td>duplex</td>
</tr>
<tr>
<td>Transport medium</td>
<td>6 twisted-pair</td>
</tr>
<tr>
<td>Connector</td>
<td>15 pin SUBD female</td>
</tr>
<tr>
<td>Line rate</td>
<td>64, 128, 144 kbit/s</td>
</tr>
<tr>
<td>Maximum line length</td>
<td>128 kbit/s</td>
</tr>
<tr>
<td></td>
<td>1300 m</td>
</tr>
<tr>
<td>Copper pair termination</td>
<td></td>
</tr>
<tr>
<td>DCE Transmit (R, S, I)</td>
<td>120 Ω</td>
</tr>
<tr>
<td>DCE Receive (T, X, C)</td>
<td>120 Ω</td>
</tr>
<tr>
<td>Power</td>
<td></td>
</tr>
<tr>
<td>External AC/DC adapter</td>
<td>220V ac/6V dc</td>
</tr>
<tr>
<td>Remote power supply</td>
<td>40-105 V</td>
</tr>
<tr>
<td>Power consumption</td>
<td>up to 1 W</td>
</tr>
<tr>
<td>Temperature</td>
<td></td>
</tr>
<tr>
<td>-5°C to +45°C</td>
<td></td>
</tr>
<tr>
<td>Dimensions</td>
<td>178 x 131.5 x 36 mm</td>
</tr>
</tbody>
</table>

NTX iDSL modem with X.21 interface
KGET
TWO INTERFACE CONVERTORS
Ethernet over E1

- Two independent Ethernet E1 Bridge
- Provides connection of remote LAN networks with Ethernet 10/100 BaseTX or 100 BaseFX interface via telecommunication network with G.703, 2 Mbit/s interface
- Easy configuration
- Integrated control and monitoring, SUNCE-M
Applications
The main application of KGET Interface Convertor is to connect devices with Ethernet interface through telecommunication network. Any of two Interface Convertor realize Ethernet Bridge function or Switch function at layer 2.

Basic functions
- Two independent Interface Convertors on one unit.
- Any of two Interface Convertor realize Ethernet Bridge function with 2048 kbit/s maximum WAN interface capacity.
- At Ethernet side there are two ports: electrical 10/100 BaseTX interface and optical 100 BaseFX interface.
- Electrical Ethernet interfaces are half/full duplex with auto negotiation procedure which define the type of interface 10 or 100 Mbit/s.
- Interface Convertors are transparent for all higher order protocol (TCP-IP, XNS, ISO,...).
- VLAN can be configured for any port independently.
- Support for QoS priority choice according to the port or IEE802.1p
- Synchronization: local clock or external clock from received G.703 signal.
- Loop test possibility.
- Integrated control and monitoring using OLC unit.

### T E C H N I C A L  D A T A

**G.703 (2 Mbit/s)**

**Input**
- Signal type: 2048 kbit/s ±50 ppm (HDB3)
- Impedance: 75 Ω/120 Ω
- Cable attenuation: 0 to 6 dB at 1024 kbit/s
- Input jitter: according to ITU-T G.823
- Reflection attenuation: according to ITU-T G.703/9.3

**Output**
- Signal type: 2048 kbit/s ±50 ppm (HDB3)
- Impedance: 75 Ω/120 Ω
- Impulse level: 2.37 V ±0.237 V, 75 Ω
- 3 V ±0.3 V, 120 Ω
- Impulse width: 244 ns
- Impulse shape: according to ITU-T 15/G.703
- Output jitter: according to ITU-T G.823

**Ethernet 10-100 BaseTX**
- Transport type: duplex
- Electrical characteristics: IEEE 802.3
- Transmission: symmetrical
- Section length (UTP cable class 5): 135 m
- Connector: RJ45

**Ethernet 100 BaseFX**
- Transport type: duplex
- Optical characteristics: IEEE 802.3
- Transmission: singlemode optical fiber
- Section length: 2000 m
- Connector: SC

---

Diagram showing the connectivity of devices such as KGET, SDH/PDH network, LAN, Switch, and Router.
KGET8 INTERFACE CONVERTOR
Ethernet over 8 x E1

- Provides connection of remote LAN networks with Ethernet 10/100 BaseTX or 100 BaseFX interface via telecommunication network with G.703, 2 Mbit/s interface
- Easy configuration
- Integrated control and monitoring, SUNCE-M
## Applications
- Connection of remote LAN networks with Ethernet interface
- Connection of small capacity IP DSLAM to IP Switch
- IP DSLAM and IP Base station backup/backhaul
- Remote corporate networks LAN connection

## Basic functions
- Enables connection of remote Ethernet networks with 8 x E1 links
- Broadband service based on Ethernet technology for existing TDM PDH and SDH network
- For TDM transmission maximum capacity of non framing E1 signal is used
- Interface Convertor realize Ethernet Bridge function with 8 x 2048 kbit/s maximum WAN interface capacity
- At Ethernet side there are two ports: electrical 10/100 BaseTX interface and optical 100 BaseFX interface
- Electrical Ethernet interfaces are half/full duplex with auto negotiation procedure which define the type of interface 10 or 100 Mbit/s
- Interface Convertors are transparent for all higher order protocol (TCP-IP, XNS, ISO,...)
- VLAN can be configured for any port independently

## Technical Data
### G.703 (2 Mbit/s)
#### Input
- Signal type: 2048 kbit/s ±50 ppm (HDB3)
- Impedance: 75 Ω/120 Ω
- Cable attenuation: 0 to 6 dB at 1024 kHz
- Input jitter: according to ITU-T G.823
- Reflection attenuation: according to ITU-T G.703/9.3

#### Output
- Signal type: 2048 kbit/s ±50 ppm (HDB3)
- Impedance: 75 Ω/120 Ω
- Impulse level: 2,37 V ±0,237 V, 75 Ω
  - 3 V ±0,3 V, 120 Ω
- Impulse width: 244 ns
- Impulse shape: according to ITU-T 15/G.703
- Output jitter: according to ITU-T G.823

### Ethernet 10-100 BaseTX
- Transport type: duplex
- Electrical characteristics: IEEE 802.3
- Transmission: symmetrical
- Section length (UTP cable class 5): up to 135 m
- Connector: RJ45

### Ethernet 100 BaseFX
- SFP plug-in module
- Transport type: duplex
- Optical characteristics: IEEE 802.3
- Transmission: singlemode optical fiber
- Section length: up to 2000 m
- Connector: SC

### Protocols
- HDLC X.86/LAPS
- IEEE 802.1D
- IEEE 802.1p
- IEEE 802.1Q
- ML-PPP
- bridging
- QoS
- VLAN

### Power supply
- 48 Vdc or 220 Vac

### Operating temperature range
- -5°C up to +45°C (class 3.2)
KTG-X
TDM over IP & Ethernet switch

- TDMoIP: up to 8 E1/T1 interfaces
- Ethernet switch (L2):
  - 6 100/1000 Base-TX electrical Ethernet interfaces
  - 2 100 or 1000 Base-FX optical Ethernet interfaces
- Multiprotocol encapsulation supporting IPv4, IPv6, UDP, RTP, L2TPv3, MPLS and Metro Ethernet
- Compliant with IETF PWE3 Internet drafts for SAToP, CESoPSN, TDMoIP AAL1, HDLC, unframed, framed, with CAS frame (PCM frame and multi-frame)
- Recovered clock jitter and wander compliant with ITU-T G.823, G.824 and G.8261
- Supports adaptive clock recovery, differential clock (common clock) (using RTP)
- ToS support for IP level priority, VLAN 802.1p and 802.1Q support for MAC level priority
- Adding and extracting traffic on 100/1000 Mbit/s TX/FX interfaces
- Integrated Ethernet switch makes it modular device
- Power: 48VDC or optional 220VAC/48VDC (automatic switching)
- Management:
  - Embedded Web Server and SNMP Agent
  - EMS/NMS software SUNCE-O
Application

KTG-X is a device for aggregation, integration, and transmission of packet (FE, GbE) and TDM (E1) traffic over IP/MPLS or OTN/DWDM network.

- Transparent transmission of E1 links over IP/MPLS or OTN/DWDM network.
- Transparent transmission of synchronization for base stations (E1, PTP1588).
- Transparent transmission of HDLC, GPON/EPON, CATV traffic.

Basic Functions

- DMoIP converter up to eight E1/T1 interfaces.
- Ethernet switch (L2) with six 100/1000 Base-TX electrical Ethernet interfaces and two 100 or 1000 Base-FX optical Ethernet interfaces.
- 1 Uplink Ethernet 100/1000 Base-TX.
- 1 Add/Drop Uplink Ethernet 100/1000 Base-TX.
- 3 general purpose Ethernet 100/1000 Base-TX interfaces.
- 1 management (MNG) Ethernet 100/1000 Base-TX.

- 1 Uplink Ethernet 100/1000 Base-FX.
- 1 Add/Drop Uplink Ethernet 100/1000 Base-FX.
- 1 local management RS232 interface (with RJ45 connector).
- Power consumption P = 10W.

Ordering codes

KTG-X -48VDC
KTG-X - AC -48VDC/220VAC (automatic switching)

X - model:
4 - 4 x E1 over IP
8 - 8 x E1 over IP
KGET4/8/16
ETHERNET ACCESS INTERFACE CONVERTOR
Ethernet over up to 16x E1 with GFP, VCAT and LCAS

- Transparent Ethernet connection over existing TDM infrastructure
- Provides Ethernet connection over up to 16 E1
- GFP, VCAT and LCAS encapsulation and bonding for up to 16 groups
- QoS and SLA Support for Ethernet subscribers
- Feature rich diagnostics and fault management on all TDM and Ethernet ports
- Monitoring and Configuration via embedded Web Server and SNMP
Applications
- High Capacity Transparent Ethernet Service over existing PDH/SDH networks
- IP DSLAM, WiMAX and Mobile Base station backhaul
- Remote corporative networks LAN connection

Basic features
- KGET16 complies to the latest NG-PDH standards
- KGET16 provides transparency for all higher order protocols (TCP-IP, XNS, ISO,...)
- Generic Framing Procedure (GFP) enables efficient Ethernet packet encapsulation and TDM bandwidth utilization
- Virtual Concatenation (VCAT) provides flexible bandwidth allocation for different subscribers by bonding multiple E1 links into single virtual pipe
- Link Capacity Adjustment Scheme (LCAS) enables smooth virtual pipe capacity change, by adding or removing E1 links from the pipe, without traffic loss
- VLAN capabilities includes stacking and striping for both ingress and egress traffic for all ports independently thus keeping user VLAN settings unchanged. Management traffic can be isolated from user traffic with separate VLAN
- QoS support includes per port VLAN based priority or QoS based on IEE802.1p enabling fine traffic shaping in order to fulfill user requirements for delay sensitive real time voice or video applications

KGET16 provides local port and in band capacity for remote management via embedded Web Server. For TMN purposes device provides SNMP agent

E1 port test facility includes loop tests and signal generation and error measurements. All E1 ports under tests are excluded from VCAT LCAS groups thus preventing Ethernet loop storms.

**TECHNICAL DATA**

**E1, G.703 (2 Mbit/s)**
- Number of ports: 4, 8, 16
- Connector: RJ45

**Input**
- Signal type: 2048 kbit/s ±50 ppm (HDB3)
- Impedance: 75 Ω/120 Ω
- Cable attenuation: 0 to 6 dB at 1024 kHz
- Input jitter: according to ITU-T G.823
- Reflection attenuation: according to ITU-T G.703/9.3

**Output**
- Signal type: 2048 kbit/s ±50 ppm (HDB3)
- Impedance: 75 Ω/120 Ω
- Impulse level: 2.37 V ±0.237 V, 75 Ω
- Impulse width: 244 ns
- Impulse shape: according to ITU-T 15/G.703
- Output jitter: according to ITU-T G.823

**Ethernet 10-100 BaseTX**
- Number of ports: 2, 4
- Transport type: duplex
- Electrical characteristics: IEEE 802.3
- Transmission: symmetrical
- Section length: (UTP cable class 5) up to 135 m
- Connector: RJ45

**Ethernet 100 BaseFX SFP plug-in module**
- Number of ports: 0, 2
- Transport type: duplex
- Optical characteristics: IEEE 802.3
- Transmission: singlemode optical fiber
- Section length: up to 2000 m
- Connector: SC

**Protocols**
- Encapsulation: GFP, G.7041, GFPoPDH, G.8040
- Bonding: VCAT G7043, LCAS, G.7042
- Delay Compensation: up to 250 ms
KGET4/8/16S
ETHERNET ACCESS INTERFACE CONVERTOR
Ethernet over up to 16x E1 with GFP, VCAT, LCAS and Encryption

- Transparent Ethernet connection over existing TDM infrastructure with built in AES Encryption
- Per E1 port configurable AES128/192/256 encryption module with flexible key and access management
- Provides Ethernet connection over up to 16 E1
- GFP, VCAT and LCAS encapsulation and bonding for up to 16 groups
- QoS and SLA Support for Ethernet subscribers
- Feature rich diagnostics and fault management on all TDM and Ethernet ports
- Monitoring and Configuration via embedded Web Server and SNMP
**Applications**

- Secured High Capacity Transparent Ethernet Service over existing PDH/SDH networks for government, financial and other institutions that requires secured data transmission over public telecommunication network.
- IP DSLAM, WiMAX and Mobile Base station backhaul for public and private users
- Secured remote corporative networks LAN connection

**Basic features**

- KGET16S complies to the latest NG-PDH standards
- KGET16S provides transparency for all higher order protocols (TCP-IP, XNS, ISO,...)
- Advanced Encryption Standard (AES) provides high confidence level of data security over public telecommunication network. Each E1 link at the device is possible to configure to perform data encryption with different key length, key management and key schedule. Encryption procedure includes key exchange, authentication and user data encryption. Each phase of encryption procedure uses their own key.
- Generic Framing Procedure (GFP) enables efficient Ethernet packet encapsulation and TDM bandwidth utilization
- Virtual Concatenation (VCAT) provides flexible bandwidth allocation for different subscribers by bonding multiple E1 links into single virtual pipe
- Link Capacity Adjustment Scheme (LCAS) enables smooth virtual pipe capacity change, by adding or removing E1 links from the pipe, without traffic loss
- VLAN capabilities includes stacking and striping for both ingress and egress traffic for all ports independently thus keeping user VLAN settings unchanged. Management traffic can be isolated from user traffic with separate VLAN
- QoS support includes per port VLAN based priority or QoS based on IEE802.1p enabling fine traffic shaping in order to fulfill user requirements for delay sensitive real time voice or video applications
- KGET16S provides local port and in band capacity for remote management via embedded Web Server. For TMN purposes device provides SNMP agent
- E1 port test facility includes loop tests and signal generation and error measurements. All E1 ports under tests are excluded from VCAT LCAS groups thus preventing Ethernet loop storms

**TECHNICAL DATA**

**E1, G.703 (2 Mbit/s)**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of ports</td>
<td>4, 8, 16</td>
</tr>
<tr>
<td>Connector</td>
<td>RJ45</td>
</tr>
<tr>
<td>Input</td>
<td></td>
</tr>
<tr>
<td>Signal type</td>
<td>2048 kbit/s ±50 ppm (HDB3)</td>
</tr>
<tr>
<td>Impedance</td>
<td>75 Ω/120 Ω</td>
</tr>
<tr>
<td>Cable attenuation</td>
<td>0 to 6 dB at 1024 kHz</td>
</tr>
<tr>
<td>Input jitter</td>
<td>according to ITU-T G.823</td>
</tr>
<tr>
<td>Reflection attenuation</td>
<td>according to ITU-T G.703/9.3</td>
</tr>
<tr>
<td>Output</td>
<td></td>
</tr>
<tr>
<td>Signal type</td>
<td>2048 kbit/s ±50 ppm (HDB3)</td>
</tr>
<tr>
<td>Impedance</td>
<td>75 Ω/120 Ω</td>
</tr>
<tr>
<td>Impulse level</td>
<td>2.37 V ±0.237 V, 75 Ω</td>
</tr>
<tr>
<td></td>
<td>3 V ±0.3 V, 120 Ω</td>
</tr>
</tbody>
</table>

**Ethernet 10-100 BaseTX**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of ports</td>
<td>2</td>
</tr>
<tr>
<td>Transport type</td>
<td>duplex</td>
</tr>
<tr>
<td>Electrical characteristics</td>
<td>IEEE 802.3</td>
</tr>
<tr>
<td>Transmission</td>
<td>symmetrical</td>
</tr>
<tr>
<td>Section length</td>
<td>(UTP cable class 5)</td>
</tr>
<tr>
<td></td>
<td>up to 135 m</td>
</tr>
<tr>
<td>Connector</td>
<td>RJ45</td>
</tr>
</tbody>
</table>

**Ethernet 100 BaseFX SFP plug-in module**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of ports</td>
<td>0.2</td>
</tr>
<tr>
<td>Transport type</td>
<td>duplex</td>
</tr>
<tr>
<td>Optical characteristics</td>
<td>IEEE 802.3</td>
</tr>
<tr>
<td>Transmission</td>
<td>singlemode optical fiber</td>
</tr>
<tr>
<td>Section length</td>
<td>up to 2000 m</td>
</tr>
<tr>
<td>Connector</td>
<td>SC</td>
</tr>
</tbody>
</table>

**Protocols**

<table>
<thead>
<tr>
<th>Encapsulation</th>
<th>GFP, G.7041, GFPoPDH, G.8040</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bonding</td>
<td>VCAT G7043, LCAS, G.7042</td>
</tr>
<tr>
<td>Delay Compensation</td>
<td>up to 250 ms</td>
</tr>
<tr>
<td>AES</td>
<td>NIST, FIPS197</td>
</tr>
</tbody>
</table>
KTP INTERFACE CONVERTOR SERIES
TDM over IP

- Performs TDM circuit emulation over enterprise or carrier packet-switched Ethernet L2/L3 networks for different types of user interfaces
- At the Ethernet line side supports both electrical Fast and optical 100 FX Ethernet interface
- Multiprotocol encapsulation supporting IPv4, IPv6, UDP, RTP, L2TPv3, MPLS and Metro Ethernet.
- Compliant with IETF, ITU-T, MFA Forum and Metro Ethernet Forum Technical Specifications
- Recovered clock jitter and wander compliant to ITU-T G.823, G.824. Supports adaptive clock recovery, differential clock (common clock) (using RTP)
- Lost/misordered packet compensation
- Embedded Web Server and SNMP Agent
- Optional AES 128/192/256 Encryption of TDM Stream
Applications

KTP devices perform TDM circuit emulation over packet switched network thus enabling transparent TDM services over enterprise or carrier Ethernet network.

Besides TDM traffic transmission over IP based networks KTP provides many value-added functions in order to meet different customers needs including different network management capabilities, traffic protection, synchronization etc.

- In carrier network KTP typically finds applications for:
  - TDM services over Ethernet MAN, broadband wireless, CATV
  - 2G / 2.5G cellular backhaul over IP/MPLS
  - HDLC-based traffic (ex. Frame Relay) trunking over IP/MPLS
  - PSTN-IP network bridging
  - SS7 transport over IP

- In enterprise applications KTP is suitable to be used for:
  - Private line/toll bypass via Ethernet MAN
  - TDM PBX migration to Ethernet MAN

- In access networks KTP typically finds application as Multi Tenant Multi Dwelling Unit MTU/MDU

Basic functions

- Broad range of, framed or unframed, PDH tributary interfaces
- One 10/100 electrical and one 100 optical Ethernet interface
- Multiprotocol encapsulation supporting IPv4, IPv6, UDP, RTP, L2TPv3, MPLS and Metro Ethernet
- Recovered clock jitter and wander compliant to ITU-T G.823, G.824 synchronization interface
- Lost/misordered packet compensation
- Compliant with:
  - IETF PWE3 Internet drafts for SAToP, TDMoIP, CESoPSN, HDLC
  - MFA Forum Implementation Agreements 4.1, 5.1 and 8.0.0
  - Metro Ethernet Forum Technical Specification MEF8
  - Supports adaptive clock recovery, differential clock (common clock) (using RTP)
  - Embedded Web Server and SNMP Agent

Ordering codes

KTP - P - S

I - interface:
  - X - X.21/V.11 codirectional or contradirectional n x 64 kbit/s over IP
  - V - V.35
  - N - NRZ, NATO, 75 Ω, n x 64 kbit/s over IP
  - E1 - E1 over IP
  - 2E1 - 2 x E1 over IP
  - 4E1 - 4 x E1 over IP
  - E3 - E3 over IP

P - power option:
  - D - 48 Vdc desktop unit
  - N - 220 Vac with external AC/DC adapter
  - R - card - rack version

S - encryption option:
  - L - no encryption
  - S - with encryption
KTG
INTERFACE CONVERTOR SERIES
TDM over IP

- Performs TDM circuit emulation over enterprise or carrier packet-switched 1G Ethernet L2/L3 networks for different types of user interfaces
- At the Ethernet line side supports one 10/100 BaseTx, one 100 BaseFx, two 1000 BaseT and one 1000 BaseX Ethernet interfaces
- Multiprotocol encapsulation supporting IPv4, IPv6, UDP, RTP, L2TPv3, MPLS and Metro Ethernet.
- Compliant with IETF, ITU-T, MFA Forum and Metro Ethernet Forum Technical Specifications
- Recovered clock jitter and wander compliant to ITU-T G.823, G.824. Supports adaptive clock recovery, differential clock (common clock) (using RTP)
- ToS support for IP level priority, VLAN 802.1p and 802.1Q support for MAC level priority
- Lost/misordered packet compensation
- Embedded Web Server and SNMP Agent
- Optional AES 128/192/256 Encryption of TDM Stream
Applications

KTG devices perform TDM circuit emulation over packet switched network thus enabling transparent TDM services over enterprise or carrier Ethernet network.

Besides TDM traffic transmission over IP based networks KTP provides many value-added functions in order to meet different customers needs including different network management capabilities, traffic protection, synchronization etc.

- In carrier network KTG typically finds applications for:
  - TDM services over Ethernet MAN, broadband wireless, CATV
  - 2G / 2.5G cellular backhaul over IP/MPLS
  - HDLC-based traffic (ex. Frame Relay) trunking over IP/MPLS
  - PSTN-IP network bridging
  - SS7 transport over IP
- In enterprise applications KTG is suitable to be used for:
  - Private line/toll bypass via Ethernet MAN
  - TDM PBX migration to Ethernet MAN
  - In access networks KTP typically finds application as Multi Tenant Multi Dwelling Unit MTU/MDU

Basic functions

- Broad range of, framed or unframed, PDH tributary interfaces
- One electrical Fast Ethernet 10/100 BaseTx and one optical Fast Ethernet 100 BaseFx interfaces, two 1G electrical and one 1G optical Ethernet interfaces
- Multiprotocol encapsulation supporting IPv4, IPv6, UDP, RTP, L2TPv3, MPLS and Metro Ethernet
- Recovered clock jitter and wander compliant to ITU-T G.823, G.824 synchronization interface
- Lost/misordered packet compensation
- Compliant with:
  - IETF PWE3 Internet drafts for SAToP, TDMoIP, CESoPSN, HDLC
  - MFA Forum Implementation Agreements 4.1, 5.1 and 8.0.0
  - Metro Ethernet Forum Technical Specification MEF8
- Supports adaptive clock recovery, differential clock (common clock) (using RTP)
- Embedded Web Server and SNMP Agent

Ordering codes

KTG: \( I \cdot P \cdot S \)

\( I \) - interface:
- \( X \) - X21/V.11 codirectional or contradirectional n x 64 kbit/s over IP
- \( V \) - V.35
- \( N \) - NRZ, NATO, 75 Ohm, n x 64 kbit/s over IP
- \( E1 \) - E1 over IP
- \( 2E1 \) - 2 x E1 over IP
- \( 4E1 \) - 4 x E1 over IP
- \( E3 \) - E3 over IP

\( P \) - power option:
- \( D \) - 48 Vdc desktop unit
- \( N \) - 220 Vac with external AC/DC adapter
- \( R \) - card - rack version

\( S \) - encryption option:
- \( \_ \) - no encryption
- \( S \) - with encryption
GMC-2U
Unmanaged Gigabit
SFP Media Converter

- Configurable Link-Fault-Pass-Through and fiber auto/force mode
- 8192 MAC addresses
- Supports 802.3/802.3u/802.3ab/802.3z/802.3x. Auto-negotiation and Auto MDI/MDIX.
- Full wire-speed forwarding rate
- Supports 10k Jumbo packet size
- Suitable for traffic control and industrial applications in hazardous environment
Introduction
IRITEL GMC-2U Hardened SFP Media Converter provides solution for rugged environments, transportation road-side cabinets, industrial shop floors, multi tenant dwellings or Fiber To The Home (FTTH) applications. Capable of operating at temperature extremes of -20°C to +60°C, this is by far the media converter of choice for harsh environments in which space constraints exist.

Plug-and-Play Solution:
The hardened media converter is a plug-and-play compact media converter which doesn’t have any complicated software to set up.

Applications
- Network distance extension
  Extend the network distance between two twisted pair Gigabit Switches and/or a Gigabit File Servers with 1000 Base-T interfaces.

Fiber Mode-Conditioning
Gigabit Fiber Mode-Conditioning and/or extend the network distance between two twisted pair Gigabit Switches and optical Gigabit Switches/File Servers.

Technical data
Connecting Ethernet Ports
- Connect copper port
  - Plug RJ-45 jack
- Connect optical port
  - Use SFP transceivers supplied by IRITEL or other manufacturers of MSA compliant SFPs.
  - Insert 1G SFP module into the cage.
  - Plug optical connector into the SFP.
Supports Desktop, DIN-Rail, Panel, or Rack Mounting installation.

Specifications

<table>
<thead>
<tr>
<th>Applicable Standards</th>
<th>IEEE 802.3 10Base-T</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IEEE 802.3u 10Base-TX</td>
</tr>
<tr>
<td></td>
<td>IEEE 802.3ab 1000Base-T</td>
</tr>
<tr>
<td></td>
<td>IEEE 802.3z 1000Base-SX/LX/BX</td>
</tr>
<tr>
<td>Fixed Ports</td>
<td>One copper port, one fiber port</td>
</tr>
<tr>
<td>Speed</td>
<td>10Base-T 10/20Mbps for half/full-duplex</td>
</tr>
<tr>
<td></td>
<td>10Base-TX 100/200Mbps for half/full-duplex</td>
</tr>
<tr>
<td></td>
<td>1000Base-T 2000Mbps for full-duplex</td>
</tr>
<tr>
<td></td>
<td>1000Base-SX/LX/BX 2000Mbps for full-duplex</td>
</tr>
<tr>
<td>Cable 1000Base-T</td>
<td>4-pair UTP/STP Cat. 5 up to 100m</td>
</tr>
<tr>
<td>Fiber 1000Base-X</td>
<td>Multi mode 50 or 62.5μm</td>
</tr>
<tr>
<td></td>
<td>Single mode 9 or 10μm</td>
</tr>
<tr>
<td>LED Indicators</td>
<td>Power Good (PG)</td>
</tr>
<tr>
<td></td>
<td>Fiber port Link and Activity (LINK/ACT)</td>
</tr>
<tr>
<td></td>
<td>Copper port Link and Activity (LINK/ACT)</td>
</tr>
<tr>
<td></td>
<td>Speed 10/100/1G (SPEED)</td>
</tr>
<tr>
<td>Dimensions</td>
<td>Width 78mm</td>
</tr>
<tr>
<td></td>
<td>Depth 27mm</td>
</tr>
<tr>
<td></td>
<td>Height 120mm</td>
</tr>
<tr>
<td>Weight</td>
<td>220.5 gr</td>
</tr>
<tr>
<td>Power</td>
<td>DC Jack 5VDC, External AC/DC</td>
</tr>
<tr>
<td></td>
<td>Max. Current 0.88A</td>
</tr>
<tr>
<td>Power Consumption</td>
<td>3W</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>-20°C ~ 60°C</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-40°C ~ 85°C</td>
</tr>
<tr>
<td>Humidity</td>
<td>5 ~ 95%, non-condensing</td>
</tr>
</tbody>
</table>
KFE INTERFACE CONVERTOR SERIES
Ethernet over TDM

- Ethernet over TDM Bridge
- Provides connection of remote LAN networks with Ethernet 10/100 BaseTX or 100 BaseFX interface via PDH/SDH telecommunication network
- Different TDM interface support:
  - G.703, E1, E3, DS-3, OC-3, V.11, V.35, NRZ
  - SHDSL, SHDSL.bis compliant to EFM applications
- Embedded Web Server and SNMP Agent
- Optional AES 128/192/256 Encryption of TDM Stream
Applications

KFE devices enables connectivity of different equipment with Ethernet interface by utilizing existing TDM or copper infrastructure.

Interface converter KFE basically performs L2 (layer 2) Ethernet Bridge/Switch functionality thus making them transparent for all higher layer protocols.

KFE devices in both, public and private networks, typically find applications for:

- Remote LAN segments connection
- Campus
- Interbuilding
- Subscriber connection to Internet Service Provider
- ISP hosting
- Remote terminal connections.
- Point of Sell, POS, and info terminals
- Automated Teller Machine (ATM)
- Electronic payment systems, parking, pay tool...
- Remote video surveillance
- Schools, universities
- Stadiums or sport arenas
- Cultural and other public institutions, museums,
- Galleries
- Warehouses, shopping centres
- Process control in private in public utility companies
- Railway
- Distribution and transmission of electricity
- Oil and gas utilities

Basic functions

- For traffic control at
  - Big junctions, crossroads
  - Bridges and tunnels
  - Crowded roads
  - Highways
- In special systems requiring data encryption
  - Army
  - Police
  - Government institutions and agencies

Basic functions

- Enable transparent Ethernet service over TDM/copper infrastructure
- At Ethernet side there are two ports: electrical 10/100 BaseTX interface and optical 100 BaseF interface
- Electrical Ethernet interfaces are half/full duplex with auto negotiation procedure which define the type of interface 10 or 100 Mbit/s
- Interface Convertors are transparent for all higher order protocol (TCP-IP, XNS, ISO,...)
- VLAN can be configured for any port independently
- Support for QoS priority choice according to the port or IEE802.1p
- Synchronization: local clock or external clock from received signal
- Optional AES 128/192/256 Encryption of TDM Stream
- Loop test possibility

Ordering codes

KFE - I - P - S

I - interface:
- X - Ethernet over X21/V.11 codirectional or contradirectional n x 64 kbit/s
- V - V.35
- N - Ethernet over NRZ, NATO, 75 Ω, n x 64 kbit/s
- E1 - Ethernet over E1
- E3 - Ethernet over E3
- 2E3 - Ethernet over 2 x E3
- S1 - Ethernet over one copper pair
- S2 - Ethernet over 2 copper pairs
- S4 - Ethernet over 4 copper pairs

P - power option:
- D - 48 Vdc with external DC/DC adapter
- N - 220 Vac with external AC/DC adapter
- R - card - rack version

S - encryption option:
- no encryption
- with encryption

D
**KG**

Universal TDM, E1 interface converter platform, fractional multiplexer, cross connect device with exchangeable user interface module and optional built-in AES encryption

- Device enables user to connect their equipment over exchangeable user interface module via TDM E1 based telecommunication network
- Built in non blocking cross connect enables easy and cost effective add-drop of user interface traffic over spare, non used, E1 time slots with minimum delay including CAS signalling
- Basic Features:
  - 2 E1 framed or non framed interfaces.
  - 1 factory exchangeable user interface module with different number and/or interface types
  - Non blocking cross connect between E1 links and user interface modules including CAS signaling, where applicable
  - Different user interface modules with: X.21/V11, V.35, NRZ/NATO, RS232 synchronous and asynchronous interfaces
  - Embedded Web server for local management
  - Embedded SNMP agent for TMN application
  - Optional AES 128/192/256 encryption of user interface data
**Application**

KG Series Interface Converter is usually used for connecting different devices through a transport TDM digital network that is based on the E1 interface.

In public and private telecommunication networks KG Series typically finds application for:
- Connecting remote LAN segments
- Connecting users to ISP
- Connecting remote terminals
- Remote video surveillance
- Industrial process control.
- Traffic control.
- SCADA systems
- In special service networks which requires data encryption.

**Basic features**

- The device converts user signal from removable interface modules to E1 signal in one of two E1 network interfaces and vice versa
- E1 links can be configured to work in framed and unframed mode
- Maximum conversion speed in unframed mode is 2048 kbit/s
- In framed mode it is possible to perform the capacity allocation of user signal from removable module to one of the E1 network interface in 64 kbit/s steps
- Unassigned capacity of E1 link can be mutually cross-connect or unlocated E1 link can be used as a protection link (1+1)
- Advanced fault diagnosis (loop test, integrated BER tester) of E1 and user interfaces
- The device can be synchronized from received E1, external reference or from received signal of user (synchronous serial) interface
- Control of remote devices in framed mode; allocating appropriate capacity of E1 signal to the system for centralized monitoring
- Content from the user interface can be encrypt or decrypt before mapping to the desired E1 direction
- The desktop version of the device can be used independently as an interface converter
- In board version of the device can be used as an independent interface converter, or as a part of fractional multiplexer, which in itself combines multiple interface converters with an appropriate user interfaces
- Centralized monitoring and supervision based on the standard packet protocols, SNMP, HTTP, ICMP...

**Ordering codes**

**KG-I-P-S**

**I - Digital Interface:**
- E – Ethernet
- X – X.21 codirectional or contradirectional
- V – V.35
- R/2R – 1/2 x RSR232 asynchronous and synchronous
- N – NRZ/NATO, 75/50 Ω
- C/2C – 1/2 x G.703 codirectional
- DIO – 8 digital inputs / outputs

**- Analog interfaces:**
- FXS – analog telephone, user side
- FXO – analog telephone, exchange side
- E&M – 2w/4w analog exchange side
- AIO – 8 analog inputs / outputs

**P - Power Option**
- D – 48 Vdc with external DC/DC adapter
- N – 220 Vac with external AC/DC adapter
- R – card - rack version

**S - Encryption Option**
- no encryption
- with encryption
SMH884 - FPX

High Performance, 20 port, PoE enabled L2/L3 Fully Managed Ethernet Switch with Fast Hardware based Failover on Optical Links

- Provides 8 electrical Ethernet 10/100 BaseTX, 8 electrical PoE 10/100 BaseTX and 4 Optical SFP 100 BaseFX interfaces
- Provides up to 125 W of power and automatic sensing and power consumption classification for 8 remotely powered devices (PD), 15.4 W per port
- Optical SFP 100 BaseFX interfaces can be configured to work in pure hardware controlled, 1+1 protection mode, thus enabling fast, less than 50 ms, traffic restoration
- Compliant with IEE802.3, IEE802.3u and IEE802.3af standards
- Performs wire speed Ethernet Switching function between all user ports, Ethernet 10/100 BaseTX and 100 BaseFX
- Traffic protection through STP, RSTP and MSTP protocol
- Class of service (CoS) with 4-level priority queuing
- Full duplex, Half duplex Flow Control
- Automatic address learning, address aging and address migration
- Static MAC address filtering, MAC address management
- Up to 12 K MAC address space (different MAC addresses)
- Storm control, broadcast and multicast flooding
- GARP VLAN registration protocol (GVRP)
- Port trunking support, Link Aggregation Group (LAG)
- Software/Firmware field upgrade support, gold configuration backup and restore
- SNMP1/2 based network management interface
- Management thought Embedded Web Server accessible via standard WEB browser
- User name and password based security
- 19” Rack and Desktop mountable metal housing, IP30 protection
- Rear access to all user connectors, LED indication at front panel of device
- External input and output alarm contacts
- Extended temperature and tropicalized interior against excessive humidity
- Redundant DC 48V power supply option
**Description**

IRITEL SMH884-FPX is hardened, 20 port, fully managed, Power over Ethernet (PoE) enabled, High Performance Ethernet L2/L3 Switch designed to operate in harsh environments.

**TECHNICAL DATA**

**Ethernet Interface**

*According to IEEE 802.3 Ethernet 10/100Base-TX:*

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface type</td>
<td>duplex</td>
</tr>
<tr>
<td>Electrical characteristics</td>
<td>IEEE 802.3</td>
</tr>
<tr>
<td>Transfer</td>
<td>symmetrical</td>
</tr>
<tr>
<td>Range (UTP CAT5)</td>
<td>135 m</td>
</tr>
<tr>
<td>Isolation</td>
<td>1500 Vrms/50Hz/60s according to IEC EN 60950</td>
</tr>
<tr>
<td>Connector</td>
<td>standard RJ45</td>
</tr>
</tbody>
</table>

**Power over Ethernet:**

- **Power delivery mode:** Mode A, phantom
- **Power range:**
  - Type 1: 15.40 W
  - Maximum power at PD: 12.95 W
  - Maximum current: 350 mA
  - Maximum cable resistance (CAT 3): 20 Ω
- **Voltage Range:** 44 - 57 V

**Ethernet 10/100Base-FX:**

- **Transport type:** duplex
- **Electrical characteristics:** IEEE 802.3
- **Transport medium:** single mode optical fiber, multimode fiber (option)

**Optical SFP Ethernet interfaces**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>SFP Plug in Transceiver Type 1</td>
<td>OLS1A1</td>
</tr>
<tr>
<td>Connector type</td>
<td>LC</td>
</tr>
<tr>
<td>Transmitter type</td>
<td>1310 nm FPLD</td>
</tr>
<tr>
<td>Output power</td>
<td>-5 to 0 dBm</td>
</tr>
</tbody>
</table>

**Alarm Interface**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input</td>
<td>Activation current: 5 mA, Maximum current: 30 mA, Maximum voltage: 70 V</td>
</tr>
<tr>
<td>Output</td>
<td>Maximum current: 0.5 A, Relay, Maximum voltage: 110 V</td>
</tr>
</tbody>
</table>

**Environment conditions**

- Extended operation class: -25° to +60° C
- Relative Humidity: 5-95% (non condensing)

**System Configuration**

- **1U Metal Case Dimension:** 440 mm x 257 mm x 43.2 mm (17.32” x 10.11” x 1.70”)
- **Case Weight:** 3.15 kg

**APPLICATION**

```
PoE IP Camera
  +-----------------+-----------------+-----------------+-----------------+
  | PC              | PoE IP Camera  | DVR             | PoE IP Camera  |
  +-----------------+-----------------+-----------------+-----------------+
  | PoE Splitter    | PoE IP Camera  | PoE IP Camera  | PoE IP Camera  |
  +-----------------+-----------------+-----------------+-----------------+
  | PoE IP Camera   | SMH884 - FPX    | Centre of Surveillance | PoE IP Camera  |
  +-----------------+-----------------+-----------------+-----------------+
  | 100Base-TX UTP  | 100Base-TX UTP  | 100Base-TX UTP  |
  +-----------------+-----------------+-----------------+
  | Power Line (DC) | Power Line (DC) |
  +-----------------+-----------------+
  | PoE               |
  +-----------------+
```
PoE24S-2F
High Performance, L2/L3 Fully Managed Gigabit Ethernet Switch,
24 PoE 10/100/1000 BaseTX
2 Optical 100 BaseFX or 1000 BaseX

- Provides 24 electrical PoE 10/100/1000 BaseTX and 2 Optical SFP 100 BaseFX or 1000 BaseX interface
- Provides up to 375 W of power and automatic sensing and power consumption classification for 24 remotely powered devices (PD), 15.4 W per port
- Compliant with IEEE802.3, IEEE802.3u and IEEE802.3af standards
- Performs wire speed Ethernet Switching function between all user ports, Ethernet 10/100/1000 BaseTX and 100 BaseFX or 1000 BaseX
- Traffic protection through STP (Spanning Tree Protocol)
- Quality of service (QoS) support with four traffic classes
- Full duplex, Half duplex, Flow Control
- Automatic address learning, address aging and address migration
- Support for up to 8K MAC address entries with automatic learning and aging

- Egress tagging/untagging selectable per port or by 802.1Q VLAN ID
- Port based VLANs supported in any combination across multiple chips
- Port trunking support
- Software/Firmware field upgrade support, gold configuration backup and restore
- Network management system SUNCE
- SNMP v1/v2/v3 based network management Interface
- Management thought Embedded Web Server accessible via standard WEB browser
- User name and password based security
- 19” Rack and Desktop mountable metal housing, IP30 protection
- Front access to all user connectors, LED indication at front panel of device
- Extended temperature and tropicalized interior against excessive humidity
- Internal power supply, -48V DC or 220 V AC (option)
**Description**

IRITEL PoE24S-2F is hardened, 26 ports, Gigabit Ethernet Switch, allowing transparent connectivity to PoE devices, including any IEEE802.3af-compliant end device. Ethernet Switch designed to operate in harsh environments.

**Technical Data**

**Ethernet Interface**

According to IEEE 802.3

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface type</td>
<td>duplex</td>
</tr>
<tr>
<td>Electrical characteristics</td>
<td>IEEE 802.3</td>
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<td>symmetrical</td>
</tr>
<tr>
<td>Range (UTP CAT 5)</td>
<td>100 m</td>
</tr>
<tr>
<td>Isolation</td>
<td>1500 Vrms/50Hz/60s according to IEC 60950</td>
</tr>
<tr>
<td>Connector</td>
<td>standard RJ45</td>
</tr>
</tbody>
</table>

**Power over Ethernet:**

- Power delivery mode: Mode A, phantom
- Power range:
  - Type 1: Maximum delivered power 15.40 W, Maximum power at PD 12.95 W, Maximum current 350 mA, Maximum cable resistance (CAT 3) 20 Ω, Voltage Range 44 - 57 V

**Ethernet 100 BaseFX, 1000 BaseFX:**

- Transport type: duplex
- Electrical characteristics: IEEE 802.3
- Transport medium: single mode optical fiber, multimode fiber (option)

**Optical SFP Ethernet interfaces 1000 BaseFX**

- SFP Plug in Transceiver Type 1: OLGbE-AS
- Connector type: LC
- Transmitter type: 1310 nm MQW FPLD, Output power -10 to -3 dBm

**Power**

- DC Power Supply: without PoE 48V (40 ~ 72V) with PoE IEEE 802.3af, 48V (45 ~ 57V)
- Dissipation (PoE not included): up to 55 W

**Environment conditions**

- Extended operation class
- Temperature: -25º to +60º C
- Relative Humidity: 5-95% (non condensing)

**System Configuration**

- 1U Metal Case Dimension: 440 mm x 210 mm x 45 mm (17.32" x 8.27" x 1.77")
- Case Weight: 2.85 kg

**Centre of Surveillance**

**Application**

PoE24S-2F High Performance, L2/L3 Fully Managed Gigabit Ethernet Switch, 24 PoE 10/100/1000 BaseTX, Optical 100 BaseFX or 1000 BaseX
MGE41/84/88/168F
L2/L3 Managed Ethernet Switch with 16 x FE and 8 x E1 media converters

- Compliant with IEEE802.3, IEEE802.3u standards
- Up to 16 10/100 Mbit/s Auto-Negotiation RJ45 ports supporting Auto-MDI/MDX
- Up to 8xE1 2048 kbit/s ITU-T G.703 ports with EoE1 media converters, HDCL encapsulation
- Port-Based VLAN and IEEE 802.1Q tag VLAN

- Static MAC address and filtering MAC address management
- Static Port Priority and IEEE 802.1p Class of Service (CoS) with 4-level priority queuing
- Firmware upgrade, gold configuration backed up and restored
- Rack/Desktop - mountable case options
- Management through Embedded Web Server (EWS) which can be accessed via WEB browser
- GARP VLAN Registration Protocol (GVRP)
- Storm control, broadcast and multicast flooding
- Per port ingress and egress rate control
- STP, RSTP, MSTP
- Trunking, Link Aggregation Group (LAG)
- Test facilities, Virtual cable tester and PRBS BIST
- Internal power supply, -48 Vdc or 220 Vac option
**Description**

IRITEL MGExxxxF series of High performance Managed Ethernet Switching devices besides of the true Ethernet access, offers versatile combination of user interfaces integrated together with media converters, thus reducing the need for external media converters.

**Application**

MGExxxxF devices provides edge connectivity utilizing existing E1 and copper infrastructure, applicable in midsized and large scaled campus, corporate and metro access networks, MGExxxxF series especially tailored to provide connectivity and LAN extensions between numerus remote sites.

**Management**

Management can be performed through an embedded Web Server (EWS) by using standard internet browser. The well known WEB interfaces significantly reduce learning time and minimize the cost of deployment.

For the Centralized Network Management we offer embedded SNMPv1/2/3 agent.

**Available options**

- **MGE41F**
  4 x Fast Ethernet, electrical interface
  1 x E1, 2048 kbit/s G.703 interfaces

- **MGE84F**
  8 x Fast Ethernet, electrical interface
  4 x E1, 2048 kbit/s G.703 interfaces expandable with additional 4 x E1

- **MGE88F**
  8 x Fast Ethernet, electrical interface
  8 x E1, 2048 kbit/s G.703 interfaces

- **MGE168F**
  16 x Fast Ethernet, electrical interface
  8 x E1, 2048 kbit/s G.703 interfaces

**TECHNICAL DATA**

**Performance**

- Wire speed switching on all Ethernet and E1 ports
- Store and forward mode
- Non blocking switch fabric
- Port speed:
  - 10/100-TX RJ-45
  - E1 2048 kbit/s RJ-45
- Internal power supply

**Interface Standards**

- 802.3 10Base-T & 10Base-FL
- 802.3u 100Base-TX
- E1 ITU-T G.703, HDLC encapsulation

**General Standards**

- 802.1d Bridging
- 802.3x Backpressure/ Flow Control

**Redundancy Standards**

- 802.1D Spanning Tree Protocol
- 802.1W Rapid Spanning Tree
- 802.1s Multiple Spanning Tree
- Link Aggregation, Static port trunk

**VLANs**

- IEEE 802.1Q VLAN Tagging
- Port-based VLANs
- MAC-based VLANs
- GARP VLAN Registration Protocol (GVRP)

**Management and Monitoring**

- WEB
  - RFC 1157 SNMPv1/v2c
  - RFC 2570 SNMPv3
  - RFC1213 MIB-II
  - RFC1493 Bridge MIB
  - RFC 2863 Interfaces group MIB
  - RFC 1643 Ethernet like MIB
  - Stats, History, Alarms, Events
  - RFC 2674 802.1Q MIB
  - IP address allocation

**Security**

- Management Security: user name and password protection

**Fault Protection**

- Broadcast Storm Control
- Ingress egress rate control

**Quality of Services (QoS)**

- QoS in layer 2
- Traffic prioritization using 802.1p

**System Configuration**

- W x D x H 440mm x 257mm x 43.2mm
  (17.32" x 10.11" x 1.70")
- Weight 3.15kg (6.94lb)
- Mounting 19" rack-mountable hardware included

**Power supply**

- Internal – 48 Vdc, or 220 Vac option

**Operating temperature range**

- 5°C up to +45°C, (class 3.2)
MGE168FS
L2/L3 Managed Ethernet Switch with 16 x FE and 8 x E1 media converters with Encryption

- Compliant with IEEE802.3, IEEE802.3u standards
- Up to 16 10/100 Mbit/s Auto-Negotiation RJ45 ports supporting Auto-MDI/MDX
- Up to 8xE1 2048 kbit/s ITU-T G.703 ports with EoE1 media converters, HDCL encapsulation
- Port-Based VLAN and IEEE 802.1Q tag VLAN
- Per E1 port configurable AES128/192/256 encryption module with flexible key and access management

- Static MAC address and filtering MAC address management
- Static Port Priority and IEEE 802.1p Class of Service (CoS) with 4-level priority queuing
- Firmware upgrade, gold configuration backed up and restored
- Rack/Desktop - mountable case options
- Management through Embedded Web Server (EWS) which can be accessed via WEB browser
- GARP VLAN Registration Protocol (GVRP)
- Storm control, broadcast and multicast flooding
- Per port ingress and egress rate control
- STP, RSTP, MSTP
- Trunking, Link Aggregation Group (LAG)
- Test facilities, Virtual cable tester and PRBS BIST
- Internal power supply, -48 Vdc or 220 Vac option
**Description**

IRITEL MGE168FS high performance Managed Ethernet Switching device besides of the true Ethernet access offers versatile combination of user interfaces integrated together with media converters with encryption, thus reducing the need for external media converters.

Encryption Standard (AES) provides high confidence level of data security over public telecommunication network. Each E1 link at the device is possible to configure to perform data encryption with different key length, key management and key schedule. Encryption procedure includes key exchange, authentication and user data encryption. Each phase of encryption procedure uses their own key.

**Application**

MGE168FS provides edge connectivity utilizing existing E1 and copper infrastructure, applicable in midsized and large scaled campus, corporate and metro access networks. MGE168FS is especially tailored to provide connectivity and LAN extensions between numerous remote sites with encryption.

**Management**

Management can be performed through an embedded Web Server (EWS) by using standard internet browser. The well known WEB interfaces significantly reduce learning time and minimize the cost of deployment.

For the Centralized Network Management we offer embedded SNMPv1//2/3 agent.

---

**TECHNICAL DATA**

**Performance**

Wire speed switching on all Ethernet and E1 ports  
Store and forward mode  
Non blocking switch fabric  
Port speed:  
10/100-TX RJ-45  
E1 2048 kbit/s RJ-45  
Internal power supply

**Interface Standards**

802.3 10Base-T & 10Base-FL  
802.3u 100Base-TX  
E1 ITU-T G.703, HDLC encapsulation

**General Standards**

802.1d Bridging  
802.3x Backpressure/ Flow Control  
AES: NIST FIPS197

**Redundancy Standards**

802.1D Spanning Tree Protocol  
802.1W Rapid Spanning Tree  
802.1s Multiple Spanning Tree  
Link Aggregation, Static port trunk

**VLANs**

IEEE 802.1Q VLAN Tagging  
Port-based VLANs  
MAC-based VLANs  
GARP VLAN Registration Protocol (GVRP)

**Management and Monitoring**

WEB  
RFC 1157 SNMPv1/v2c  
RFC 2570 SNMPv3  
RFC1213 MIB-II  
RFC1493 Bridge MIB  
RFC 2863 Interfaces group MIB  
RFC 1643 Ethernet like MIB  
Stats, History, Alarms, Events  
RFC 2674 802.1Q MIB  
IP address allocation

**Security**

Management Security: user name and password protection  
Fault Protection  
Broadcast Storm Control  
Ingress egress rate control

**Quality of Services (QoS)**

QoS in layer 2  
Traffic prioritization using 802.1p

**System Configuration**

W x D x H 440mm x 257mm x 43.2mm  
(17.32” x 10.11” x 1.70”)

Weight 3.15kg (6.94lb)  
Mounting 19’’ rack-mountable hardware included

**Power supply**

Internal – 48 Vdc, or 220 Vac option

**Operating temperature range**

– 5⁰ C up to +45⁰ C, (class 3.2)
MGE88/168G
Stackable Gigabit L2/L3 Managed Ethernet Switch with 16xFE, 4xGE and 8xE1 media converters

- Up to 4 10/100/1000 Mbit/s Auto-Negotiation RJ45 ports supporting Auto-MDI/MDX, 1 G SFP optional
- Up to 16 10/100 Mbit/s Auto-Negotiation RJ45 ports supporting Auto-MDI/MDX
- Up to 8xE1 2048 kbit/s ITU-T G.703 ports with EoE1 media converters, HDCL encapsulation
- Stacked devices are fully manageable and behaves as a single device
- Port-Based VLAN and IEEE 802.1Q tag VLAN
- Static MAC address and filtering MAC address management
- Static Port Priority and IEEE 802.1p Class of Service (CoS) with 4-level priority queuing
- Firmware upgrade, gold configuration backed up and restored
- Rack/Desktop - mountable case options
- Internal power supply, -48 Vdc or 220 Vac option
Description
IRETEL MGExxxG series of High performance Managed Ethernet Switching devices besides of the true Ethernet access MGExxxG offers versatile combination of user interfaces integrated together with media converters thus reducing the need for external media converters. Stacked switches behaves as larger switch managed as a single device.

Application
MGExxxF devices provides edge connectivity utilizing existing E1 and copper infrastructure, applicable in midsized and large scaled campus, corporate and metro access networks, MGxxG is especially tailored to provide connectivity and LAN extensions between numerous remote sites. MGxxG devices are scalable and they are ideal for extending port count in order to fulfill network growing requirements.

Management
Management can be performed through an embedded Web Server (EWS) by using standard internet browser. The well known WEB interfaces significantly reduce learning time and minimize the cost of deployment.

   For the Centralized Network Management we offer embedded SNMPv1/2/3 agent.

Available options
- MGE88G
  8 x Fast Ethernet, electrical interface
  8 x E1, 2048 kbit/s  G.703 interfaces
  2 x 1G Electrical interfaces
  2 x 1G Optical (SFP) interfaces

TECHNICAL DATA

Performance
Wire speed switching on all Ethernet and E1 ports
Store and forward mode
Non blocking switch fabric
Port speed:
  10/100-TX RJ-45
  E1 2048 kbit/s RJ-45
Internal power supply

Interface Standards
802.3 10Base-T & 10Base-FL
802.3u 100Base-TX
E1 ITU-T G.703, HDLC encapsulation

General Standards
802.1d Bridging
802.3x Backpressure/ Flow Control

Redundancy Standards
802.1D Spanning Tree Protocol
802.1W Rapid Spanning Tree
802.1s Multiple Spanning Tree
Link Aggregation, Static port trunk

VLANs
IEEE 802.1Q VLAN Tagging
Port-based VLANs
MAC-based VLANs
GARP VLAN Registration Protocol (GVRP)

Management and Monitoring
WEB
RFC 1157 SNMPv1/v2c
RFC 2570 SNMPv3
RFC 1213 MIB-II
RFC 1493 Bridge MIB
RFC 2863 Interfaces group MIB
RFC 1643 Ethernet like MIB
Stats, History, Alarms, Events
RFC 2674 802.1Q MIB
IP address allocation

Security
Management Security: user name and password protection

Fault Protection
Broadcast Storm Control
Ingress egress rate control

Quality of Services (QoS)
QoS in layer 2
Traffic prioritization using 802.1p

System Configuration
W x D x H 440mm x 257mm x 43.2mm
(17.32” x 10.11” x 1.70”)
Weight 3.15kg (6.94lb)
Mounting 19” rack-mountable hardware included

Power supply
Internal – 48 Vdc, or 220 Vac option

Operating temperature range
- 5⁰ C up to +45⁰ C, (class 3.2)
SUNCE+
Network Management System

- Continuous hierarchical management of complex networks, subnetworks, stations, and devices
- Service and network monitoring
- Operation and maintenance tool, essential for network design
- Enables evolutionary network management redesign
- OSS/BSS system integration
Applications
- Enables integration of all IRITEL transmission systems
- Integration of all elements in network or their subset
- Network topology is presented in hierarchical tree view, from a sub-network layer to a single location and elements in it
- Fast identification of network resource problems improves quality of service
- Client-server architecture enables multi-user access
- Distributed hardware platform
- Operations on IRITEL OTN, SDH and PDH network elements
- Distributed hardware platform, depending on number and complexity of managed systems
- Automatic database failover
- Web browser for application access, over LAN or VPN
- FCAPS management functions (Fault, Configuration, Accounting, Performance, Security)
- Monitoring of current network state and its history
- Monitoring user actions in SUNCE+

Base Module
- Enables database integration, access using Web browser and system administration. Other functions are supported in separate modules.

Module Alarms
- Presents filtered set of current alarms on hierarchical levels
- Monitoring of predefined set of alarms
- Reports of any subset of alarms are generated from history log

Module Remote Access
- Remote access to SUNCE-M system, with local operator rights
- View change network element parameters and trail management in network

Integration
- Integration with OSS/BSS system (Northbound interface)
- Direct access to new device types through Southbound interface
- Open management interfaces: SNMP, XML...

Module OTN
- Network management system for IRITEL OTN devices

Module Inventory
- Collecting service data from network elements
- Device reports and statistics (unit types, hardware and software versions...)

Module Performance
- Provides service availability information on selected customer
- Presents information on point to point free transport capacity

Module Accounting
- Provides services remuneration through access to accounting data

ITU-T Recommendations
- M series: M.3010, M.3300, M.3400
SUNCE-O
OTP10G/100G OTN/DWDM NMS

- Unified and scalable NMS management solution
- Client-server architecture
- From small/local up to large networks
- Easy to meet network growth and development
- Fault, configuration, performance and security management
- Inventory management
- OSS/BSS system integration
- Single platform for OTN and DWDM layers
- Lower CAPEX and OPEX, faster ROIn
System description
- Configuration and monitoring of OTP10G/100G OTN/DWDM networks
- Element management and network management layers
- Standalone NMS or a module of SUNCE+
- Multi-tier system organization, with multi-user access
- Management functions (Fault, Configuration, Performance, Security)
- Scalable from single to multiple servers
- High availability of servers (automatic failover)
- Northbound interface to OSS/BSS (SNMP, CORBA)
- J2EE software architecture
- Java based rich client software

GUI main features
- Intuitive graphical views
- Network topology is presented in hierarchical tree view (network, sub-network, groups, stations, NE)
- Drag & Drop

Fault management and warnings
- Alarms
- Loops

Configuration management
- OTN
- DWDM
- ODUk cross-connect
- SDH
- Ethernet

Performance management
- Real-time performance data collection and analysis
- Numerical and graphical performance metrics

 Provisioning
- Automatic (trail manager)
- Manual provisioning

Security management
- Role based security model with user authentication and authorization
- Audit Log with user activities information
- Secure SNMPv3 protocol for device access

Inventory
- Collecting service data from NE and network
- HW&SW device report

TECHNICAL DATA

International standards support:
- ITU-T: M.3010, M.3100, M.3300, M.3400
- TMF 513, 608, 814 Development

System requirements for
Server side computers

Operating system
- Linux 64 bit
  (recommended: CentOS 6.3 or newer)

Supported databases
- MariaDB (recommended)
- MySQL
- PostgreSQL
- Oracle

Java
- JRE/JDK 1.6, 1.7

System requirements for
Client side computers

Operating system
- Windows (32 bit or 64 bit)
- Linux (32 bit or 64 bit)

Java
- JRE/JDK 1.6, 1.7
SUNCE-M
Integrated Network Management System

- Management system covering the full range of IRITEL SDH and PDH equipment
- Easy to use – from network views to functional blocks on a single board
- Trail manager featuring automatic route calculation
**Basic Functions**

- Integrated solution for continuous centralized monitoring of the entire network and individual network element
- Intuitive Graphical User Interface facilitates a range of operations, from network view and containment tree view, to functional blocks on a single board
- Enables TMN (Telecommunications Network Management) management functions – fault, configuration, performance and security management
- Provides functions of Network Management Layer and Element Management Layer of the TMN functional architecture
- The computer in Management Operations Center is connected to one network element using Ethernet or RS232 serial interface (F interface)
- Provides integration in Network Management System SUNCE+

**Network Elements**

Each network element is equipped with System Management Unit that exchanges information with SUNCE-M. Supported products in Network Management System:

- SDH (STM-16/4/1) Optical Digital Systems: ODS2G5, ODS622/ODS622C, OTS622, ODS155
- Access Systems: FM-MSAN, IP µDSLAM, IAM-MSAN, V5CAS and FM2x2
- DSL modems: PSH (SHDSL) and LTH-E1 (HDSL)
- Optical Terminal and Secondary Multiplexer OTSM 4x2Mbit/s
- Interface Convertors: KGXV, 2 Mbit/s G.703 to X.21/V.35 and KGET, KGET8, 2 Mbit/s G.703 to Ethernet
Fault Management

Alarm reports from each of the network elements are received automatically and displayed as visual and textual information

- Alarms classification:
  - Communication alarms (transmission and synchronization)
  - Performance alarms
  - Equipment alarms
- Alarm summary is available on various layers - from network element to equipment functional blocks

- Assign alarm severity
- Acknowledge active alarms
- Testing:
  - Close local and remote loops on various levels
  - Configure PMP (Protected Monitoring Point)
  - Use built-in PRBS generators and detectors
- Fault event history for the entire network is stored in database, with filtering options for any set of network elements categorized by type of network element, time, classification, severity, acknowledgement and status of the event

Configuration Management

- Create and change network topology using visual network editor
- Create and delete network elements
- Connect elements using optical and electrical links
- Elements can be grouped upon their location
- Edit network element properties
  - Network parameters
  - Module equipping
  - Synchronization parameters
  - Cross-connections
  - Quick configuration using configuration files
- Trail manager with complete trail lifecycle management:
  - Simple point and click to create, change and delete trails
  - Automatic calculation of possible trail routes between network elements
  - Visual presentation of existing trails in network topology view
- Inventory management capabilities include:
  - Tributaries - configuration and services
  - Network status
  - Serial numbers, hardware and software versions
**TECHNICAL DATA**

**System requirements**

*Operating System*

- Windows 8
- Windows 7
- Windows Vista
- Windows XP

*RAM*

- 2 GB (4 GB recommended)

*Free Hard disk capacity*

- > 1 GB

**ITU-T Recommendations**

- G series: G.781, G.783, G.784, G.826, G.841
- M series: M.3010, M.3300, M.3400

**Performance Management**

- Analyze and aggregate network performance data on a per network element basis
- Collect performance events grouped in 15 minutes and 24 hours intervals according to ITU-T G.826
- ES – Errored Seconds
- SES – Severely Errored Seconds
- BBE – Background Block Error
- UAS – UnAvailable Seconds
- Adjust performance alarms thresholds
- Examine UAT (UnAvailable Time) intervals

**Security Management**

- User-based security model
- Role based user access control
- User data editing (add, delete, change)
- Review of user actions log with filtering

SUNCE-M: Integrated Network Management System
SIPDAT
SIP Interactive Voice Response Device

- IVR (Interactive Voice Response)
- PC in local network
- SIPDAT “speaks” your data
- Great capacity of concurrent calls (default 8, up to 64)
- SIPDAT is accessible through PSTN and Internet
- Easily changeable voice messages
- Easy programming
- Remote access
- Tailored to customer needs

LET YOUR DATA SPEAK!
Using SIPDAT
- Automatic reading of storehouse data over phone
- Public information on changeable data (temperature, exact time, number of cars on the road section, ...)
- Private data with authorisation (credit card balance, personal documents, ...)
- Hosting

SIPDAT Customers
- Telecommunication providers
- Government institutions and agencies
- Power plant companies
- Banks and other financial institutions
- Trade organizations
- Any company which needs:
  - Fast and cheap access to important data,
  - Surveillance of automated processes,
  - Control of unattended objects

Basic features
Voice messages:
- Easy recording – wav format
- Correct pronunciation of data (grammar)
- User can record his own messages

Communication:
- SIP RFC 3261
- SDP RFC 4566
- Other references: RFC 2617, RFC 2976, RFC 3262, RFC 3263, RFC 3966, ...
- Families of codecs (G.711, Speex, GSM, L16)
- Various improvements:
  - Voice Activity Detector (VAD)
  - Comfort Noise Generator (CNG)
  - Perceptual Enhancement (PENH)
  - Packet Lost Concealment (PLC)
  - Echo cancelation
- SIPDAT can be reached from public and mobile telephone networks
- Conference
- Recording and playing of speech
- RTP and RTCP
- Security – SRTP and SRTCP
- Tone generation

Data base access
- Oracle data base client
- MySQL data base client
- Remote data base access
- Remote SQL query formatting

Remote SIPDAT configuration
- Web server
- Web browser access
- Configuration data:
  - Recording and playing of messages
  - SQL query input
  - Administration
  - Supervision

SIPDAT in IRITEL
- Oracle client – connected with IRIS (information system)
- SIP client connected with ippbx (SIP server)
- Accessible from IRINET (LAN), Internet, PSTN and PLMN
- Reading of any data from IRIS, for instance:
  - Number of a certain component in storehouse
  - Number of employees in the company at the moment

If you want to test SIPDAT in test configuration in IRITEL please contact: Ivan Vidaković
Phone: 381 11 3073 412
Mob: 381 65 3073 412
Mail: ivica@iritel.com
sip: 712@ippbx.iritel.com
712@193.203.19.248
VoIP – TDM to IP telephony switch
- Up to 200 simultaneous VoIP-POTS conversions for 2400 subscribers
- Stand-alone device or part of Access Multiplexer
- Signalization: SIP or MEGACO (H.248)
- Network management system SUNCE-M or SNMP-based management
**Implementation**
- IMG connects POTS subscribers with IP network by transforming classic telephone traffic to VoIP and vice versa
- IMG can be realized as a stand-alone device or as a unit of Integrated access multiplexer Access Multiplexer
- Access Multiplexer enables different subscribers (POTS, ISDN, xDSL, Ethernet, X.21, V.35...) to access PSTN and IP networks

**Configuration**
IMG consists of Engines – software units that can be executed on different hardware platforms and are connected by UDP/TC/IP protocols. This organisation enables big flexibility and skalability.

IMG contains:
- ME (Media Engine): is working on voice coding/encoding
- SE (Signalization Engine): is dealing with signalization
- AE (Application Engine): controls software applications and functions
- TE (TDM Engine): is dealing with POTS

When IMG is a part of Access Multiplexer it contains ME, SE and AE, and TE functions are performed by Access Multiplexer

**TECHNICAL DATA**

**Voice packetisation**

**Voice coders/encoders**
- G.711 Appendix 1 and 2: Linear PCM 64 kbit/s
- A law/μ law, VAD/CNG, and PLC
- G.723.1: MP-MLQ 6.3 kbit/s / ACELP 5.3 kbit/s
- G.726: ADPCM 16, 24, 32, 40 kbit/s
- G.729 A/B: CS-ACELP 8 kbit/s
- GSM-AMR: 4.75-12.2 kbit/s
- T.38 Fax Relay: G3 Fax Relay 2.4-14.4 kbit/s
- SMV: 0.8-8.55 kbit/s
- EVRC: 0.8-8.55 kbit/s

**Voice processing, quality enhancements**
- Echo cancelation: per ITU-T G.168-2000 ECAN 10 ms, 16 ms, 32 ms, 128 ms tail sparse window
- Voice detection: analyzes voice activity to detect silence intervals
- Packet Loss Concealment: per ITU-T G.711 Appendix 1
- Comfort Noise Generation: per ITU-T G.711 Appendix 2
- Adaptive Jitter Buffer Manager: fully adaptive or static; de-jitter and packet reordering
- Audio Conferencing: support for 3 to N party audio conferences per DSP core
- Prompts: playback of prompts from local memory

**Telephony Algorithms**
- DTMF Detect and Generate: per Bellcore GR-506-CORE, TIA 464-B, ITU-T Q.23 and Q.24
- DTMF Relay: per RFC 2833

**Call Progress Tone Handling:**
- per Bellcore GR-506-CORE, ITU-T Q.35

**Caller Identification:**
- per ETSI, NTT and Telcordia algorithms

**DSP data transfer**
- RTP/RTCP: per RFC 1889 and 3550
- UDP: per RFC 768
- IP: per RFC 791

**Signalization**
- SIP: per RFC 3261
- SDP: per RFC 2327
- MEGACO: per RFC 3525 – option

**Capacity**
- IMG can handle up to max. 200 simultaneous VoIP connections
- TDM H.110 bus capacity (IAM-MSAN) is 2400 subscribers
- IMG has: 2 x 10/100 BaseTx interfaces
- IAM-MSAN supports up to 6 IMG Media Gateway

**Software**
- Operating system: eLinux (Freescale)
- Applications: written in C

**Hardware**
- Processor: Power PC II MSC8260
- VoIP cores: 1 to 2 x DSP MSC8122
- Aggregator: DSP MSC 8103
- SDRAM: 64 MB, FLASH: 64 MB
- Digital Switch: MT90866
- Ethernet Switch: ZL50405
First VoIP device belonging to a family of IMG devices developed by IRITEL for use in NGN (Next Generation Network)

Used to support service 95 (exact time speaking service) in Telekom Srbija

Contemporary IVR (Integrated Voice Response) system with adequate number of voice channels (VoIP channels to IVR channels ratio is 1:1)

Connected to NGN via SIP protocol

Media transfer is performed using RTP/RTCP protocol

Exact time is established using NTP protocol
Configuration

Exact time speaking function is supplied by Exact Time System – STV which consists of two IMG95 devices and two switches connected in order to increase the reliability of a system.

STV is working in active/stand-by mode and fulfils the “no single point of failure” criteria.

STV is maintained by computer NU from IT network.

IMG95 contains printed boards:
- IMG – basic board with embedded Linux
- PFC – DSP processors for voice packing
- VMU – voice machine unit

Operation and maintenance

Operation and maintenance is performed by computer NU from IT network.

NU functions are:
- Statistics – data on number of calls, duration, etc. is gathered every 15 minutes
- Alarms – heavy, medium and light alarms are gathered and displayed
- Archives – all gathered data are archived in daily reviews (15 min. statistics, from-until statistics, alarms)
- Web – IMG95 devices have their own web pages with configuration data
- Docs – help documentation
- NU transfers data to higher level of hierarchy by ftp protocol or writes them in database using SQL language

Basic references and standards

SIP/SDP:
- RFC 3261 - SIP: Session Initiation Protocol
- RFC 2327/4566 - SDP: Session Description Protocol
- RFC 2617 - HTTP Authentication: Basic and Digest Access Authentication
- RFC 3310 - Hypertext Transfer Protocol (HTTP) Digest Authentication Using Authentication and Key Agreement (AKA)

Media flow
- RFC 3550 - A Transport Protocol for Real-Time Applications
- RFC 2833 - Telephony Signals
- RFC 3605 - Real Time Control Protocol (RTCP) attribute in Session Description Protocol (SDP)

Codec’s:
- G.711 App. 1 & 2 - Linear PCM 64 kbps
- A Law/μ Law, VAD/CNG, and PLC
- G.729 A/B - CS-ACELP 8 kbps
- ITU-T G.168-2000 - Echo cancelation -ECAN
  10 ms, 16 ms, 32 ms, 128 ms window

Other:
- RFC 791 - Internet protocol
- RFC 768 - User Datagram Protocol

TECHNICAL DATA

Traffic 86 Erl (up to 147 Erl)
Number of VoIP channels 120 (up to 200)
BHCA - Busy Hour Call Attempts around 10,000 (17,000)

Connection to IP/MPLS network
- 4 x 100 BaseTx Fast Ethernet IEEE 802.3μ

Codec’s
- G.711, G.729

VQE – Voice Quality Enhancements
- EC, VAD, PLC, CNG, AJBM

Power supply
- internal converter 220 V~ to 48V= around 2 kg

Dimensions
- rack 19” wide, 1 U high, 300 mm deep

IP/MPLS network connections:
- ETH – IT network connection (maintenance, ntp)
- SIGN – SIP signalization
- DATA – RTP/RTCP media transfer
- VMU – voice machine unit control

VQE techniques are:
- EC – echo cancelation
- VAD – voice activity detection
- PLC – packet loss concealment
- CNG – comfort noise generation
- AJBM – adaptive jitter buffer manager
CJ-1P
Cellular Jammer

- High quality jamming equipment for mobile communications
- Blocking up to three frequency bands simultaneously GSM 900, GSM 1800 and UMTS
- Various applications
- Compact and modular design
Description

CJ-1P is a high quality jamming equipment for mobile communications. The CJ-1P cell phone jammer unit is intended for blocking all mobile phone types within designated indoor or outdoor areas. Its unique design combines effective jamming and strict compliance with international standards of safety and electromagnetic compatibility.

CJ-1P is a ‘plug and play’ unit, its installation is quick and its operation is easy. Once the CJ-1P cellular jammer is operating, all mobile phones present within the jamming coverage area are blocked, and cellular activity in the immediate surroundings (including incoming and outgoing calls, SMS, pictures sending, etc.) is jammed.

Basic features

- Fully digitalized
- Effective jamming in a radius between 5-100 meters (depending on cellular signal strength at site)
- Can block up to three frequency bands simultaneously GSM 900, GSM 1800 and UMTS
- Remote controlled
- Blocking range selection
- Can be operated via 12 Vdc power source

Applications

- Prevention of eavesdropping and information transfer:
  - Briefing rooms
  - Military and governmental offices
  - Interrogation rooms
- Prisons
- Conference rooms
- Embassies
- Government facilities
- Financial institutions
- Sensitive locations, churches, faculties
- Acoustic isolation:
  - Theatres / cinemas
  - Concert halls
  - Lecture rooms / libraries
  - Exclusive restaurants
  - Trains
  - Gaming facilities
  - Sensitive locations
- Secret services
- Government agencies
- Police Negotiation Team
- Military facilities and forces
- Police Special Forces
- VIP protection agencies
- Elite units

**TECHNICAL DATA**

<table>
<thead>
<tr>
<th>Frequency ranges:</th>
</tr>
</thead>
<tbody>
<tr>
<td>GSM 900</td>
</tr>
<tr>
<td>GSM 1800</td>
</tr>
<tr>
<td>UMTS</td>
</tr>
<tr>
<td>Synthesizer type</td>
</tr>
<tr>
<td>digital</td>
</tr>
<tr>
<td>Jamming signal type</td>
</tr>
<tr>
<td>white noise with uniform distribution</td>
</tr>
<tr>
<td>Output power</td>
</tr>
<tr>
<td>ON/OFF possibility and adjustable</td>
</tr>
<tr>
<td>0 - 30 dB for every band independently</td>
</tr>
<tr>
<td>Resolution output power</td>
</tr>
<tr>
<td>1 dB</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Antenna system</th>
</tr>
</thead>
<tbody>
<tr>
<td>three PCB antennas</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Antenna1</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANTEENA1</td>
</tr>
<tr>
<td>ANTEENA2</td>
</tr>
<tr>
<td>ANTEENA3</td>
</tr>
<tr>
<td>JAMMER UNIT</td>
</tr>
<tr>
<td>BRIEFCASE</td>
</tr>
<tr>
<td>Power supply</td>
</tr>
<tr>
<td>Consumption</td>
</tr>
<tr>
<td>Operated temperature range</td>
</tr>
<tr>
<td>12 Vdc/battery 12 Ah</td>
</tr>
<tr>
<td>30 VA</td>
</tr>
<tr>
<td>-40°C to + 85°C</td>
</tr>
</tbody>
</table>

**S.W.R. in bandwidth**

| ≤ 2.0:1 from 880 to 960 MHz |
| ≤ 1.8:1 from 1710 to 2170 MHz |

**Impedance**

| 50 Ω unbalanced |

**Radiation (H-plane)**

| 70° at 920; 60° at 1920 MHz |

**Radiation (E-plane)**

| 70° at 920; 60° at 1920 MHz |

**Front to back ratio**

| ≥ 15 dB from 880 to 960 MHz |
| ≥ 15 dB from 1710 to 2000 MHz |
| ≥ 10 dB from 2000 to 2170 MHz |

**Polarization**

| vertical |

**Gain**

| 9 dBi |

**Max. power**

| 2 Watts (CW) at 50° C |

**Connector**

| SMA-male |

**Material**

| FR4 substratum the depth of 1.6 ± 10% Cu + Sn plate |

**Dimensions**

| ANTENNA1 148.3 x 127 x 45 mm |
| ANTENNA2 148.3 x 127 x 30 mm |
| ANTEENA3 120.5 x 75.5 x 20 mm |
| JAMMER UNIT 300 x 265 x 80 mm |
| BRIEFCASE 500 x 400 x 130 mm |

**Power supply**

| 12 Vdc/battery 12 Ah |

**Consumption**

| 30 VA |

**Operated temperature range**

| -40°C to + 85°C |
ARK3000
Antenna Distribution System

- 8 antenna inputs and 16 receiver outputs
- Frequency range 20 – 3000 MHz
- Solid state switching matrix
- Seamless Integration
- Local and remote control (Ethernet) as RoIP element
- Modular structure
- Compact and modular design
Antenna Distribution System ARK3000 receives signals from the eight antennas in the frequency range from 20 MHz to 3 GHz and distributes / switches received signal to the sixteen receivers whereby any of RF outputs can be assign any antenna, or pre-defined combination of antennas.

**Description**

**General characteristics**

- **Control**
  - Local via front panel (touchscreen)
  - Remote via Ethernet link, using any Internet browser via the intuitive user interface
- **Easy integration into automated systems for monitoring radio spectrum and radio-surveillance**
- **Working in an autonomous / manual mode**
- **Options**
  - Digitally controlled attenuators on inputs
  - DC power supply 12 V/24 V/48 V
  - Different types of input connectors
  - Different types of input filters
  - Control via RS232 or USB interface
  - Adaptation of protocols and structure of management posts in order to emulate the existing antenna distributor

**TECHNICAL DATA**

**Antenna Inputs**

<table>
<thead>
<tr>
<th>Number of inputs</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Frequency subband input</strong></td>
<td></td>
</tr>
<tr>
<td>VHF1: 20 – 88 MHz</td>
<td>2 inputs</td>
</tr>
<tr>
<td>VHF2: 110 – 180 MHz</td>
<td>2 inputs</td>
</tr>
<tr>
<td>VHF/UHF1: 225 – 470 MHz</td>
<td>2 inputs</td>
</tr>
<tr>
<td>UHF1: 100 – 1400 MHz</td>
<td>1 input</td>
</tr>
<tr>
<td>UHF2: 500 – 3000 MHz</td>
<td>1 input</td>
</tr>
<tr>
<td><strong>Input impedance</strong></td>
<td>50 Ω</td>
</tr>
</tbody>
</table>

**Input SWR**

≤ 3

**Maximum input level**

+ 17 dBm

**Attenuation of input to output**

- **VHF1** ≥ 60 dB
- **VHF2** ≥ 50 dB
- **VHF/UHF1** ≥ 50 dB
- **UHF1** ≥ 50 dB
- **UHF2** ≥ 50 dB

**RF outputs**

<table>
<thead>
<tr>
<th>Number of RF outputs</th>
<th>16</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Output impedance</strong></td>
<td>50 Ω</td>
</tr>
<tr>
<td><strong>Output SWR</strong></td>
<td>≤ 1.5</td>
</tr>
<tr>
<td><strong>1 dB compresion point</strong></td>
<td>&gt; +10 dBm</td>
</tr>
</tbody>
</table>

**Attenuation between any two outputs**

- **VHF1** ≥ 50 dB
- **VHF2** ≥ 45 dB
- **VHF/UHF1** ≥ 45 dB
- **UHF1** ≥ 45 dB
- **UHF2** ≥ 40 dB

**IP2 (the second order intercept)**

min 35 dB

**Type of connectors (input/output)**

N

**Gain**

min 1 dB

**Noise ratio**

≤ 5 dB

**Interface for remote control**

Ethernet 10/100 Mbit/s

**Power**

220V ±10 %, 50 Hz

**Consumption**

50 VA

**Dimensions**

480 x 133 x 365 mm

**Weight**

15 kg

**Operating temperature range**

-5 do +45 °C

Control over Internet
SDNU
System for Remote Monitoring & Control of Power Electronic Devices

- Simultaneous monitoring and control of power electronics from different vendors, technologies and generation
- Modular system for monitoring and control of power electronic devices in remote locations:
  - Peripheral device for monitoring and control - DNU24
  - Monitoring and control center (local)
  - Main monitoring operations center
- Peripheral device for monitoring and control - DNU24:
  - Continuous measures of electrical and non-electrical values in the remote objects and data forwarding to the monitoring center at its request
- Measured electric and non-electrical values can be wireless send to DNU24
- Monitoring of alarms and in the case of their appearance forwarding to the monitoring center
- Control signals from the monitoring center are forwarded to power electronic devices which is possible to control
- Communication between monitoring and control center and DNU24 through TDM, IP and GSM telecommunication network
- Communication between monitoring and control center (local) and main monitoring operations center through SNMP
- Remote control of batteries quality with and without additional load
**System Description**

Monitoring and control system, for power electronics devices at remote locations, contains different number of DNU24 devices. Each device collecting and transmitting data to monitoring and control center.

DNU24 is connected with monitoring and control center over TDM (modem, ISDN), IP (Ethernet 10/100 baseTx) or GSM (GPRS) telecommunication network. Type of connection is defined by user in accordance with technical availability.

**DNU24**
- Capacity of DNU24 are 16 analogue and 8 digital signals
- Measurement and sending data related to electrical values: dc voltage, ac voltage, dc current
- Capturing, and sending to the monitoring and control center, signal wave shapes with 1 ms resolution
- Capturing, and sending data related to incident situations: measuring values 250 sec after and before incident happened
- Measurement and transmission of different values - temperature, pressure, liquid level and other non electrical values
- Data are collected and memorized in internal memory of DNU24 every 1 s
- Monitoring and control center collects data from DNU24 every 15 minutes
- Digital alarm signals, generated from devices under monitoring, DNU24 send to monitoring and control center immediately after their detection
- DNU24 have capacity of control over 4 output digital signals and over RS232 interface

**Battery capacitive test**
- Optionally connecting of batteries to additionally test load
- Recording batteries current discharge curves
- Comparison with manufacturer catalogue discharge curve
- Estimation of batteries quality
Monitoring and Control Center
PC with installed necessary software are located in center for remote monitoring and control. Measured data from DNU24 are periodically collecting. Data is stored in the particular database.

In the monitoring center, all data are presented in a clear manner so that the operator have a clear picture about the current state of the system. It is possible to generate a report with the results of measurements over a defined period of time.

- The structure of the system for remote monitoring and control
- The structure of device that is monitored and controlled for each object
- The measured values of all parameters
- The on/off values on remote devices that are controlled
- The data required for system administration
- Statistical data

All data are presented in tabular and graphical way.
Measurement ranges can be changed from the monitoring and control center.

Alarms are present in the monitoring and control center until the authorized person terminate them or until they disappear because the cause is disappeared. No matter how alarms go away, the date and time of an alarm condition are registered and the moment and the reason when the are gone. Low battery alarm is combined with an estimation of how much time the object will have to work on battery.

Monitoring and control center and main monitoring operations center allow statistical analysis of all collected data and generating of reports on all the alarms and the measured values deviations from the nominal value.

Information stored in the database can be transferred to a standard format database (Access, SQL, Oracle, ...) for further processing and eventual integration into other systems for monitoring users.

Control of power electronics devices are available in two ways: through the digital control signals directly from DNU24 and through a defined communication protocol (given from manufacturer of the device which is under control in the object); in that case, communication flows through special ports of DNU24). Commands are given from the center for monitoring and control (sent to DNU24). When the command is executed by a digital signal from DNU24, it is realized as a time switch (time-limited duration with the possibility of interruption).

Safety Procedures
- Authorization of access by user name and password
- Assigning user accounts that have limit access to options in the system
- Administration of system user - adding, deleting and changing data
- Over viewing of the user history (log files, filtering)

Monitoring and Control Network
Centers for monitoring and control can be connected in a hierarchical network for monitoring and control via an IP network to communicate with the main center.

Protocol for communication with the main monitoring operations center is standardized (SNMP).
**TECHNICAL DATA**

**DNU24:**

**Analog measurement**
- DC voltage (0 - 1000 V) 5 inputs
- AC voltage (0 - 300 Veff) 6 inputs
- DC currents (-1000 - 1000 A) or AC currents (0 - 1000 A) 3 inputs
- Temperature 2 inputs

**Digital inputs**
- Alarms (galvanic isolation) 4 inputs

**Digital outputs control signals**
- Optically isolated 2 outputs
- Realised with relays 2 outputs

**Monitoring and Control center:**
- PC computer with Windows XP Professional

**Software**
- GUI software for monitoring and control center
- Software for control of AC voltage wave shapes
- Communication software
- Software for control
- Administration software
- Statistical data analysis software
- Database software
- Software for connecting with main center for monitoring and control

**Interfaces**
- Local communication with other equipment RS232, RS485
- Communication with control and monitoring center ISDN, Ethernet, GPRS

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**Constructed and tested according to**

- Safety EN 60950 (UL1950)
- EMC EN 55022/CISPR22, class A

**Environmental conditions**
- Working temperature 0 to +50°C

**Dimensions (W x D x H)**
- 440 x 210 x 55 mm

**Weight**
- 3 kg
SNN12
Power Supply System 54 Vdc / 3 x 7.5 A

- Compact modular power supply system:
  - SN12 - one shelve (3 rectifiers modules), power 1200 W
  - SNN12 - two shelves (6 rectifiers modules), power 2400 W
- Full front access design – ease of installation and operation
- Parallel working of rectifiers – active current sharing, true redundant configuration (N+1)
- Natural convection cooling – no fans
- Power factor 0.98 (IEC 1000-3-2)
- Two independent battery breaker, up to six load breakers
- Optimal Charging of Batteries
- Programmable low voltage disconnect (LVD)
- Integrated control and monitoring system, SUNCE-M
**Description**

SNN12 system is power solution designed for telecom, datacom and network applications (48 Vdc nominal) which need to have reliable and permanent DC power supply regardless on main supply failure.

The main parts of SNN12 system are: cabinet, up to two shelves (main and for expansion), and batteries (working and reserve). SNN12 is modular and configurable for different load power: 400, 800 and 1200 W (SN12- main shelf, up to 3 rectifiers units) or 1600, 2000 and 2400 W (two shelves, up to 6 rectifiers units) or 2 ETSI shelves (up to 6 rectifiers). In redundant configuration off power supply system (N+1), reserve rectifier is in parallel work with others rectifiers. Accuracy of rectifiers active current sharing is 5%.

Batteries are paralleled with load and system output. Battery management includes controlled current charging of batteries independent of load current, IU characteristic, automatic temperature compensation with additional cable and sensor and programmable low voltage disconnect.

**System overview**

SNN12 system is composed of:

- Up to two AC distribution (ACD)
- Up to 6 rectifier modules (IM400), power of each rectifier 400 W (nominal)
- Load (DC) distribution (DCD2/6) with two or six output fuses (terminals ended with connectors)
- Low Voltage Disconnect module (battery board - BB) with battery breakers and terminal connectors (double)
- BCU – basic control unit (module) for control, monitoring and communications with LCD display and keyboard for self-guided controller operation, LEDs, RS232 and other interfaces
- Batteries

**Protections**

Protections include:

- Overload (current limit) and short circuit protection, active and passive, programmable
- Electronic Low Voltage Disconnect (LVD) - over discharging protection; value of battery turn-off threshold is programmable through keyboard or RS232 interface
- Battery current overcharging – value of charging current is controlled (apart of control module - BCU) and programmable through keyboard or RS232 interface (BCU)
- Over Voltage Protection (OVP) – output dc voltage and input ac voltage, active and passive
- Thermal rectifier protection (active)
System monitoring

System monitoring and control can be achieved locally or remotely - integrated through telecommunication network.

All main voltages and currents in system are measured and can be readout on display (also alarms) or via remote user PC-based software package; accidental data, independently of usual measurements are buffered in history files.

- Through keyboard and LCD display (local monitoring and control) next values are enable to adjust:
  - Number of shelves and number of rectifiers
  - Maximal load voltage and current
  - Battery turn-off threshold
  - Maximal battery charging current

- Light indication of basic system alarms are realized with LEDs and also monitored with BCU. These alarms are:
  - Low ac input voltage
    (main supply alarm – MSA)
  - Rectifier fail (rectifier error alarm – REA)
  - Battery voltage less than 44.5 Vdc i.e. rest capacity ≤10% (under voltage alarm – UVA)
  - Battery alarm less than 53 Vdc (under charge alarm – UCA)
  - Input ac fuse failure (main fuse failure – MFA)
  - Battery fuse failure (battery fuse alarm – BFA)
  - Output load fuse failure (distribution fuse alarm – DFA)
  - Rack door open (open door alarm – ODE)
  - Green and red LED on each rectifier indicates correct work or rectifier fail.
  - Green and red LED on battery board indicates correct connection and battery employing.
  - Integrated System monitoring of basic alarms through telecommunication network is achieved in conjunction with other Iritel equipment using:
    - Q2 bus, with graphic oriented PC based software package (SUNCE-M option – network manager),
    - SN12 connection with flexible multiplexer FM2x2, using RS232 interface.
## TECHNICAL DATA

### Input data
- **AC Input voltage**: 230 Vac (175 — 255 V)
- **AC Frequency**: 50 Hz (47 — 63 Hz)
- **Inrush current according to**: EN61000-3-2
- **Power factor**: ≥ 0.98

### Rectifier IM400
- **Output voltage (main ac supply present)**: 54.6 Vdc
- **Output voltage (main ac supply present)**: 48 Vdc nominal
- **Output power**: 400 W nominal (7.5 A/54.6 Vdc)
- **Output dynamic response**: 1.5%
- **Output load line response**: ±1%
- **Output voltage noise**: ≤50 mVeff, ≤100 mVp-p
- **Psomometric noise**: Ueff ≤ 2 mV (according to CCITT norms)
- **Efficiency**: η > 87%

### System data
- **Output voltage**: 54.6 Vdc, nominal
- **Charging current**: 3 A, standard (30 Ah capacity)
  - adjustable: 2.2 — 22 A
- **Temperature compensation**: 4 mV/C°/cell standard,
  - adjustable: 1 — 5 mV/C°/cell

Max. Output voltage protection (adjustable using BCU): 50 — 58 Vdc
Max. Load current protection (adjustable using BCU): n x 7.5 A
n - number of rectifier modules

**Output specifications under absence of main ac supply**
- **Output voltage**: 40 — 56 Vdc
- **Low voltage battery disconnect (LVD) turn-off threshold**: adjustable 40 — 44 Vdc
- **Battery turn-on threshold**: 49 — 52 Vdc

**DC (load) distribution**
- **DCD2**: 2 terminal connectors, up to 30A (automatic) fuse
- **DCD6**: 6 terminal connectors, up to 10A (slow) fuse

### F - remotes alarms interface (DB9 connector)
- **Interface**: RS232
- **Number of signals (alarms)**: 8
- **Isolation**: optoisolation

**Batteries**
- 48 V/24 — 180 Ah

**Designed and tested according to**
- **Safety standard**: EN 60950 (UL1950)
- **EMC standard**: EN 55022/CISPR22, class A

**Environmental**
- **Ambient operating temperature**: 0 to +50°C

**Dimensions (V x L x H)**
- **Rectifier (IM400)**: 150 x 105 x 200 mm
- **ETSI shelf (RE-SN1/2)**: 150 x 533 x 220 mm
- **ETSI cabinet**: 1000/1200/2200 x 600 x 300 mm

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**SN12**
SN12/110
Power Supply System 110 Vdc / 3 x 7.5 A

- Compact modular power supply system - one rack with 3 rectifier modules, power up to 2400 W
- Full front access to supply system – easy installation and operation
- Parallel working of rectifiers – active current sharing, true redundant configuration (N+1)
- Power factor ≥0.98
- Optimal Charging of Batteries
- Additional output for extra battery charging - optionally
- Two independent battery breakers and two load breakers
- Programmable battery low voltage disconnect (LVD) - optionally
- Communication with remote monitoring center
- Use of IRITEL SDNU System for remote monitoring and control of power electronic devices – optionally
SN12/110 system is power solution designed for measurement, control, regulation and telecommunication applications with 110 Vdc (nominal) on output. Voltage supplied to load need to be reliable and permanent DC power supply regardless on main supply failure.

Power supply system SN12/110 is modular and consists from up to 3 rectifier modules in one rack. System is positioned inside cabinet (with additional place inside for other devices included monitoring and control equipment and/or smaller batteries). SN12/110 can be configured for different load power: 800, 1600 or 2400 W. In redundant configuration of power supply system (N+1), reserve rectifier is also active and work in parallel work with others rectifiers. Accuracy of rectifiers active current sharing is 5%.

SN12/110 are delivered in two configurations: basic (described above) and extended for additional batteries charging. Second version going when additional string of batteries is present at user. That auxiliary battery string is connected with primary set of batteries when battery voltage goes under 107 V (without presence of main ac voltage). In this configuration, additional battery charger is delivered with SN12/110 V.

Batteries are paralleled with load and system output. Battery management includes controlled current charging of batteries independent of load current (IU characteristic), automatic temperature compensation. Up to two battery sets can be connected to SN12/110 (parallel to each other).

Temperature compensation with additional cable and sensor is available, also, programmable low voltage disconnect (optionally).

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**System overview**

SN12/110 system is composed of:
- AC distribution (ACD)
- Up to 3 rectifier modules (IM800), power of each rectifier 800 W (nominal)
- Load (DC) distribution (DCD2) with two fuses (two equal terminals for user)
- Battery board (BB) with double battery fuses and terminals (for two battery sets) – delivered optionally with Low Voltage Disconnect (LVD) part inside module
- BCU – basic control unit for control, monitoring and communications, with LCD display and keyboard for selfguided controller operation, LEDs, RS232 and other interfaces
- Module for connection with additional battery set - delivered optionally

**Protections**

Protections include:
- Overload (current limit) and short circuit protection, active and passive, programmable and with fuses
- Electronic Low Voltage Disconnect (LVD) – battery over discharging protection; value of battery turn-off threshold is programmable (through keyboard or RS232 interface) – this is optionally
- Battery current overcharging – value of charging current is controlled independently of load current (even in the case BCU is not active for some reason) and programmable through keyboard or RS232 interface (BCU)
- Over Voltage Protection (OVP) – output dc voltage and input ac voltage, active and passive
- Thermal rectifier protection (active)
System monitoring

System monitoring and control can be achieved locally (display and keyboard on BCU) or remotely through existing telecommunication network. All voltages and currents in system are measured and can be readout on BCU display (also alarms if exist) or via remote user PC-based software; accidental data, independently of usual measurements can be buffered in databases.

Local monitoring and control through keyboard and LCD display on BCU module allows:

- Measuring of voltages and currents in the system
- Adjusting of next working parameters:
  - Number of shelves and number of rectifiers
  - Maximal load voltage and current
  - Battery turn-off threshold (optionally)
  - Maximal battery charging current
  - Floating and boost voltage and value of current when system goes from boost to float voltage on output

Local light indication of basic system alarms are realized with LEDs on BCU mask. These alarms are:

- Low ac input voltage (main supply alarm – MSA)
- Rectifier fail (rectifier error alarm – REA)
- Battery voltage less than 93 Vdc i.e. rest capacity ≤10% (under voltage alarm – UVA)
- Battery voltage less than 107 Vdc (under charge alarm – UCA)
- Input ac fuse failure (main fuse failure – MFA)
- Battery fuse failure (battery fuse alarm – BFA)
- Output load fuse failure (distribution fuse alarm – DFA)

Green and red LED on each rectifier indicates correct work or rectifier failure.

Green and red LED on battery board indicates correct connection and battery employing.

Connection with system for remote monitoring and control

SN12/110 can be connected with any other communication system. Data formatting and protocol are known to end user. For example, System for remote monitoring and control of power electronics – SDNU (IRITEL) or monitoring system SUNCE-M (Network Manager, IRITEL) can be used to communicate with SN12/110 (monitoring of values, control of system by changing system working parameters, data collecting). Also, some already existing monitoring system at user or just PC based software (delivered with SN12/110) are also suitable.

Batteries charging process

- Battery voltage less than 97 Vdc
- Battery voltage less than 93 Vdc
- Battery voltage less than 91 Vdc
- Battery voltage less than 89 Vdc
- Battery voltage less than 87 Vdc
- Battery voltage less than 85 Vdc
- Battery voltage less than 83 Vdc
- Battery voltage less than 81 Vdc
- Battery voltage less than 79 Vdc
- Battery voltage less than 77 Vdc
- Battery voltage less than 75 Vdc
- Battery voltage less than 73 Vdc
- Battery voltage less than 71 Vdc
- Battery voltage less than 69 Vdc
- Battery voltage less than 67 Vdc
- Battery voltage less than 65 Vdc
- Battery voltage less than 63 Vdc
- Battery voltage less than 61 Vdc
- Battery voltage less than 59 Vdc
- Battery voltage less than 57 Vdc
- Battery voltage less than 55 Vdc
- Battery voltage less than 53 Vdc
- Battery voltage less than 51 Vdc
- Battery voltage less than 49 Vdc
- Battery voltage less than 47 Vdc
- Battery voltage less than 45 Vdc
- Battery voltage less than 43 Vdc
- Battery voltage less than 41 Vdc
- Battery voltage less than 39 Vdc
- Battery voltage less than 37 Vdc
- Battery voltage less than 35 Vdc
- Battery voltage less than 33 Vdc
- Battery voltage less than 31 Vdc
- Battery voltage less than 29 Vdc
- Battery voltage less than 27 Vdc
- Battery voltage less than 25 Vdc
- Battery voltage less than 23 Vdc
- Battery voltage less than 21 Vdc
- Battery voltage less than 19 Vdc
- Battery voltage less than 17 Vdc
- Battery voltage less than 15 Vdc
- Battery voltage less than 13 Vdc
- Battery voltage less than 11 Vdc
- Battery voltage less than 9 Vdc
- Battery voltage less than 7 Vdc
- Battery voltage less than 5 Vdc
- Battery voltage less than 3 Vdc
- Battery voltage less than 1 Vdc
- Battery voltage less than 0 Vdc

"I" part of charging characteristics

"U" part of charging characteristics

Time
TECHNICAL DATA

Input data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input voltage</td>
<td>230 Vac (175 — 255 V)</td>
</tr>
<tr>
<td>Frequency</td>
<td>50 Hz (47 — 63 Hz)</td>
</tr>
<tr>
<td>Inrush current according to EN61000-3-2</td>
<td></td>
</tr>
<tr>
<td>Power factor</td>
<td>≥ 0.98</td>
</tr>
</tbody>
</table>

Rectifier IM800

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output voltage (nominal)</td>
<td>110 Vdc</td>
</tr>
<tr>
<td>Output power (nominal)</td>
<td>800 W nominal (7.5 A/110 Vdc)</td>
</tr>
<tr>
<td>Output current limit</td>
<td>7.5 Acdc</td>
</tr>
<tr>
<td>Output dynamic response</td>
<td>1.5%</td>
</tr>
<tr>
<td>Output load line stability</td>
<td>±1%</td>
</tr>
<tr>
<td>Output voltage noise</td>
<td>≤ 50 mVeff, ≤ 100 mVp-p</td>
</tr>
<tr>
<td>Efficiency</td>
<td>η &gt; 87%</td>
</tr>
</tbody>
</table>

System data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output voltage (nominal)</td>
<td>110 Vdc, nominal</td>
</tr>
<tr>
<td>Max. Output voltage (adjustable using BCU)</td>
<td>116 - 128 Vdc</td>
</tr>
<tr>
<td>Max. Load current (adjustable using BCU, n - number of rectifier modules)</td>
<td>n x 7.5 A</td>
</tr>
<tr>
<td>Charging current</td>
<td>0.1C standard</td>
</tr>
<tr>
<td></td>
<td>adjustable: 2—16 A</td>
</tr>
<tr>
<td>Temperature compensation</td>
<td>4 mV/C°/cell (standard), adjustable: 1—5mV/C°/cell</td>
</tr>
</tbody>
</table>

Output specifications under absence of main ac supply

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output voltage</td>
<td>90 — 120 Vdc</td>
</tr>
<tr>
<td>Low voltage battery disconnect (LVD), adjustable, optionally</td>
<td>88 — 96 Vdc</td>
</tr>
<tr>
<td>Battery turn-on threshold, adjustable</td>
<td>98 — 104 Vdc</td>
</tr>
</tbody>
</table>

DC (load) distribution

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>DCD2</td>
<td>2 terminal connectors, up to 30 A fuse (ceramic, 6.3x32 mm)</td>
</tr>
</tbody>
</table>

F - remote alarms interface (DB9 connector)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interface</td>
<td>RS232</td>
</tr>
<tr>
<td>Number of signals (alarms)</td>
<td>8</td>
</tr>
<tr>
<td>Isolation</td>
<td>optoisolation</td>
</tr>
</tbody>
</table>

Designed for Batteries with capacity 110 V/24 – 200 Ah

Designed and tested according to

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety standard</td>
<td>EN 60950 (UL1950)</td>
</tr>
<tr>
<td>EMC standard</td>
<td>EN 55022/CISPR22, class A</td>
</tr>
</tbody>
</table>

Environmental

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient operating temperature</td>
<td>0 to +50°C</td>
</tr>
</tbody>
</table>

Dimensions (L x W x H)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rectifier (IM800)</td>
<td>150 x 105 x 200 mm</td>
</tr>
<tr>
<td>ETSI rack with fan unit</td>
<td>195 x 533 x 220 mm</td>
</tr>
<tr>
<td>ETSI cabinet</td>
<td>1000/1200 x 600 x 450 mm</td>
</tr>
</tbody>
</table>

SN12/110 with extra battery charging, additional devices and system for remote monitoring and control (DNU24) in one cabinet (1000 mm)
NN301/48 Vdc
Small DC Power Supply System

- Compact uninterruptible dc power supply system - in one enclosure:
  - Rectifier 230 Vac/48 Vdc, up to 175 W
  - Battery Charger 220 Vac/40,5 — 56 Vdc, up to 125W
  - Batteries 48 Vdc/12 Ah/17 Ah/24 Ah
  - Low Voltage Disconnect block

- Optimal Charging of Batteries
- Each system is completely wired, charged and ready to go
Applications

DC power supply system NN301 is designed for:

- Applications in which electronic equipment need to have reliable and permanent DC power supply regardless on main supply failure
- Equipment to be used in telecom, datacom, and network applications
- Equipment to be used in security and monitoring applications

Typical Applications

- Fiber Optic Networks
- Data communications
- PABX/ISDN
- Industrial
- Customer premises

System overview

NN301 contains:

- Rectifier/Charger N301:
  - Rectifier - DC/DC converter (MN175) providing DC output power to load
  - Charger – DC/DC converter (MP125) providing battery charging:
    - Battery charging is independent of rectifier and move according to optimal charging characteristics given by battery manufacturer
    - It works like current/voltage source (IU characteristics)

- System of semiconductor switches providing uninterruptible DC output power to load:
  - Connecting load and batteries when ac power is loss (rectifier off)
  - Assuring permanent power to load

- Control block:
  - Controlling system of semiconductor switches mentioned above
  - Detection of system failures – overload detection, loss of AC detection, battery damage

- Battery set (up to 24 Ah)
- Enclosure
- N301 can be used separately

Batteries charging process

NN301 Block diagram
**Protections**

Protections include:
- Overload (current limit) and short circuit protection - both rectifier and charger
- Over Voltage Protection (OVP) - both rectifier and charger
- Electronic Low Voltage Disconnect (LVD) - Disconnect the battery to the load when the battery drops below 40.5 V
- Output fuse, one 5 A in-line with system negative output,

**Batteries and charging**

Inside NN301 are stored set of four sealed lead-acid batteries, standard dimensions, with maximum 24 Ah capacity. These kinds of batteries do not need special maintenance. Optimal charging process increasing working life (5 to 12 years) and protect from determination. Automatic temperature compensation is accomplished using temperature sensor on batteries. Charging process has next stages:
- Soft start, charging with constant current, Imax (charger working like current source)
- Charging in two-stage voltage mode:
  - Boost mode - after reaching Vblk voltage, constant voltage of that value is maintained
  - Float mode - after charging current fall under Imin value, voltage become Vfloat (keeping that value), batteries are fully charged

**System Monitoring**

With LED indicators user can monitoring status of correct NN301 functioning:
- Red neon light on main switch – presence of ac voltage
- Green LED OUT – power to load from rectifier (ac lines)
- Green LED BATT – power to load from batteries
- Green LED1 – charging of batteries in Current/Boost Voltage mode
- Yellow LED2 – charging of batteries in float mode
- Red LED3 – failure of batteries or decreasing of battery capacity

Remote alarms - optoisolated interface:
- Failure (loss or incorrect) main supply voltage
- Output power from batteries (rectifier do not work)
- Battery low level (remain battery capacity low)
- Non-correct charging of battery (failure of charger or batteries)
**TECHNICAL DATA**

**Input data:**
- AC Input Voltage: 230 V±10% / –15%
- AC Frequency: 50 Hz ±5%

**Output data (MN175):**
- Output voltage (main ac supply present): 48 Vdc, nominal, adjustable: 48 – 49.5 Vdc
- Output power: 175 W nominal, (3.7 A/48.6 V)
- Output current limit: 4 A, nominal, adjustable: 4.2 – 1.8 A
- Output dynamic response (change load 20% to 100%): ±1.5%
- Output load line response: ±1%
- Output voltage ripple and noise: ±50 mVmax
- Psomometric noise: $U_{\text{eff}} \leq 1 \text{ mV}$
- Efficiency: $\eta > 80\%$

**Output data (MP125):**
- Output battery voltage: 54 Vdc, nominal

**Output data under failure of main ac supply:**
- Output voltage: 40.5 – 56 Vdc
- Low voltage battery disconnect (LVD) threshold adjustable: 40 – 44 Vdc
- Threshold of battery connect: 45 – 47 Vdc

**Standard battery delivered within NN301:**
- NP24-12, 12V/24Ah, Yuasa, 4 pcs. in set
- Battery recharge time: 10h (±1h)

**Remote alarms interface (DB9 connector):**
- Number of signals (alarms): 4
- Isolation: optoisolation
- Output voltage: 5 – 10 V

**Designed and tested according to:**
- Safety standard: EN60950 (UL1950)
- EMC standard: EN55022/CISPR22, class A
- Environmental:
  - Ambient operating temperature: +5°C to +50°C
- Dimensions:
  - Physical Size (WxLxH): 415 x 250 x 301 mm
  - Weight: 50 kg (with batteries)
DC UPS
Uninterruptible Power Supply with DC Output Voltage 300 Vdc

- 300/400/600/800 W power uninterruptible power supply
- Provide uninterruptible working of computer and telecommunication equipment supplying from line ac voltage
- DC UPS is applicable in systems which already have equipment supplying from uninterruptible 24/36/48/110 V dc voltage sources
- Protection of batteries from under voltage
- Protection of devices from ac line disturbances and low line voltages
Applications

DC UPS provides uninterruptible working of computer and telecommunication equipment normally supplying from 230 Vac line voltage, 300/400/600/800 W power.

Modern equipment, on their input, have rectification of line voltage, without line transformer. From the line voltage rectifier generates about 300 Vdc, which means that such devices could be supply with 300 Vdc (approximately) instead 230 Vac line voltage.

DC UPS use this possibility. On its output, when line voltage exists, DC UPS generates dc voltage (about 300 Vdc), made by rectification of 230 Vac line voltage. When line voltage is not present, dc output voltage is generated by converting reserve 48 Vdc input voltage (batteries). Reserve 48 Vdc is available in systems, which have uninterruptible dc power supply (for example, telecommunication companies, railroad companies, power distribution companies, etc.).

DC UPS-400 with built in charger (4.5 A/48 V) is marked DC UPS-400/P.

Switching from ac line supplying to reserve battery supplying and vice-versa, is going without time period of output voltage interrupt (that happens with classic off-line UPSs - at output of classic AC UPS exist interrupt in energy supply in period 5-15 ms, because of adding ac voltages, which are not synchronous). That can be accomplished because, on output of DC UPS, dc voltage generated from rectified ac line voltage and dc voltage generated from dc/dc converter are connected in parallel; their sum is output DC UPS voltage.

Signalization

LED1 • Batteries are low and disconnected (Vbat < 44 Vdc)
LED2 • Batteries are low (Vbat < 46 Vdc)
LED3 • Line ac voltage is incorrect (not exist or the line is to low), load supplying come from batteries energy
LED4 • Line is correct, load supplying come from line energy

TECHNICAL DATA

<table>
<thead>
<tr>
<th>Input voltage</th>
<th>230 Vac (205 — 252 V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line voltage frequency</td>
<td>48 — 64 Hz</td>
</tr>
<tr>
<td>Input dc voltage (batteries)</td>
<td>48 Vdc</td>
</tr>
<tr>
<td>Optional</td>
<td>24/36/110/220 Vdc</td>
</tr>
<tr>
<td>Output dc voltage</td>
<td>310 — 340 Vdc</td>
</tr>
<tr>
<td>working “on” line voltage</td>
<td>300 Vdc</td>
</tr>
<tr>
<td>working “on” batteries</td>
<td></td>
</tr>
<tr>
<td>Load power</td>
<td>300/400/600/800 Wmax</td>
</tr>
<tr>
<td>Switch time from working on line to working on batteries</td>
<td>0 ms</td>
</tr>
<tr>
<td>Protection of batteries from overdischarge</td>
<td>&lt;44 Vdc</td>
</tr>
<tr>
<td>Batteries charging time (48 V/38 Ah) DC UPS-400/P</td>
<td>&lt;10 h</td>
</tr>
</tbody>
</table>

Number of output connections

| DC UPS-300 | 4 |
| DC UPS-400 | 5 |
| DC UPS-600/800 | 3 |

EMC standard Class B
Safety standard EN 60950

Dimension (H x W x L)

| DC UPS-300 | 57 x 237 x 335 mm |
| DC UPS-400/600/800 | 88 x 258 x 423 mm |

Weight

| DC UPS-300 | 2 kg |
| DC UPS-400/600/800 | 5 kg |
SF25
Phase Selector

- SF25 - additional level of security in the overall power supply system
- Monitoring the voltage of each phase from the three-phase mains connection
- Supplying one-phase user by choosing priority phase (Vac>180Vac) from a three-phase main connection
- Maximum load current 25A
- Voltage and time hysteresis during restore of the correct phase
Applications
Phase Selector is a device whose input is three-phase voltage and one phase is forwarded to the output. Neutral is directly forwarded to the output.

- SF25 continuously monitors all present phases present and based on the fact the phases are correct or not and their mutual priorities, determine which phase will be forwarded to the user (output).
- Line is correct if the phase voltage is greater than the minimum. In this way, phase selector plays the role of an additional level of security throughout the whole power supply system.
- With disappearance of one or two phases, user did not stay without main power supply

Basic functions

- The user is connected to one phase only. The control electronics determines which phase form the input will be forwarded to the output. Selector switches off the active phase when registering their disappearance or too low voltage. After that connects the load to the next correct phase, in accordance with the priority of the phase that is determined in advance.
- Switching is performed by relays. The time between fault phase detection, the incorrect phase switch-off and move to the next correct phase, is about 100 msec.
- For each phase there is a voltage and time hysteresis.
- Voltage hysteresis means that, when the phase come on again, after disappearance, voltage must be greater than the upper threshold of hysteresis (eg. 200 Vac), to forward this phase to user again. During the work, phase voltage must be greater than the lower hysteresis threshold (eg. 170 Vac), to consider the phase is correct.

- Time hysteresis means that, after the detection of phase failure, during the one period of time (about 7-8 seconds), return of the same phase to user is stopped (although it is correct and have a greater priority than the current active phase). In this way, it overcomes the problem of instability of the main power network during disappearance of one of the phases.
- Local monitoring of the SF25 functioning and situation with phases can be done via leds.
- SF25 can be delivered to customer already wired

SF25 Block diagram

Technical Data

<table>
<thead>
<tr>
<th>Input</th>
<th>230 Vac nom.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>50 Hz nom.</td>
</tr>
<tr>
<td>Input current per phase</td>
<td>25 Aac max</td>
</tr>
</tbody>
</table>

Phase selector operating parameters

<table>
<thead>
<tr>
<th>Time hysteresis</th>
<th>5 sec min.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hysteresis voltage</td>
<td>40 V min.</td>
</tr>
<tr>
<td>Phase switch-off (for European standard)</td>
<td>180 Vac nom.</td>
</tr>
<tr>
<td>Fixed Adjustable</td>
<td>165 – 210 Vac</td>
</tr>
</tbody>
</table>

Input/output terminal connections

<table>
<thead>
<tr>
<th>Terminals, for cable cross-section (min)</th>
<th>6 mm²</th>
</tr>
</thead>
</table>

Local LED signalization

<table>
<thead>
<tr>
<th>Control electronics</th>
<th>green LED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correct phase</td>
<td>green LED (one per phase)</td>
</tr>
</tbody>
</table>

Designed and tested according to

Safety standard EN60950 (UL1950)

Environmental

<table>
<thead>
<tr>
<th>Ambient operating temperature</th>
<th>− 25°C to +50°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air circulation</td>
<td>Natural</td>
</tr>
</tbody>
</table>

Dimensions

<table>
<thead>
<tr>
<th>Plastic box (WxDxH)</th>
<th>200 x 155 x 80 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enclosure protection</td>
<td>IP55, IP56</td>
</tr>
</tbody>
</table>
Manufacturing and Assembly of Electronic Devices

**SMT ASSEMBLY**
- Continuous flow SMT line
- Components QFP, QFN, CSP, 0201 to 55mm, fine pitch ≥0.4 mm
- BGA, μBGA ≥0.5 mm
- RoHS & non-RoHS Services
- PTH, SMT & mixed technology, Hi-Tech assembly
- Top and bottom placement with Single & double-sided assembly
- Selective soldering of TH components
- No-Clean flux process and closed loop aqueous cleaning system
- Repair and rework including BGA & QFP
- Automated Optical Inspection

- Complete electronic & mechanical design
- PCB design service
- Electronic and electromechanical assemblies
- Wire/cable assembly
- Functional testing
- Temperature cycling
- Burn-in test
- Two surface mount manufacturing lines
- Line for manufacturing prototype
Manufacturing possibilities

- Automatic continuous flow SMT line with 70,000 chp/h capacity:
  - Dual vision screen printer
  - Two SMD automatic pick & place machines
  - Reflow soldering processes - 7 and 9 temperature zones
  - Automatic optical inspection
  - Automation

- Other manufacturing equipment:
  - Automatic wave soldering, two waves
  - Selective soldering of TH components
  - DI water cleaning, 4 chambres
  - Alcohol solvent cleaning
  - Four clima chambres
  - Assembled PCB rework system

- Prototype and low volume manufacturing line:
  - Semi-automatic screen printer
  - Automatic pick and place components (SMD)
  - Reflow soldering process with 4 temperature zones
Quality Assurance

- Reliability prediction of component parts, equipment and systems
- Reliability testing of component parts, equipment and systems
- Burn-in testing of component parts, equipment and systems
- Environmental testing of component parts, equipment and systems
- Attesting of component parts, equipment and systems
Quality Assurance

Permanently quality improvement of our existing products and service, and quality assurance of new products represent one of our basis business policy (politics).


Testing determines conformity of product characteristics to standards, technical regulations and specifications: Serbian standards (SRPS), international standards (ISO, IEC, CEE) and military standards (SNO, MIL).

Environmental Testing

In our environmental testing laboratory we simulate the environmental conditions to which various products are exposed.

We simulate the conditions to which electrical devices are exposed during both, transportation and operation.

We simulate extreme temperature and humidity in various combinations.

Climatic exposures:
- Cooling up to –80°C
- Heating up to +100°C
- Humidification study state and cyclic, from +10°C to +90°C, and 10% to 98% relative humidity
- Salt mist testing

Mechanical resistance:
- Test samples can be exposed to diverse mechanical impacts on all three axes:
  - Sinusoidal vibrations at constant frequency
  - Sinusoidal vibrations at changing frequencies (frequency range from 5 Hz to 2000 Hz with accelerations up to 50 g)
  - Bump testing with accelerations up to 40 g

IP testing:

IP testing helps us to confirm the level of protection against access to dangerous parts, ingress of solid foreign objects (major objects, testing finger, thorn, wire, dust), and ingress of water.