Complete solutions for networking

# ToPGATE

Version 6XX

Optical multiplexers

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**Terminology**

| | |
|---|---|
| E1 stream | – a data channel having an interface in accordance with ITU-T G. 703 standard for data transmission with a nominal bit rate of 2048 kbit/s, both with a cyclic organization in accordance with the ITU-T G. 704 standard (or PCM-30), and without a cyclic organization. |
| E1 interface | – equipment interface in accordance with ITU-T G. 703 standard. |
| Ethernet channel | – a data channel having switchable or auto-detected interface of 10BASE-T, 100BASE-TX or 1000BASE-T for connection to LAN in accordance with IEEE 802.3 standard. |
| Ethernet interface | – hardware interface according to IEEE 802.3 standard. |
| Fiber optic Ethernet interface | – equipment interface for data transmission via fiber optic cable in accordance with IEEE 802.3 standard. |
| Aggregate interface | – Ethernet interface designed to transfer E1 data and user data from one multiplexer to another. |
| Subscriber interface | – Ethernet interface designed to connect Ethernet subscriber networks and to connect the control computer. |
| Led indicators | – signal green, yellow and red LEDs designed to indicate the status of the interfaces. |
| Straight cable | – a cable in which the connector pins at one end are connected to the same-name connector pins at the other end. |
| Crossover cable | – a cable in which the connector pins intended for transmission at one end are connected to the connector pins intended for reception at the other end. |
| Control computer | – a personal computer designed to monitor and control the multiplexer. |

# 1 Design and operation

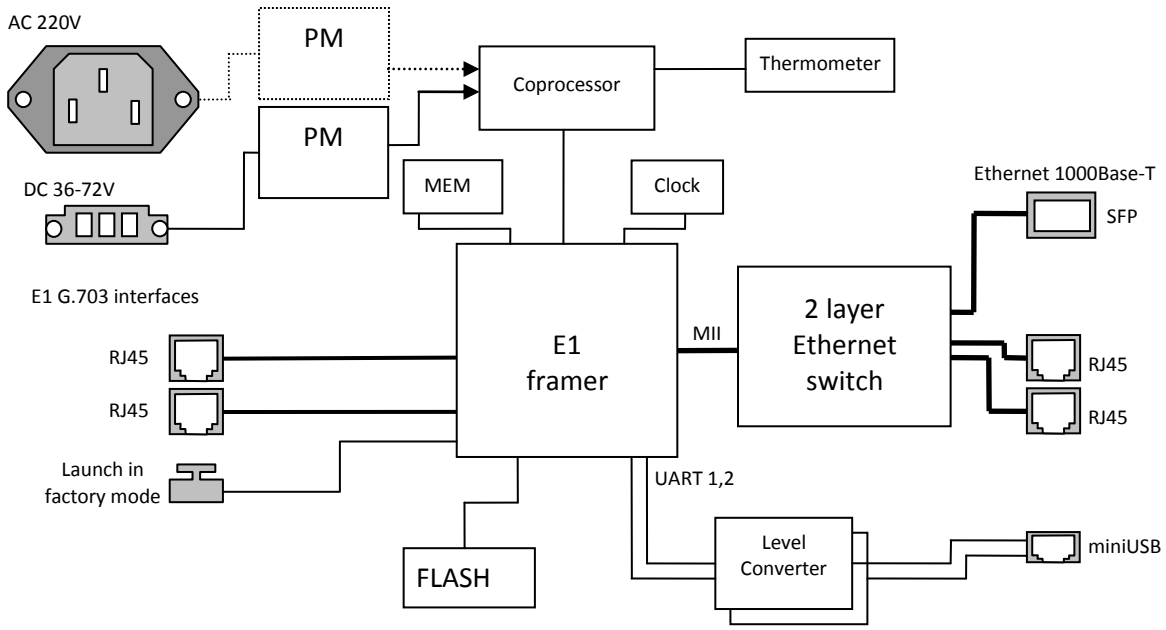
This Chapter introduces the topgate multiplexer (hybrid multiplexer) and describes its main features and algorithms.

## 1.1 ToPGATE series multiplexers' hardware

ToPGATE series multiplexer is a sophisticated microprocessor-based device , consisting of the following main nodes: E1 framer, which includes the Central processor (CPU), 2 layer Ethernet switch and coprocessor of measurements.

The nodes mentioned above operate under the control of the Central processor, the software of which performs the following basic functions:

- checking and configuration of all the nodes of the multiplexer at power up;
- loading firmware into E1 frame;
- packeting and transmission of E1 streams via Ethernet channel;
- control of input signal parameters and state of aggregate interfaces during multiplexer operation;
- recording to nonvolatile memory of data on all deviations from the norm of input signals and violations of the multiplexer performance;
- indication of multiplexer operation state and issuing of diagnostic data via telnet, SSH, HTTP, SNMP.




Key nodes of the ToPGATE series multiplexer.

Incoming E1 streams are received by the device's subscriber interfaces. The state of the interface (no signal, code errors, loss of frame structure) is continuously monitored by the E1 frame. The CPU splits the passed stream into packets of 128 to 1408 bytes, which contain from 4 to 44 G.704 frames (in case of a transfer of 32 time-slots) and from 4 to 252 G.704 frames in case of less than 32 time-slots transmission. These packets are provided with priority marks and headers according to one of the supported standards, and are routed to the packet switch. The packet switch, on the basis of the available information on the routes (and on the basis of the learning algorithm), taking into account the priority and VLAN tags, forwards packets that contain information on E1 stream to a transmission line together with user packets received through the subscriber packet interfaces.

The counter multiplexer receives the packets addressed to it, performs control of the received data, if necessary, requesting repetition of lost packets, and sends user packets to the subscriber Ethernet interfaces, and packets with streaming data to the output queue of the flow processor.

The multiplexer operates under the built-in operating system LP OS. Operating system code and multiplexer settings are stored in flash memory chips organized into a file system.

A multiplexer software update may be performed:

- using console commands via "terminal" connection or via telnet, ssh protocols, after copying the update files to the device via FTP;

- using Web-interface via HTTP;

For protection against unauthorized access, the password is requested, and verification of management station IP address is performed.

### 1.1.1 E1 streams

E1 stream (2048 Kbps) is a primary channel of the plesiochronous digital hierarchy (PDH). The basic characteristics of the physical layer are the encoding algorithm of the signal and pulse shape. In literature, as a rule, two coding algorithms are specified — AMI (Alternate Mark Inversion) and HDB3 (High Density Bipolar 3), in practice, in most cases, the latter is used. Violations of linear coding cause so-called code errors, but this parameter is secondary. Code error does not always lead to a bit error, namely the bit error rate (bit error rate — BER) is the most important characteristic of digital transmission systems.

The structure of the E1 stream is determined at the channel level. As you know, this stream is formed by temporarily multiplexing of 32 channels of 64 Kbit/s. The so-called cycle (frame) E1 is formed from 32 eight-bit time slots, numbered from 0 to 31. Zero time slot is used for service purposes: the transmission of FAS (Frame Alignment Signal) or NFAS signal (Not contain Frame Alignment Signal), error messages and alarms. If at the same time all other time slots are allocated for user information, then this stream structure is called cyclic (FAS) or PCM31. The PCM-31 systems are used for data transmission and in some ISDN applications.

If, in addition to the zero time slot, the 16th time slot is assigned to service purposes – it transmits signals of the in-channel telephone signaling (A, B, C, D) and MFAS — MultiFrame Alignment Signals, then this structure is called superframe (MFAS) or PCM-30. The 16 cycles make up the supercycle, during which the signaling for all 30 conversation channels is transmitted. PCM-30 systems are used in classical telephone networks.

In addition to the PCM-30 and PCM-31, there is another type of E1 stream, which is characterized by the absence of any structure at all, i.e. division into channels. Unstructured E1 stream is usually used in data networks.

**E1 transmission protocol**

Topgate series multiplexers are capable to transmit from one to twenty-four E1 streams over packet data networks (e.g. IP networks or Ethernet). The transmission process is transparent to all protocols and signaling systems and thus compatible with all existing equipment using E1 interfaces.

The technology of E1 streams transmission through a packet Ethernet or IP environment is based on the principle of splitting the bit stream into equal fragments and transferring each of them through a packet environment in the form of a separate packet, equipped with a corresponding header. As you know, the basic “brick” of TDM networks — a E1 stream is formed by temporary multiplexing of 32 channels 64 Kbit/s. At the same time, the so-called frame E1 consists of 32 time slots (bytes), two of which are usually used for service purposes: one for synchronization, the other for signaling. Thus, the natural portion of the E1 bitstream is a frame or a group of frames. At first glance, it may seem that for a reliable, connection-oriented service, you should use the TCP transport Protocol. However, the TCP-implemented guaranteed packet delivery is extremely redundant, and the retransmission mechanism used in the Protocol is not designed for real-time applications.

A transport layer Protocol based on the transmission of datagrams without receipts is more appropriate, and it is optionally possible to use a data retransmission mechanism based on an explicit transmission request. In this case, the share of service information (redundancy) is much smaller: Ethernet header (14-18 bytes), optional UDP and IP header (8+20 bytes), TDMoP header (14 bytes) and FCS header (4 bytes). Total — 60 bytes when using IP/UDP protocols and 32 bytes without using these protocols (+4 bytes when using VLAN tag). Already at 256-byte payload, it is quite acceptable. This merging of frames will not result in any significant increase in delay, as each frame lasts only 125 µs. Even the use of a group of eight frames, will bring an additional delay of only 1 ms, which is far less than 15 ms delay of 8 Kbit/s codec, used in IP-telephony systems.

Whatever the details of the implementation of the digital stream packet transmission system, it is important to note that they provide transparent forwarding of TDM frames without changing either the time slots or the signaling channels or the transmitted information. Therefore, they can be used to transport the traffic of any E1 services, even if some of the channels are busy with data or an E1 stream has no structure at all (i.e., it is an unstructured bit stream). The technology is also applicable for the Fractional E1 service, in this case, to reduce the amount of traffic, special information bytes are included in the IP packet.

Consider the use of each of the three types of signaling: in-band, channel-associated signaling (CAS) and common-channel signaling (CCS). When in-band signaling is used, service information is transmitted over the conversation channel in the same frequency range as the speech itself. Service messages are simply tone signals (such as DTMF or MFCR2 codes) and therefore are transparently sent by E1oIP systems along with speech. CAS signaling messages are sent in the same E1 frame as the speech itself (a 16th time slot is specially allocated for them), but not in the speech frequency range. E1oIP systems pass them absolutely transparently. The most well-known representative of the common-channel signaling systems is the system SS No.7 (SS7) or QSIG, which uses 64-Kbit/s channels for data transmission. The latter are often channels (time slots) inside E1 streams. In this case, the signaling messages also follow through the E1oIP devices without problems.

To ensure the quality (and sometimes the possibility) of E1 traffic transmission, it is necessary to maintain the proper level of synchronization. The packets transmitted over Ethernet networks (and especially IP networks) experience a certain delay, and its value can vary greatly. To emulate the operation of the TDM network in an IP network, it is necessary to reduce the delay variation to a certain level that provides high-quality telephone communication. This problem is solved by the receiving multiplexer of the ToPGATE series using a smoothing buffer and a special algorithm for restoring the transmission frequency of E1 stream.

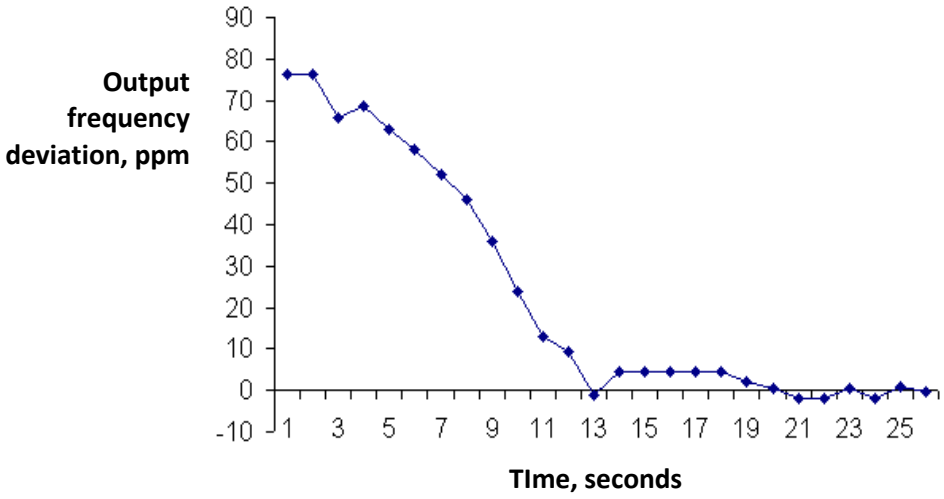
**Synchronization**

To ensure the transparency of the E1 stream transmission through the packet environment, where the delay time (the time required to transfer the packet from the point of departure to the destination) for each data packet can vary widely, it is necessary to smooth the variations in delays and maintain a constant frequency of data transmission, exactly corresponding to the receiving frequency.

The transmission algorithm is as follows:

Incoming E1 streams are received by the device's subscriber interfaces. The received stream is divided into packets of 128 to 1408 bytes lenght, which contain from 4 to 44 frames G. 704 (if transferring 32 time-slots) and from 4 to 252 G. 704 frames (if transferring less than 32 time-slots). These packets are provided with headers in accordance with one of the supported standards and priority tags, and at regular intervals, due to the constant frequency of the received stream, they are sent to the aggregate interface and to the transmission line. The algorithms of packet switches ensure priority transmission of packets containing streaming data. The opposite device receives the packets addressed to it, and after the integrity control sends the user packets to the buffer of the subscriber interface. Based on the information about the degree of buffer filling, the frequency of the output stream is set. The output frequency adjustment procedure is performed 20 times per second, which allows you to restore the original frequency with high accuracy. Within a few seconds after switching on the device, the output stream rate adjusts to the input

stream rate and remains exactly equal to it during the entire operating time of the device. The instantaneous deviations of data rate does not exceed 1-2 ppm.




The process of adjusting and synchronizing the E1 output stream at the first turning on the device.

**Setting E1**

To configure E1, you should set the connection and transmission parameters. The connection parameters include the address of the remote multiplexer and the port number on it, as well as the basic parameters of data packets carrying the E1 stream such as packet size, VLAN tags and prioritization, pause compression mode. I.e., to establish a connection between the specified E1 interfaces on the local multiplexer and the remote, you must specify: the E1 interface number on the local multiplexer, the IP address of the remote multiplexer and the E1 interface number on the remote multiplexer. This can only be done by an administrator and must be configured at both ends of the virtual connection.

It is possible to establish a connection from only one end. This is possible when the remote device has the interface you want to connect to set to Listen mode.

The following options are available:

Transfer options:

- ***VLANID***

The VLAN number. You must select a VLAN so that packets can pass through from one device to another. There are options from 0 to 4095, 0 means no VLAN tag.

- ***VLANPri***

The embedded switch of multiplexer requires a priority of 6 or 7 to ensure absolute priority. However, any priority can be used if additional hardware prioritization capabilities are used. In this case, the multiplexer marks only E1 packets, and the additional switches are responsible for giving priority according to the VLAN information. It is necessary that E1 traffic have the highest priority on the local Ethernet network.

- ***Compression***

Enable/disable compression. Compression is performed without loss. If compression is enabled, the unused timeslots in the channel are not transmitted, therefore the size of the transmitted packets and, consequently, the amount of data transferred are reduced.

- ***KeyFrameInterval***

The interval between packets transmission with all time slots in case of enabled compression (i.e. the interval between transfers of control (constant) values).

It can take values from 0 to 65535 frames.

The default value is 16 frames, i.e. a packet with all time slots will be sent every 16 frames.

- ***DSCP***

The code of Differenciated Service is a value encoded in the DS field. Each DS node must use this value to select a per-hop behavior (PHB), to decide on the classification of each forwarded packet, traffic conditioning features such as measurements, marking, processing and control. The differentiated service (DS) field occupies the 6 highest bits of the (former) IPv4 TOS octet and the (former) IPv6 Traffic Class octet;

The following differentiated service code values are possible:
***default*** – provide forwarding if possible (RFC 2474)
***cs[1..7]*** – the Class Selector Codepoint (RFC 2474)Table 1.1 – matches with ToS values.
***af[1..4][1..3]*** – Assured Forwarding (RFC 2597, RFC 3260). Table1.2 - matches with ToS values.
***ef*** – Expedited Forwarding (RFC 3246)

Table 1.1 – Class Selector Codepoint

| DSCP | | ToS | | |
|---|---|---|---|---|
| **Class Selector Codepoint** | **Value (dec)** | **Precendence (0-2 bits of ToS)** | **Value (dec)** | **Value (hex)** |
| cs1 | 8 | 1 | 32 | 20 |
| cs2 | 16 | 2 | 64 | 40 |
| cs3 | 24 | 3 | 96 | 60 |
| cs4 | 32 | 4 | 128 | 80 |
| cs5 | 40 | 5 | 160 | A0 |
| cs6 | 48 | 6 | 192 | C0 |
| cs7 | 56 | 7 | 224 | E0 |

Table1.2 – Assured Forwarding

| | **Class 1 (the lowest)** | **Class 2** | **Class 3** | **Class 4 (the highest)** |
|---|---|---|---|---|
| Low packet drop priority | AF11 (001010)<br>DSCP 10<br>ToS 40 | AF21 (010010)<br>DSCP 18<br>ToS 72 | AF31 (011010)<br>DSCP 26<br>ToS 104 | AF41 (100010)<br>DSCP 34<br>ToS 136 |
| Average packet drop priority | AF12 (001100)<br>DSCP 12<br>ToS 48 | AF22 (010100)<br>DSCP 20<br>ToS 80 | AF32 (011100)<br>DSCP 28<br>ToS 112 | AF42 (100100)<br>DSCP 36<br>ToS 144 |
| The highest packet drop priority | AF13 (001110)<br>DSCP 14<br>ToS 56 | AF23 (010110)<br>DSCP 22<br>ToS 88 | AF33 (011110)<br>DSCP 30<br>ToS 120 | AF43 (100110)<br>DSCP 38<br>ToS 152 |

When you change the value of the DSCP parameter and save the configuration, the DSCP code value and ToS value are recoreded to the configuration file system.cfg, for example:

```
#TDMoP{
 #0{
  #config{
   Set ToS=32;
   Set DSCP=cs1;
  }
 }
}
```

- ***FrameSize***

Sets the frame size to ½ ms. Possible values: from 1 to 63. The default value is 2. Keep in mind that the larger the packet, the lower the overhead of header transfer. The greater the delay on packeting. The greater the loss of bits when a single packet is lost.

Reception parameters:

- ***JBSize***

Setting the output queue size, in milliseconds.

It should be more than a fluctuation of transit time in the network. For example, if the transit time for a hundred packets varies from 2.5 to 6.5 ms, the buffer must be at least 4 ms so that no packet is lost. It is better if the buffer is even larger so that the mechanism of re-request of lost packets can work. In all cases where the delay time variance is greater than one millisecond, the buffer size is a trade-off between the delay and the number of packets lost. Possible values: from 1 ms to 2000 ms per port, but no more than 4000 ms per device (starting from 9.4SR26).

Note that the maximum number of Ethernet frames in the jitter buffer is limited to 512, i.e. the condition JBSize/FrameSize < 256 (starting from 9.4SR28) must be met.

- ***MaxTimeout***

The maximum extrapolation time (repetition of the last received packet in case of temporary termination of the input packet flow, for example, when switching Ethernet link to a backup one in case of an accident) of the output stream E1. The value range is from 0 to 7000 ms.

- ***SyncSource***

Specifies the E1 stream synchronization source, the number of the E1 interface will choose the incoming stream on the specified interface as a source of synchronization; -1 (by default) frequency recovery mode.

Slip parameters:

- ***SlipLeft, % and SlipRight, %***

The minimum value of the jitter buffer as a percentage of its size (left and right borders). It is used to track slippage (i.e. either overrun or underrun of the jitter buffer) while the external synchriniztion.

#### 1.1.1.1 Setting up E1 streams transmission via the menu

To do this, go to the submenu «/TDMoP/port/config submenu». It is used to establish a virtual connection between the specified E1 interfaces on the local multiplexer and the remote one defined by its IP address.

The configuration can only be performed by an administrator and must be performed appropriately on both ends of the virtual connection.

When the settings are reset (default settings) the menu item looks as follows:

```
/TDMoP/0/config LPOS                              Advanced  ESC+h - Help
|>..                                  | Description
| --Status--                          | JBSize             4
| StrStatus          Power Down       | LocalTS            0-31
| SIPStatus          WaitingInvite    | RemoteTS           0-31
| LinkStatus         Down             | Loop               No
| CurrentJB          0                | SpeedReg           PID
| Speed              0                | Compression        Disabled
| --NetConfig--                       | KeyFrameInterval   16
| AdminStatus        Listen           | DoubleSend         -1
| RemoteIP           0.0.0.0          | LostRequest        Enabled
| RemoteChannel      0                | ConstSpeed         No
| FrameSize          2                | ConstSpeedValue    0
| VLANID             32               | Slip               Disabled
| VLANPri            6                | SlipLeft           75
| DSCP               default          | SlipRight          125
| MaxTimeout         4000             | --NATConfig--
| UseIP              Yes              | WANIP              0.0.0.0
| GatewayBypass      Disabled         | SIPPort            5060
```

```
| --Config--                          | TDMPort           41000
Filter: <Press any letter key to start filtering items>
```

The detailed description of the settings is below in the paragraph «/TDMoP/port/config submenu».

**Example:**

To create an E1 virtual channel between the first interfaces of two multiplexers: the first one with an IP address of *192.168.0.22* and the second one – *192.168.0.23*, you must properly configure the devices on both ends.

Device configuration with IP address *192.168.0.22*:

```
/TDMoP/1/config LPOS_22                                Advanced  ESC+h - Help
|>..                                  | Description
| --Status--                          | JBSize             4
| StrStatus          Working,PID Sync | LocalTS            0-31
| SIPStatus          Connected        | RemoteTS           0-31
| LinkStatus         Up               | Loop               No
| CurrentJB          3999             | SpeedReg           PID
| Speed              942              | Compression        Disabled
| --NetConfig--                       | KeyFrameInterval   16
| AdminStatus        Connect          | DoubleSend         -1
| RemoteIP           192.168.0.23     | LostRequest        Enabled
| RemoteChannel      1                | ConstSpeed         No
| FrameSize          2                | ConstSpeedValue    0
| VLANID             32               | Slip               Disabled
| VLANPri            6                | SlipLeft           75
| DSCP               default          | SlipRight          125
| MaxTimeout         4000             | --NATConfig--
| UseIP              Yes              | WANIP              0.0.0.0
| GatewayBypass      Disabled         | SIPPort            5060
| --Config--                          | TDMPort            41000
Filter: <Press any letter key to start filtering items>
```

Device configuration with IP address *192.168.0.22*:

```
/TDMoP/1/config LPOS_23                                Advanced  ESC+h - Help
|>..                                  | Description
| --Status--                          | JBSize             4
| StrStatus          Working,PID Sync | LocalTS            0-31
| SIPStatus          Connected        | RemoteTS           0-31
| LinkStatus         Up               | Loop               No
| CurrentJB          1572             | SpeedReg           PID
| Speed              4030             | Compression        Disabled
| --NetConfig--                       | KeyFrameInterval   16
| AdminStatus        Listen           | DoubleSend         -1
| RemoteIP           192.168.0.22     | LostRequest        Enabled
| RemoteChannel      1                | ConstSpeed         No
| FrameSize          2                | ConstSpeedValue    0
| VLANID             32               | Slip               Disabled
| VLANPri            6                | SlipLeft           75
| DSCP               default          | SlipRight          125
| MaxTimeout         4000             | --NATConfig--
| UseIP              Yes              | WANIP              0.0.0.0
| GatewayBypass      Disabled         | SIPPort            5060
| --Config--                          | TDMPort            41000
Filter: <Press any letter key to start filtering items>
```

#### 1.1.1.2 Setting up the transfer of unframed E1 streams

Then, you need to go to the menu on the way «**3.2.1.1/E1/port/config submenu**» and set the *Unframed* parameter to *Yes*. This action must be performed both from the local side and from the remote side (if the parameter AdminStatus = Listen on one of the devices, the Unframed parameter can be changed only on one device with AdminStatus = Connect). Accordingly, the stream from PBX should be unframed.

#### 1.1.1.3 Configuring compression for the transmission of E1 streams

If compression is enabled, the unused timeslots in the channel are not transmitted, therefore the size of the transmitted packets and, consequently, the amount of data transferred are reduced. Compression is performed without loss.

To enable compression, go to the menu by the path **«3.2.2.1/TDMoP/port/config submenu»** and set the *Compression* parameter to *Enabled*.

If compression is enabled, you can adjust the interval between packet transmissions with all time slots (*KeyFrameInterval*). It can take values from 0 to 65535 frames.

The default value is 16 frames, i.e. a packet with all time slots will be sent every 16 frames.

#### 1.1.1.4 Configuring E1 stream synchronization from an external source

To synchronize from an external source, in the «**3.2.1.1/E1/port/config submenu**» menu item, the *SyncSource* parameter must be set to the value of port from which the E1 stream will be synchronized on the current interface.

By default: -1 (frequency recovery mode)

If you enable synchronization from an external source, you need to enable the slip tracking mode (set the *Slip* parameter to *Enable* in the settings */TDMoP/port/config*).

Example:

In the */E1/0/config* menu item, the *SyncSource* parameter is set to 1.

The E1 stream of 0 interface will take synchronization from the E1 stream incoming to port 1.

#### 1.1.1.5 Configuring duplication of E1 frames

To enable duplication of TDMoP frames, go to the menu item «**/TDMoP/port/config submenu**» and configure *DoubleSend* parameter.

The value of the parameter specifies when to send a duplicated frame (after how many frames).

It can take values from -1 to 63 frames.

By default: -1 (duplication is disabled);

Example:

*DoubleSend* is set to 0;

The duplicate frame will be sent next;

Example:

*DoubleSend* has a value of 1;

The duplicated frame will be sent after 1 frame;

### 1.1.2 STP redundancy protocol (Spanning Tree Protocol)

Spanning Tree Protocol is a network protocol that runs on the second layer of the OSI model. The protocol is based on the algorithm of the same name, the developer of which is the "Mother of the Internet" — Radia Perlman).

The main task of STP is to bring an Ethernet network with multiple links to a tree topology that excludes packet cycles. It is performed by automatic blocking of unnecessary ports for full port connectivity. The Protocol is described in IEEE 802.1d standard.

The principle of STP operation:

- One root bridge is selected in the network
- Next, each non-root bridge calculates the shortest path to the root. The corresponding port is called the root port. Any non-root switch has only one root port!
- After that, the shortest path to the root port is calculated for each network segment. The bridge, over which this path passes, becomes designated to this network. The bridge port directly connected to the network is the designated port.
- Then, on all the bridges, all ports that are non-root and designated are blocked. The result is a tree structure (mathematical graph) with a vertex in the form of a root switch.

The algorithm of the STP:

- After plugging in the switches, by default, every (!) switch considers itself a root one.
- Then the switch starts sending Hello BPDU configuration packets every 2 seconds to all ports.
- Based on the data of Hello BPDU packets, a switch acquires the status of root.
- Then all ports except the root port and designated port are blocked.
- There is a sending of Hello-packets every 20 seconds or at disappearance/restoration of any link, for the purpose of an obstacle of emergence of loops in a network.

### 1.1.3 Rapid Spanning Tree Protocol (RSTP)

Rapid STP (RSTP) is characterized by significant improvements in STP, among which it is necessary to note a decrease in the convergence time and higher stability.

The principle of operation in general is similar to STP: the root switch, to which each of the switches involved in building the tree looks for the shortest route (based on bandwidth) through adjacent switches (or directly), is selected. Lines that are not in the route are put on hold and are not used for data transmission while the main lines are in operation. In case of failure of the main lines, the waiting lines are used to build an alternative topology, after which one of the lines becomes active, and the rest continue to be in standby mode.

#### 1.1.3.1 Root guard feature

Root guard feature provides opportunity to set a location of root bridge on the network. This ensures that the port on which root guard is enabled is the designated port. Typically, all root bridge ports are assigned if two or more root bridge ports are not connected together. If a bridge receives high-priority STP BPDU data items on the root port for which root guard is enabled, root guard puts the port into the STP state which is called root inconsistency. The root inconsistency state is similar to the listening state. Traffic is not forwarded through the port in this state. Thus, root guard specifies the location of the root bridge. Root guard must be enabled on all ports that should not become root.

#### 1.1.3.2 Configuring RSTP

RSTP mode should be enabled on each port separately (the mode is disabled by default).

In the menu tab «**3.2.3.12/Eth/port/config submenu**» the *Reservation* parameter must be set to *RSTP*.

```
/Eth/1/config LPOS                                  Advanced  ESC+h - Help
|>..
| Description
| Speed             Auto
| Duplex            Auto
| Link              Auto
| FlowControl       Disable
| Reservation       RSTP
| Learning          Enabled

Filter: <Press any letter key to start filtering items>
```

| | |
|---|---|
| | Sets the redundancy operation mode. |
| ***Reservation*** | ***No*** – no reservation (by default); |
| | ***RSTP*** – redundancy via RSTP. |

The menu tab «**3.2.4.5/System/RSTP/Interfaces/port submenu**» is used to configure and view RSTP parameters.

```
/System/RSTP LPOS                                   Advanced  ESC+h - Help
|>..
| global
| Interfaces

Filter: <Press any letter key to start filtering items>

LOG:02.08.16 09:30:32.307 : [rstp] Eth port [1] changed state to Block
```

In the *Interfaces* section you may view the roles of device ports, their statuses, the *Bridge ID* of the main device serving this network segment, the *Bridge ID* of the root device and also choose the port for more fine-tuning.

**Example 1:**

There are 2 devices to be connected to each other by two ports, these ports have RSTP enabled.

BridgeId of device 1: 8000-54a54b681130

BridgeId of device 2: 8000-5a003b190d9e

The device 1 will be the root device because it has a smaller *BridgeId*.

```
/System/RSTP/Interfaces LPOS                        Advanced  ESC+h - Help
|>..               Role        State       Bridge            Root
| 0                Designated  Forwarding  8000-54a54b681130 8000-54a54b681130
| 1                Designated  Forwarding  8000-54a54b681130 8000-54a54b681130

Filter: <Press any letter key to start filtering items>

LOG:02.08.16 09:34:02.527 : [console] Control session finished by admin from d
```

**Example 2:**

Set smaller *BridgePriority* to the device 2 so that *BridgeId* was less than *BridgeId* of device 1. Therefore, device 2 will be the root of the network.

```
/System/RSTP/Interfaces LPOS                        Advanced  ESC+h - Help
|>..               Role        State       Bridge            Root
| 0                Alternative Discarding  1000-5a003b190d9e 1000-5a003b190d9e
| 1                Root        Forwarding  1000-5a003b190d9e 1000-5a003b190d9e

Filter: <Press any letter key to start filtering items>
```

```
LOG:02.08.16 09:34:02.527 : [console] Control session finished by admin from d
```

More detailed, all the parameters of RSTP ports of the device is represented in «**3.2.4.5/System/RSTP/Interfaces/port submenu**», the RSTP parameters for the whole device are described in the paragraph «**3.2.4.6/System/RSTP/global submenu**».

### 1.1.4 IGMP (Internet Group Management Protocol) is a protocol for managing group (multicast) data transmission in networks based on the IP.

End users who want to receive multicast packets should be able to inform the nearest routers that they want to become a member of the multicast group and receive packets dedicated to that group. Internet Group Management Protocol (IGMP) is used to maintain membership in the multicast group. IGMP is also used to negotiate the operation of multiple multicast routers, which is performed by selecting one router as a "master". This router monitors the membership of multicast groups that have active members on the network. IGMP is used to determine whether the router should send received packets to the connected subnets or not. When the router accepts a multicast packet, it checks if there is at least one member of the multicast group that has made a request to receive the multicast packets. If so, the packet is forwarded. If no member of the multicast group exists, the packet is dropped.

**IGMP operations**

IGMP works locally. A multicast router that connects to a network has a list of multicast group addresses with at least one known member on that network.

For each group, there is one router that operates in the distribution mode of packets intended for that group. This means that if there are three multicast routers connected to the network, their group IDs (groupids) are the only ones.

The host or multicast router can have group membership. When a host has membership, it means that one of its processes (the application) receives multicast packets from a group. When a router has membership, it means that the network connected to one of its other interfaces receives these multicast packets. We say that the host or router have interest in the group. In both cases — the host and the router maintain a list of group IDs and forward their request to the distribution router.

**Merging groups**

The host or router can join the group. The host maintains a list of processes that have group membership. When a process wants to join a new group, it sends its request to the host. The host adds the process name and the name of the required group to its list. If this is the first occurrence for this particular group, the host sends a membership message. If this is not the first occurrence, you do not need to send this message because the host is already a member of the group; it is already receiving multicast traffic for this group.

The router also maintains a list of group IDs that shows membership for the networks connected to each interface. When a new interest in the group for any of these interfaces appears, the router sends a membership message. In other words, the router here acts like a host, but its group list is wider because it accumulates members that are connected to its interfaces. Note that the membership message is sent from all interfaces except the one from which the request comes.

#### 1.1.4.1 IGMP Snooping

When switch receives messages from some ports about connecting to some multicast group – a source multicast (IGMP Report), the switch “understands” that there are clients behind these ports and adds them to the list of downstream ports for this group. If an IGMP Query message came to a port of the switch, it means that the source of multicast traffic is behind this port , and the switch adds this port to the list of upstream ports.

Thus, the incoming multicast data stream will not be transmitted to all ports, but only to those in which clients subscribed to it.

#### 1.1.4.2 IGMP Snooping Proxy

IGMP Snooping Proxy is a mechanism which allows to reduce quantity of IGMP messages on a network. In the usual way, a router – a source of the multicast traffic – sends IGMP Query to an interface periodically, and the switch sends it to all active multicast clients. Those, in turn, should send an IGMP Report in response. To suppress such fan mailings, the switch can proxy IGMP packets by sending, for example, a single IGMP Report to the router immediately after the IGMP Query, instead of sending it to clients.

#### 1.1.4.3 MVR (Multicast VLAN Replication)

If there are multiple VLANs within the same switch whose users must receive the same multicast traffic, then multiple copies of the same traffic in different user VLANs will be transmitted from the multicast source router to the switch. MVR allows to avoid this: multicast traffic is transmitted from the router only in multicast VLANS, and on the switch it is replicated to all user VLANs. Thus, the load is removed from the upper router, and the line is utilized less.

### 1.1.5 SNMP (Simple Network Management Protocol)

SNMP is a communication network management protocol based on the TCP/IP architecture.

It is a technology designed to manage and control devices and applications in a communications network by exchanging management data between agents located on network devices and managers located on management stations. Nowadays, SNMP is the basic protocol of the Internet network management. SNMP defines a network as a collection of network management stations and network elements (host machines, gateways and routers, terminal servers) that together provide administrative communications between network management stations and network agents.

Typically, when using SNMP, there are managed and management systems. The managed system includes a component called an agent that sends reports to the management system. In essence, SNMP agents pass management information to management systems as variables (such as "free memory", "system name", "number of running processes").

The control system can obtain information through GET, GETNEXT, and GETBULK protocol operations. The agent can independently send data without a request using the TRAP or INFORM protocol operation. Management systems can also send configuration updates or monitoring requests using the SET operation for managing the system directly. Configuration and management operations are used only when network infrastructure needs changes. Monitoring operations are usually performed on a regular basis.

The variables accessible via SNMP are organized in hierarchies. These hierarchies and other metadata (such as variable type and description) are described by the Management Information Bases (MIBs).

#### 1.1.5.1 SNMP configuration

Topgate series multiplexer supports SNMP v1, v2c, v3.

You can enable or disable these protocols by setting the *Enabled* parameter to *Yes* in the appropriate menu item « **3.2.4.11/System/SNMP/v1 submenu**».

| | |
|---|---|
| ***Enabled*** | Enable/disable snmp.<br>***Yes*** – enabled (by default);<br>***No*** – disabled. |

Then, you need to set the snmp community names. To perform this, go to the menu item «**3.2.4.8/System/SNMP/auth submenu**».

| | |
|---|---|
| ***ReadCommunity*** | Configure the SNMP community name to read («public» by default). |
| ***WriteCommunity*** | Configure the SNMP community name to write («public» by default). |

To configure sending notifications (SNMP-traps) from the device (agent) to the manager, you need to specify in the «**3.2.4.9/System/SNMP/traps submenu**».

| | |
|---|---|
| ***ServerIP*** | The address of the server to which to send messages. |
| ***Community*** | A common string (password) in the message. |
| ***Version*** | Message version (v1/v2c/3).<br>By default: ***v2c*** |

### 1.1.6 VLAN (Virtual Local Area Network)

A VLAN is a group of devices that can communicate directly with each other at the Data link layer, although physically they can be connected to different network switches. And vice-versa, devices in different VLANs are not visible to each other at the Data link layer, even if they are connected to the same switch, and communication between these devices is only possible at the Network and higher layers.

In modern networks, VLAN is the main mechanism for creating a logical network topology independent from its physical topology. VLANs are used to reduce broadcast traffic in the network. They are valuable in terms of safety, in particular as a protection against ARP spoofing.

Currently, the implementation of different VLAN types is described in the IEEE 802.1Q specification. VLANs based on IEEE 802.1Q use the additional frame fields for storing information on the membership of a VLAN while the frame moves across the network.

**Some definitions of IEEE 802.1Q.**

***Port in «Trunk» mode*** – a physical channel to transmit multiple VLAN channels that have different tags added to the packets. Trunks are usually created between «tagged ports» of VLAN-devices: switch-switch or switch-router.

***VLAN ID (VID)*** – a number of a VLAN.

***VLAN port ID (PVID)*** – a physical port of the switch, which is used to determine to which VLAN the switch will direct the incoming untagged frame from the segment connected to the port, when the frame needs to be sent to another port (inside the switch, a VID is added to headers of all untagged frames. VID equal to the PVID of the port on which they were received). This mechanism allows devices with and without IEEE 802.1Q support to exist on the same network at the same time.

***Default PVID*** – a VLAN ID assigned at the input to get untagged frames.

**Designation of membership in a VLAN**

To perform this, there are the following solutions:

- Port-based: a single VLAN is assigned to a switch port manually. Building a port-based VLAN is based only on adding additional information to the switch's address tables, not using the ability to embed VLAN membership information to the frame being transmitted. If more than one VLAN must match the same port (for example, if a VLAN connection goes through more than one switch), then that port must be a member of a trunk. The switch will add tags of the VLAN to all received frames that have no tags. Port-based VLANs have some limitations. They are very easy to install, but allow you to maintain only one VLAN per port. Therefore, this solution is not acceptable when using hubs or networks with powerful servers that are accessed by many users (the server will not be able to be included in different VLANs). In addition, making changes to a port-based VLAN is difficult, because every change requires a physical switching of the devices.

- MAC-based: VLAN membership is based on the MAC address of the workstation. In this case, the switch has a table of MAC addresses of all devices along with the VLANs which they belong to.

- Based on the additional frame fields, for storing information on belonging to the VLAN: the tagging capability allows VLAN information to be propagated across multiple 802.1Q-compliant switches over a single physical connection (trunk link); the ability to add and extract tags from frame headers allows using switches and network devices that do not support IEEE 802.1Q.

- Protocol-based: the data of 3–4 layers in a packet header are used to define VLAN membership. For example, IP machines can be relocated to the first VLAN and AppleTalk machines to the second. The main drawback of this method is that it violates the independence of the layers, so, for example, the transition from IPv4 to IPv6 will lead to disruption of the network.

- Authentication based: Devices can be automatically moved to a VLAN based on user or device authentication data when using 802.1x protocol.

#### 1.1.6.1 VLAN configuration

ToPGATE-2E1-1F devices with a single Fast Ethernet interface and ToPGATE-SFP do not have a managed switch and do not support full VLAN configuration. If root menu items do not have VLAN, ATU, EthGlobal, it means that the device has no switch and specifies tags only for E1 and control.

To set a mode for a port, go to the menu item «**3.2.3.15/Eth/port/VLAN submenu**» and select the necessary value for the Role parameter.

***multi*** – the interface forwards all frames; the default mode is used unless another mode is explicitly specified. The policy of using interfaces is determined by the external equipment, such as routers of Layer 3 which link multiplexers;
***access*** – the interface is used to transfer user data. Packets with another VLAN IDs are not switched to this interface. Packets arriving to this interface are tagged with an ID equal to the specified VLAN ID;
***trunk*** – interface transmits tagged frames only, use this mode to communicate with another multiplexer directly;
***QinQCustomer*** - client port, frames on input are always tagged with the second tag (if a frame dos not have a tag, then it is tagged with the first tag); 802.1Q is disabled.
***QinQProvider*** port which accepts frames only with QinQTag on input. The frames are switched in accordance with VLAN table.

You can also set groups of VLANs, Tag, Untag, Member and tag for QinQ mode.
***Tagged*** – the list of VLANs that will leave the port with a tag. If a port is in the trunk mode, the incoming frames must have a tag from this list;
***Untagged*** – the list of VLANs that will leave the port without a tag;
***Member*** – the list of VLANs that will leave the port without changing the tag (in the state in which they entered another port);
***QinQTag*** – a tag (ethertype) which is set for frames in QinQ mode.

To set the port VLAN, change the DefVLAN parameter.

To set a management VLAN, you need to move to the menu through the following path «**3.2.5.6/IP/stored-config submenu**», to change the parameter DefaultVlanID and save the configuration by pressing «ESC+S». After reboot, the device will be available for management in this VLAN. To change the management VLAN immediately, this parameter must be changed in the «**3.2.5.3/IP/current-config submenu**». (**ATTENTION!!! Loss of the access to the device via Ethernet is possible**)

To view and configure the VLAN table manually, go to the menu item «**3.2.6/VLAN menu**». To create a VLAN, press «ESC+C» and enter VLANID, then press «Enter». After adding, the table displays a list of VLANs and IPAddr, NetMask and Gateway settings. To be able to manage VLANs, it is necessary that the

parameter «Cpu» in the menu «**3.2.6.1/VLAN/VLANID submenu**» be set to «Management» (this is the default value of the parameter).

### 1.1.7 NAT (Network Address Translation)

NAT is a mechanism in TCP/IP networks that allows you to convert the IP addresses of transit packets. The mechanism is also called *IP Masquerading, Network Masquerading, Native Address Translation*.

**The operation of NAT**

Address translation by NAT can be performed by almost any routing device — router, access server, firewall. The most popular is SNAT. The essence of the mechanism is to replace the *source* address when a packet passes in one direction and replace *destination* address in the response packet. In addition to source/destination addresses, source and destination port numbers can also be changed.

When receiving a packet from the local computer, the router looks at the destination IP address. If this is a local address, the packet is forwarded to another local computer. If not, the packet should be sent out to the Internet. But the return address in the packet is the local address of the computer, which will be unavailable from the Internet. Therefore, the router «on-the-fly» translates the IP address and port and saves this translation in its time table. Later, when the client and the server have finished exchanging packets, the router will erase the entry of the n-th port in its table as the old one.

In addition to source NAT (providing users with a local network with internal Internet access addresses), destination NAT is also often used when external requests are translated by a firewall to the user's computer on the local network, which has an internal address and therefore is not available from the outside directly (without NAT).

There are 3 basic concepts of address translation: static (Static NAT), dynamic (Dynamic NAT) and port address translation (NAPT, NAT Overload, PAT).

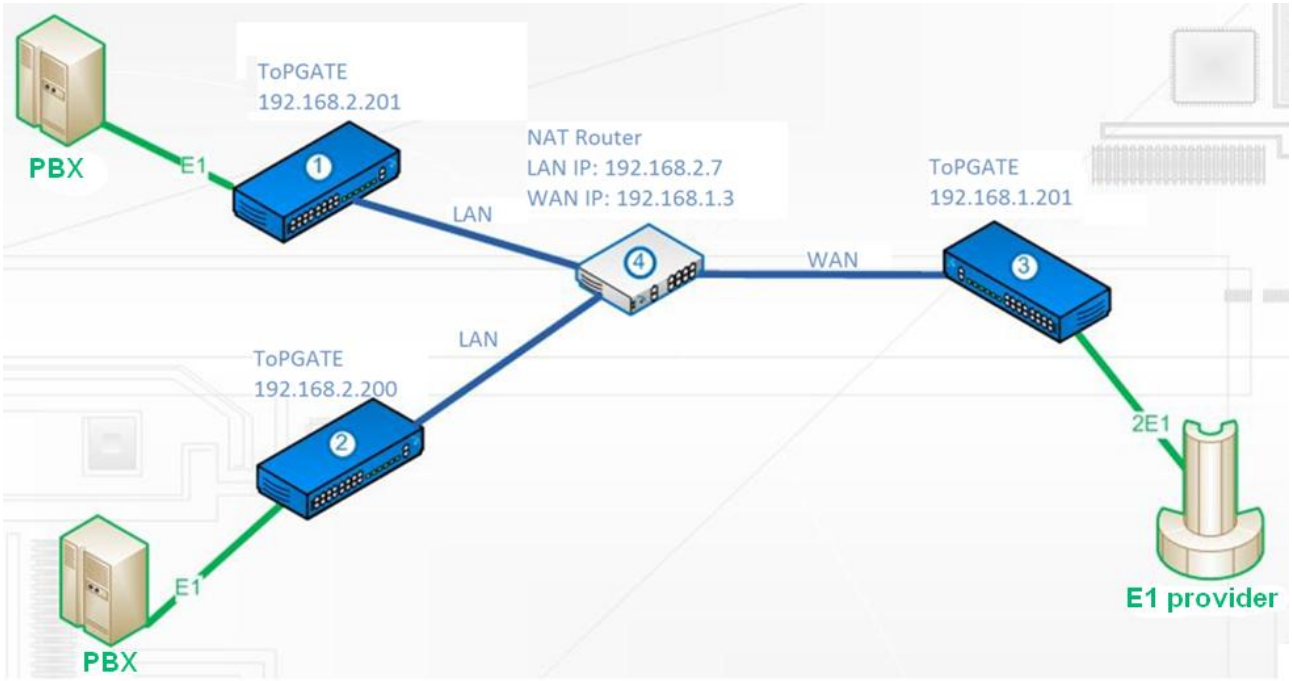
Static NAT – a mapping between an unregistered IP address and a registered IP address based on one-to-one. It is especially useful when the device needs to be accessible from outside the network.

Dynamic NAT - maps an unregistered IP address to a registered address from a group of registered IP addresses. Dynamic NAT also sets the direct mapping between unregistered and registered address, but the mapping can vary depending on the registered address available in the address pool during communication.

NAT Overload (NAPT, PAT) is a form of dynamic NAT that maps multiple unregistered addresses to a single registered IP address using different ports. Also known as PAT (Port Address Translation). When overloaded, each computer on the private network is translated to the same address but with a different port number.

#### 1.1.7.1 Configuring the transmission of E1 streams using NAT

Assume that the provider E1 allocates 2 E1 streams that need to be transmitted to the devices 1 and 2 (see the diagram below).




Topgate series multiplexers must be configured as follows **(the function is available on the software version – LPOS 1.0.9.4SR4 and higher):**

Set an IP address (*NetworkAddr*) and a gateway (*DefaultGateway*) in «**3.2.5.3 /IP/current-config**»:

Multiplexer 1:

*NetworkAddr - 192.168.2.201*

*DefaultGateway - 192.168.2.7*

Multiplexer 2:

*NetworkAddr - 192.168.2.200*

*DefaultGateway - 192.168.2.7*

Multiplexer 3:

*NetworkAddr - 192.168.1.201*

*DefaultGateway - 192.168.1.1*

Then, go to «*/TDMoP/port/config*» and perform the following settings:

Multiplexer 1:

*RemoteIP - 192.168.1.201*

*RemoteChannel - 0*

*WANIP - 192.168.1.3*

Multiplexer 2:

*RemoteIP - 192.168.1.201*

*RemoteChannel - 1*

*WANIP - 192.168.1.3*

Multiplexer 3 - port 0:

*RemoteIP - 192.168.1.3*

*RemoteChannel - 0*

*SIPPort - 5062*

*TDMPort - 41004*

Multiplexer 3 - port 1:

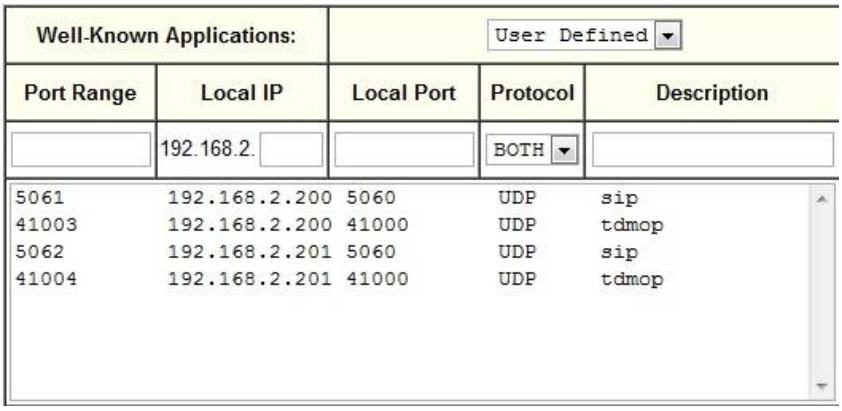
*RemoteIP - 192.168.1.3*

*RemoteChannel - 0*

*SIPPort - 5061*

*TDMPort - 41003*

It is necessary to forward ports on the NAT Router, for example, as shown below.




### 1.1.8 LLDP - Link Layer Discovery Protocol

Link Layer Discovery Protocol (LLDP) is a Data link layer protocol that allows network devices to announce information about themselves and their capabilities to the network, as well as to collect this information about neighboring devices.

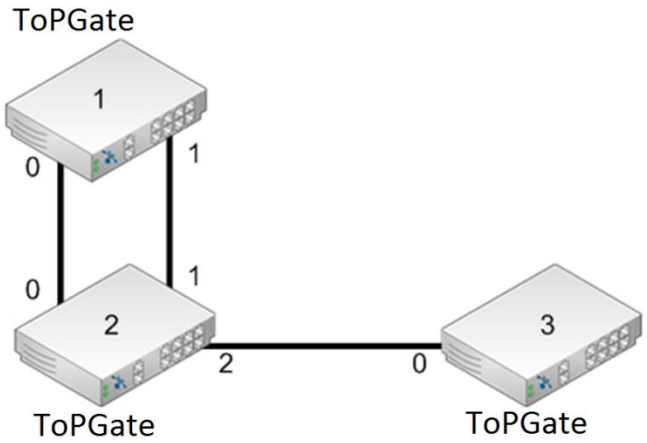
A device that uses LLDP stores neighbor information but does not forward it further (regardless of whether the device supports LLDP).

The information on Topgate series multiplexer that can be transmitted using LLDP:

- MAC address (ChassisID) – the MAC address of the opposite device;
- Port ID – the port of the opposite device through which it sends LLDP messages;
- System Name – a name of the opposite device;
- Management address – the IP address of the opposite device;

#### 1.1.8.1 The principle of LLDP operation

The protocol works only between directly attached devices. It means that, for example, in the figure:




- ToPGATE (2) will get LLDP information from two neighbors: from ToPGATE (1) via two ports and from ToPGATE (3) via one port;
- ToPGATE (1) will receive LLDP information only from ToPGATE (2), but through both ports;
- ToPGATE (3) will receive LLDP information only from ToPGATE (2).

LLDP messages might be sent through ports that are blocked by STP.

#### 1.1.8.2 Configuring LLDP

LLDP is enabled for the entire device and is enabled by default. To configure the parameters, go to the menu «**3.2.4.4/System/LLDP/config submenu**».

| | |
|---|---|
| ***Enabled*** | Enable/disable LLDP.<br>***Yes*** – enabled (by default);<br>***No*** – disabled. |
| ***TXInterval*** | The frequency of LLDP messages transmission to neighbors.<br>It can take values from 5 to 500 seconds.<br>By default: 30 sec. |
| ***TXHoldMultiplier*** | The multiplier, by which *TXInterval* is multiplied to obtain TTL.<br>TTL - time during which the neighbor will store information on the device.<br>*TXHoldMultiplier* can take values from 2 to 10.<br>By default, *TXHoldMultiplier* is set to 4, respectively, neighboring devices will store information for 120 seconds. |

Also in the item «**3.2.4.3/System/LLDP/Interfaces/port submenu**», you must specify the parameter ***Admin*** - receive, send, or receive and send LLDP messages, and specify the ***TLVs*** data. By default, all ports are configured to receive and transmit all LLDP information.

# 2 The operation of the multiplexer

## 2.1 The power-on algorithm

If the ToPGATE series multiplexer has been stored at temperatures below +5 C, it must be kept at room temperature for at least two hours before being switched on for the first time.

Connection is recommended to be performed by the following algorithm:

1. Connect the earth bonding point located on the rear panel of the device to an external protection ground.

2. Connect the power cable to the earth bonding point located on the rear panel of the multiplexer.

3. Supply voltage to the multiplexer. (After the power is turned on, the equipment is automatically self-tested.)

4. Configure the multiplexer. The steps to quick set up and enable the devices are described in **APPENDIX A**. Rapid deployment of the multiplexers. Control of the multiplexer and its full configuration are described in Chapter 4.

5. Connect the plugs of the cables of external physical lines to the corresponding connectors of the multiplexer interfaces. After connecting all the cables (assuming normal operation of all communication lines) LED indication should correspond to the normal operation mode. Otherwise, it is necessary to diagnose the condition of the multiplexer.

ToPGATE series multiplexer operates in normal operating mode. The connection can be considered completed.

## 2.2 Getting started

After the installation, the multiplexer does not require any periodic maintenance procedures. Once configured, it works autonomously. The current status of the multiplexer is constantly displayed using the LED indicators on the front panel, in addition, it can be controlled remotely via the network.

The multiplexer must be configured for proper operation. The devices can be supplied pre-configured for transparent transmission of E1 streams in the «point-to-point» scheme (between the same interfaces of connected multiplexers).

The multiplexer must be reconfigured to meet specific requirements. This operation can be performed by the manufacturer when the device is delivered, or at the installation site – via a serial port using a console program, or remotely over a network using Telnet, SSHv2, SNMP, HTTP, and FTP protocols.

The following management and monitoring functions are supported:

- view system information (software version, file structure, device configuration);
- managing user interfaces;
- view status and statistics for user interfaces and for the multiplexer as a whole;
- installation of diagnostic loops.

## 2.3 Front panel indicators

On ToPGATE series multiplexers, after the power is supplied, the yellow indicator SYST on the front panel shows the status of the multiplexer. The possible states of SYST indicator are shown in the following table:

| SYST indicator light | The state of the multiplexer |
|---|---|
| Frequent flashing | Initial loading process and multiplexer diagnostisc. |

| | |
|---|---|
| One flash, pause | The initial loading has been finished, the multiplexer is ready to operate. |
| Two flashes, pause | The firmware of the E1 framer is not loaded |
| Four flashes, pause | Invalid System ID |
| Slow flashing | Coprocessor program is not loaded |
| Long flash, pause | The multiplexer is able to work, but you need to replace the lithium battery |
| Two long flashes, pause | Supply voltage or temperature is out of range |
| Steady light or lack of it | Control microprocessor failure |

If the SYST indicator does not correspond to the ready-to-work mode after the power has been supplied, turn off the power supply and turn it on again after a few seconds. It is recommended to connect the multiplexer to the control computer for diagnostics via the serial port.

The status of the Ethernet interface is indicated by two LED indicators: green LINK and yellow ACT, located in the RJ-45 connector of this interface. The possible states of the interfaces are listed in the table below.

| Ethernet interface state | LINK – green indicator | ACT – yellow indicator |
|---|---|---|
| The connection is not established | Off | Off |
| The connection is established | Constant glow | Off |
| Data transfer is in progress | Constant glow | Flashing |

The status of each E1 interface is indicated by two LED indicators: green LINK and yellow FAIL, located in the RJ-45 connector of this interface.

If the multiplexers are connected, the states of both the local and remote E1 interfaces are indicated. The possible states of E1 interfaces are listed in the table below.

| The state of E1 interface of the local multiplexer | The state of E1 interface of the remote multiplexer | LINK – green indicator | FAIL – yellow indicator |
|---|---|---|---|
| Disabled (power down mode) | Any | Off | Off |
| Disabled (Listen mode) | Any | Off | Rare flashes |
| Test mode, there is a signal at the input | Any | Frequent flashing | Frequent flashing |
| Test mode, there is no signal at the input | Any | Frequent flashing | Constant glow |
| A loop is installed, there is a signal at the input | Normal operation | Frequent flashing | Off |

| | | | |
|---|---|---|---|
| A loop is installed, there is a signal at the input | No signal at the input | Frequent flashing | Frequent flashing |
| A loop is installed, there is no signal at the input | Any | Frequent flashing | Constant glow |
| Establishing a connection, no signal at the input | Not found | Off | Rare flashes |
| Establishing a connection, there is a signal at the input | Not found | Off | Rare flashes |
| Establishing a connection, connection error | Any | Off | Rare flashes |
| Normal operation | Normal operation | Constant glow | Off |
| RAI | Normal operation | Constant glow | One flash, pause |
| The line is disconnected (no signal at the input of the receiver) | Normal operation | Off | Frequent flashing |
| Normal operation | The line is disconnected (no signal at the input of the receiver) | Constant glow | Rare flashes |
| The line is disconnected (no signal at the input of the receiver) | The line is disconnected (no signal at the input of the receiver) | Off | Rare flashes |

### 2.4 Configuration

For the proper operation of ToPGATE series multiplexer on the network, they must be properly configured. All the settings are stored in the */mnt/flash/system.cfg* file in the form of a structured tree running at the device startup. To save the changes made to the configuration of the device, press *«ESC+S»*. The generated file can be recorded to the *mnt/flash* directory through the network via FTP. The contents of the file with the current configuration can be displayed in the terminal window on pressing *«ESC+M»*.

Each time the device is turned on, the device performs the configuration specified in the system.cfg file. The file is located in the mnt/flash directory in the flash memory of the device.

#### 2.4.1 File system

The file system of ToPGATE series multiplexer combines the files, process identifiers, devices and etc. The structure of the file system:

- dev
- drivers
- mnt
  - flash
  - mem
- proc
- svc
- system
- sys

### 2.4.2 Operating with the file system

An FTP client in passive mode can be used to access the multiplexer file system.

#### 2.4.2.1 Operation via FTP

The ToPGATE series multiplexer contains a built-in FTP server that provides visual and convenient operation with its file system. Files are read and recorded using an FTP client. The program must use the passive exchange mode (passive mode). For example, in Internet Explorer, this mode is set as follows: Tools->Internet Options->Advanced->Use passive FTP; when creating a new FTP connection in Total Commander, check the Use passive mode for transfers box. Only the privileged admin user has access to the FTP server.

### 2.4.3 Users and passwords

Both local and remote access to the multiplexer is available to perform configuration and diagnostic commands, as well as to modify and update the software.

The process of granting access to the device using the TACACS+, RADIUS protocols and the local user base is implemented in the current firmware version.

Both types of access contain a single mechanism of protection against unauthorized access, based on identification by user name and password. The device supports the identification of three different local users: privileged with the name admin and unprivileged with the names oper1 and oper2. A privileged user can change device settings and update software, unprivileged users have limited ability to configure the device, and can view diagnostic messages.

The manufacturer sets the following passwords by default:

| User name | Password |
|---|---|
| admin | admin |
| oper1 | oper1 |
| oper2 | oper2 |

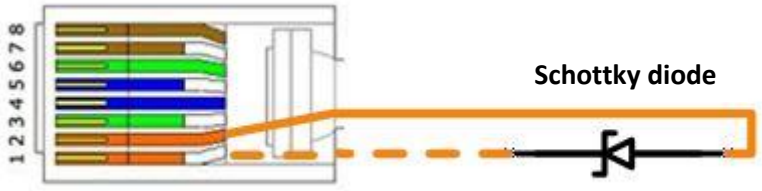
For security reasons, you must change these passwords using passwd command before you use the device. New passwords can represent a sequence of Latin letters and numbers up to and including 18 characters.

If the user forget the password, the only way to access the device is to reset the user settings to the factory ones. The passwords will accept the default values mentioned above. In addition, an IP address of the device will be set to *192.168.0.24* and the subnet mask will be set to *255.255.255.0*.

If you need to access the ToPGATE multiplexer (1E1-1FG, 2E1-1F, 4E1-2FG, 8E1-2FG, 16E1-2FG, 24E1-2FG), i.e. restore the default IP address, password, etc., turn off the device. Find a small hole on the rear panel of ToPGATE (1E1-1FG, 2E1-1F) or front panel of ToPGATE (4E1-2FG, 8E1-2FG, 16E1-2FG, 24E1-2FG). With a thin object, such as a toothpick, press the button in the hole. Hold down the button to turn on the power of the device. Hold down the button for 2-3 seconds more. Press *«ESC+Q»* to exit the menu to the command line mode and run the *mnt* command**.** Then, run the *menu* command**.** Next, you need to perform the whole configuration procedure. The device is accessed via IP address *192.168.0.24.* To save the configuration, press *«ESC+S»* in the menu.

If you need to access the ToPGATE-SFP multiplexer, i.e. return the factory default IP address, password, etc., disconnect the device (remove it from the switch). For ToPGATE-SFP-1E1, install the plug in the form of RJ-45 supplied in the delivery package. For ToPGATE-SFP-2E1, set the DIP switch on the device to "RST". Connect ToPGATE-SFP to the switch with the SFP cage. Press *«ESC+Q»* to exit the menu to the command line mode and run the command – *mnt.* Then, run the *menu command.* Next, you need to perform the whole configuration procedure. The device is accessed via IP address *192.168.0.24.* To save the configuration, press *«ESC+S»* in the menu. Remove ToPGATE-SFP from the switch and, for ToPGATE-SFP-1E1, remove the plug from it.
For ToPGATE-SFP-2E1, set the DIP switch on the device to «RST».

The plug for the ToPGATE-SFP-1E1 multiplexer can be manufactured by crimping the twisted pair into the RJ-45 connector and soldering the Schottky diode between pins 1 and 2 with any polarity.




The ToPGATE multiplexer password information is stored in the file */mnt/flash/config.sys* in encrypted form. The encryption algorithm uses the serial number of a specific device, so when you transfer this file to another ToPGATE series multiplexer, it will not be loaded. When you delete *config.sys* (this operation will be available only for the administrator) passwords will accept the default values.

## 2.5 System settings

This Chapter describes the basic parameters of the ToPGATE multiplexer.

### 2.5.1 Built-in calendar and clock

The multiplexer has a built-in real-time clock and a battery-powered calendar (there is no battery on ToPGATE-SFP). They are used to specify when events occur in the log. At each start, the multiplexer checks the information stored in the nonvolatile memory of the clock, and in case of reading error, indicates the need of changing the lithium battery of the clock.

#### 2.5.1.1 Date and time settings

The system time and date on ToPGATE multiplexers can be changed in the menu «**3.2.4.17/System/time submenu**», configuring the *Time* and *Date* parameters, as well as using the SNMP agent.

### 2.5.2 Symbolic name

Each multiplexer can have a symbolic name that is displayed in the console prompt and facilitates the identification of the multiplexer.

#### 2.5.2.1 Setting a symbolic name

The name of the ToPGATE multiplexer can be changed in the menu in the «**3.2.4.7/System/global submenu**» tab by changing the *Name* parameter, as well as using the menu and SNMP agent.

### 2.5.3 The address on the network

Each multiplexer has one system Ethernet interface connected to the built-in switch of the second layer. A MAC address, IP address, mask, and default gateway are set for this interface. The manufacturer assigns a unique MAC address to each multiplexer, that depends on the hardware serial number of the device. If you change the MAC address of the device, you must monitor the address mismatch between different hosts.

#### 2.5.3.1 Network address setting

The IP address, mask, and default gateway for the ToPGATE multiplexer can be changed in the menu «**3.2.5.3/IP/current-config submenu**», «**3.2.5.6/IP/stored-config submenu**», and SNMP agent.

For any VLAN, different IP-address, mask and gateway can be set in «**3.2.6.1/VLAN/VLANID submenu**».

### 2.5.4 Trusted nodes

For security reasons, the device can only be accessed from selected management computers (computers with specific network addresses). You can use specific IP addresses, all addresses on the current subnet (using the address and mask of the multiplexer network), and all nodes on all networks to define a list of trusted network nodes.

#### 2.5.4.1 Configuring trusted nodes

The list of trusted nodes of ToPGATE multiplexer can be changed in the menu in the «**3.2.5.4/IP/hosts submenu**» item, as well as with the help of SNMP agent.

**Trusted nodes configuration is available for the firmware version: LPOS 1.0.9.4SR3.**

Here, you may edit the list of trusted nodes. These nodes allow access to the device. To enable/disable, you must configure the *TrustAll* and *TrustLocal* parameters, which are in the «**3.2.5.3/IP/current-config submenu**» and «**3.2.5.6/IP/stored-config submenu**» menu items.

| | |
|---|---|
| ***TrustAll*** | Enable/disable the list of trusted nodes that can be specified in the «**3.2.5.4/IP/hosts submenu**» menu item.<br>***Yes*** – trust all. With this value, everyone has access regardless of the trusted nodes list (by default).<br>***No*** – allows access to the device only to nodes which are in the list of trusted nodes. This value also takes into account the ***TrustLocal*** parameter.<br>**It is available from the firmware version: LPOS 1.0.9.4SR3.** |
| ***TrustLocal*** | Enable/disable trusted nodes from the local network.<br>It is taken into account when ***TrustAll*** parameter has ***No*** value.<br>***Yes*** – local nodes from the hosts list will be trusted (by default).<br>***No*** – only nodes from the hosts list will be trusted.<br>**It is available from the firmware version: LPOS 1.0.9.4SR3.** |

The menu item «**3.2.5.4 /IP/host**» looks as follows:

```
/IP/hosts LPOS                                      Advanced  ESC+h - Help
|>.. Network         Mask              | 19  0.0.0.0         255.255.255.255
| 1  0.0.0.0         255.255.255.255   | 20  0.0.0.0         255.255.255.255
| 2  0.0.0.0         255.255.255.255   | 21  0.0.0.0         255.255.255.255
| 3  0.0.0.0         255.255.255.255   | 22  0.0.0.0         255.255.255.255
| 4  0.0.0.0         255.255.255.255   | 23  0.0.0.0         255.255.255.255
| 5  0.0.0.0         255.255.255.255   | 24  0.0.0.0         255.255.255.255
| 6  0.0.0.0         255.255.255.255   | 25  0.0.0.0         255.255.255.255
| 7  0.0.0.0         255.255.255.255   | 26  0.0.0.0         255.255.255.255
| 8  0.0.0.0         255.255.255.255   | 27  0.0.0.0         255.255.255.255
| 9  0.0.0.0         255.255.255.255   | 28  0.0.0.0         255.255.255.255
| 10 0.0.0.0         255.255.255.255   | 29  0.0.0.0         255.255.255.255
| 11 0.0.0.0         255.255.255.255   | 30  0.0.0.0         255.255.255.255
| 12 0.0.0.0         255.255.255.255   | 31  0.0.0.0         255.255.255.255
| 13 0.0.0.0         255.255.255.255   | 32  0.0.0.0         255.255.255.255
| 14 0.0.0.0         255.255.255.255
| 15 0.0.0.0         255.255.255.255
| 16 0.0.0.0         255.255.255.255
| 17 0.0.0.0         255.255.255.255
| 18 0.0.0.0         255.255.255.255
Filter: <Press any letter key to start filtering items>
```

```
LOG:02.08.16 10:44:31.484 : [SID=8] Control session started by admin from 192.
```

To add a new node to the list, select the line with ***0.0.0.0*** and press ***«Enter»***.

```
/IP/hosts/1 LPOS                                    Advanced  ESC+h - Help
| ..
|>Network           192.168.0.131
| Mask              255.255.255.255

Filter: <Press any letter key to start filtering items>

LOG:02.08.16 10:46:23.546 : [SID=8] /IP/hosts/1/Network changed to 192.168.0.1
```

| | |
|---|---|
| ***Network*** | Sets the IP address of the host. |
| ***Mask*** | Sets the subnet mask for this node. |

**ATTENTION!** *Changing the address list of trusted hosts through a telnet session can cause the session to break without being able to reconnect from that host if it is excluded from the trusted list.*

### 2.5.5 Timeout

If the user does not enter commands within a certain time, the connection via the serial port using the console program, or remotely via the network using Telnet protocol, will be terminated by the multiplexer. The default timeout is 15 minutes.

#### 2.5.5.1 Configuring the timeout

On ToPGATE multiplexers, the timeout can be changed via the menu in the «**3.2.4.16/System/telnet submenu**» item by changing the *Timeout* parameter.

## 2.6 E1 interface

E1 interface is the equipment interface in compliance with ITU-T G. 703 standard.

The multiplexer contains one, two, four, eight, sixteen or twenty-four E1 interfaces for data transmission at 2048 kbps, in accordance with the G. 703 specification. The physical interface is symmetrical, with a line resistance of 120 Ohms.

To send E1 stream, you must configure a virtual connection between the interfaces of two multiplexers. The connection is set up using the menu item «**3.2.2.1/TDMoP/port/config submenu**».

In case multiplexers are connected to each other directly or via Ethernet switches, an E1 stream can be transmitted inside Ethernet frames without IP headers. This ensures minimum delay time and minimum channel bandwidth loss. The data stream coming from each of active E1 interfaces, is divided into frames of fixed length, and supplied with a header of virtual connection adaptation level and an Ethernet header indicating the MAC address of the destination multiplexer. For each of the E1 interfaces that you use, you must specify the IP address of the destination multiplexer and the number of its E1 interface to which the virtual connection will be established, and you must specify the VLAN ID for the frames that transport this E1 stream. ID equal to 0 indicates that the multiplexer does not need to tag frames. If the transport network does not only transmit frames with TDM data, you must specify the 802.1p priority field of the 802.1q tagged frame. The value of this field should give the highest priority to frames with TDM data. You can turn off the unused interfaces.

If multiple devices are connected in a star or chain topology, the configuration is similar to the point-to-point case for each interface pair. It is necessary to allocate individual MAC - and IP addresses to each device's and to describe the virtual connection for all active E1 interfaces. Each of these interfaces can be connected to any other interface of any multiplexer on the network.

All the E1 interfaces of the multiplexer are denoted by decimal numbers in ascending order starting from zero. To operate with a subchannel, you must specify the time slot numbers used in the subchannel in the following format:

interface number: time slot range (start time slot – end time slot) or comma separated list of time slots

for example, *0–16 or 0,1,16.*

If numbers of time slots are not specified, all 32 time slots are used.

## 2.7 Ethernet interface

Ethernet interface is an equipment interface according to IEEE 802.3 standard.

The multiplexer contains 10/100/1000Base-T Ethernet interfaces for data transmission at 10, 100 or 1000 Mbps in accordance with the IEEE 802.3 specification. The Ethernet interface of the multiplexer can operate in auto-negotiation mode, and also allows you to manually set the speed and duplex mode for each interface separately.

**ATTENTION!** *Mismatch of speed and duplex settings on the Ethernet port of the multiplexer and the port of the connected equipment can lead to blocking of the built-in Ethernet switch and impossibility of data transfer both through the incorrectly configured port, and through other ports!*

**ATTENTION!** *The transmission of E1 streams through an Ethernet interface set to half-duplex mode can result in timing errors and high BER levels due to frequent collisions in this configuration!*

The menu item «**3.2.3.12/Eth/port/config submenu**» adjusts the operation mode of the selected packet interface, speed, duplex.

The interface can operate in one of the following modes:

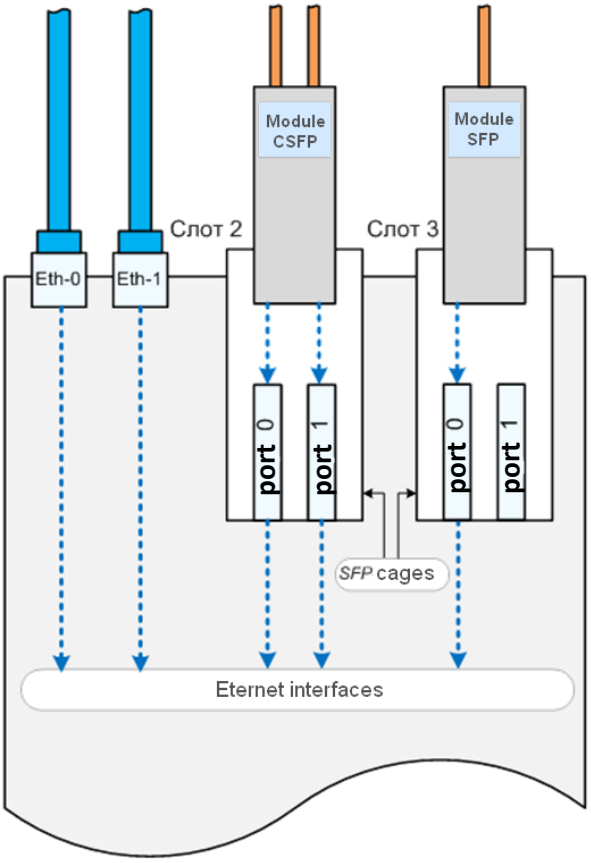
| | |
|---|---|
| **down** | the interface is down; |
| **trunk** | interface transmits tagged frames only, use this mode to communicate with another multiplexer directly; |
| **multi** | the interface forwards all frames; the default mode is used unless another mode is explicitly specified. The policy of using interfaces is determined by the external equipment, such as routers of Layer 3 which link multiplexers; |
| **access** | the interface is used to transfer user data. Packets with another VLAN IDs are not switched to this interface. Packets arriving to this interface are tagged with an ID equal to the specified VLAN ID; |
| **QinQCustomer** | a client port, frames on input are always tagged with the second tag (or the first one, if they had no tags); 802.1 Q is disabled; |
| **QinQProvider** | a port which accepts frames only with QinQTag on input. The frames are switched in accordance with VLAN table.<br>QinQTag – a tag, which is set to frames in QinQProvider mode. |

### 2.7.1 Features of using Ethernet interfaces

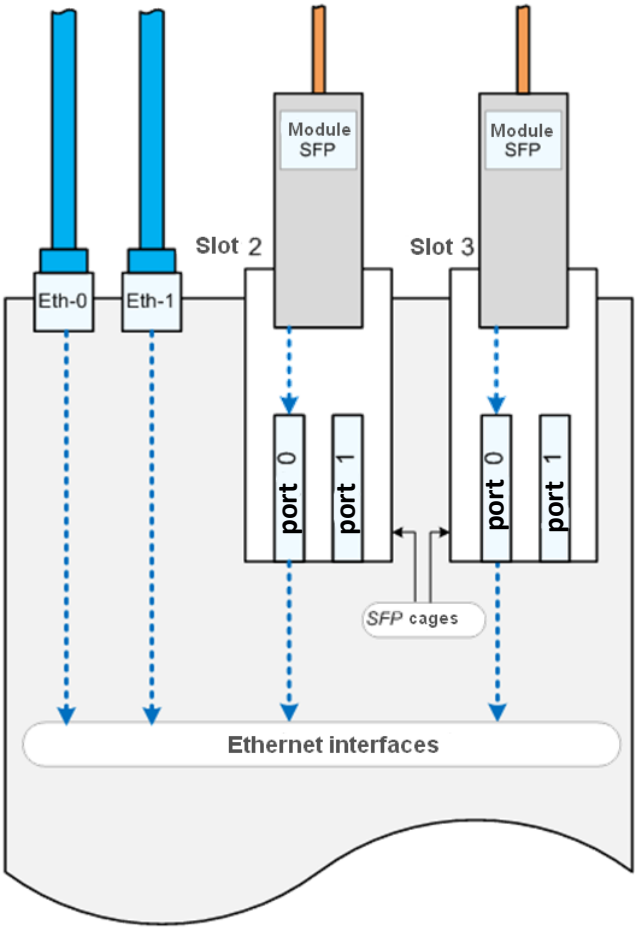
The following illustrations show examples of using Ethernet interfaces when there are 2 Gigabit Ethernet interfaces and 2 SFP/CSFP 1Gb interfaces on a multiplexer switch.

In the Slot 2 and Slot 3 of SFP cage, you may install SFP and CSFP modules.

- If a CSFP module is installed in SFP/CSFP slot 2 or 3, CSFP ports 0 and 1 are used.
- If an SFP module is installed in SFP/CSFP slot 2 or 3, the CSFP port number 0 is used.

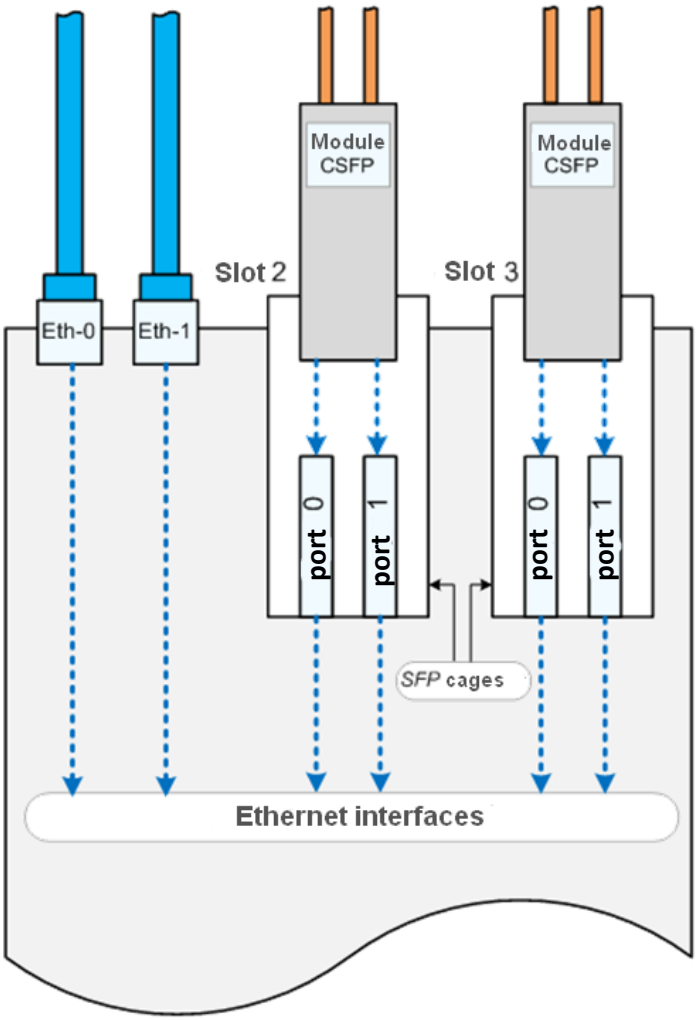



CSFP module is installed in Slot 2, and SFP module is installed in Slot 3




SFP modules are installed in Slot 2 and 3

Figure 2. 1




CSFP modules are installed in Slot 2 and 3

## 3 Local and remote access to the multiplexer.

Both local and remote access to the multiplexer switch is available. The default users and passwords are listed in the table in «**2.4.3Users and passwords**» section.

Local access to the device is perdormed via the serial port. To do this, you need to connect the device and the serial port of the control computer with a cable and run a terminal program on the control computer that supports ANSI terminal emulation, for example, Hyperterminal from Windows, or third-party programs such as: PuTTY, SecureCRT, etc.

**Computer serial port settings – 115000 kbps (Speed Baud rate), 8 bits (Data bits), no parity (Parity: None), no flow control (Flow control: XON/XOFF).**

After starting the terminal program, in response to the system prompt, you need to type the user name and then the password, and then the configuration menu opens.

After this, you can enter any of the management and configuration commands described below.

Remote access to the device is performed through an IP network via telnet, ssh or HTTP. To do this, you need to connect one of the Ethernet subscriber interfaces to the network and make sure that the LED indicators show the connection.

To connect via HTTP, you need to enter the Web-interface of the device, for example, at *http://192.168.0.24*, then enter your username and password. By default, login is *admin*, password is *admin*.

To connect via telnet/ssh protocols, you should run any Telnet client program on the control computer, for example, Hyperterminal, telnet from Windows, SecureCRT, PuTTY. You must specify the IP-address of the multiplexer, and in the section «**3.2.5.4/IP/hosts submenu**» of the multiplexer, access to the control computer with this IP-address must be allowed. You can allow access only from specific computers, from all computers on the local network, or from any computer. The availability of the multiplexer can be checked by *ping* comand from a remote computer.

Configuration of telnet should include the ANSI terminal emulation and a newline after carriage return.

After starting the telnet/ssh client in response to the system prompt you need to type a username and password, which opens the configuration menu.

Then you can configure the multiplexer through the menu items described below.

If the user does not configure the device within a certain time, the telnet/ssh connection will be terminated by the multiplexer for security reasons. By default, the timeout is 15 minutes and can be changed via the menu items «**3.2.4.16 /System/telnet submenu**», «**3.2.4.21 /System/SSH submenu**».

Reading and writing of software files with remote access is performed via FTP. To do this, run an FTP client program, such as Internet Explorer, on the remote computer. The program should use passive mode (in IE the corresponding settings ***Tools > Internet Options > Advanced > Use passive mode***). The login and password to access the /mnt/flash directory are the same as for privileged access to the device. Reading, writing and deleting of files are supported.

### 3.1 Terminal management commands

This section describes the management and diagnostic commands available from the device's local terminal (console) and remotely via telnet/ssh. To set these commands, you must establish a connection to the multiplexer via the serial port or through the network via telnet. The command must be completed with the carriage return key **<CR>**. Help for all currently available commands can be obtained by typing «?»

Help for using a specific command can be obtained by typing

***command_name<TAB>*** or

***command_name<?>***

### 3.1.1 Command syntax

The syntax of commands entered to the command line:

***command*** *[parameter | parameter] [key [parameter]]*

where:

| | |
|---|---|
| Command | is a strictly specified sequence of characters that determines further parameters and the meaning of the action performed (the commands are case-insensitive); |
| Parameter | a keyword, IP address, network mask, MAC address, number, word, string. |
| Key | a «-» sign followed by one character. |

The command, keys, and parameters are separated by space characters.

The following symbols are used to describe the command syntax:

- the required parameters are specified in angle brackets <>;
- optional parameters are given in square brackets [];
- the symbol «|» denotes a logical «or» – a choice between different parameters;
- keywords are highlighted in bold.

Types of command options:

Keyword – a word carrying a certain meaning, for example, the name of the input parameter.

IP address – A.B.C.D – is given as four decimal numbers separated by dots.

The netmask – A.B.C.D – is given as four decimal numbers separated by dots.

The MAC address – HH-HH-HH-HH-HH-HH – is given as six groups of numbers separated by «-» characters. Each group consists of two hexadecimal numbers.

The last five commands are stored in the buffer. To use the previously entered command, press «↑» (up) or «↓» (down).

### 3.1.2 Error messages

The table below lists the error messages that may be displayed when you are working with the command line.

| Error message | Error description | Recommended actions |
|---|---|---|
| syntax error: invalid parameter | invalid parameter | enter the correct parameter |
| syntax error: omitted parameter | the parameter has been missed | enter the missing parameter |
| syntax error: invalid type | invalid parameter type | enter the parameter correctly |
| syntax error: missed value | the parameter has been missed | enter the missing parameter |
| syntax error: invalid delimeter | a mandatory separator has been missed | enter the missing separator |
| privileged comand: no rights enough | the command is not available to the user | use the su command to log in as admin |

| | | |
|---|---|---|
| is not recognized as a command | the command was not identified, an error command was entered | you should check the correctness of the entered command using help «?». |
| open error | file opening failed | enter the correct file name |

### 3.1.3 System commands

These commands allow you to view or change operating system settings, user account information, terminal session settings, and so on.

***aaasess***

Display a list of currently open communication sessions.

**Syntax:**

***aaasess***

**Example:**

View the list of active sessions.

```
LPOS > aaasess
                user |                  addr |                  port
               admin |  192.168.0.131:62647 |                telnet
          tacacsuser |  192.168.0.131:62653 |                  http
              petrov |  192.168.0.131:62657 |                   ssh

LPOS >
```

***aaatest***

Test the AAA authentication.

**Syntax:**

***aaatest*** *[-p password] [-u user] [port port] [rem remote side]*

**Parameters:**

| | |
|---|---|
| ***-p*** | 2.2.1.1 The password for the account on the AAA server |
| ***-u*** | 2.2.1.2 User account |
| ***port*** | **2.2.1.3** Port number |
| ***rem*** | 2.2.1.4 Remote side |

**Example:**

Test connection to TACACS+ server.

```
LPOS > aaatest -u tacacsuser -p tacacspassword rem 192.168.0.131
port 49
Login complete via 0
Login complete via 1
Login complete via 2

LPOS >
```

***arp***

Display the MAC and IP address mapping table.

**Syntax:**

***arp*** *[-a] [-c] [-v]*

**Parameters:**

| | |
|---|---|
| ***-a*** | show table; |
| ***-c*** | clear the table; |
| ***-v*** | filter the table output by the specified VLAN ID; |

***cd***

Change the current directory to the dirname subdirectory of the current directory (you can use «/», «.» and «..» to specify the root, current, and parent directories respectively).

**Syntax:**

***cd*** *<dirname>*

**Example:**

Go to the mnt directory from the root directory.

```
LPOS > cd mnt
```

***cls***

Clear the terminal screen.

**Syntax:**

***cls***

***copy-config***

Copy part of the configuration from one location to another.

**Syntax:**

***copy-config*** *[source path] [destination path]*

**Parameters:**

| | |
|---|---|
| ***source path*** | The path to the settings you want to copy. |
| ***destination path*** | The path to where you want to copy the settings. |

**Example:**

Copy transfer settings of the 0 E1 interface to the 1st E1 interface

```
LPOS  > copy-config /E1/0 /E1/1
LPOS  >
```

***exec***

Execute command-line interface commands from a file.

**Syntax:**

***exec*** *<String filename>*

**Example:**

```
LPOS > exec  /mnt/flash/running_command
```

***exec-config***

Execute the configuration file in the system.cfg form.

**Syntax:**

***exec*** *<String filename>*

**Examples:**

```
LPOS > exec  /mnt/flash/my.cfg
...
LPOS > exec  /mnt/flash/system.cfg
```

***exit***

End the current management session. Stop the current telnet session and close the connection.

**Syntax:**

***exit***

***list***

Show a list of options.

**Syntax:**

***list*** *[path to attribute]*

**Parameters:**

***path to attribute*** the path to the parameters of interest.
- supports the use of wildcard (replacement templates) such as «*» and lists, for example: «[0-1,3]»
- hint on possible parameters, works by pressing "TAB»

**Example:**

Display list of parameters through TDMoP/1 path

```
LPOS  > list TDMoP/1
config                Directory
state                 Directory
statistics            Directory
```

**Example 2:**

Display parameter list using wildcard

```
LPOS  > list tdmop/[0-1,3]/config/*size
/tdmop/0/config
FrameSize           2
JBSize              4
/tdmop/1/config
FrameSize           2
JBSize              4
/tdmop/3/config
FrameSize           2
JBSize              4
```

**Example 3:**

Displaying a hint on the available parameters is available by pressing «TAB»

```
LPOS  > list e<TAB>
Show attribute list
```

```
[String path to attribute
E1
Envir
Eth
EthGlobal
]
```

**Example 4:**

Display a list of paramters

```
LPOS  > list eth/0/con*
/eth/0
config              Directory

LPOS  > list eth/0/con*/
/eth/0/config
Description
Speed               Auto
Duplex              Auto
Link                Auto
FlowControl         Disable
Reservation         No
Learning            Enabled
```

***log***

Display a list of system messages since the last time the device was turned on.

**Syntax:**

***log*** *[-a][-e][-f filter]*

**Parameters:**

***-a*** enable output of all system messages stored in the log file;

***-e*** clear the list;

***-f*** filtering of command output;

***debug*** Enable/disable debug mode

**Example:**

```
LPOS > log –f ethstat
28.08.15 12:10:56.439 : [ethstat] Eth 0: 1G Up Full duplex
28.08.15 12:11:20.455 : [ethstat] Eth 1: 100M Up Half duplex
```

***ls***

List the files in the current directory of the multiplexer.

**Syntax:**

***ls***

***lua***

A command to execute scripts in lua. The command allows you to extend the functionality of devices, for example, for comprehensive device testing.

**Syntax:**

***lua*** *<-f filename | -i>*

**Parameters:**

| | |
|---|---|
| ***-f*** | Execute the file filename in the lua language; |
| ***-i*** | Launch lua in interactive mode; |

**Example:**

Display the status of E1 interfaces (enabled/disabled).

```
LPOS  > show lua 01.txt
e1 = vfs.list("e1")
for i,name in ipairs(e1) do
 io.write(name," Enabled= ", vfs.get("e1/" .. name
.."/config/Enable"),"\r\n");
end

LPOS  > lua -f lua_01.txt
0 Enabled= Yes
1 Enabled= Yes

LPOS  >
```

***mail***

Send a mail message.

**Syntax:**

***mail*** *[--binary] [--stat] [-f Attach file] [-p [1..65535] SMTP port ] <-r Remote server ip> [-s subject ] [-v [0..4094] SMTP server vlan] [body String Body] <from String From> [pass String Password] <to String To>*

**Parameters:**

| | |
|---|---|
| ***--binary*** | send files in binary mode; |
| ***--stat*** | send statistics; |
| ***-f*** | path to attachment files, delimiter between files «;» – semicolon |
| ***-p*** | SMTP port, available values [1..65535]; |
| ***-r*** | IP address of the remote server (SMTP server); |
| ***-s*** | message subject; |
| ***-v*** | VLAN of the SMTP server, value range [0..4094]; |
| ***body*** | message text. If not specified, it is taken from the stdio stream; |
| ***from*** | e-mail address of a sender; |
| ***pass*** | password; |
| ***to*** | e-mail address of a recipient; |

**Examples:**

```
LPOS > mail -r 192.168.0.221 from ToPGate228@nsc-com.com to
ToPGate221@nsc-com.com -s test_subject body test_body
```

```
LPOS > mail -r 198.168.0.221 from sender@domain.com to
recipient@domain.com pass mypassword body text_body --stat -f
system.cfg;log
```

***mapmac***

Show the packet switching table.

**Syntax:**

***mapmac*** *[-c] [-f] [-m part of MAC] [-p ports]*

**Parameters:**

- ***-c*** clear the table from the auto-added mac addresses;
- ***-f*** displays all mac addresses, including those added automatically;
- ***-m*** part of the mac addresses to be displayed; if no mac address is specified, a table of mac addresses is shown;
- ***-p*** filter the table output by the specified list of ports;

**Example:**

Show MAC address table for port 0

```
LPOS > mapmac -f -p 0
  #        MAC address              name pri ttl ports
  25 54-A5-4B-AA-14-32                     0   6 0
  26 5A-00-3B-00-19-9F                     0   7 0
  35 F0-79-59-5C-17-01                     0   7 0
  37 FF-FF-FF-FF-FF-FF            bcast    0   7 0,1,cpu
```

View the entire routing database

```
LPOS > mapmac -f
  #       MAC address         name    pri ttl   ports
  0 00-10-20-30-40-50         user      1   7   0,2
  1 00-13-D4-4A-9B-30      learned      0   5   3
  2 00-16-EC-2B-36-D4      learned      0   6   3
  3 00-18-F3-06-D1-94      learned      0   7   3
  4 00-30-4F-3E-06-61      learned      0   7   3
  5 01-80-C2-00-00-00      learned      3   6   cpu
  6 5A-00-3B-19-DD-A8      learned      0   7   2
  7 5A-00-3B-1C-2F-F5      learned      0   7   cpu
  8 5A-00-3B-1D-30-F6      learned      0   5
```

***menu***

Launch the menu interface.

**Syntax:**

***menu***

***mirror***

Mirrorng of the traffic to /mnt/mem/mirror.pcap. file Does not include TDMoP traffic. The file can be viewed using Wireshark and other network traffic analyzers.

**Syntax:**

***mirror** [-l [64..1600]] [clear] [enable] [save]*

**Parameters:**

| | |
|---|---|
| ***-l*** | the maximum length of a frame, valid values are [64..1600]; |
| ***clear*** | clear the previous traffic mirroring session; |
| ***enable*** | enable traffic mirroring; |
| ***save*** | save the result to a file; |

**Example:**

Clear the previous traffic mirroring session, enable mirroring, wait for the required period of time and save the result to a file.

```
LPOS > mirror clear
LPOS > mirror enable
LPOS > mirror save
Saved to /mnt/mem/mirror.pcap
```

***ps***

Show information on the active processes of the device.

**Syntax:**

***ps***

**Example:**

```
LPOS > ps
 name            state                 wait  sleep  cpu time
          idle   ready started                      90.623%
     SCPUMon-1   susp  event             89      0   0.663%
           Log   susp  event            708      1   0.016%
    ATUMonitor   susp  sleep              1      0   2.091%
       ethstat   susp  sleep             76      0   2.463%
       ethlink   susp  event          41045      0   0.000%
      ipdeamon   susp  lock              31      0   0.184%
    TCP_Deamon   susp  sleep             27      0   0.112%
     SIPServer   susp  lock              13      0   0.093%
  IGMPSnooping   susp  lock              95      0   0.057%
           NTP   susp  lock              77      1   0.074%
          LLDP   susp  sleep             38      1   0.048%
     E1_daemon   susp  sleep             47      0   0.841%
    statistics   susp  sleep             12      0   0.080%
          rstp   susp  lock             137      0   0.470%
     DyingGasp   susp  sleep            623      1   0.008%
     ftpdeamon   susp  event            707      1   0.008%
    httpdaemon   susp  event            705      1   0.008%
     SNMPTraps   susp  lock              45      0   0.040%
     SNMPAgent   susp  lock             521      1   0.006%
  telnetdeamon   susp  event            648      1   0.009%
       console   ready unsuspended                  0.000%
    monitoring   susp  sleep             12      0   2.096%
```

***pwd***

Displays the name of the current directory.

**Syntax:**

***pwd***

***reset-config***

Set some settings of the current configuration to default values.

**Syntax:**

***reset-config*** *[relative path]*

**Parameters:**

***relative path*** The path to the settings whose current values should be reset to the default values.

**Example:**

Reset the settings to the default values for the second E1 interface

```
LPOS  > running-config
…
set E1/2/config/Enable No
set E1/2/config/Unframed Yes
…

LPOS  > reset-config E1/2
Reverted 2 changed. Failed to revert 0
LPOS  >
```

***running-config***

Display the current device configuration as command-line interface commands. By default, parameters with values different from the default values are included in the command output.

**Syntax:**

***running-config*** *[-f dest filename] [filter Filter string] [full] [-r relative path]*

**Parameters:**

***-f*** a file for storing the result of the command;

***filter*** filter for any part of the output parameter name;

***full*** show the full configuration;

***-r*** show parameters located by the relative path specified after the key

**Example:**

Print the configuration using the filter on the line "/3"

```
LPOS > running-config filter /3
set E1/3/config/SyncSource 3
set TDMoP/3/config/FrameSize 11
set TDMoP/3/config/JBSize 11
set TDMoP/3/config/RemoteIP 192.168.0.225
set TDMoP/3/config/RemoteChannel 1
set TDMoP/3/config/Slip Enabled
```

```
set TDMoP/3/config/AdminStatus Connect
set VLAN/32/Name VLAN-32
```

Display the configuration of Ethernet interfaces with relative paths

```
LPOS  > running-config -r Eth
set 0/VLAN/DefVLAN 99
set 0/VLAN/Role access
set 1/VLAN/Role access
set cpu/VLAN/DefVLAN 123
set CSFP2/VLAN/DefVLAN 123
set CSFP2/VLAN/Tagged 3,5,123
set CSFP2/VLAN/Role QinQProvider
```

***save-config***

Save the current configuration to /mnt/flash/system.cfg

**Syntax:**

***save-config***

**Example:**

```
LPOS > save-config
Saving configuration to /mnt/flash/system.cfg
Saved
```

***set***

Set the parameter value.

**Syntax:**

***set*** *<attribute> <value>*

**Parameters:**

| | |
|---|---|
| ***attribute*** | the path to the parameter(s);<br>- supports the use of wildcard (replacement templates) such as «*» and lists, for example: «[0-1,3]»<br>- hint on possible parameters, works by pressing "TAB» |
| ***value*** | parameter value; |

**Example:**

Set «VLAN-32» to «VLAN/32/Name»

```
LPOS > set VLAN/32/Name VLAN-32
```

**Example 2:**

Change the size of the Jitter buffer at channels 0, 1, 2, 4 to 5 ms

```
LPOS  > set tdmop/[0-2,4]/con*/jbsize 5
/tdmop/0/config/JBSize changed to 5
/tdmop/1/config/JBSize changed to 5
/tdmop/2/config/JBSize changed to 5
/tdmop/4/config/JBSize changed to 5
```

***show***

Display the contents of the specified file in the console.

**Syntax:**

***show*** *<filename>*

**Parameters:**

***filename*** a name of the file for output;

**Example:**

Display the contents of the system.cfg file.

```
LPOS > show system.cfg
#System{
        #global{
        Set Name=LPOS;
        }
}
```

***stat***

Show the status of the device interfaces. The command without parameters displays only non-zero counters.

**Syntax:**

***stat*** *[--cont] [--new] [--rate] [--step [1..96]] [-c columns] [-i [1..1000]] [-m modules] [-p ports] [-t type]*

**Parameters:**

| | |
|---|---|
| ***--cont*** | to update the statistics every second. «Ctrl+C» to exit |
| ***--new*** | start new statistics interval |
| ***--rate*** | values displaying in units per second |
| ***--step*** | the interval of grouping the statistics, the number of intervals in the group |
| ***-c*** | the list of column filters for displaying (rx,Ok – displays all columns in behalf of which there is either rx or Ok) |
| ***-i*** | the depth of the history of statistics in intervals, the range of values [1..1000] |
| ***-m*** | The list of filters for the statistics modules names to display statistics, for example: E1, Eth, TDMoP (you can specify any part of the module name, for example, in the th filter, statistics related to the Eth module will be displayed) |
| ***-p*** | list of filters by ports to display statistics, for example: 0, 1, sfp... |
| ***-t*** | List of table names filters to display statistics: Errors, Info, Warning, Extend, Hist (in – displays all tables whose name contains in, in this case these are tables: **In**fo, Warn**in**g) |

**Example:**

```
LPOS > stat -m E1 -p 1,3 -t Info
  E1-Info dd.mm hh:mm Total rxOk txOk rxFDev txFDev
        1  Now  17:54 554   554  554  0      0
        3  Now  17:54 554   554  554  0      0
```

***stored-config***

Display the saved device configuration as command-line interface commands. By default, parameters with values different from the default values are included in the command output.

**Syntax:**

***stored-config*** *[-f dest filename] [filter Filter string]*

**Parameters:**

***-f*** a file for storing the result of the command;

***filter*** filter for any part of the output parameter name;

**Example:**

Display the saved configuration using the filter by the line «VLAN»

```
LPOS > stored-config filter VLAN
set Eth/0/VLAN/DefVLAN 32
set Eth/0/VLAN/Tagged 10
set Eth/0/VLAN/Role trunk
set Eth/1/VLAN/DefVLAN 10
set Eth/1/VLAN/Untagged 10,32
set Eth/1/VLAN/Role access
set Eth/CSFP2/VLAN/Member 32
set Eth/CSFP2.1/VLAN/Member 32
set Eth/CSFP3/VLAN/Member 32
set Eth/CSFP3.1/VLAN/Member 32
set IP/stored-config/DefaultVlanID 10
set IP/stored-config/TrustUnkVlan No
set VLAN/10/Name control
set VLAN/10/Auto Disabled
set VLAN/32/Name VLAN-32
```

***su***

Allows you to log on again with another user name without disconnecting the current connection.

**Syntax:**

***su*** *[username]*

**Parameters:**

***username*** user name;

**Example:**

Login as admin.

```
LPOS > su admin
Enter password
LPOS >
```

***udploop***

Set loopback to UDP port.

**Syntax:**

***udploop*** *<port udpport>*

**Parameters:**

***port*** The number of UDP port (udpport) to install loopback;

**Examples:**

```
2.2.1.5  LPOS  > udploop port 10000
2.2.1.6  Press Ctrl-C to exit
2.2.1.7  1000 pps, 4208000 bps
2.2.1.8  1000 pps, 4208000 bps
2.2.1.9  1000 pps, 4208000 bps
2.2.1.10 1000 pps, 4208000 bps
2.2.1.11 1000 pps, 4208000 bps
2.2.1.12
2.2.1.13 LPOS >
```

***whoami***

Displays the name of the current user (admin, oper1, oper2).

**Syntax:**

***whoami***

### 3.1.4 File management commands

***copy***

Copies the file to another destination.

**Syntax:**

***copy*** *<source filename> <dest filename>*

**Parameters:**

***source filename*** the name of the source file to copy;

***dest filename*** the destination file name;

**Example:**

```
LPOS > copy /mnt/flash/system.cfg /mnt/flash/backup_system.cfg
```

***delete***

Deletes a file or directory.

**Syntax:**

***delete*** *<filename>*

**Parameters:**

***filename*** file or directory name;

**Example:**

Delete the backup_system.cfg file

```
LPOS > delete /mnt/flash/backup_system.cfg
```

***format***

Formats the file system to flash. Logs and the saved device configuration will be deleted. The operating system image is not damaged.

**Syntax:**

***format***

***mkdir***

Creates a new directory

**Syntax:**

***mkdir*** *<dirname>*

**Parameters:**

***dirname*** name of directory to create;

**Example:**

Create the htdocs directory.

```
LPOS > mkdir htdocs
```

***mnt***

Mount the file system to flash memory. It must be used to save the configuration if the flash memory has been previously unmounted, for example, by running the umnt command or by booting a device with factory settings.

**Syntax:**

***mnt***

***umnt***

Unmount file system from flash memory.

**Syntax:**

***umnt***

### 3.1.5 Flow control commands

***spregdebug***

Command to debug the parameters of the speed controller

**Syntax:**

***spregdebug*** *[-r IP]*

**Parameters:**

***-r*** The IP address of the server with the software for monitoring the parameters of speed controller;

**Example:**

```
LPOS > spregdebug –r 192.168.0.130
```

### 3.1.6 Network commands

***nscache***

Show/clear the cache of allowed domain names.

**Syntax:**

***nscache*** *[clear] [show]*

**Parameters:**

| | |
|---|---|
| ***clear*** | Clear the cache of allowed domain names. |
| ***show*** | Show the cache of allowed domain names. |

**Example:**

```
LPOS > nscache show
                Name|vlan|              IP|ttl
        srvtest.domain|   0|      192.168.0.10|31535966
          my-pc.domain|   0|     192.168.0.120|31535996

LPOS >
```

***ping***

Sends an ICMP packet to the specified network address and displays the time of its round trip or no response message in the terminal window.

**Syntax:**

***ping*** *<IP address or host name> [-i TTL] [-l size] [-n repeat] [-t] [-v VLAN ID] [-w timeout ms]*

**Parameters:**

| | |
|---|---|
| ***IP address*** | IP address or host name of the device being pinged |
| ***-i*** | Setting the lifetime of packets (TTL) |
| ***-l*** | The send buffer size, value range [1..1600]; |
| ***-n*** | Number of requests. |
| ***-t*** | Pings the specified host until stopped. Press any key to stop. |
| ***-v*** | The VLAN number in which the ping is performed, the range of values [1..4094]; |
| ***-w*** | Response timeout (default 1000 ms), range [1..30000]; |

**Example:**

Ping the IP address 192.168.0.225 with two queries.

```
LPOS > ping 192.168.0.225 -t 2
Echo reply 0.248ms
Echo reply 0.240ms
Ping statistics:
        Packets: Sent 2, Received 2, Lost 0 (0% loss)
Approximate round trip times:
                Minimum 0.240ms, Maximum 0.248ms, Average 0.244ms
```

***telnet***

Connect to the host via telnet.

**Syntax:**

***telnet*** *<host> [port] [-v vlanid]*

**Parameters:**

| | |
|---|---|
| ***host*** | IP address of the remote computer; |
| ***port*** | port number, valid values [1..65534]; |
| ***-v*** | VLAN ID; |

**Example:**

```
LPOS > telnet 192.168.0.225 -v 32
connecting...
..
Welcome to LPOS_225
login:
```

***tracert***

Determine the route of the data to the specified host.

**Syntax:**

***tracert*** *<IP address or host name> [-h max hops] [-v VLAN ID] [-w timeout ms]*

**Parameters:**

| | |
|---|---|
| ***IP address or host name*** | IP address or domain name of the host to determine the route. |
| ***-h*** | Maximum number of transitions, range of values [1..255]. |
| ***-v*** | The VLAN number in which the trace is performed, the range of values [1..4094]; |
| ***-w*** | Response timeout (default 1000 ms), range [1..30000]; |

**Example:**

Ping the IP address 192.168.0.225 with two queries.

```
LPOS > ping 192.168.0.225 -t 2
Echo reply 0.248ms
Echo reply 0.240ms
Ping statistics:
        Packets: Sent 2, Received 2, Lost 0 (0% loss)
Approximate round trip times:
                Minimum 0.240ms, Maximum 0.248ms, Average 0.244ms
```

### 3.1.7 Commands for firmware update and device restart

***reset***

Causes reset and restart of the control microprocessor, and initial loading of all multiplexer nodes. This command can be run by an administrator only.

**Syntax:**

***reset***

***systemupdate***

Multiplexer firmware update

**Syntax:**

***systemupdate***

### 3.1.8 Operating system commands

***passwd***

Allows you to change the password of this user or another user (if you specify their name). The password can consist of Latin letters and digits and can be up to 18 characters long. To avoid errors, the password is entered twice. The admin user can change the password of any user.

**Syntax:**

***passwd*** *[user name]*

**Example:**

Admin user change the password of oper1 user.

```
LPOS > passwd oper1
Enter old password
Enter new password
Enter new password again
```

***scpuup***

Update the software of the processor responsible for monitoring the environment (temperature, voltage ...)

**Syntax:**

***scpuup*** *<filename>*

**Parameters:**

***filename*** a path to the update file;

**Example:**

```
LPOS > scpuup /mnt/flash/fileupd.bin
```

### 3.1.9 Special commands

***debug***

Monitoring and displaying of debug message log

**Syntax:**

***debug*** *[-d] [-e] [-m module] [clear] [show]*

**Parameters:**

***-d*** disable debugging;

***-e*** enable debugging;

***-m*** specify module name (CP, SIP, IP, ICMP, EMAC, FFS);

***clear*** clear the current log;

***show*** show debug log;

**Example:**

Clear previous debugging session, enable ICMP module debugging, make test Ping, disable debugging. View the result.

```
LPOS > debug clear
LPOS > debug -e -m ICMP
LPOS > ping 192.168.0.225
Echo reply 0.759ms
Ping statistics:
        Packets: Sent 1, Received 1, Lost 0 (0% loss)
Approximate round trip times:
                Minimum 0.759ms, Maximum 0.759ms, Average 0.759ms
```

```
LPOS > debug -d
LPOS > debug show
...
[4] 04169861.641 Echo request
[8] 04169862.044 IP
[4] 04169862.239 ICMP income
[4] 04169862.420 Rcv reply
[4] 04169862.680 Echo ok
...
```

### 3.1.10 General diagnostic commands

The commands show the current supply voltage and temperature inside the multiplexer and provide access to a log that records all the multiplexer system messages. The log contains 2730 most recent messages and is in the system memory of the multiplexer, and users, both privileged and unprivileged, cannot erase messages. All the anomalies in the operation of the multiplexer: loss or appearance of the signal on the external interfaces, connection and disconnection of the control computer for the configuration of the multiplexer – are recorded in the log indicating the time of occurrence.

***envir***

Displays system data on the device.

**Syntax:**

***envir***

**Example:**

```
LPOS > envir
Name: 62x, 63x scpu
Ver: 2.4.8.9 [boot 2.1]
SN: 7C 19 17 00
```

***getkey***

Displays the license key.

**Syntax:**

***getkey***

**Example:**

```
LPOS > getkey
8C3SIQ2F-OE5VF4QL-R9C12KD4-B3F6T1J5
```

***getsign***

Displays the data required to generate the license key

**Syntax:**

***getsign***

**Example:**

```
LPOS > getsign
6BD17JDF-U4L9BH6N-KPSJ6N17-SSEMF2J0
```

***lasterr***

Show the last dump after a system failure.

**Syntax:**

***lasterr*** *[clear]*

**Parameters:**

***clear*** clear the last dump;

***sendpkt***

Send a user-defined frame to the network

**Syntax:**

***sendpkt*** *[-l length] [-n count] [-p port] [-r] [-v vlanid]*

**Parameters:**

***-l*** length of a frame, valid values are [50..1500];

***-n*** number of frames;

***-p*** the destination port number of the multiplexer;

***-r*** generate random source MAC address;

***-v*** VLAN ID;

**Example:**

```
LPOS > sendpkt -l 64 -n 10 -p 1 -v 10

FF FF FF FF FF FF 54 A5  4B 7C 19 17 81 00 00 0A
00 2E 00 01 00 02 00 03  00 04 00 05 00 06 00 07
00 08 00 09 00 0A 00 0B  00 0C 00 0D 00 0E 00 0F
00 10 00 11 00 12 00 13  00 14 00 15 00 16 00 17
```

***setkey***

Set a license key.

**Syntax:**

***setkey*** *<key>*

**Parameters:**

***key*** license key;

**Example:**

```
LPOS > setkey 8C3SIQ2F-OE5VF4QL-R9C12KD4-B3F6T1J5
8C3SIQ2F-OE5VF4QL-R9C12KD4-B3F6T1J5
```

***sysdump***

Creates an archive with debugging information for technical support

**Syntax:**

***sysdump***

**Example:**

```
LPOS > sysdump
Dump saved to /mnt/mem/dump.zip
```

### 3.2 Configuration menu

For a complete and more detailed configuration, there is an interface in the form of a text hierarchical menu. To launch it, type **menu** command and press **«Enter»**. To go to the required submenu, select it with the arrow keys «↑» (up) or «↓» (down) and press «Enter». To return to the top-level menu, select «..». The example of the main menu is shown in the figure.

```
LPOS                                                Advanced  ESC+h - Help
|>..
| AAA
| ATU
| E1
| Envir
| Eth
| EthGlobal
| flash
| IP
| system
| TDMoP
| VLAN

Filter: <Press any letter key to start filtering items>

LOG:02.08.16 10:47:39.529 : [SID=8] /IP/hosts/1/Network changed to 0.0.0.0
```

The top line indicates the name of the displayed menu and its position in the menu structure.

To launch the menu, You need to connect to the device via the serial port (miniUSB) or via the Ethernet interface.

When using the serial interface, you need to install special drivers that can be downloaded from websites on the Internet, and the terminal program (for example, HyperTerminal, PuTTY).

When using the Ethernet interface for management, the ***Telnet*** or ***SSH*** client must be installed on the management computer. By default, the device has an IP address of ***192.168.0.24*** and a mask of ***255.255.255.0***. Make sure that the control computer is on the same subnet as the multiplexer. The device must respond to the ***ping*** command.

After connecting to the device, you must enter your username and password. By default, login is ***admin***, password is ***admin***. Then, you will see the ***LPOS>*** prompt. Enter the ***menu*** command and press ***«Enter»*** to access the device menu.

To go to the required section, select it with the arrow keys «↑» (up) or «↓» (down) and press ***«Enter»***. To change the value of the parameter, select it with the arrows «↑» (up) or «↓» (down) and press ***«Enter»***. Then you need to either enter a value from the keyboard and press ***«Enter»***, or select a new parameter value from the proposed using arrows and press 2 times ***«Enter»***.

To view menu items that are off the screen, you can use the cursor keys «↑» (up) or «↓» (down) or the keyboard shortcuts ***«ESC+P»***, ***«ESC+N»***.

To reset the statistics, use the **«*ESC+R*»** key combination. If you press «***ESC+R***» in the root menu item, all statistics will be reset. To reset some specific statistics, move to it in the menu and press **«*ESC+R*»** to reset. I.e. all the statistics included to the current menu item will be reset.

To enable the advanced menu mode (more detailed configuration), press ***«ESC+A»***.

To view the current configuration of the device (the configuration which is operating at the moment), press ***«ESC+M».*** The current configuration may differ from the basic configuration with which the device boots after reboot, if you change the settings and do not save them to memory (***«ESC+S»***).

Also, you may use filter for all the items for quick navigation. To do this, enter the letters contained in the item needed, and the items will be filtered by name.

**Example**:

Enter the letter **t**, all the menu items that contain the letter **t** will be displayed, namely, ***TDMoP, Eth, System, ATU, EthGlobal*.**

At the very bottom of the window, the last event recorded in the log is displayed.

In order to save the changes made to the configuration, and to make changed configuration load next time with these settings, use **«*ESC+S*»**.

To exit menu mode and enter command mode, press ***«ESC+Q»*** or ***«CTRL+C»***.

To return to the top-level menu, select ***«..»*** and press ***«Enter»***.

### 3.2.1 /E1 menu

The /E1 submenu is used to view the current status of E1 ports and select E1 port for its further configuration and to view error statistics.

```
/E1 LPOS                                          Advanced  ESC+h - Help
|>.. Name      Status
| 0           Send: Ok Recv: Ok Unframed
| 1           Send: Ok Recv: Ok

Filter: <Press any letter key to start filtering items>

LOG:02.08.16 09:20:21.440 : [SID=9] Control session started by admin from 192.
```

#### 3.2.1.1 /E1/port/config submenu

This submenu allows you to configure the selected E1 interface.

```
/E1/1/config LPOS                                 Advanced  ESC+h - Help
|>..                                 | CRC4
| --Status--                         | FASOffload         Disabled
| StrStatus         Send: Ok Recv: Ok  | NoLogEvents
| LinkStatus        Up
| SignalLevel
| RTT               0
| RX                Ok
| TX                Ok
| --Config--
| LongLine          Disabled
| Description
| Enable            Yes
| Loop              No
| Unframed          No
| SendFormat        TDMoP
| SyncSource        -1
| PRBSCheck         No
| RxSpeed           4025
| Encoding          HDB3
```

```
Filter: <Press any letter key to start filtering items>

LOG:02.08.16 09:20:21.440 : [SID=9] Control session started by admin from 192.
```

| | |
|---|---|
| ***StrStatus*** | Displays the receiver/transmitter status of E1 port.<br>***OK*** – no errors in the operation of the E1 port receiver/transmitter;<br>***AIS*** – the presence of the AIS signal in the received/transmitted E1 stream;<br>***RAI*** – the presence of the RAI signal in the received/transmitted stream E1;<br>***LOS*** – the presence of the LOS signal in the received/transmitted stream E1;<br>***AZS*** – the presence of the AZS signal in the received/transmitted E1 stream;<br>***NOS*** – no signal on E1 port receiver/transmitter;<br>***CodeErr*** – encoding errors (AMI/HDB3) on E1 port receiver/transmitter;<br>***PRBSErr*** – the presence of pseudo-random binary sequence (PRBS) errors on the receiver/transmitter of port E1 (possible if the PRBS transmission format is set on the port);<br>***TestErr*** – the presence of errors in the operation of the tester E1 on the E1 port receiver/transmitter (possible if the port is set to transfer format Test);<br>***MfASErr*** – multiframe synchronization errors;<br>***CRC4Err*** – errors in CRC-4;<br>***RCRC4Err*** – presence of installed bits of CRC-4 error indication in the last two odd frames of the multiframe;<br>***RarePulseErr*** – errors that indicate that the pulses arrive less frequently than expected in coding AMI/HDB3;<br>***TXlock*** – short circuit (TX+ and TX-) on the port;<br>***Unframed*** – the port is operating in unframed mode;<br>***Loop*** – local loop is enabled on the port;<br>***Remote loop*** – remote loop is enabled on the port.<br>***RTT*** – time from the moment of sending a request to the moment of receiving a response. |
| ***LinkStatus*** | Displays the port status.<br>***Up*** – there is a connection;<br>***Down*** – no connection. |
| ***SignalLevel*** | Signal level, dBm.<br>Only when the *LongLine* algorithm for adjusting the signal level on long E1 lines (more than 100 m) is enabled***.*** |
| ***LongLine*** | Enable/disable signal level adjustment algorithm on long E1 lines (more than 100 m).<br>It is not recommended to switch it on at short distances.<br>***Disabled*** – disabled (by default);<br>***Enabled*** – enabled. |

| | |
|---|---|
| ***RTT*** | Displays ***Round Trip Time*** – from the time the request is sent to the time the response is received.<br>It is displayed if transfer of test framed E1 stream is enabled (*SendFormat - Test*).<br>It is measured in UI – unit interval. 1UI = 0.48 µs. |
| ***RX*** | Displays the status of the E1 port receiver.<br>***OK*** – no errors in the operation of the E1 port receiver/transmitter;<br>***AIS*** – the presence of the AIS signal in the received/transmitted E1 stream;<br>***RAI*** – the presence of the RAI signal in the received/transmitted stream E1;<br>***LOS*** – the presence of the LOS signal in the received/transmitted stream E1;<br>***AZS*** – the presence of the AZS signal in the received/transmitted E1 stream;<br>***NOS*** – no signal on E1 port receiver/transmitter;<br>***CodeErr*** – the presence of encoding errors (AMI/HDB3) on E1 port receiver/transmitter;<br>***PRBSErr*** – the presence of pseudo-random binary sequence (PRBS) errors on the receiver/transmitter of port E1 (possible if the PRBS transmission format is set on the port);<br>***TestErr*** – the presence of errors in the operation of the tester E1 on the E1 port receiver/transmitter (possible if the port is set to transfer format Test);<br>***RarePulseErr*** – errors that indicate that the pulses arrive less frequently than expected in coding AMI/HDB3;<br>***MfASErr*** – multiframe synchronization errors;<br>***CRC4Err*** – errors in CRC-4;<br>***RCRC4Err*** – presence of installed bits of CRC-4 error indication in the last two odd frames of the multiframe; |
| ***TX*** | Displays the status of the E1 port transmitter.<br>Can take values similar to RX: ***NOS, AIS, AZS, LOS, RAI, PRBSErr, TestErr, Loop, TXLock,MfASErr, CRC4Err, RCRC4Err, Ok***.<br>***TXlock*** – short circuit (TX+ and TX-) on the port; |
| ***Description*** | The description of the interface. |
| ***Enable*** | Enable/disable E1 port.<br>***Yes*** – enabled (by default);<br>***No*** – disabled |
| ***Loop*** | Installation of remote loop on E1 port.<br>***Yes*** — loop is set — the data coming to the output of the E1 port transmitter is wrapped and transmitted back to the remote gateway. Equivalent to setting the physical plugs to the E1 port.<br>***No*** — loop is removed — E1 port works in normal mode (by default). |
| ***Unframed*** | Enable/disable the control for the frame structure of the input E1 stream. |

| | |
|---|---|
| | ***Yes*** — the transfer mode without frame structure control is set;<br>***No*** — the transmission mode with frame structure control is set (by default). |
| ***SendFormat*** | Data transmitted to the line.<br>***AZS*** — test mode — an AZS signal is sent to the output of the E1 port;<br>***AIS*** — test mode — an AIS signal is sent to the E1 port output;<br>***PRBS*** — test mode — a pseudo-random binary sequence PRBS ( i.e. a non-fragmented test data stream at a speed of 2048 kbit/s) is sent to the output of the E1 port;<br>***Test*** — test mode — the test E1 stream is sent to the E1 port output;<br>***TDMoP*** — normal operation mode of the E1 port (by default). |
| ***SyncSource*** | Setting the source of synchronization for the E1 output stream. Here, you may specify the name of the E1 port that is the source of the E1 output stream synchronization for this port (not recommended).<br>By default, the device operates in the frequency recovery mode and the value is set to: -1. |
| ***PRBSCheck*** | Enable/disable PRBS errors registration mode.<br>Checks the stream as PRBS-31 sequence.<br>***Yes*** – enabled;<br>***No*** – disabled. |
| ***RxSpeed*** | The deviation of the incoming stream frequency from the internal one, in ppb |
| ***Encoding*** | Signal encoding method.<br>***HDB3*** – high density bipolar encoding (by default);<br>***AMI*** – alternate inversion of 1s. |
| ***CRC4*** | The use of the cyclic redundancy check in multiframes. By default, all CRC-4 options are disabled.<br>***Check*** – recalculate CRC-4 and check it with the transmitted;<br>***Send*** – to calculate and send CRC-4 (if option FASOffload – generating the 0-th time-slot is enabled);<br>***REICheck*** – check CRC-4 error indication bits;<br>***REISend*** – set CRC-4 error indication bits. |
| ***FASOffload*** | The generation of the 0-th time-slot.<br>***Enabled*** – generate -0-th time slot;<br>***Disabled*** – do not generate the 0th time slot, send it transparently with TDMoP stream (by default). |
| ***NoLogEvents*** | Disable logging of selected events.<br>It is possible to disable logging of events: NOS, AIS, AZS, LOS, RAI, PRBSErr, TestErr, TXLock, CodeErr, FastPulseErr, RarePulseErr, MfASErr, RCRC4Err, CRC4Err, Ok<br>**It is available from the firmware version: LPOS 1.0.9.4SR38.** |

#### 3.2.1.2 E1/port/statistics submenu

This submenu allows you to viwe the statistics of the selected E1 interface.

- In the statistics submenu, counters starting with rx characterize the operation of the E1 port receiver;
- the ones starting on tx display the values of the counters characterizing the operation of the E1 port transmitter;

```
/E1/1/statistics LPOS                              Advanced  ESC+h - Help
|>..                                  | rxMfASErr          0
| Total             65930             | txOk               65930
| Start             01.08.16 16:50:05 | txNOS              0
| Finish            02.08.16 11:08:54 | txAIS              0
| rxOk              65930             | txAZS              0
| rxNOS             0                 | txLOS              0
| rxAIS             0                 | txRAI              0
| rxAZS             0                 | txPRBSErr          0
| rxLOS             0                 | txLocks            0
| rxRAI             0                 | txFDev             4032
| rxPRBSErr         0                 | txCRC4Sec          0
| rxTestErr         0                 | txCRC4Rem          0
| rxCodeErr         0                 | txMfASErr          0
| rxRareErr         0
| rxFastErr         0
| rxFDev            4011
| rxCRC4            0
| rxCRC4Sec         0
| rxCRC4Rem         0
Filter: <Press any letter key to start filtering items>

LOG:02.08.16 09:20:21.440 : [SID=9] Control session started by admin from 192.
```

| | |
|---|---|
| ***Total*** | Total time of collection of data transmission and reception statistics via E1 port. |
| ***Start*** | Date and time of the beginning of data transmission and reception statistics collection via E1 port. |
| ***Finish*** | Date and time of the end of statistics collection of data transmission and reception via port E1. |
| ***rxOk*** | Time in seconds during which the received E1 stream has no errors. |
| ***rxNOS*** | Time in seconds during which there is no an input signal on E1 port receiver. |
| ***rxAIS*** | Time in seconds during which AIS signal is being received. |
| ***rxAZS*** | Time in seconds during which AZS signal is being received. |
| ***rxLOS*** | Time in seconds during which LOS (the lack of synchronization G.704 indicator) signal is being received. |
| ***rxRAI*** | Time in seconds during which RAI (remote error indicator in E1 stream set by the station) signal is being received. |
| ***rxPRBSErr*** | The number of errors in the PRBS (pseudo-random binary sequence), this counter is used when the PRBS transmission format is set on port E1. |

| | |
|---|---|
| ***rxTestErr*** | The number of errors of the E1 tester, this counter is used when the E1 port is set to the Test transfer format. |
| ***rxCodeErr*** | The quantity of AMI/HDB3 encoding errors on E1 port receiver. |
| ***rxRareErr*** | The number of errors indicating that the pulses come less often than expected when using AMI/HDB3 encoding. |
| ***rxFastErr*** | The number of errors indicating that the pulses come more often than expected when using AMI/HDB3 encoding. |
| ***rxFDev*** | The deviation of the incoming stream frequency from the internal one, in ppb |
| ***rxCRC4*** | Number of CRC-4 errors on the receiver |
| ***rxCRC4Sec*** | Time in seconds during which CRC4 errors were detected on the receiver. |
| ***rxCRC4Rem*** | Time in seconds during which errors were detected in the CRC-4 error indication bits on the receiver |
| ***rxMfASErr*** | Time in seconds during which multiframe synchronization errors were detected on the receiver |
| ***txOk*** | Time in second during which there were no errors in the transmitted E1 stream. |
| ***txNOS*** | Time in second during which there was no signal on E1 port transmitter output. |
| ***txAIS*** | Time in second during which AIS signal is being transmitted. |
| ***txAZS*** | Time in second during which AZS signal is being transmitted. |
| ***txLOS*** | Time in seconds during which LOS (the lack of synchronization G.704 indicator) signal is being transmitted. |
| ***txRAI*** | Time in seconds during which RAI (remote error indicator in E1 stream set by the station) signal is being transmitted. |
| ***txPRBSErr*** | The number of errors in the PRBS (pseudo-random binary sequence), this counter is used when the PRBS transmission format is set on port E1. |
| ***txLocks*** | Errors that are logged when a short circuit on the transmission (TX+ to TX-) occurs. |
| ***txFDev*** | The deviation of the outgoing stream frequency from the internal one, in ppb |
| ***txCRC4Sec*** | Time in seconds during which CRC4 errors were detected on the transmitter. |
| ***txCRC4Rem*** | Time in seconds during which errors were detected in the CRC-4 error indication bits on the transmitter |
| ***txMfASErr*** | Time in seconds during which multiframe synchronization errors were detected on the transmitter |

### 3.2.2 /TDMoP menu

The /TDMoP submenu is used to view the current status of TDMoP ports and select TDMoP port for its further configuration and to view statistics.

```
/TDMoP LPOS                                          Advanced  ESC+h - Help
|>.. Name      Status
| 0            Working,FT
| 1            Working,PID Sync

Filter: <Press any letter key to start filtering items>

LOG:02.08.16 09:20:21.440 : [SID=9] Control session started by admin from 192.
```

```
/TDMoP/1 LPOS                                        Advanced  ESC+h - Help
|>..
| config
| E1
| redundancy
| state
| statistics

Filter: <Press any letter key to start filtering items>

LOG:17.04.17 10:34:03.339 : [SID=4] Control session started by admin from 192.
```

| | |
|---|---|
| ***config*** | Configuring TDMoP transmission on the selected interface. |
| ***E1*** | Link to the root E1 menu item. |
| ***redundancy*** | Redundancy settings (1+1)<br>**It is available from the firmware version: LPOS 1.0.9.4SR38.** |
| ***state*** | Current status of the selected TDMoP interface |
| ***statistics*** | The error counters of the selected TDMoP interface |

#### 3.2.2.1 /TDMoP/port/config submenu

This submenu allows you to configure the selected TDMoP interface.

When the settings are reset (default settings) the menu item looks as follows:

```
/TDMoP/0/config LPOS                                 Advanced  ESC+h - Help
|>..                                  | --Config--
| --Status--                          | Description
| StrStatus          Power Down       | JBSize             4
| SIPStatus          WaitingInvite    | LocalTS            0-31
| LinkStatus         Down             | RemoteTS           0-31
| CurrentJB          0                | Loop               No
| Speed              0                | SpeedReg           PID
| Protocol           TDMoP            | Compression        Disabled
| --NetConfig--                       | KeyFrameInterval   16
| AdminStatus        Listen           | DoubleSend         -1
| RemoteIP           0.0.0.0          | LostRequest        Enabled
| RemoteChannel      0                | ConstSpeed         No
```

```
| FrameSize         2                 | ConstSpeedValue    0
| VLANID            32                | Slip               Disabled
| VLANPri           6                 | SlipLeft           75
| DSCP              default           | SlipRight          125
| MaxTimeout        4000              | --NATConfig--
| UseIP             Yes               | WANIP              0.0.0.0
| GatewayBypass     Disabled          | SIPPort            5060
Filter: <Press any letter key to start filtering items>

LOG:07.06.17 17:29:24.991 : [SID=2] Control session started by admin from 192.
```

| | |
|---|---|
| ***StrStatus*** | Displays the status of the TDMoP transmission. |
| ***SIPStatus*** | Displays status of the connection via SIP.<br>***Down*** – the connection is not established;<br>***WaitingInvite*** – waiting for the invite to setup a SIP connection;<br>***WaitingResponce*** – waiting response to invitation to setup a SIP connection;<br>***WaitingAck*** – waiting for confirmation that a response has been received;<br>***ResolvingHost*** – define the MAC of the remote side;<br>***Too much frames in JB*** – exceeded the maximum possible size of the jitter buffer (maximum number of Ethernet frames in the jitter-buffer is limited by the number 512, i.e., the following condition must fulfill JBSize/FrameSize < 256);<br>***Connected*** – connection is established; |
| ***LinkStatus*** | The state of this connection.<br>***Up*** – the connection is established, the reception and transmission of TDMoP frames is in progress;<br>***Down*** – no reception or transmission of TDMoP frames; |
| ***CurrentJB*** | Displays the current jitter buffer size in µs. |
| ***Speed*** | The value of the output frequency of the stream on the E1 interface. The value of this parameter is set based on the internal algorithm of restoring the synchronization frequency. The values can be different on two gateways for the same E1 stream, but the value on the same gateway should not change much over time. |
| ***Protocol*** | Virtual connection protocol.<br>***TDMoP*** – TDM-over-Packet – by default.<br>***SAToP*** - Structure-Agnostic Time Division Multiplexing over Packet, RFC 4553.<br>***CESoPSN*** - Structure-Aware Time Division Multiplexed Circuit Emulation Service over Packet Switched Network, RFC 5086<br>**It is available from the firmware version: LPOS 1.0.9.4SR39.** |
| ***AdminStatus*** | Sets the operating mode for this port. The operating mode is selected separately for each port.<br>***Listen*** – in this mode, the gateway waits for a connection request from the remote |

| | |
|---|---|
| | gateway (by default);<br>***Connect*** – in this mode, the gateway sends connection requests;<br>***Blocked*** – the port is blocked, connection cannot be established for this port.<br>***AlwaysSend*** – force stream transfer without creating a SIP connection. |
| ***RemoteIP*** | The IP address of the remote gateway. |
| ***RemoteChannel*** | The E1 port number on the remote gateway to which you are connecting. |
| ***FrameSize*** | Sets the frame size to ½ ms. Possible values: from 1 to 63 (31.5 ms). The default value is 2. |
| ***VLANID*** | The 802.1p VLAN ID tag for packets on this port is set as decimal number in the range of 0 to 4095. 0 means no tag.<br>Default value: 32. |
| ***VLANPri*** | The priority bits in the VLAN ID 802.1p tag. The value is set as decimal number in the range of 0 to 7.<br>Default value: 6.<br>It is necessary that E1 traffic have the highest priority on the local Ethernet network. |
| ***DSCP*** | Setting the value of Differentiated Services Code Point for the connection. Available values: 0-63, af[1..4][1..3], cs[1..7], default, ef.<br>Default value: default (0).<br>***default*** – provide forwarding if possible (RFC 2474)<br>***cs[1..7]*** - Class Selector Codepoint (RFC 2474, section 4.2.2)<br>***af[1..4][1..3]*** – Assured Forwarding (RFC 2597, RFC 3260)<br>***ef*** – Expedited Forwarding (RFC 3246)<br>Matching of DSCP values with the ToS values is presented in the description of parameter «***DSCP***» in the table 1.1 Class Selector Codepoint.<br>**It is available from the firmware version: LPOS 1.0.9.4SR36.** |
| ***MaxTimeout*** | Sets the maximum extrapolation time in milliseconds. The maximum amount of time that, if there are no E1 stream data packets, the gateway will restore the contents of these packets based on the previous received packets and thus support the E1 output stream. Possible values: from 0 to 7000.<br>Default value: 4000 ms. |
| ***UseIP*** | Enable/disable the transmission mode of E1 stream data packets without IP/UDP headers.<br>This operation mode allows you to reduce the bandwidth required for the transmission of the flow E1, with the value of the parameter "No". The operation in this mode is possible only if the gateways are in the same IP subnet. The connection between the gateways occurs using the IP headers. Without IP headers, only E1 stream data packets are transmitted.<br>***Yes*** – enabled (by default); |

| | |
|---|---|
| | ***No*** – disabled. |
| ***GatewayBypass*** | Responsible for the E1 stream forwarding between different subnets, bypassing the gateway. It is used when the subnets, in fact, form a single local network, while exchanging normal data through the gateway.<br>***Disabled*** – disabled (by default);<br>***Enabled*** – enabled. |
| ***Description*** | Description of the port. |
| ***JBSize*** | Setting the output queue size, in milliseconds.<br>It should be more than a fluctuation of transit time in the network. For example, if the transit time for a hundred packets varies from 2.5 to 6.5 ms, the buffer must be at least 4 ms so that no packet is lost. It is better if the buffer is even larger so that the mechanism of re-request of lost packets can work. In all cases where the delay time variance is greater than one millisecond, the buffer size is a trade-off between the delay and the number of packets lost.<br>Possible values: from 1 ms to 2000 ms per port, but no more than 4000 ms per device (starting from 9.4SR26).<br>Note that the maximum number of Ethernet frames in the jitter buffer is limited to 512, i.e. the condition JBSize/FrameSize < 256 (starting from 9.4SR28) must be met.<br>The default value is 4 ms. |
| ***LocalTS*** | The list of time slots of input E1stream of the local gateway. The data on these time slots will be transmitted to the remote gateway via IP/Ethernet network. The list of time slots is specified by enumeration (20,11,18,19), range (18-20) or their combinations (11, 18-20). The order in which time slots are listed is irrelevant.<br>Default value: 0-31. |
| ***RemoteTS*** | List of time slots of E1 output stream of the remote gateway. The data received from the IP/Ethernet network by the remote gateway will be stored in these time slots. The list of time slots is set similarly to LocalTS.<br>Default value: 0-31. |
| ***Loop*** | Installation of local loop on E1 port.<br>***Yes*** - loop is set - the data coming from the E1 line is sent back into the line;<br>***No*** — loop is removed — E1 port works in data transmission mode (by default). |
| ***SpeedReg*** | Sets the frequency recovery mode. Possible values: ***PID, FT***. |
| ***Compression*** | Enable/disable E1 stream compression. Compression is performed without loss. If compression is enabled, unused timeslots in the channel are not transferred;<br>***Disabled*** – disabled (by default);<br>***Enabled*** – enabled. |
| ***KeyFrameInterval*** | If compression is enabled, you can adjust the interval between packet transmissions with all time slots (KeyFrameInterval). It can take values from 0 to 65535 frames.<br>The default value is 16 frames, i.e. a packet with all time slots will be sent every 16 |

| | |
|---|---|
| | frames. |
| ***DoubleSend*** | Delay before sending duplicate frames;<br>The value range is from -1 to 63 frames.<br>1 (default) redundancy is disabled;<br>0 – the duplicate frame will be sent next;<br>1 – the duplicated frame will be sent after one frame;<br>2 - duplicate frame will be sent after two frames; |
| ***LostRequest*** | Enable/disable re-querying of lost frames.<br>***Enabled*** – enabled (by default).<br>***Disabled –*** disabled. |
| ***ConstSpeed*** | Enable/disable constant speed mode.<br>***Yes*** – enabled; If ***Yes*** is set, you must set the speed in the ***ConstSpeedValue*** parameter. (not recommended)<br>***No*** – disabled. |
| ***ConstSpeedValue*** | Sets the value of the constant speed. It is used if the value of the parameter ***ConstSpeed*** takes the value ***Yes***. |
| ***Slip*** | Enable/disable slip tracking (i.e. either overrun or underrun of the jitter buffer) when using the external clock.<br>***Disabled*** – disabled (by default);<br>***Enabled*** – enabled. |
| ***SlipLeft*** | The left border in a percentage of the jitter buffer.<br>It can take values in the range of ***10-90%***.<br>The default value is ***75%***. |
| ***SlipRight*** | The right border in a percentage of the jitter buffer.<br>It can take values in the range of ***110-200%***.<br>The default value is ***125%***. |
| ***WANIP*** | IP address of NAT router's WAN port.<br>By default ***0.0.0.0*** – is not set. |
| ***SIPPort*** | SIP port of the device on the remote end.<br>The default value is ***5060***.<br>UDP protocol is used; |
| ***TDMPort*** | UDP port on the remote device for transmission via UDP/TDMOP.<br>The default value is ***41000***. |
| ***InterpMode*** | Interpolation mode (in case of lack of E1 stream data packets during ***MaxTimeout***). |

***PrevData*** – send previous received packets (by default);

***AIS*** – ***AIS*** signals transmission.

*Note: In the console menu, this setting is not included in the primary screen (you can move the cursor to the last item and then, using the cursor «down», or ESC+n, ESC+p, navigate among screens), or set the setting with the **set** command, for example:*

***Set TDMoP/0/config/InterpMode AIS***

*or via the web interface of the multiplexer*

#### 3.2.2.2 /TDMoP/port/state submenu

This submenu displays the current status of the selected TDMoP interface.

```
/TDMoP/0/state LPOS                                Advanced  ESC+h - Help
|>..
| StrStatus          Power Down
| SIPStatus          WaitingInvite
| Uptime             0 days, 0 hours, 0 min, 0 sec
| LinkStatus         Down
| Timeout            0
| RedirectedMAC      00:00:00:00:00:00
| RedirectedIP       0.0.0.0
| RedirectedChannel  0
| CurrentJB          0
| Speed              0
| UsedTimeslots      0
| FPS                1000
| EthFrameSize       316
| Bandwidth          2528
| MinJB              0
| MaxJB              0

Filter: <Press any letter key to start filtering items>

LOG:02.08.16 10:47:39.529 : [SID=8] /IP/hosts/1/Network changed to 0.0.0.0
```

| | |
|---|---|
| ***StrStatus*** | Displays the status of the TDMoP transmission. |
| ***SIPStatus*** | Displays status of the connection via SIP.<br>***Down*** – the connection is not established;<br>***WaitingInvite*** – waiting for the invite to setup a SIP connection;<br>***WaitingResponce*** – waiting response to invitation to setup a SIP connection;<br>***WaitingAck*** – waiting for confirmation that a response has been received;<br>***ResolvingHost*** – define the MAC of the remote side;<br>***Too much frames in JB*** – exceeded the maximum possible size of the jitter buffer (maximum number of Ethernet frames in the jitter-buffer is limited by the number 512, i.e., the following condition must fulfill JBSize/FrameSize < 256);<br>***Connected*** – connection is established; |
| ***Uptime*** | Stream transmission time; |
| ***LinkStatus*** | Displays the status of the port link; |

| | |
|---|---|
| ***Timeout*** | Shows for how long there were no frames, ms |
| ***RedirectedMAC*** | The MAC address to which frames were redirected |
| ***RedirectedIP*** | The IP address to which frames were redirected |
| ***RedirectedChannel*** | The namber of channel to which frames were redirected |
| ***CurrentJB*** | The current value of the jitter buffer, µs |
| ***Speed*** | The current deviation from the reference frequency (2048 Hz), ppb |
| ***UsedTimeslots*** | Number of time slots that are currently changing |
| ***FPS*** | Frames per second |
| ***EthFrameSize*** | Total frame size |
| ***Bandwidth*** | Current bandwidth, kbps |
| ***MinJB*** | The minimum (instantaneous) size of the jitter buffer, µs |
| ***MaxJB*** | The maximum (instantaneous) size of the jitter buffer, µs |

#### 3.2.2.3 /TDMoP/port/statistics submenu

This submenu displays the error counter of the selected TDMoP interface.

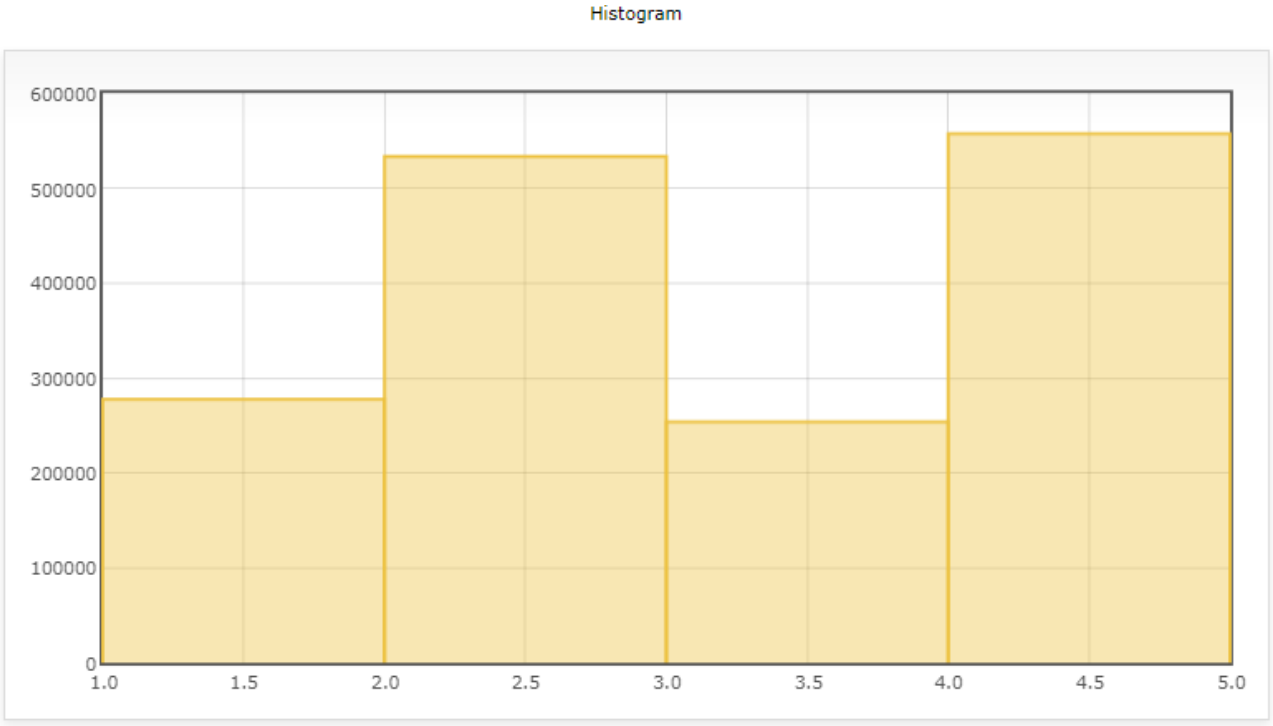
```
/TDMoP/0/statistics LPOS                          Advanced  ESC+h - Help
|>..                                  | MinJB               4
| Start             23.07.16 15:20:56  | MaxJB               4
| Finish            02.08.16 11:18:08  | RecommenedJB        4
| Valid             0
| Resend            0
| Ovf               0
| Undf              0
| Ignored           0
| Interp            0
| Resync            0
| SlipAdd           0
| SlipRem           0
| Lost              0
| LostReq           0
| Restored          0
| Fatal             0
| txDiscards        0
| AvgSpeed          0
| AvgJB             0
Filter: <Press any letter key to start filtering items>

LOG:02.08.16 10:47:39.529 : [SID=8] /IP/hosts/1/Network changed to 0.0.0.0
```

| | |
|---|---|
| ***Start*** | Start collecting statistics. |
| ***Finish*** | End of statistics collection. |
| ***Valid*** | The number of received TDMoP frames with no errors. |

| | |
|---|---|
| ***Resend*** | The number of frames retransmitted upon the request of the remote multiplexer. |
| ***Ovf*** | The number of frames dropped due to input buffer overflow. |
| ***Undf*** | The number of failures caused by insufficient data in the transfer buffer. |
| ***Ignored*** | The number of dropped TDMoP frames. |
| ***Interp*** | The number of frames that were replaced during transmission to the previous packet due to a delay or loss of data in the Ethernet network. |
| ***Resync*** | The number of transfer process initiations. It occurs due to resynchronization. |
| ***SlipAdd*** | The amount of slips encountered due to the low occupancy of the jitter buffer. It is registered when external synchronization is used. |
| ***SlipRem*** | The number of slips that occur due to jitter buffer overflow. It is registered when external synchronization is used. |
| ***Lost*** | The number of lost TDMoP frames. |
| ***LostReq*** | The number of repeated request of TDMoP frames. |
| ***Restored*** | The number of restored TDMoP frames using the retransmission procedure. |
| ***Fatal*** | The number of hardware errors. |
| ***txDiscards*** | The number of packets that were dropped and not processed due to an overflow of the output queue. |
| ***AvgSpeed*** | Average speed. |
| ***AvgJB*** | The average size of the jitter buffer, μs. |
| ***MinJB*** | The minimum size of the jitter buffer, ms. |
| ***MaxJB*** | The maximum size of the jitter buffer, ms. |
| ***RecommenedJB*** | The recommended size of the jitter buffer, ms. |

In the Web-interface, this item additionally displays a histogram of the Jitter buffer size, see the figure below.




Histogram - Number of measurements / Jitter buffer Size, ms

#### 3.2.2.4 /TDMoP/port/redundancy submenu

This submenu allows you to configure the settings for the TDMoP stream transmission redundancy. It is available from the firmware version: LPOS 1.0.9.4SR38.

Redundancy scheme 1+1 is available at the momemt. The same stream can be transmitted in different VLANs (**TDMoP/<port>/redundancy**)

```
/TDMoP/0/redundancy LPOS_634                    Advanced  ESC+h - Help
|>..
| Enabled           Yes
| RemoteIP          192.168.0.223
| VLANID            64
| DSCP              default
| UseIP             Yes
| VLANPri           6

Filter: <Press any letter key to start filtering items>

LOG:17.04.17 10:34:03.339 : [SID=4] Control session started by admin from 192.
```

| | |
|---|---|
| ***Enabled*** | Enable/disable redundant transmission of TDMoP traffic in a separate VLAN.<br>***No*** – disabled (by default).<br>***Yes*** – enabled; |
| ***RemoteIP*** | The IP address of the opposite device. |
| ***VLANID*** | VLAN ID 802.1p tag.<br>The value range is from 0 to 4095. 0 – no tag. |

| | |
|---|---|
| | Default value: 32. |
| ***DSCP*** | Setting the value of Differentiated Services Code Point for the connection. Available values: 0-63, af[1..4][1..3], cs[1..7], default, ef.<br>Default value: default (0).<br>***default*** – provide forwarding if possible (RFC 2474)<br>***cs[1..7]*** - Class Selector Codepoint (RFC 2474, section 4.2.2)<br>***af[1..4][1..3]*** – Assured Forwarding (RFC 2597, RFC 3260)<br>***ef*** – Expedited Forwarding (RFC 3246)<br>Matching of DSCP values with the ToS values is presented in the description of parameter «***DSCP***» in the paragraph 1.1.1 |
| ***UseIP*** | Enable/disable the transmission mode of E1 stream data packets without IP/UDP headers.<br>This operation mode allows you to reduce the bandwidth required for the transmission of the flow E1, with the value of the parameter "No". The operation in this mode is possible only if the gateways are in the same IP subnet. The connection between the gateways establishes using an IP header. Without an IP header, only E1 stream data packets are transmitted.<br>***Yes*** – enabled (by default);<br>***No*** – disabled. |
| ***VLANPri*** | The priority bits in the VLAN ID 802.1p tag. The value is set as decimal number in the range of 0 to 7.<br>Default value: 6. |

### 3.2.3 /Eth menu

The /Eth submenu is used to view the current status of Ethernet ports and select Ethernet port for its further configuration and to view statistics.

```
/Eth LPOS                                          Advanced  ESC+h - Help
|>..      Name       Link  Speed Duplex STP       ChangeTime         Queue
| 0                  Up    100M  Full   Forward   23.07.16 15:20:58 0
| 1                  Down  N/A   N/A    Forward   23.07.16 15:20:56 0
| cpu                Up    100M  Full   Forward   23.07.16 15:20:56 0
| CSFP2              Down  N/A   N/A    Disable   23.07.16 15:20:56 0
| CSFP2.1            Down  N/A   N/A    Disable   23.07.16 15:20:56 0
| CSFP3              Down  N/A   N/A    Disable   23.07.16 15:20:56 0
| CSFP3.1            Down  N/A   N/A    Disable   23.07.16 15:20:56 0
| emac               Up    100M  Full   Forward   23.07.16 15:20:56 0

Filter: <Press any letter key to start filtering items>

LOG:02.08.16 10:47:39.529 : [SID=8] /IP/hosts/1/Network changed to 0.0.0.0
```

Not connected ports are highlighted in red. To configure and view statistics, you must select the necessary port.

#### 3.2.3.1 /Eth/emac submenu

The *emac* port is the port from the cpu towards the switch.

```
/Eth/emac LPOS                                     Advanced  ESC+h - Help
```

```
|>..
| config
| state
| statistics

Filter: <Press any letter key to start filtering items>

LOG:02.08.16 10:47:39.529 : [SID=8] /IP/hosts/1/Network changed to 0.0.0.0
```

#### 3.2.3.2 /Eth/emac/config submenu

In this submeu, you may specify a text description for the *emac* port and view the mac address of the multiplexer.

```
/Eth/emac/config LPOS                              Advanced  ESC+h - Help
|>..
| Description
| PhysAddress       54:A5:4B:7C:19:17

Filter: <Press any letter key to start filtering items>

Auto Refresh: disabled
```

| | |
|---|---|
| ***Description*** | Text description of the port; |
| ***PhysAddress*** | Physical address of the multiplexer (MAC address); |

#### 3.2.3.3 /Eth/emac/state submenu

This submenu displays the status, data transmission rate, and duplex mode of the *emac* port.

```
/Eth/emac/state LPOS                             Advanced  ESC+h - Help
|>..
| Status            Up
| Speed             100M
| Duplex            Full
| LastChange        23.07.16 15:20:58
| MTU               1522
| RXUtil            1
| TXUtil            1

Filter: <Press any letter key to start filtering items>

LOG:02.08.16 09:20:21.440 : [SID=9] Control session started by admin from 192.
```

| | |
|---|---|
| ***Status*** | The status of the interface.<br>***Up*** – enabled.<br>***Down*** – disabled. |
| ***Speed*** | The data transmission rate of the interface.<br>***10M*** – 10 Mbps<br>***100M*** – 100 Mbps<br>***1G*** – 1 Gbps<br>***Auto*** – automatic negotiation. |
| ***Duplex*** | Data exchange mode of the selected interface. |

| | |
|---|---|
| | ***Auto*** – auto negotiation (by default)<br>***Full*** – full-duplex mode: simultaneous transmission and reception.<br>***Half*** – half-duplex mode: either transmission or reception takes place in a certain moment of time (one direction at a time). |
| ***LastChange*** | Date and time of the last change. |
| ***MTU*** | The maximum frame size |
| ***RXUtil*** | Occupied bandwidth of the interface for reception, in percent. |
| ***TXUtil*** | Occupied bandwidth of the interface for transmission, in percent. |

#### 3.2.3.4 /Eth/emac/statistics submenu

This submenu displays error counters for the *emac* port.

- Counters starting with rx display the values of received packets;
- Counters starting with tx display the values of the packets transmitted;

```
/Eth/emac/statistics LPOS                          Advanced  ESC+h - Help
|>..
| rxUnicast          9620
| rxNUnicast         296
| rxBroadcast        295
| rxMulticast        1
| rxPause            0
| rxUndersize        0
| rxOversize         0
| rxErr              0
| rxFCSErr           0
| rxDiscard          0
| rxFiltered         0
| rxGoodOctets       820456
| txUnicast          8789
| txNUnicast         171702
| txBroadcast        1770
| txMulticast        169932
| txGoodOctets       29055565
| free               336
Filter: <Press any letter key to start filtering items>

LOG:02.08.16 11:26:05.305 : [SID=8] Init log
```

| | |
|---|---|
| ***rxUnicast*** | The number of received unicast packets. |
| ***rxNUnicast*** | The number of non-unicast packets received, i.e., the number of broadcast + multicast packets. |
| ***rxBroadcast*** | The number of  received broadcast packets. |
| ***rxMulticast*** | The number of received multicast packets. |
| ***rxPause*** | The number of received pause packets. |
| ***rxUndersize*** | The number of packets with length less than 64 bytes and true FCS. |

| | |
|---|---|
| ***rxOversize*** | The number of packets with a length greater than the maximum (1522 bytes) and with true FCS. |
| ***rxErr*** | The number of errors on reception. |
| ***rxFCSErr*** | The number of received packets with valid length (64-1522 bytes) and invalid FCS. |
| ***rxDiscard*** | The number of packets that were dropped and not processed due to an overflow of the incoming queue. |
| ***rxFiltered*** | The number of received packets that were dropped due to an incorrect VLAN ID or MAC address filtering on the port. |
| ***rxGoodOctets*** | The number of bytes received without errors. |
| ***txUnicast*** | The number of transmitted unicast packets. |
| ***txNUnicast*** | The number of non-unicast packets transmitted, i.e. the number of broadcast + multicast packets. |
| ***txBroadcast*** | The number of transmitted broadcast packets. |
| ***txMulticast*** | The number of transmitted multicast packets. |
| ***txGoodOctets*** | The number of bytes transmitted without errors. |
| ***free*** | The number of free buffers for the operating system to receive and transmit frames |

#### 3.2.3.5 /Eth/SFP port submenu

In this submenu, you can go to the port configuration, view status statistics, error counters, information on the SFP module.

```
/Eth/CSFP2 LPOS                                    Advanced  ESC+h - Help
|>..
| config
| DDM
| IDProm
| LLDP
| PHY
| QoS
| RSTP
| state
| statistics
| VLAN

Filter: <Press any letter key to start filtering items>

LOG:02.08.16 11:26:05.305 : [SID=8] Init log
```

#### 3.2.3.6 /Eth/SFP port/DDM submenu

In this submenu, you can view DDM (Digital Diagnostics Monitoring) – the function of digital control of SFP module performance parameters. It provides real-time tracking for the following parameters: voltage, module temperature, offset current and laser power, received signal level, alarms and warnings. The example of displaying information when ToPGATE-SFP is connected to the SFP port, without configured TDMoP transfer is shown below. Temperature is 0 because ToPGATE-SFP does not support temperature measurement. The LoRXPower signal informs on the low transmission signal – TDMoP is not

transmitted. The LoTXPower signal informs on a low signal at the input of the E1 interface – no signal is on the input.

```
/Eth/CSFP2/DDM LPOS                                  Advanced  ESC+h - Help
|>..
| Temperature       0
| VCC               0.0000
| TXBias            0.4
| TXPower           0.0000
| RXPower           0.0000
| RXLevel            -87.3
| Alarms
| Warnings

Filter: <Press any letter key to start filtering items>

LOG:02.08.16 11:37:37.377 : [ethstat] Eth CSFP2: 1G Up Full duplex
```

| | |
|---|---|
| ***Temperature*** | Temperature, °C; |
| ***VCC*** | Voltage, V; |
| ***TXBias*** | Laser pump current, A; |
| ***TXPower*** | Laser power, mW; |
| ***RXPower*** | Receiving power, mW; |
| ***RXLevel*** | Received signal level, dBm; |
| ***Alarms*** | Alarm:<br>***HiTemp*** – high temperature;<br>***LoTemp*** – low temperature;<br>***HiVCC*** – high voltage;<br>***LoVCC*** – low voltage;<br>***HiBias*** – high bias current;<br>***LoBias*** – low bias current;<br>***HiTXPower*** – high power of signal transmission;<br>***LoTXPower*** – low power of signal transmission;<br>***HiRXPower*** – high power of signal reception;<br>***LoRXPower*** – low reception of signal reception; |
| ***Warnings*** | Warning signals:<br>***HiTemp*** – high temperature;<br>***LoTemp*** – low temperature;<br>***HiVCC*** – high voltage;<br>***LoVCC*** – low voltage;<br>***HiBias*** – high bias current; |

***LoBias*** – low bias current;

***HiTXPower*** – high power of signal transmission;

***LoTXPower*** – low power of signal transmission;

***HiRXPower*** – high power of signal reception;

***LoRXPower*** – low reception of signal reception;

#### 3.2.3.7 /Eth/SFP port/IDProm submenu

In this submenu, you can view the IDProm of the SFP module. It provides real-time tracking for the following parameters: device type, connector type, transmission data rate, wavelength. The example of displaying information when an SFP module manufactured by APAC Opto is connected to the SFP port is shown below.

```
/Eth/CSFP2/IDProm LPOS                              Advanced  ESC+h - Help
|>..
| Type              SFP
| Connector         SC
| Encoding          4B5B
| Speed             200
| WaveLength        1310
| CPLinkLength
| FBLinkLength      20
| Vendor            OEM
| PartNumber        AP-B34011-3CDS20
| Revision          1.00
| SerialNumber      SF34210700045
| Manufactured      13.03.2011

Filter: <Press any letter key to start filtering items>

LOG:02.08.16 11:40:15.017 : [ethstat] Eth CSFP2: Down
```

| | |
|---|---|
| ***Type*** | Device type; |
| ***Connector*** | External connector type; |
| ***Encoding*** | Code for serial encoding algorithm. Possible values: *Unspecified, 8B10B, 4B5B, NRZ, Manchester, Reserver.* |
| ***Speed*** | Transfer data rate, Mbps; |
| ***WaveLength*** | The wavelength for transmission, nm; |
| ***CPLinkLength*** | Transmission distance of copper SFP module, m; |
| ***FBLinkLength*** | Transmission distance of optical SFP module, km; |
| ***Vendor*** | Manufacturer of SFP module; |
| ***PartNumber*** | SFP module board number; |
| ***Revision*** | SFP module board revision number; |
| ***SerialNumber*** | The serial number of the SFP module; |

| | |
|---|---|
| ***Manufactured*** | Date of manufacture of the SFP module; |

#### 3.2.3.8 /Eth/port/PHY submenu

This submenu allows you to configure the selected Ethernet port at the physical level.

```
/Eth/0/PHY LPOS                                    Advanced  ESC+h - Help
|>..
| Loopback          No
| Speed             1G
| Aneg              Enabled
| PWDown            No
| RestartAneg       No
| Duplex            Full
| AnegDone          Yes
| Modes             10Half,10Full,100Half,100Full,1000Half,1000Full
| PartnerModes      10Half,10Full,100Half,100Full,Pause

Filter: <Press any letter key to start filtering items>

LOG:02.08.16 11:43:25.827 : [ethstat] Eth CSFP2: Down
```

| | |
|---|---|
| ***Loopback*** | Enable/disable loopback for reception or transmission.<br>***Yes*** – enabled;<br>***No*** – disabled (by default). |
| ***Speed*** | The data transmission rate of the interface.<br>***10M*** – 10 Mbps<br>***100M*** – 100 Mbps<br>***1G*** – 1 Gbps<br>***Auto*** – automatic negotiation. |
| ***Aneg*** | Enable/disable auto negotiation<br>***Enabled*** – enabled (by default).<br>***Disabled*** – disabled. |
| ***PWDown*** | The state of the interface.<br>***No*** – interface enabled (default);<br>***Yes*** – the interface is disabled. |
| ***RestartAneg*** | Restart auto negotiation.<br>***Yes*** – enabled;<br>***No*** - disabled. |
| ***Duplex*** | Data exchange mode of the selected interface.<br>***Auto*** – auto negotiation (by default)<br>***Full*** – full-duplex mode: simultaneous transmission and reception.<br>***Half*** – half-duplex mode: either transmission or reception takes place in a certain moment of time (one direction at a time). |

| | |
|---|---|
| ***AnegDone*** | Informs whether the interface speed has been auto negotiated or has been defined by default.<br>***Yes*** – auto-negotiation of data rate has been performed successfully;<br>***No*** – data rate has been defined by default. |
| ***Modes*** | Possible modes of the current interface. |
| ***PartnerModes*** | The possible modes of the interface on the opposite device. |

#### 3.2.3.9 /Eth/port/QoS submenu

```
/Eth/0/QoS LPOS                                    Advanced  ESC+h - Help
|>..
| InLimitMGMT       Disabled
| InLimitMode       All
| InRate            0
| InRateDouble
| OutRate           0
| VlanPriMap        01234567
| DefPri            BK0
| Priority          tag
| PriOverride

Filter: <Press any letter key to start filtering items>

LOG:02.08.16 11:43:25.827 : [ethstat] Eth CSFP2: Down
```

| | |
|---|---|
| ***InLimitMGMT*** | Enable/disable traffic restriction for incoming management traffic (mgmt → BPDU, IGMPSnooping...).<br>***Disabled*** – disabled (by default);<br>***Enabled*** – enabled. |
| ***InLimitMode*** | Incoming traffic that needs to be restricted.<br>***All*** – all traffic (by default).<br>***BMuU*** – broadcast + multicast + unknown unicast.<br>***BMcast*** – broadcast + multicast.<br>***Bcast*** – broadcast. |
| ***InRate*** | The bandwidth limitation at the input, kbps. |
| ***InRateDouble*** | Bandwidth limitation for all 4 queues.<br>By default: no value is set (in fact it is ***Q0***) – the limit is valid for all 4 queues.<br>***Q1=2xQ0*** – the bandwidth for this queue is limited to a double value for the Q0 queue.<br>***Q2=2xQ1*** – the bandwidth for this queue is limited to a double value for the Q1 queue.<br>***Q3=2xQ2*** – the bandwidth for this queue is limited to a double value for the Q2 queue.<br>***Example:***<br>For example, limit the port to 1 Mbps (***InRate***).<br>If you do not set InRateDouble to any value (by default, queue Q0), all 4 queues will be |

| | |
|---|---|
| | limited to 1 Mbps.<br><br>If you set InRateDouble to:<br>*Q1=2xQ0*, then the queue will have different priority in terms of bandwidth. Q1,Q2, Q3 will be processed twice as fast as Q0, the total bandwidth of all queues will remain 1 Mbps.<br><br>If you set InRateDouble to:<br>*Q1=2xQ0*,<br>*Q2=2xQ1*, the queues Q2 and Q3 will be processed 4 times faster than Q0, and Q1 2 times faster than Q0.<br><br>If you set InRateDouble to:<br>*Q1=2xQ0*,<br>*Q2=2xQ1*,<br>*Q3=2xQ2*, the Q3 queue will be processed 8 times faster than Q0, Q2 – 4 times faster than Q0, and Q1 – 2 times faster than Q0. |
| ***OutRate*** | The bandwidth limitation on output, Kbps. |
| ***VlanPriMap*** | Re-define the priority of tagged frames VLAN ID.<br>The default is 01234567.<br><br>**Example:**<br>Set the value: 00112233 |

| **The priority of incoming tagged frames** | **The changed priority in accordance with the parameter VlanPriMap** |
|---|---|
| 0 | 0 |
| 1 | 0 |
| 2 | 1 |
| 3 | 1 |
| 4 | 2 |
| 5 | 2 |
| 6 | 3 |
| 7 | 3 |

| | |
|---|---|
| | **Example 2**:<br>Set the value: 76543210.<br>The incoming frame with priority 3 will have priority 4 being on output. |
| ***DefPri*** | The priority when frames are tagged with a VLAN tag (802.1q) according to the 802.1p standard.<br><br>For the priority, 3-bit space is allocated in the PCP (Priority code point) in the header of IEEE 802.1q.<br><br>***BK0*** – Background (the lowest priority).<br><br>***BE1*** – Best Effort.<br><br>***EE2*** – Excellent Effort.<br><br>***CA3*** – Critical Applications. |

***VI4*** – Video, <100ms lantecy and jitter.

***VO5*** – Voice, <10ms lantecy and jitter.

***IC6*** – Internetwork Control.

***NC7*** – Network Control (the highest priority).

By default: ***BK0 (the lowest priority)***.

A method for priorities assignment may be one of the following: *tag, ip, tagip, iptag, no;* defines the order of precedence for incoming frames.

***no*** – priority is determined based on *DefPri*.

***tag*** – for untagged frames, priority is determined based on *DefPri*; for tagged frames, priority is determined based on the priority rules for tagged frames **(by default)**.

***ip*** – if a frame with an IP header has arrived, the priority is determined based on the priority of the frame set in the DSCP field; if a frame without an IP header has arrived, the default priority is set: *DefPri*.

***tagip*** – if an untagged frame has arrived, the priority is determined based on the set priority of the frame, for example, DSCP; if a tagged frame has arrived, the priority is determined based on the priority rules for the tagged frames.

***iptag*** - if an untagged frame has been received, the priority is determined based on the set priority frame, for example, DSCP; if it came tagged frame's priority is determined from the priority frame set, for example, in the DSCP field for frame with IP header or frame header IP priority rules for tagged frames.

***Priority***

***Let us consider tagip:***

If ***tagip*** is set and an IP frame has arrived, the priority for the queue is determined based on the priority of the frame set, for example, DSCP;

If ***tagip*** is set and a tagged frame arrives, the priority for the queue is determined based on the ***Priority*** field specified in the 802.1Q header.

**A summary table on sources of priority for different incoming packets:**

| | **Frame type** | **untagged** | **untaggedip** | **tagged** | **taggedip** |
|---|---|---|---|---|---|
| **Priority** | | | | | |
| **no** | | DefPri | DefPri | DefPri | DefPri |
| **tag** | | DefPri | DefPri | 802.1Q | 802.1Q |
| **ip** | | DefPri | DSCP | DefPri | DSCP |
| **tagip** | | DefPri | DSCP | 802.1Q | 802.1Q |
| **iptag** | | DefPri | DSCP | 802.1Q | DSCP |

where,

***DefPri*** – the value of the DefPri parameter in the menu item «**3.2.3.9/Eth/port/QoS submenu**»

***DSCP*** – the value of the ToS field that determines the type of service from the IP packet header processed by IPPri rules from the menu item «**3.2.10/EthGlobal menu**»

***802.1Q*** – 3 bits to set the priority in the 802.1Q header

| | |
|---|---|
| ***PriOverride*** | ***VLAN*** – priority is determined by referring to the VLAN ID Priority.<br>If ***PriOverride*** is specified as ***VLAN*** and in the submenu «**3.2.6.1/VLAN/VLANID submenu**» parameter ***PriOverride*** is set to ***Enabled***, the priority is determined based on ***Priority*** set to the VLAN ID.<br>***SAMac*** – priority is determined by referring to Source MAC address Priority.<br>If ***PriOverride*** is specified as ***SAMac*** and there is a static entry in the ATU table with this MAC address, the priority is determined based on the ***Priority*** set to this MAC address.<br>***DAMac*** – priority is determined by referring to Destination MAC address Priority.<br>If ***PriOverride*** is specified as ***DAMac*** and there is a static entry in the ATU table with this MAC address, then priority is determined based on the ***Priority*** set to this MAC address. |

#### 3.2.3.10 /Eth/port/LLDP submenu

This submenu allows you to configure RSTP parameters for a specific port. A detailed description of the parameters can be found in the section «**3.2.4.3/System/LLDP/Interfaces/port submenu**».

```
/Eth/0/LLDP LPOS                                    Advanced  ESC+h - Help
|>..
| Admin             txAndRx
| TLVs              All

Filter: <Press any letter key to start filtering items>

LOG:02.08.16 11:43:25.827 : [ethstat] Eth CSFP2: Down
```

#### 3.2.3.11 /Eth/port/RSTP submenu

This submenu allows you to configure RSTP parameters for a specific port. A detailed description of the parameters can be found in the section «**3.2.4.5/System/RSTP/Interfaces/port submenu**».

```
/Eth/0/RSTP LPOS                                    Advanced  ESC+h - Help
|>..                                 | DesignatedPort     8001
| Priority          128
| Edge              Yes
| AdminCost         0
| P2P               Auto
| RootGuard         No
| --Status--
| PathCost          200000
| Role              Designated
| State             Forwarding
| Partner           Rapid
| rxBPDU            0
| rxConfig          0
| rxTCN             0
| Uptime            0 days, 0 hours, 0 min, 8 sec
| PortID            8001
| BridgeID          8000-54a54b7c1917
| RootID            8000-54a54b7c1917
| DesignatedCost    0
Filter: <Press any letter key to start filtering items>

LOG:02.08.16 11:50:32.432 : [rstp] Eth port [0] changed state to Forward
```

#### 3.2.3.12 /Eth/port/config submenu

This submenu allows you to configure the selected Ethernet interface.

```
/Eth/0/config LPOS                                  Advanced  ESC+h - Help
```

```
|>..
| Description
| Speed              Auto
| Duplex             Auto
| Link               Auto
| FlowControl        Disable
| Reservation        No
| MTU                1522
| Learning           Enabled
| SAFilter           Disabled
| EgressPolicy       ForwardAll

Filter: <Press any letter key to start filtering items>

Auto Refresh: disabled
```

| | |
|---|---|
| ***Description*** | The character description. |
| ***Speed*** | The data transmission rate of the interface.<br>***10M*** – 10 Mbps<br>***100M*** – 100 Mbps<br>***1G*** – 1 Gbps<br>***Auto*** – auto negotiation (by default) |
| ***Duplex*** | Data exchange mode of the selected interface.<br>***Auto*** – auto negotiation (by default)<br>***Full*** – full-duplex mode: simultaneous transmission and reception.<br>***Half*** – half-duplex mode: either transmission or reception takes place in a certain moment of time (one direction at a time). |
| ***Link*** | Port state.<br>***Up*** – enable port.<br>***Down*** – disable port.<br>***Auto*** – auto negotiation (by default) |
| ***FlowControl*** | Flow control function. If the device does not have time to receive the frames sent to it by the counter device, it sends a Pause frame to pause the transmission.<br>***Enabled*** – enabled;<br>***Disabled*** – disabled (by default);<br>***Auto*** – enabled if the remote side supports Pause frames. |
| ***Reservation*** | Reservation type.<br>***No*** – no reservation (by default);<br>***RSTP*** – redundancy via RSTP. |
| ***MTU*** | Maximum Ethernet frame size.<br>This option is not supported on all hardware versions of switch multiplexers. |

| | |
|---|---|
| ***Learning*** | Dynamic adding of MAC addresses, from which packets come to this port, to the ATU table .<br>***Enabled*** – enabled (by default).<br>***Disabled*** – disabled. |
| ***SAFilter*** | Filtering of Ethernet frames by MAC addresses of the sender.<br>See «**3.2.7/ATU menu**»<br>***Disabled*** – disabled (by default);<br>***Include*** – forward packets with the MAC address of the sender;<br>***Exclude*** – drop packets with the MAC address of the sender;<br>Some possible values of this parameter are not supported on some hardware versions of multiplexers. |
| ***EgressPolicy*** | The prohibition of unknown frames transfer.<br>***ForwardAll*** – Forward all frames (by default)<br>***BlockAllUnknown*** – drop all unknown frames (with unlearned MAC addresses);<br>***BlockUnknownUnicast*** – discard all frames with an unknown unicast MAC address;<br>***BlockUnknownMulticast*** – drop all unknown frames with multicast MAC address;<br>Some possible values of this parameter are not supported on some hardware versions of multiplexers. |

#### 3.2.3.13 /Eth/port/state submenu

This submenu allows you to view the status, data rate, duplex mode, and time of the last modification.

```
/Eth/0/state LPOS                                   Advanced  ESC+h - Help
|>..
| Status            Up
| Speed             100M
| Duplex            Full
| FlowControl       Disabled
| LastChange        23.07.16 15:20:58
| MTU               1522
| QLen              0
| RXUtil            0
| TXUtil            0

Filter: <Press any letter key to start filtering items>

LOG:02.08.16 11:51:43.818 : [SID=8] Configuration saved by user admin
```

| | |
|---|---|
| ***Status*** | The status of the interface.<br>***Up*** – enabled.<br>***Down*** – disabled.<br>***Auto*** – auto negotiation (by default) |
| ***Speed*** | The data transmission rate of the interface. |

| | |
|---|---|
| | ***10M*** – 10 Mbps<br>***100M*** – 100 Mbps<br>***1G*** – 1 Gbps<br>***Auto*** – auto negotiation (by default) |
| ***Duplex*** | Data exchange mode of the selected interface.<br>***Auto*** – auto negotiation (by default)<br>***Full*** – full-duplex mode: simultaneous transmission and reception.<br>***Half*** – half-duplex mode: either transmission or reception takes place in a certain moment of time (one direction at a time). |
| ***FlowControl*** | Flow control function. If the device does not have time to receive the frames sent to it by the counter device, it sends a Pause frame to pause the transmission.<br>***Enabled*** – enabled;<br>***Disabled*** – disabled (by default);<br>***Auto*** – enabled if the remote side supports Pause frames. |
| ***LastChange*** | Date and time of the last change. |
| ***MTU*** | The maximum frame size |
| ***QLen*** | Transmission queue, the value is specified in data blocks |
| ***RXUtil*** | Occupied bandwidth of the interface for reception, in percent. |
| ***TXUtil*** | Occupied bandwidth of the interface for transmission, in percent. |

#### 3.2.3.14 /Eth/port/statistics submenu

This submenu allows you to view the statistics of received and transmitted packets through the interface. To reset the statistics, use the «*ESC+R*» key combination.

- Counters starting with rx display the values of received packets;
- Counters starting with tx display the values of the packets transmitted;

```
/Eth/0/statistics LPOS                              Advanced  ESC+h - Help
|>..                                    | txFCSErr           0
| rxUnicast          16                 | txFiltered         0
| rxBroadcast        0                  | txGoodOctets       8846
| rxMulticast        0                  | txCollisions       0
| rxPause            0                  | txDeferred         0
| rxUndersize        0                  | txSingle           0
| rxOversize         0                  | txMultiple         0
| rxErr              0                  | txExcessive        0
| rxFCSErr           0                  | txLate             0
| rxDiscard          0                  | h64Oct             20
| rxFiltered         0                  | h65_127            0
| rxGoodOctets       1024               | h128_255           0
| rxBadOctets        0                  | h256_511           0
| rxFragments        0                  | h512_1023          13
| rxJabber           0                  | h1024_max          0
| txUnicast          17
| txBroadcast        0
| txMulticast        0
```

```
| txPause            0
Filter: <Press any letter key to start filtering items>

LOG:02.08.16 11:51:43.818 : [SID=8] Configuration saved by user admin
```

| | |
|---|---|
| ***rxUnicast*** | The number of received unicast packets. |
| ***rxBroadcast*** | The number of  received broadcast packets. |
| ***rxMulticast*** | The number of received multicast packets. |
| ***rxPause*** | The number of received pause packets. |
| ***rxUndersize*** | The number of packets with length less than 64 bytes and true FCS. |
| ***rxOversize*** | The number of packets with a length greater than the maximum (***MTU*** bytes) and true FCS. The MTU value is set in the menu «**3.2.10/EthGlobal menu**» |
| ***rxErr*** | The number of errors on reception. |
| ***rxFCSErr*** | The number of received packets with valid length (64 - ***MTU*** bytes) and invalid FCS. The MTU value is set in the submenu «**3.2.10 /EthGlobal submenu**» |
| ***rxDiscard*** | The number of packets that were dropped and not processed due to an overflow of the incoming queue. |
| ***rxFiltered*** | The number of received packets that were dropped due to an incorrect VLAN ID or MAC address filtering on the port. |
| ***rxGoodOctets*** | The number of bytes received without errors. |
| ***rxBadOctets*** | The number of received bytes with errors. |
| ***rxFragments*** | The number of received packets with length less than 64 bytes and incorrect FCS. |
| ***rxJabber*** | The number of received packets with a length greater than the maximum (***MTU*** bytes) and incorrect FCS.<br>The MTU value is set in the submenu «**3.2.10 /EthGlobal submenu**» |
| ***txUnicast*** | The number of transmitted unicast packets. |
| ***txBroadcast*** | The number of transmitted broadcast packets. |
| ***txMulticast*** | The number of  transmitted multicast packets. |
| ***txPause*** | The number of transmitted pause packets. |
| ***txFCSErr*** | The number of packets transmitted with a valid length (64 - byte ***MTU***) and an incorrect FCS.<br>The MTU value is set in the submenu «**3.2.10 /EthGlobal submenu**» |
| ***txFiltered*** | The number of packets dropped on transmission because of the rules on output |
| ***txGoodOctets*** | The number of bytes without errors. |
| ***txCollisions*** | The number of collisions on the transmission. |
| ***txDeferred*** | The number of transmitted packets that were delayed due to occupied transmission media during the first attempt. |

| | |
|---|---|
| ***txSingle*** | The number of successfully transmitted packets, during transmission of which only one collision occurred. |
| ***txMultiple*** | The number of successfully transmitted packets that encountered more than one collision during transmission. |
| ***txExcessive*** | The number of not transmitted packets due to the fact that 16 collisions in a row occurred. |
| ***txLate*** | The number of times a collision was detected after transmission of 512 or more bits. |
| ***h64Oct*** | The number of transmitted and received frames with a length of 64 bytes. |
| ***h65_127*** | The number of transmitted and received frames with a length of 65 to 127 bytes. |
| ***h128_255*** | The number of transmitted and received frames with a length of 128 to 255 bytes. |
| ***h256_511*** | The number of transmitted and received frames with a length of 256 to 511 bytes. |
| ***h512_1023*** | The number of transmitted and received frames with a length of 512 to 1023 bytes. |
| ***h1024_max*** | The number of transmitted and received frames with a length of 1024 bytes and more. |

#### 3.2.3.15 /Eth/port/VLAN submenu

```
/Eth/0/VLAN LPOS                                    Advanced  ESC+h - Help
|>..
| DefVLAN           1
| DefVLANPri        BK0
| Tagged
| Untagged
| Member
| Auto              1,32
| Role              multi
| QinQTag           8100
| ForceVLANId       No
| RemoveVLANs

Filter: <Press any letter key to start filtering items>

LOG:02.08.16 11:51:43.818 : [SID=8] Configuration saved by user admin
```

| | |
|---|---|
| ***DefVLAN*** | VLAN assigned to the frames by default |
| ***DefVLANPri*** | The priority assigned to default frames according to the 802.1p standard. For the priority, 3-bit space is allocated in the PCP (Priority code point) in the header of IEEE 802.1q. Matches Eth/port/QoS/DefPri<br>***BK0*** – Background (the lowest priority).<br>***BE1*** – Best Effort.<br>***EE2*** – Excellent Effort.<br>***CA3*** – Critical Applications.<br>***VI4*** – Video, <100ms lantecy and jitter.<br>***VO5*** – Voice, <10ms lantecy and jitter. |

| | |
|---|---|
| | ***IC6*** – Internetwork Control.<br>***NC7*** – Network Control (the highest priority).<br>By default: ***BK0 (the lowest priority).*** |
| ***Tagged*** | Tagged – the list of VLANs that will leave the port with a tag.<br>If a port is in the trunk mode, the incoming frames must have a tag from this list; |
| ***Untagged*** | The list of VLANs that will leave the port without a tag; |
| ***Member*** | The list of VLANs that will leave the port without changing the tag (in the state in which they entered another port); |
| ***Auto*** | The list of VLANs automatically added by the operating system, they will work in the mode corresponding to the «*Role*» parameter:<br>***multi*** – Member;<br>***QinQCustomer*** – Member;<br>***QinQProvider*** – Member;<br>***trunk*** – Tagged;<br>***access*** – Untagged<br>For example, the VLAN ID specified in the DefVlan parameter will be present in this list. |
| ***Role*** | The operating mode of the port.<br>***multi*** – the interface forward all frames; the default mode is used unless another mode is explicitly specified. The policy of using interfaces is determined by the external equipment, such as routers of Layer 3 which link multiplexers;<br>***access*** – the interface accepts only untagged frames, tags them with a DefVLAN/DefVLANPri tag.<br>The mode is used for user data transmission.<br>***trunk*** – the interface forwards only tagged frames from the Tagged list. This mode is used to communicate directly with another multiplexer;<br>***QinQCustomer*** – a client port, frames on input are always tagged with the second tag (or the first one, if they had no tags); 802.1Q is disabled;<br>***QinQProvider*** – a port which accepts frames only with *QinQTag*. The frames are switched in accordance with VLAN table.<br>The default value is ***multi.*** |
| ***QinQTag*** | The 802.1Q header for frames in QinQ mode.<br>The default value is 8100.<br>***Tag Protocol Identifier (TPID): 88A8*** – Service VLAN tag identifier (S-Tag), according to 802.1Q-2014 clause 9.5 (see also RFC 7042) |
| ***ForceVLANId*** | Forced VLAN tag replacement mode (802.1q) on incoming frames, on DefVLAN.<br>***No*** – disabled (by default).<br>***Yes*** – enabled. |

| | |
|---|---|
| ***RemoveVLANs*** | The list of VLANS to be excluded from Tagged/Untagged/Member lists (except Auto). |

#### 3.2.3.16 /Eth/port/PIRL submenu

This submenu is not supported on all hardware versions of multiplexers.

***PIRL*** - Port Ingress Rate Limiting - limit the port bandwidth for incoming traffic. Use this submenu to view the current inbound restriction rules for the selected Ethernet interface and select a rule to configure it.

```
/Eth/1/PIRL 631_228                                Advanced  ESC+h - Help
|>.. Enabled   Rate      Class     Type
| 0  No        0         Low0,Mid1,Norm2,High3
| 1  No        0         Low0,Mid1,Norm2,High3
| 2  No        0         Low0,Mid1,Norm2,High3
| 3  No        0         Low0,Mid1,Norm2,High3
| 4  No        0         Low0,Mid1,Norm2,High3

Filter: <Press any letter key to start filtering items>

LOG:14.01.00 03:28:49.499 : [console] Control session started by admin from de
```

#### 3.2.3.17 /Eth/port/PIRL/rule number submenu

This submenu is used to configure the incoming traffic restriction rule.

```
/Eth/1/PIRL/0 631_228                              Advanced  ESC+h - Help
|>..
| Rule              0
| Enabled           No
| Rate              0
| Type
| Class             Low0,Mid1,Norm2,High3
| Counting          L2
| FactRate          0

Filter: <Press any letter key to start filtering items>

Auto Refresh: disabled
```

| | |
|---|---|
| ***Rule*** | The number of the current rules. There are 5 rules (0-4) available. |
| ***Enabled*** | Enable/disable the current rule.<br>***No*** – disabled (by default).<br>***Yes*** – enabled; |
| ***Rate*** | Rate limit to the specified value, in kbps. |
| ***Type*** | The type of traffic that is under the restriction.<br>***UnkUcast*** – unknown unicast traffic<br>***UnkMcast*** – unknown multicast traffic<br>***Bcast*** – broadcast traffic<br>***Mcast*** – multicast traffic<br>***Ucast*** – unicast traffic<br>***Mgmt*** – Managment (RSTP,LLDP, etc) |

| | |
|---|---|
| | ***ARP*** – arp traffic<br>***TCPD*** – TCP Data<br>***TCPCtl*** – TCP Control (TCP-SYN,TCP-FIN)<br>***UDP*** – udp traffic<br>***NonTCPUdp*** – not TCP or UDP traffic |
| ***Class*** | The priority of the traffic that you want to limit.<br>***Low0*** – 0 priority;<br>***Mid1*** – 1 priority;<br>***Norm2*** – 2 priority;<br>***High3*** – 3 priority;<br>***OrWithType*** – take type of traffic into account as well.<br>By default: ***Low0,Mid1,Norm2,High3***. |
| ***Counting*** | The method of calculating rate limits.<br>***frames*** – conversion to frames,<br>L1 – total number of bytes at layer 1 of the OSI model [preamble(8bytes)..frame..CRC32+IFG (12bytes)]<br>L2 – total number of bytes at layer 2 of the OSI model (Frame DA..CRC32) (by default)<br>L3 – total number of bytes at layer 3 of the OSI model (Frame DA..CRC32)-18-4(if tagged). |
| ***FactRate*** | Limited rate after conversion (***Counting***). |

The general idea is as follows:

There are N rules, each of which is a rate limit.
All frames that satisfy this rule (by type or priority) are under the limiter, and are either forwarded or discarded (if the limitation is exhausted).
**Example:**

Let us consider that there are 2 rules on the port:
1. TCPData or 3rd priority. 10Mbps
2. UDP or 2nd priority. 40Mbps
All traffic that is under the priority 3 rule or TCP data will be limited to 10Mbps.
All traffic that is under the priority 2 rule or UDP data will be limited to 40Mbps.

### 3.2.4 /System menu

This menu allows you to select system parameters and protocols for viewing and configuring.

```
/System LPOS                                        Advanced  ESC+h - Help
|>..
| EthMirror
| global
| HTTP
| HTTPS
| LLDP
| RSTP
| SNMP
| SSH
| syslog
```

```
| telnet
| time

Filter: <Press any letter key to start filtering items>

Auto Refresh: disabled
```

#### 3.2.4.1 /System/LLDP/Entries submenu

This submenu displays a table with the parameters of neighboring devices obtained through LLDP. The table shows which device (its IP and MAC addresses) and which port is connected to the current device.

```
/System/LLDP/Entries LPOS                                    ESC+h - Help
| .. Port      Chassis           RPort     ManAddr
|>1  0         54-a5-4b-7c-44-32 SFP0      192.168.0.201
| 2  CSFP3     54-a5-4b-8d-45-37 CSFP0     192.168.0.221
| 3  0         54-a5-4b-80-21-33 0         192.168.0.202

Filter: <Press any letter key to start filtering items>

Auto Refresh: disabled
```

#### 3.2.4.2 /System/LLDP/Entries/port submenu

This submenu allows you to view the parameters of the LLDP entries.

```
/System/LLDP/Entries/1 LPOS                        Advanced  ESC+h - Help
| ..
|>Port              0
| Active            true
| ChassisID         54-a5-4b-7c-44-32
| RemotePortID      SFP0
| SysName           ToPGate(LPOS)
| SysDesc           LPOS 1.0.9.4SR33 (08.06.2016) [1661 ,11177D][631.100]: Eth.2
E1.1
| ManAddr           192.168.0.201
| RecvTime          03.08.16 15:22:18

Filter: <Press any letter key to start filtering items>

LOG:03.08.16 14:29:21.841 : [SID=12] Control session started by admin from 192
```

| | |
|---|---|
| ***Port*** | Current port. |
| ***Active*** | Activity. |
| ***ChassisID*** | The MAC address of the device connected to this port. |
| ***RemotePortID*** | The device port which is connected to this port. |
| ***SysName*** | The system name of the opposite device. |
| ***SysDesc*** | Description of the opposite device. |
| ***ManAddr*** | The IP address of the opposite device. |
| ***RecvTime*** | Time to receive LLDP messages. |

#### 3.2.4.3 /System/LLDP/Interfaces/port submenu

This submenu allows you to configure LLDP settings for a specific port.

```
/System/LLDP/Interfaces/0 LPOS                    Advanced  ESC+h - Help
|>..
| Admin             txAndRx
| TLVs              All

Filter: <Press any letter key to start filtering items>

LOG:03.08.16 14:29:21.841 : [SID=12] Control session started by admin from 192
```

| | |
|---|---|
| ***Admin*** | Protocol operation mode.<br>***tx*** – transmit LLDP information.<br>***rx*** – receive LLDP information.<br>***txAndRx*** – transmit and receive LLDP information (by default).<br>***Disabled*** – disabled. |
| ***TLVs*** | TLV (type-length-value) is a binary construction of three fields (type, length, value), where the first two have a fixed size and set the size for the third, which makes it easy to encode/decode any sequence of field-value data.<br>***All*** – all LLDP information (by default).<br>***portDesrc*** – description of the port.<br>***sysName*** – device name.<br>***sysDesc*** – description of the device.<br>***sysCap*** – device capabilities. |

#### 3.2.4.4 /System/LLDP/config submenu

This option allows you to configure the LLDP settings.

```
/System/LLDP/config LPOS                          Advanced  ESC+h - Help
|>..
| Enabled           Yes
| TXInterval        30
| TXHoldMultiplier  4

Filter: <Press any letter key to start filtering items>

LOG:03.08.16 14:29:21.841 : [SID=12] Control session started by admin from 192
```

LLDP is enabled for the entire device, not for each port separately. LLDP is enabled by default.

| | |
|---|---|
| ***Enabled*** | Enable/disable LLDP.<br>***Yes*** – enabled (by default);<br>***No*** – disabled. |
| ***TXInterval*** | The frequency of LLDP messages transmission to neighbors.<br>It can take values from 5 to 500 seconds.<br>By default: 30 sec. |
| ***TXHoldMultiplier*** | The multiplier, by which *TXInterval* is multiplied to obtain TTL. |

| | |
|---|---|
| | TTL - time during which the neighbor will store information on the device.<br>The value range is from 2 to 10.<br>By default, the parameter is set to 4, thus, neighboring devices will store information for 120 seconds. |

#### 3.2.4.5 /System/RSTP/Interfaces/port submenu

In this submenu, you can configure RSTP parameters for the selected Ethernet port.

```
/System/RSTP/Interfaces/0 LPOS                    Advanced  ESC+h - Help
|>..                                  | DesignatedPort     8001
| Priority          128
| Edge              Yes
| AdminCost         0
| P2P               Auto
| RootGuard         No
| --Status--
| PathCost          200000
| Role              Designated
| State             Forwarding
| Partner           Rapid
| rxBPDU            0
| rxConfig          0
| rxTCN             0
| Uptime            0 days, 0 hours, 25 min, 39 sec
| PortID            8001
| BridgeID          8000-54a54b7c1917
| RootID            8000-54a54b7c1917
| DesignatedCost    0
Filter: <Press any letter key to start filtering items>

Auto Refresh: disabled
```

| | |
|---|---|
| ***Priority*** | This parameter allows you to set the port priority. By changing the value, you change the chance of this port to become the Root Port. A lower value increases the chance.<br>The default value is 128. Range of values: from 0 to 240. |
| ***Edge*** | Enable/disable edge port mode – the extreme port; if enabled, it is switched to the transfer mode when an external network is connected, without delay.<br>***Yes*** – enabled (by default);<br>***No*** – disabled |
| ***AdminCost*** | Specifies the connection cost, the lower the connection cost – the higher the port priority, the default value depends on the connection speed:<br>10Mbps: Cost=2 000 000<br>100Mbps: Cost=200 000<br>1Gbps: Cost=20 000<br>Therefore, the default value is 0. |
| ***P2P*** | Enable/disable point-to-point connection.<br>***Yes*** – enabled |

| | |
|---|---|
| | ***No*** – disabled<br>***Auto*** – auto negotiation (by default) |
| ***RootGuard*** | Enable/disable the Root Guard function.<br>Root guard feature provides opportunity to set a location of root bridge on the network. This ensures that the port on which root guard is enabled is the designated port. Root guard must be enabled on all ports that should not become root.<br>***Yes*** – enabled<br>***No*** – disabled (by default). |
| ***PathCost*** | Connection cost, the lower the connection cost – the higher the port priority, the default value depends on the connection speed:<br>10Mbps: Cost=2 000 000<br>100Mbps: Cost=200 000<br>1Gbps: Cost=20 000<br>You may adjust the connection cost by changing the parameter *AdminCost*. |
| ***Role*** | The role of the port.<br>***NonSTP*** – redundancy is disabled on the port;<br>***Root*** – root, involved in data forwarding;<br>***Designed*** – assigned, also works;<br>***Alternative*** – optional, not involved in data forwarding, backup root;<br>***Backup*** – backup, also not involved, assigned backup. |
| ***State*** | Port operation state<br>***Discarding*** – discarding, the port listens and starts sending BPDU itself, does not send frames with data.<br>***Learning*** – learning: the port listens and sends BPDUs, and makes changes to the MAC address table, but does not redirect data.<br>***Forwarding*** – sends/receives BPDUs, and operates with the data, and participates in the maintenance of the MAC address table. I.e., this is the normal state of the operating port. |
| ***Partner*** | The type of STP used on the other side. |
| ***rxBPDU*** | The number of received BPDU packets. |
| ***rxConfig*** | The number of received C-BPDU (Configuration BPDU). During operation, devices announce themselves and the settings of its ports through a C-BPDU. |
| ***rxTCN*** | The number of received TCN (Topology Change Notification) BPDU packets. These packets are sent when the device detects a change in the network topology. |
| ***Uptime*** | Operating time. |
| ***PortID*** | The current ID of the port. It consists of priority (*Priority*) and the MAC address of |

| | |
|---|---|
| | the device. The lower the value, the higher the priority.<br>You can adjust it by changing the *Priority* parameter.<br>The smaller the *PortID* is, the greater the chance of this port becoming root. |
| ***BridgeID*** | Device current ID. It consists of a priority (*BridgePriority*) that is configured in the submenu «**3.2.4.6/System/RSTP/global submenu**» and a MAC address of the device. The smaller the *BridgeID* is, the greater the chance of the device winning the root device election and becoming the root. |
| ***RootID*** | The ID of the root device. |
| ***DesignatedCost*** | The cost of the designated port connection. |
| ***DesignatedPort*** | ID of the assigned port – the port that serves this network segment. |

#### 3.2.4.6 /System/RSTP/global submenu

This submenu allows you to configure RSTP settings for the entire device.

```
/System/RSTP/global LPOS                          Advanced  ESC+h - Help
|>..
| BridgePriority    32768
| ForwardDelay      15
| HelloTime         2
| MaxAge            8
| RootID            this device
| BridgeID          8000-54a54b7c1917
| RootPort          this device
| RootCost          0

Filter: <Press any letter key to start filtering items>

LOG:03.08.16 15:54:43.524 : [SID=12] Control session started by admin from 192
```

| | |
|---|---|
| ***BridgePriority*** | This parameter allows you to set the priority of the switch. By changing this value, you change the switch's chance of winning the Root Bridge election. Decreasing the value increases the chance.<br>The default value is 32768. Range of values: from 0 to 61440 in increments of 4096. |
| ***ForwardDelay*** | The time (in seconds) that the switch ports spend in Listening and Learning modes.<br>The default value is 15 seconds. Range of values: from 4 to 30.<br>*2*(Forward Delay - 1) >= Max Age* |
| ***HelloTime*** | The interval (in seconds) between BPDU transmissions by the switch.<br>The default value is 2 seconds. Range of values: from 1 to 10.<br>*Max Age >= 2*(Hello Time + 1)* |
| ***MaxAge*** | The time (in seconds) that the switch waits before it begins to reconfigure the network. If it does not receive the BPDU during this time, it tries to start the reconfiguration.<br>The default value is 8 seconds. Range of values: from 6 to 40.<br>*Max Age >= 2*(Hello Time + 1)* |

| | |
|---|---|
| | *2*(Forward Delay - 1) >= Max Age* |
| ***RootID*** | ID of the current root.<br>***this device*** – the device is a root device. |
| ***BridgeID*** | ID of this device |
| ***RootPort*** | The port leading to the root device |
| ***RootCost*** | The cost of the path to the root device |

#### 3.2.4.7 /System/global submenu

This submenu allows you to view the system parameters of the multiplexer, set or change its name and location for easy identification, reboot the device.

```
/System/global LPOS                                Advanced  ESC+h - Help
|>..
| Uptime             11 days 0 hours 38 mins
| Contact
| Name               LPOS
| Location
| Description        ToPGate
| Hardware version   634.110
| Modification       4E1.2GE.2CSFP.DC48AC220
| System ID          B00WG3G6
| OldSystem ID       634WG3G7
| Software version   LPOS 1.0.9.4SR34RC1 (29.06.2016) [1674M ,11177D]
| LicenseValid       Yes
| Slave
| Update             NotReady
| Vendor             "NSC Communication Siberia Ltd.", Novosibirsk, Ordzhonikidze

Filter: <Press any letter key to start filtering items>

LOG:03.08.16 15:54:43.524 : [SID=12] Control session started by admin from 192
```

| | |
|---|---|
| ***Uptime*** | Time since the last device turning on. |
| ***Contact*** | Set the contact information. |
| ***Name*** | Sets the device name. |
| ***Location*** | Sets the location of the device. |
| ***Description*** | Device description. |
| ***Hardware version*** | The hardware version of the device. |
| ***Modification*** | The current modification of the device. |
| ***System ID*** | System identifier. |
| ***OldSystem ID*** | Previous system ID. |
| ***Software version*** | Software version. |

| | |
|---|---|
| ***LicenseValid*** | The validity of the license.<br>***Yes*** – the license is valid.<br>***No*** – license is invalid.<br>**ATTENTION!!!**<br>**This parameter must be set to *Yes* for the device to be fully functional. If the value is set to *No*, it means that the license to use the device is over and must be purchased. At the end of the license, the device does not work correctly, i.e. ceases to transmit E1 streams.** |
| ***Slave*** | A list of the hardware versions of the used slave modules |
| ***Update*** | Launch the update process if there is a firmware file in the /mnt/flash directory of the switch.<br>***NotReady*** – there is no update file in /mnt/flash.<br>***Ready*** – there is an update file in /mnt/flash.<br>***Updating nn*** – there is an update process with a progress indicator in percent.<br>***Complete*** – the update is complete, you must reboot the device with the **reset** command. After rebooting the device, it will be loaded with the new software. |
| ***Vendor*** | Device manufacturer. |

#### 3.2.4.8 /System/SNMP/auth submenu

In this submenu, you can set snmp community names.

```
/System/SNMP/auth LPOS                              Advanced  ESC+h - Help
|>..
| ReadCommunity     public
| WriteCommunity    public

Filter: <Press any letter key to start filtering items>

LOG:03.08.16 15:54:43.524 : [SID=12] Control session started by admin from 192
```

| | |
|---|---|
| ***ReadCommunity*** | Used for read authentication (default is “public”); |
| ***WriteCommunity*** | Used for write authentication (default is “public”); |

#### 3.2.4.9 /System/SNMP/traps submenu

In this submenu, you can change the settings for sending notifications (SNMP-traps) from the device (agent) to the manager.

```
/System/SNMP/traps LPOS                             Advanced  ESC+h - Help
|>..
| ServerIP          0.0.0.0
| Community         public
| Version           v2c

Filter: <Press any letter key to start filtering items>

LOG:03.08.16 15:54:43.524 : [SID=12] Control session started by admin from 192
```

| | |
|---|---|
| ***ServerIP*** | The address of the server to which to send messages. |
| ***Community*** | A common string (password) in the message. |
| ***Version*** | Message version (v1/v2c/3).<br>By default: ***v2c*** |

#### 3.2.4.10 /System/SNMP/users/user submenu

In this submenu, you can configure snmp user settings.

```
/System/SNMP/users/0 LPOS                          Advanced  ESC+h - Help
|>..
| UserName
| Enabled           No
| WRights
| AuthKey           ********
| PrivKey           ********
| MinSecLevel       noAuthNoPriv
| Secret

Filter: <Press any letter key to start filtering items>

LOG:03.08.16 15:54:43.524 : [SID=12] Control session started by admin from 192
```

| | |
|---|---|
| ***UserName*** | User name (Maximum 31 characters). |
| ***Enabled*** | Enable/disable user.<br>***No*** – disabled (by default).<br>***Yes*** – enabled. |
| ***WRights*** | Write permissions.<br>***E1*** – E1 parameters;<br>***Net*** – Ethernet parameters;<br>***Mux*** – multiplexer parameters;<br>***OS*** – operating system parameters;<br>By default, none of the values are set. |
| ***AuthKey*** | Password for user authentication. 8 characters minimum. The authentication Protocol is MD5. |
| ***PrivKey*** | Encryption key. 8 characters minimum. Privacy Protocol – DES. |
| ***MinSecLevel*** | Security level.<br>***noAuthNoPriv*** – passwords are transmitted open, no confidentiality of the data (by default);<br>***authNoPriv*** – authentication without privacy;<br>***authPriv*** – authentication and encryption, the maximum level of security. |
| ***Secret*** | The encrypted sequence of keys. |

#### 3.2.4.11 /System/SNMP/v1 submenu

In this submenu, you can enable/disable snmp v1 Protocol.

```
/System/SNMP/v1 LPOS                                Advanced  ESC+h - Help
| ..
|>Enabled           Yes

Filter: <Press any letter key to start filtering items>

LOG:03.08.16 15:54:43.524 : [SID=12] Control session started by admin from 192
```

| | |
|---|---|
| | Enable/disable snmp v1. |
| ***Enabled*** | ***Yes*** – enabled (by default); |
| | ***No*** – disabled |

#### 3.2.4.12 /System/SNMP/v2c submenu

In this submenu, you can enable/disable snmp v2c Protocol.

```
/System/SNMP/v2c LPOS                               Advanced  ESC+h - Help
|>..
| Enabled           No

Filter: <Press any letter key to start filtering items>

LOG:03.08.16 15:54:43.524 : [SID=12] Control session started by admin from 192
```

| | |
|---|---|
| | Enable/disable snmp v2c. |
| ***Enabled*** | ***Yes*** – enabled, |
| | ***No*** – disabled (by default). |

#### 3.2.4.13 /System/SNMP/v3 submenu

In this submenu, you can enable/disable snmp v3 Protocol.

```
/System/SNMP/v3 LPOS                                Advanced  ESC+h - Help
|>..
| Enabled           No
| EngineID          0000A7AE0000000000000000

Filter: <Press any letter key to start filtering items>

LOG:03.08.16 15:54:43.524 : [SID=12] Control session started by admin from 192
```

| | |
|---|---|
| | Enable/disable snmp v3. |
| ***Enabled*** | ***Yes*** – enabled, |
| | ***No*** – disabled (by default). |
| ***EnginedID*** | The unique identifier of the device. |

#### 3.2.4.14 /System/SNMP/stat submenu

The menu item to reflect the statistics of SNMP operation (SNMP counters from RFC 3414, 3418).

```
/System/SNMP/stat LPOS                              Advanced  ESC+h - Help
|>..                                    | InGetResponses     0
```

```
| InPkts            4672              | InTraps           0
| InBadVersions     0                 | OutGetResponses   4672
| InBadCommNames    0                 | OutTraps          0
| InBadCommUses     0                 | UnsuppSecLevels   0
| InASNParseErrs    0                 | NotInTimeWindows  0
| SilentDrops       0                 | UnknownUserNames  0
| ProxyDrops        0                 | UnknownEngineIDs  0
| OutPkts           4672              | WrongDigests      0
| InTooBigs         0                 | DecryptionErrors  0
| InNoSuchNames     0
| InBadValues       0
| InReadOnlys       0
| InGenErrs         0
| InTotalReqVars    4343
| InTotalSetVars    0
| InGetRequests     4672
| InGetNexts        0
| InSetRequests     0
Filter: <Press any letter key to start filtering items>

LOG:03.08.16 15:54:43.524 : [SID=12] Control session started by admin from 192
```

| | |
|---|---|
| ***InPkts*** | The number of received packets |
| ***InBadVersions*** | The number of received packets with unsupported version |
| ***InBadCommNames*** | The number of received packets with incorrect common string (for v1, v2c) |
| ***InBadCommUses*** | The number of received data request packets not allowed for the specified shared string |
| ***InASNParseErrs*** | The number of ASN.1 or BER errors while decoding a received message |
| ***SilentDrops*** | Number of dropped packets with responses to requests due to exceeding the maximum size of the resulting response with empty associated variables |
| ***ProxyDrops*** | The number of dropped packets with answers because of the timeout when sending messages to the proxy agent |
| ***OutPkts*** | The number of transmitted packets |
| ***InTooBigs*** | The number of received packets with the value "tooBig" (too large) in the error-status field |
| ***InNoSuchNames*** | The number of received packets with the value «noSuchName» in the error-status field |
| ***InBadValues*** | The number of received packets with the value «badValue» in the error-status field |
| ***InReadOnlys*** | The number of received packets with the value «readOnly» in the error-status field |
| ***InGenErrs*** | The number of received packets with the value «genErr» in the error-status field |
| ***InTotalReqVars*** | The number of successfully requested MIB objects as a result of Get-Request and Get-Next requests |

| | |
|---|---|
| ***InTotalSetVars*** | The number of successfully modified the values of the MIB objects in the result of Set-Request queries |
| ***InGetRequests*** | The number of received and processed Get-Request requests (requests to get the value of a variable or a list of variables) |
| ***InGetNexts*** | The number of received and processed Get-Next requests (requests to find available variables and their values) |
| ***InSetRequests*** | The number of received and processed Set-Request requests (requests to change a variable or list of variables) |
| ***InGetResponses*** | The number of sent Get-Response (responses for GetRequest, SetRequest, GetNextRequest, GetBulkRequest, and InformRequest) |
| ***InTraps*** | The number of received and processed Trap notifications (asynchronous notification from agent to manager) |
| ***OutGetResponses*** | The number of sent responses |
| ***OutTraps*** | The number of sent trap notifications |
| ***UnsuppSecLevels*** | The number of dropped requests due to unsupported security level |
| ***NotInTimeWindows*** | The number of dropped requests due to going beyond the time window |
| ***UnknownUserNames*** | The number of dropped requests due to unknown user name |
| ***UnknownEngineIDs*** | The number of requests discarded because of an unknown EngineID |
| ***WrongDigests*** | The number of dropped requests due to lack of expected numeric values |
| ***DecryptionErrors*** | The number of dropped queries due to the inability of decipher |

#### 3.2.4.15 /System/syslog submenu

In this submenu, you can configure the syslog protocol parameters.

```
/System/syslog LPOS                                Advanced  ESC+h - Help
|>..
| Enabled           Yes
| ServerIP          192.168.0.131
| Facility          kernel

Filter: <Press any letter key to start filtering items>

LOG:03.08.16 15:54:43.524 : [SID=12] Control session started by admin from 192
```

| | |
|---|---|
| ***Enabled*** | Enable/disable the ***syslog*** protocol.<br>***Yes*** – enabled,<br>***No*** – disabled (by default). |
| ***ServerIP*** | The IP address of the syslog server. |

| | |
|---|---|
| | ***0.0.0.0*** – not set (by default). |
| ***Facility*** | Type of query. Possible values: ***kernel*** (by default), ***user***, ***mail***, ***local0***, ***local1***, ***local2***, ***local3***, ***local4***, ***local5***, ***local6***, ***local7***. |

#### 3.2.4.16 /System/telnet submenu

In this submenu, you can configure telnet protocol parameters.

```
/System/telnet LPOS                                  Advanced  ESC+h - Help
|>..
| Enabled           Yes
| Timeout           15
| MaxSessions       3
| ActiveSessions    1
| DefaultShell      Menu

Filter: <Press any letter key to start filtering items>

LOG:03.08.16 15:54:43.524 : [SID=12] Control session started by admin from 192
```

| | |
|---|---|
| ***Enabled*** | Enable/disable the ***telnet*** protocol.<br>***Yes*** – enabled (by default);<br>***No*** – disabled |
| ***Timeout*** | Waiting time in minutes. This is the time after which the ***telnet*** connection will be terminated when the user is idle.<br>The default value is ***15 minutes***. |
| ***MaxSessions*** | Maximum number of SSH sessions.<br>It can take values from 1 to 10.<br>The default value is ***3***. |
| ***ActiveSessions*** | Shows the number of established SSH sessions. |
| ***DefaultShell*** | The control device shell set by default.<br>***Menu*** – menu (by default),<br>***Consol*** – command mode. |

#### 3.2.4.17 /System/time submenu

In this submenu, you can configure the date, time or parameters of synchronization with the NTP server.

NTP on ToPGATE works in Symmetric Active mode, NTP Version 3.

```
/System/time LPOS                                    Advanced  ESC+h - Help
| ..
| Time              17:10:06.872
|>Date              03.08.16
| TimeZone          7
| ServerName        pool.ntp.org
| SyncPeriod        1
| AutoSync          Disabled
| ForceSync         sync time with NTP Server
| NextSync          24.7.2016
```

```
Filter: <Press any letter key to start filtering items>

Configuration saved to: /mnt/flash/system.cfg
```

| | |
|---|---|
| ***Time*** | Sets the time on the multiplexer.<br>Input format HH:MM:SS, where HH – hours, MM – minutes, SS – seconds, all numbers are two-digit. The hours range is from 0 to 24. Specifying seconds is optional. |
| ***Date*** | Sets the date on the multiplexer.<br>Input format DD.MM.YY as a parameter, where DD is day, MM is month, YY is year, all numbers are two-digit. |
| ***TimeZone*** | Sets the time zone on the multiplexer. |
| ***ServerName*** | The name or IP address of the server with which automatic synchronization will occur.<br>When you specify the server name, you must specify the DNS server in the device settings.<br>**It is available from the firmware version: LPOS 1.0.9.4SR38.** |
| ***SyncPeriod*** | Synchronization period in days.<br>The default value is ***7 days***. |
| ***AutoSync*** | Enable/disable automatic synchronization.<br>***Enabled*** – enabled (by default). ??<br>***Disabled*** – disabled. |
| ***ForceSync*** | Synchronize time now To synchronize, press ***«Enter»*** to open the parameter, then press again to synchronize. |
| ***NextSync*** | Next synchronization time |

#### 3.2.4.18 /System/EthMirror submenu

```
/System/EthMirror LPOS                          Advanced  ESC+h - Help
|>..
| SrcIngress
| SrcEgress
| DstIngress        No
| DstEgress         No

Filter: <Press any letter key to start filtering items>

LOG:03.08.16 17:10:06.869 : [SID=12] Configuration saved by user admin
```

| | |
|---|---|
| ***SrcIngress*** | Ports, incoming frames from which will be copied and forwarded to DstIngress port. |
| ***SrcEgress*** | Ports from which all outgoing frames will be copied and sent to the DstEgress port. |

| | |
|---|---|
| ***DstIngress*** | The port to which incoming frames will be copied from SrcIngress ports. |
| ***DstEgress*** | The port to which incoming frames will be copied from SrcEgress ports. |

#### 3.2.4.19 /System/HTTP submenu

```
/System/HTTP LPOS                                   Advanced  ESC+h - Help
|>..
| Status            Working
| Enabled           Yes
| Port              80

Filter: <Press any letter key to start filtering items>

LOG:03.08.16 17:10:06.869 : [SID=12] Configuration saved by user admin
```

| | |
|---|---|
| ***Status*** | The current state of the HTTP server. |
| ***Enabled*** | Enabling and disabling the server<br>***Yes*** – enabled (by default);<br>***No*** – disabled |
| ***Port*** | TCP port for the HTTP server. |
| ***NMSKey*** | Shared Key, for authentication of NMS connections.<br>**It is available from the firmware version: LPOS 1.0.9.4SR38.** |

#### 3.2.4.20 /System/AUXa submenu

In this submenu item, the AUX port settings are configured to control the devices connected to it. This submenu is not supported on all hardware versions of multiplexers.

**Pin assignment of the DB-9 connector of the RS-232 interface**


| | |
|---|---|
| TxD | 2 |
| RxD | 3 |
| GND | 5 |

```
/System/AUX LPOS                                    Advanced  ESC+h - Help
|>..
| TCPPort           4000
| BaudRate          115200
| Parity            None
| Log               Disabled

Filter: <Press any letter key to start filtering items>

Auto Refresh: disabled
```

| | |
|---|---|
| ***TCPPort*** | The TCP port number of the connection. |
| ***BaudRate*** | The bit rate of the port. |

| | |
|---|---|
| ***Parity*** | Parity check.<br>***None*** - no control (by default);<br>***Odd*** – enable control for odd;<br>***Even*** - enable control for parity; |
| ***Log*** | Enable/disable logging to the log file when connected.<br>***Disabled*** – disabled (by default);<br>***Enabled*** – enabled. |

#### 3.2.4.21 /System/SSH submenu

In this submenu, you can configure SSHv2 protocol parameters.

It is available from the firmware version: LPOS 1.0.9.4SR36.

```
/System/SSH LPOS                                    Advanced  ESC+h - Help
|>..
| Enabled           Yes
| Timeout           15
| MaxSessions       5
| ActiveSessions    0
| TCPPort           22

Filter: <Press any letter key to start filtering items>

LOG:01.12.16 09:57:32.186 : [SID=2] Control session started by admin from 192.
```

| | |
|---|---|
| ***Enabled*** | Enable/disable the ***SSH*** protocol.<br>***Yes*** – enabled (by default);<br>***No*** – disabled |
| ***Timeout*** | Waiting time in minutes. This is the time after which the ***SSH*** connection will be terminated if the user is idle.<br>The default value is ***15 minutes***. |
| ***MaxSessions*** | Maximum number of SSH sessions.<br>It can take values from 1 to 10.<br>The default value is ***3***. |
| ***ActiveSessions*** | Shows the number of established SSH sessions. |
| ***TCPPort*** | The TCP port number of the connection.<br>The default value is ***22***. |

#### 3.2.4.22 /System/HTTPS submenu

Management settings of the web server through a secure connection.

```
/System/HTTP LPOS                                   Advanced  ESC+h - Help
|>..
| Status            Working
| Enabled           Yes
```

```
| Port              443

Filter: <Press any letter key to start filtering items>

LOG:03.08.16 17:10:06.869 : [SID=12] Configuration saved by user admin
```

| | |
|---|---|
| ***Status*** | The current state of the HTTP server. |
| ***Enabled*** | Enabling and disabling the server<br>***Yes*** – enabled (by default);<br>***No*** – disabled. |
| ***Port*** | TCP port for the HTTP server.<br>The default value is **443**. |
| ***NMSKey*** | Shared Key, for authentication of NMS connections.<br>**It is available from the firmware version: LPOS 1.0.9.4SR39.** |

### 3.2.5 /IP menu

This submenu allows you to configure IGMP, configure IP-address, mask and default gateway, list of trusted nodes, view error statistics.

```
/IP LPOS                                          Advanced  ESC+h - Help
|>..
| current-config
| hosts
| IGMP
| stat
| stored-config

Filter: <Press any letter key to start filtering items>

LOG:03.08.16 17:10:06.869 : [SID=12] Configuration saved by user admin
```

#### 3.2.5.1 /IP/IGMP/config submenu

In this submenu, you can configure the operation of the IGMP.

```
/IP/IGMP/config LPOS                              Advanced  ESC+h - Help
|>..                                  | MemberTime         255
| Mode              Disabled
| Ports
| FastLeave
| Priority          VI4
| DebugLevel        0
| --MVR--
| MVRVlan           0
| MVRUpstream
| MVRDownstream
| --Querier--
| StartupQI         30
| StartupQC         2
| Robustness        2
| QTimeout          255
| QRespTime         10
| QInterval         125
| LastQRI           1
```

```
| LastQC            2
Filter: <Press any letter key to start filtering items>

LOG:03.08.16 17:10:06.869 : [SID=12] Configuration saved by user admin
```

| | |
|---|---|
| ***Mode*** | Protocol operation mode.<br>***Disabled*** – disables IGMP snooping (by default);<br>***Snooping*** – enables IGMP snooping. In this mode, IGMP requests will leave in the user VLAN<br>***MVR*** is a mode in which you can set the 802.1p VLAN ID for multicast streams. In this mode, VLAN will be substituted to MVRVlan in IGMP requests. |
| ***Ports*** | The list of ports on which IGMP is enabled. |
| ***FastLeave*** | The list of ports for which fast leave mode should be used. |
| ***Priority*** | The priority with which MAC addresses will be added to the switching table.<br>For the priority, 3-bit space is allocated in the PCP (Priority code point) in the header of IEEE 802.1q.<br>***BK0*** – Background (the lowest priority).<br>***BE1*** – Best Effort.<br>***EE2*** – Excellent Effort.<br>***CA3*** – Critical Applications.<br>***VI4*** – Video, <100ms lantecy and jitter.<br>***VO5*** – Voice, <10ms lantecy and jitter.<br>***IC6*** – Internetwork Control.<br>***NC7*** – Network Control (the highest priority).<br>By default: ***VI4***. |
| ***DebugLevel*** | The level of debug messages output in the syslog.<br>It can take values from 0 to 5. The higher the level, the more debug messages are displayed.<br>The default value is 0. |
| ***MVRVlan*** | Sets the 802.1q VLAN ID for multicast streams (MVR mode), the tag is set as a decimal number from 0 to 4095.<br>0 – no tag.<br>The default value is 0. |
| ***MVRDownstream*** | A list of user ports which are to give the multicast broadcast to the end user; |
| ***MVRUpstream*** | The list of ports receiving multicast broadcast from the server (sources); |
| ***StartupQI*** | The interval after which the first igmp request will be sent. By default, this interval is shorter than the interval between IGMP requests, which allows you to set the state of the group as quickly as possible. |

| | |
|---|---|
| | The range of available values is from 1 to 255 seconds.<br>The default value is 30 seconds. |
| ***StartupQC*** | The number of igmp requests sent at startup. They are sent according to launch interval (***StartupQI***).<br>The range of available values is from 1 to 10 requests.<br>The default value is 2 requests. |
| ***Robustness*** | The number of packets retransmissions if they are lost on the network.<br>The value range is from 0 to 7 times.<br>The default value is 2 times. |
| ***QTimeout*** | The number of seconds that the current device must wait after the previous querier has stopped polling before becoming a querier.<br>The value range is from 1 to 255 seconds.<br>The default value is 255 seconds. |
| ***QRespTime*** | The response time to an igmp query. The value must be less than the interval between requests.<br>The value range is from 1 to 25 seconds.<br>The default value is 10 seconds. |
| ***QInterval*** | The frequency of igmp requests transmission. The higher the value, the fewer requests will be sent.<br>The value range is from 1 to 255 seconds.<br>The default value is 125 seconds. |
| ***LastQRI*** | The interval at which to respond to an igmp request after the host receives an exit message from the last active host on the network. If no messages are received during the interval, the group is deleted. You can use this value to configure how fast the transmission will stop over the network.<br>The value range is from 1 to 25 seconds.<br>The default value is 1 second. |
| ***LastQC*** | The number of igmp requests sent with the interval of the last member response (***LastQRI***) in response to logout messages from the last known active host on the network.<br>The value range is from 1 to 5 requests.<br>The default value is 2 requests. |
| ***MemberTime*** | The time interval before the igmp router decides that there is no member in the group or source does not exist in the network.<br>The value range is from 1 to 255 seconds.<br>The default value is 255 seconds. |

#### 3.2.5.2 /IP/IGMP/VLAN submenu

IGMP traffic settings in different VLANs.

The list of VLANs in this submenu is filled in automatically when Querier (multicast traffic source) is detected.

```
/IP/IGMP/VLAN LPOS                                  Advanced  ESC+h - Help
|>..    Elected       Port
| 100   0.0.0.0

Filter: <Press any letter key to start filtering items>

Auto Refresh: disabled
```

Settings of the router, which is responsible for sending multicast traffic to the segment (Querier).

```
/IP/IGMP/VLAN/100 LPOS                              Advanced  ESC+h - Help
|>..
| MyVersion         V2
| Querier           Disabled
| Elected           0.0.0.0
| ElectedPort
| ElectedTTL        0
| QuerierVersion    V2

Filter: <Press any letter key to start filtering items>

LOG:03.08.16 17:10:06.869 : [SID=12] Configuration saved by user admin
```

| | |
|---|---|
| ***MyVersion*** | The version of IGMP to send query |
| ***Querier*** | Enable/disable IGMP General Query sending.<br>***Disabled*** – disabled<br>***Enabled*** – enabled |
| ***Elected*** | Selected IGMP Querier. |
| ***ElectedPort*** | Port on which Querier is selected |
| ***ElectedTTL*** | Lifetime to re-election of Querier |
| ***QuerierVersion*** | Version of the selected Querier |

#### 3.2.5.3 /IP/current-config submenu

This submenu allows you to configure the IP address, mask, default gateway, VLAN ID tag and its priority, as well as the parameters of the list of trusted nodes «on the fly». But after rebooting, the device will be loaded with the parameters from the submenu «**3.2.5.6/IP/stored-config submenu**».

```
/IP/current-config LPOS                             Advanced  ESC+h - Help
|>..
| NetworkAddr       192.168.0.24
| NetworkMask       255.255.255.0
| DefaultGateway    0.0.0.0
| DefaultVlanID     0
| DefaultVlanPri    0
| PhysicalAddr      54:A5:4B:7C:19:17
| SecondaryMAC      54:A5:4B:7C:19:18
| TrustAll          Yes
| TrustLocal        Yes
| TrustUnkVlan      Yes
| DNS1              192.168.0.1
```

```
Filter: <Press any letter key to start filtering items>

Auto Refresh: disabled
```

| | |
|---|---|
| ***NetworkAddr*** | Sets the IP address of the device. |
| ***NetworkMask*** | Sets the subnet mask. |
| ***DefaultGateway*** | Sets the IP address of the gateway. |
| ***DefaultVlanID*** | The 802.1p VLAN ID tag for management is set as decimal number in the range of 0 and 4095. 0 means no tag. Default value: 0. |
| ***DefaultVlanPri*** | 802.1p VLAN ID priority bit for management, the priority is specified as a decimal number from 0 to 7. Default value: 0. |
| ***PhysicalAddr*** | MAC address of the device. |
| ***SecondaryMAC*** | The second MAC address of the device. Can be used for redundancy (1+1)<br>**It is available from the firmware version: LPOS 1.0.9.4SR39.** |
| ***TrustAll*** | Enable/disable the list of trusted nodes that can be specified in the «***ip/host***» submenu.<br>***Yes*** – trust all. With this value, everyone has access regardless of the trusted nodes list (by default).<br>***No*** – allows access to the device only to nodes which are in the list of trusted nodes. This value also takes into account the ***TrustLocal*** parameter.<br>**It is available from the firmware version: LPOS 1.0.9.4SR3.** |
| ***TrustLocal*** | Enable/disable trusted nodes from the local network.<br>It is taken into account when ***TrustAll*** parameter has ***No*** value.<br>***Yes*** – local nodes from the hosts list will be trusted (by default).<br>***No*** – only nodes from the hosts list will be trusted.<br>**It is available from the firmware version: LPOS 1.0.9.4SR3.** |
| ***TrustUnkVlan*** | Enable/disable the processing of frames in those VLANs, which is not defined in the VLAN table.<br>***Yes*** – nodes from an unknown VLAN will be trusted (by default).<br>***No*** – only nodes from the known VLANs will be trusted.<br>**It is available from the firmware version: LPOS 1.0.9.4SR21.** |
| ***DNS1*** | Preferred DNS server<br>**It is available from the firmware version: LPOS 1.0.9.4SR36.** |

#### 3.2.5.4 /IP/hosts submenu

Here, you may edit the list of trusted nodes. These nodes allow access to the device. To enable/disable, you must configure the *TrustAll* and *TrustLocal* parameters, which are in the «**3.2.5.3/IP/current-config submenu**» and «**3.2.5.6/IP/stored-config submenu» submenus.**

```
/IP/hosts LPOS                                      Advanced  ESC+h - Help
|>.. Network         Mask              | 19  0.0.0.0          255.255.255.255
| 1  192.168.0.133   255.255.255.0     | 20  0.0.0.0          255.255.255.255
| 2  0.0.0.0         255.255.255.255   | 21  0.0.0.0          255.255.255.255
| 3  0.0.0.0         255.255.255.255   | 22  0.0.0.0          255.255.255.255
| 4  0.0.0.0         255.255.255.255   | 23  0.0.0.0          255.255.255.255
| 5  0.0.0.0         255.255.255.255   | 24  0.0.0.0          255.255.255.255
| 6  0.0.0.0         255.255.255.255   | 25  0.0.0.0          255.255.255.255
| 7  0.0.0.0         255.255.255.255   | 26  0.0.0.0          255.255.255.255
| 8  0.0.0.0         255.255.255.255   | 27  0.0.0.0          255.255.255.255
| 9  0.0.0.0         255.255.255.255   | 28  0.0.0.0          255.255.255.255
| 10 0.0.0.0         255.255.255.255   | 29  0.0.0.0          255.255.255.255
| 11 0.0.0.0         255.255.255.255   | 30  0.0.0.0          255.255.255.255
| 12 0.0.0.0         255.255.255.255   | 31  0.0.0.0          255.255.255.255
| 13 0.0.0.0         255.255.255.255   | 32  0.0.0.0          255.255.255.255
| 14 0.0.0.0         255.255.255.255
| 15 0.0.0.0         255.255.255.255
| 16 0.0.0.0         255.255.255.255
| 17 0.0.0.0         255.255.255.255
| 18 0.0.0.0         255.255.255.255
Filter: <Press any letter key to start filtering items>

LOG:03.08.16 17:10:06.869 : [SID=12] Configuration saved by user admin
```

To add a new node to the list, select the line with ***0.0.0.0*** and press ***«Enter»***.

```
/IP/hosts/1 LPOS                                    Advanced  ESC+h - Help
|>..
| Network           192.168.0.133
| Mask              255.255.255.0

Filter: <Press any letter key to start filtering items>

LOG:03.08.16 17:27:06.697 : [SID=12] /IP/hosts/1/Mask changed to 255.255.255.0
```

| | |
|---|---|
| ***Network*** | Network address. |
| ***Mask*** | Subnet mask. |

**ATTENTION!** *Changing the address list of trusted hosts through a telnet session can cause the session to break without being able to reconnect from that host if it is excluded from the trusted list.*

#### 3.2.5.5 /IP/stat submenu

This submenu displays statistics. To reset the statistics, use the *«ESC+R»* key combination.

```
/IP/stat LPOS                                       Advanced  ESC+h - Help
|>..                                 | arp_req            320
| recv              16348            | arp_repl           2079
| drop              1                | arp req rev        0
| sent              298416           | arp_repl_rev       0
| vhlerr            0                | arp_upd            0
| lenerr            0                | arp_add            0
| fragerr           0                | arp_miss           139
| chkerr            0
| trustfail         0
| protoerr          4673
| send_im           296328
```

```
| defer             0
| defer_send        0
| defer_error       0
| defer_no_pkt      0
| defer_no_mem      0
| no route          0
| arp_income        2624
| arp_small_err     0
Filter: <Press any letter key to start filtering items>

LOG:03.08.16 17:27:57.561 : [SID=12] /IP/hosts/1/Mask changed to 255.255.255.2
```

| | |
|---|---|
| ***recv*** | The number of IP packets received. TDMoP frames are not taken into account. |
| ***drop*** | The number of IP packets dropped. |
| ***sent*** | The number of sent IP packets. |
| ***vhlerr*** | The number of errors in the version of the IP Protocol (number of not IPv4 packets). |
| ***lenerr*** | The number of errors related to the length of the IP packet. |
| ***fragerr*** | The number of received fragmented frames (fragmentation is not supported). |
| ***chkerr*** | The number of IP packets with incorrect checksum. |
| ***trustfail*** | The number of non-trusted IP packets. |
| ***protoerr*** | The number of received packets with unsupported top-level protocol type (not TCP, not UDP, ...). |
| ***send_im*** | The number of packets sent at once. |
| ***defer*** | The number of packets sent to the MAC address waiting queue. |
| ***defer_send*** | The number of packets sent from the MAC address waiting queue. |
| ***defer_error*** | The number of packets for which the MAC address could not be received. |
| ***defer_no_pkt*** | The number of overflows in delayed send queue. |
| ***defer_no_mem*** | Not enough memory to store. |
| ***no_route*** | The number of packets with unknown route. |
| ***arp_income*** | The number of received ARP requests. |
| ***arp_small_err*** | The number of too small ARP. |
| ***arp_req*** | The number of sent ARP requests. |
| ***arp_repl*** | The number of received ARP responses. |
| ***arp_req_rev*** | The number of sent RARP responses. |
| ***arp_repl_rev*** | The number of received RARP requests. |

| | |
|---|---|
| ***arp_upd*** | The number of updates to the ARP table. |
| ***arp_add*** | The number of entries in the ARP table. |
| ***arp_miss*** | The number of errors of searching the entries in the ARP table |

#### 3.2.5.6 /IP/stored-config submenu

This submenu allows you to configure the IP address, mask, default gateway, VLAN ID tag and its priority, as well as the parameters of the list of trusted nodes with which it will be loaded. Use the «ESC+S» key combination to save.

```
/IP/stored-config LPOS                              Advanced  ESC+h - Help
|>..
| NetworkAddr       192.168.0.24
| NetworkMask       255.255.255.0
| DefaultGateway    0.0.0.0
| DefaultVlanID     0
| DefaultVlanPri    0
| PhysicalAddr      54:A5:4B:7C:19:17
| SecondaryMAC      54:A5:4B:7C:19:18
| TrustAll          Yes
| TrustLocal        Yes
| TrustUnkVlan      Yes
| DNS1              192.168.0.1

Filter: <Press any letter key to start filtering items>

LOG:03.08.16 17:27:57.561 : [SID=12] /IP/hosts/1/Mask changed to 255.255.255.2
```

| | |
|---|---|
| ***NetworkAddr*** | Sets the IP address of the device. |
| ***NetworkMask*** | Sets the subnet mask. |
| ***DefaultGateway*** | Sets the IP address of the gateway. |
| ***DefaultVlanID*** | The 802.1p VLAN ID tag for management is set as decimal number in the range of 0 and 4095. 0 means no tag. Default value: 0. |
| ***DefaultVlanPri*** | 802.1p VLAN ID priority bit for management, the priority is specified as a decimal number from 0 to 7. Default value: 0. |
| ***PhysicalAddr*** | MAC address of the device. |
| ***SecondaryMAC*** | The second MAC address of the device. Can be used for redundancy (1+1)<br>**It is available from the firmware version: LPOS 1.0.9.4SR39.** |
| ***TrustAll*** | Enable/disable the list of trusted nodes that can be specified in the «***IP/hosts***» menu item.<br>***Yes*** – trust all. With this value, everyone has access regardless of the trusted nodes list (by default).<br>***No*** – allows access to the device only to nodes which are in the list of trusted nodes. This value also takes into account the ***TrustLocal*** parameter.<br>**It is available from the firmware version: LPOS 1.0.9.4SR3.** |

| | |
|---|---|
| ***TrustLocal*** | Enable/disable trusted nodes from the local network.<br>It is taken into account when ***TrustAll*** parameter has ***No*** value.<br>***Yes*** – local nodes from the hosts list will be trusted (by default).<br>***No*** – only nodes from the hosts list will be trusted.<br>**It is available from the firmware version: LPOS 1.0.9.4SR3.** |
| ***TrustUnkVlan*** | Enable/disable the processing of frames in those VLANs which are not defined in the VLAN table.<br>***Yes*** – nodes from an unknown VLAN will be trusted (by default).<br>***No*** – only nodes from the known VLANs will be trusted.<br>**It is available from the firmware version: LPOS 1.0.9.4SR21.** |
| ***DNS1*** | Preferred DNS server<br>**It is available from the firmware version: LPOS 1.0.9.4SR36.** |

### 3.2.6 /VLAN menu

To create a VLAN, press «ESC+C» and enter VLANID or range of VLAN IDs, then press «Enter». After adding, the table displays a list of VLANs. Their parameters are described in the following paragraph «**3.2.6.1/VLAN/VLANID submenu**».

```
/VLAN LPOS                                          Advanced  ESC+h - Help
|>..               Name
| 1                default
| 10               Control
| 32               FOR-E1
| 40-45            VLAN-FILIAL-4x

Filter: <Press any letter key to start filtering items>

LOG:03.08.16 17:31:50.351 : [SID=12] /VLAN/10/Name changed to Control
```

#### 3.2.6.1 /VLAN/VLANID submenu

This submenu allows you to configure the selected VLAN.

```
/VLAN/10 LPOS                                                 ESC+h - Help
|>..
| VID               10
| Name              u10
| IPAddr            192.168.0.142
| Netmask           255.255.255.0
| Gateway           192.168.0.1
| Cpu               Management
| Priority          BK0
| PriOverride       Disabled
| Remove            Remove
| Dependance        0,1,IP
| Auto              System
| DHCPClient        Enabled
| DNS1              192.168.0.1
| MACID             Primary

Filter: <Press any letter key to start filtering items>

Auto Refresh: disabled
```

| | |
|---|---|
| ***VID*** | VLAN ID; |
| ***Name*** | Symbolic description of the selected VLAN. |
| ***IPAddr*** | IPv4 address of the device.<br>0.0.0.0 – use the default settings |
| ***NetMask*** | Subnet mask. |
| ***Gateway*** | Gateway. |
| ***Cpu*** | Management access mode.<br>***NotMember*** – without access to management. The VLAN is not processed by the processor. The mode is for user traffic.<br>***Member*** – only protocols that do not allow to control the device (ICMP, TDMoP) operate.<br>***Management*** – all protocols are working, device management is available. |
| ***Priority*** | The priority when frames are tagged with a VLAN tag (802.1q) according to the 802.1p standard. For the priority, 3-bit space is allocated in the PCP (Priority code point) in the header of IEEE 802.1q.<br>***BK0*** – Background (the lowest priority).<br>***BE1*** – Best Effort.<br>***EE2*** – Excellent Effort.<br>***CA3*** – Critical Applications.<br>***VI4*** – Video, <100ms lantecy and jitter.<br>***VO5*** – Voice, <10ms lantecy and jitter.<br>***IC6*** – Internetwork Control.<br>***NC7*** – Network Control (the highest priority).<br>By default: ***BK0 (the lowest priority)***. |
| ***PriOverride*** | Forced priority update, see related settings in «**3.2.3.9/Eth/port/QoS submenu**»<br>***Disabled*** – disabled (by default);<br>***Enabled***– enabled. |
| ***Remove*** | Delete VLAN |
| ***Dependance*** | Dependency list (determined by all settings, e.g. /IP/current-config/DefaultVlanID, /TDMoP/port/config/VLANID). |
| ***Auto*** | VLAN usage mode.<br>***Enabled*** – add VLAN to all ports.<br>***System*** – add a VLAN to the port if there are dependencies.<br>***Disabled*** – do not add VLANs to ports automatically. |
| ***DHCPClient*** | Automatic IP address setting using DHCP<br>***Disabled*** – disabled (by default);<br>***Enabled***– enabled.<br>If the DHCP client is enabled in the Management VLAN and option 42 is available in the |

| | |
|---|---|
| | DHCP service, NTP settings are sent.<br>**It is available from the firmware version: LPOS 1.0.9.4SR34.** |
| ***DNS1*** | Preferred DNS server.<br>**It is available from the firmware version: LPOS 1.0.9.4SR34.** |
| ***MACID*** | The MAC address for this VLAN.<br>***Primary*** – MAC address from IP/current-config/PhysicalAddr (by default)<br>***Secondary*** – MAC address from IP/current-config/SecondaryMAC<br>**It is available from the firmware version: LPOS 1.0.9.4SR39.** |

### 3.2.7 /ATU menu

The menu shows ATU table - a table that links the MAC addresses and ports of the multiplexer. To edit the list of ports, name and priority, select the MAC address and press «Enter». To create a new record, press «ESC+C» and enter the MAC address.

```
/ATU LPOS                                          Advanced  ESC+h - Help
|>..                Name             Pri  Ports
| 54-A5-4B-7C-19-17 CPU              IC6  cpu
| FF-FF-FF-FF-FF-FF bcast            BK0  0,1,cpu,CSFP2,CSFP2.1,CSFP3,CSFP3.1

Filter: <Press any letter key to start filtering items>

LOG:03.08.16 17:31:50.351 : [SID=12] /VLAN/10/Name changed to Control
```

#### 3.2.7.1 /ATU/mac address submenu

```
/ATU/54-A5-4B-7C-19-17 LPOS                        Advanced  ESC+h - Help
|>..
| MAC               54:A5:4B:7C:19:17
| Name              CPU
| Ports             cpu
| Priority          IC6
| Source            system
| Remove            remove entry

Filter: <Press any letter key to start filtering items>

LOG:03.08.16 17:31:50.351 : [SID=12] /VLAN/10/Name changed to Control
```

| | |
|---|---|
| ***MAC*** | Mac address. |
| ***Name*** | Symbolic description of the MAC address. |
| ***Ports*** | List of ports from which packets can be sent to the current MAC address - for unicast traffic.<br>List of ports to which packets can be sent - for multicast traffic. |
| ***Priority*** | Priority for packets with the specified MAC address. |
| ***Source*** | The source that created the entry. |
| ***Remove*** | Delete the entry. Press «Enter» 2 times. |

### 3.2.8 /flash menu

In this menu, you can view the files located on the flash memory: *log_bkb, log_bkp, log*, *system.cfg*, *config.sys*

*Log* file – event Log. It is created automatically when you first turn on the device.

File *log_bkp* – copy of the event log.

File *system.cfg* – the device configuration file.

*Config.sys* file – this file is created on the flash memory of the multiplexer when changing default passwords, the passwords are stored encrypted. If you delete this file, the passwords will be reset to the factory.

To view the content, select the desired file and press «Enter». Use the up/down arrows to scroll through the content. To exit view mode, press «ESC».

```
/flash LPOS                                          Advanced  ESC+h - Help
|>..
| log_bkb           File
| config.sys        File
| log               File
| system.cfg        File

Filter: <Press any letter key to start filtering items>

LOG:03.08.16 17:31:50.351 : [SID=12] /VLAN/10/Name changed to Control
```

### 3.2.9 /Envir menu

This menu consists of two submenus:

- ADC – provides information on the temperature of the device and the voltage values at the control points of the device.
- system – provides system information on the device.

```
/Envir LPOS                                          Advanced  ESC+h - Help
|>..
| ADC
| system

Filter: <Press any letter key to start filtering items>

LOG:03.08.16 17:31:50.351 : [SID=12] /VLAN/10/Name changed to Control
```

#### 3.2.9.1 /Envir/ADC submenu

This submenu displays the temperature and voltage values in a table.

```
/Envir/ADC LPOS                                      Advanced  ESC+h - Help
|>..                Value     Type      State
| SwitchTemperature 38        C         Normal
| Temperature       45        C         Normal
| Voltage 1.2       1.21      V         Normal
| Voltage 1.8       1.82      V         Normal
| Voltage 2.5       2.53      V         Normal
| Voltage Vacin     244       V         Normal
| Voltage Vacin max 248       V         Normal
| Voltage Vacin min 237       V         Normal
| Voltage Vdcin     0         V         Down
| Voltage Vin       12.8      V         Normal

Filter: <Press any letter key to start filtering items>
```

```
LOG:03.08.16 17:31:50.351 : [SID=12] /VLAN/10/Name changed to Control
```

| | |
|---|---|
| ***SwitchTemperature*** | The temperature of the multiplexer switch, measured in degrees Celsius, which should not exceed 110°C. |
| ***Temperature*** | The temperature of the multiplexer, measured in degrees Celsius, which should not exceed 75°C. |
| ***Voltage 1.2***<br>***Voltage 1.8***<br>***Voltage 2.5*** | Voltage on different elements of the board, which must be equal 1.2/1.8/2.5 respectively. |
| ***Voltage Vacin***<br>***Vacin max***<br>***Vacin min*** | Alternating voltage supply of the device. |
| ***Vdcin*** | Constant supply voltage of the device from an external source. |
| ***Voltage Vin*** | Supply voltage of the device (constant). |

#### 3.2.9.2 /Envir/ADC/parameter submenu

```
/Envir/ADC/Temperature LPOS                          Advanced  ESC+h - Help
|>..
| ID                 0
| Value              45
| Type               C
| State              Normal
| WarnLow            5.00
| WarnHi             75.00
| ErrLow             0.00
| ErrHi              85.00

Filter: <Press any letter key to start filtering items>

LOG:03.08.16 17:31:50.351 : [SID=12] /VLAN/10/Name changed to Control
```

| | |
|---|---|
| ***ID*** | The ID of the parameter. |
| ***Value*** | The current value of the parameter. |
| ***Type*** | The units of the parameter. |
| ***State*** | The current status of the parameter. |
| ***WarnLow*** | The lower limit of the parameter value at which the warning occurs. |
| ***WarnHi*** | The upper limit of the parameter value at which the warning occurs. |
| ***ErrLow*** | The lower limit of the parameter value at which the error occurs. |
| ***ErrHi*** | The upper limit of the parameter value at which the error occurs. |

#### 3.2.9.3 /Envir/system submenu

This item displays system information about the device.

```
/Envir/system LPOS                                  Advanced  ESC+h - Help
|>..
| Description       62x, 63x scpu
| Serial            7C 19 17 00
| Uptime            11 days, 1 hours, 18 min, 45 sec
| Version           2.4.9 prep [boot 2.1]
| LicenseKey        8C3SIQ2F-O25VF4QL-R15O2KD4-B3F6T1J5
| UID               37 00 AC 07 33 58 35 34 19 17 07 44

Filter: <Press any letter key to start filtering items>

LOG:03.08.16 17:31:50.351 : [SID=12] /VLAN/10/Name changed to Control
```

| | |
|---|---|
| ***Description*** | Description of the coprocessor. |
| ***Serial*** | Device serial number. |
| ***Uptime*** | Time since the last device turning on. |
| ***Version*** | The version of the coprocessor software. |
| ***LicenseKey*** | License key. |
| ***UID*** | Unique identifier. |

#### 3.2.10 /EthGlobal menu

In this menu, global configuration of a switch is available.

```
/EthGlobal LPOS                                     Advanced  ESC+h - Help
|>..                                  | TagPri              10012233
| ATUSize           1024
| AgeTime           330
| ATUUsed           3
| VLANSize          4096
| VLANUsed          9
| VLANTroubles
| BPDUTrap          Enabled
| Scheduling        Strict
| QinQTag           8100
| MTU               1522
| IPPri01           00000000
| IPPri23           00000000
| IPPri45           11111111
| IPPri67           11111111
| IPPri89           22222222
| IPPriAB           22222222
| IPPriCD           33333333
| IPPriEF           33333333
Filter: <Press any letter key to start filtering items>

LOG:03.08.16 17:31:50.351 : [SID=12] /VLAN/10/Name changed to Control
```

| | |
|---|---|
| ***ATUSize*** | The maximum number of entries in the MAC address table (ATU). |

| | |
|---|---|
| ***AgeTime*** | The aging time for entries in the MAC address table, with 15 seconds step. |
| ***ATUUsed*** | The number of entries in the switching table |
| ***VLANSize*** | The maximum number VLAN's. |
| ***VLANUsed*** | The number of entries in the VLAN table |
| ***VLANTroubles*** | Displays issues associated with VLANs. You should configure the VLAN table. |
| ***BPDUTrap*** | Enable/disable sending BPDU-traps to the processor.<br>It is necessary for RSTP, LLDP operation.<br>***Enabled*** – enabled (by default).<br>***Disabled*** – disabled. |
| ***Scheduling*** | The scheduling algorithm of the output frames.<br>***Strict*** – Strict Priority for all queues (by default);<br>***Weighted*** – Weighted Round-Robin for all queues;<br>***Strict3Weighted210*** – Strict Priority for queue 3, and weighted Round-Robin for queues 2,1,0 (not supported on some hardware versions);<br>***Strict32Weighted10*** – Strict Priority for queue 3 and 2, and weighted Round-Robin for queues 1,0 (not supported on some hardware versions);<br>**Available from version 1.0.9 FOR LPOS.4SR10.** |
| ***QinQTag*** | QinQ tag for ports in QinQ mode and option Eth/port/VLAN/QinQTag=Global.<br>***Tag Protocol Identifier (TPID): 88A8*** – Service VLAN tag identifier (S-Tag), according to 802.1Q-2014 clause 9.5 (see also RFC 7042) |
| ***MTU*** | Maximum Ethernet frame size. |
| ***IPPri01*** | Internal priority definition map from the ToS/DSCP field of IP frames, DSCP = 0..7 |
| ***IPPri23*** | Internal priority definition map from the ToS/DSCP field of IP frames, DSCP = 8..15 |
| ***IPPri45*** | Internal priority definition map from the ToS/DSCP field of IP frames, DSCP = 16..23 |
| ***IPPri67*** | Internal priority definition map from the ToS/DSCP field of IP frames, DSCP = 24..31 |
| ***IPPri89*** | Internal priority definition map from the ToS/DSCP field of IP frames, DSCP = 32..39 |
| ***IPPriAB*** | Internal priority definition map from the ToS/DSCP field of IP frames, DSCP = 40..47 |
| ***IPPriCD*** | Internal priority definition map from the ToS/DSCP field of IP frames, DSCP = 48..55 |
| ***IPPriEF*** | Internal priority definition map from the ToS/DSCP field of IP frames, DSCP = 56..63 |
| ***TagPri*** | The map defining the internal priority of the VLAN Priority field |

### 3.2.11 /AAA menu

AAA settings (Authentication, Authorization, Accounting). The process of granting access to the device using the TACACS+, RADIUS protocols and the local user base is implemented in the current firmware version. These settings are available from the software version: LPOS 1.0.9.4SR36.

#### 3.2.11.1 /AAA/Authentification submenu

This submenu specifies the authentication parameters

```
/AAA/Authentification/login LPOS                Advanced  ESC+h - Help
|>..
| default

Filter: <Press any letter key to start filtering items>

Auto Refresh: disabled
```

a) **/AAA/Authentication/login/default submenu**

Specify the sequence for the access grant verification sources

```
/AAA/Authentification/login/default LPOS         Advanced  ESC+h - Help
|>..
| Seq               group radius-1.domain group 192.168.0.102 local
| Remove            Remove

Filter: <Press any letter key to start filtering items>

LOG:01.12.16 14:20:26.401 : [E1_daemon] E1 0 changed state to RX: Ok, TX: Ok
```

| | |
|---|---|
| ***Seq*** | The sequence of the sources of verification for granting access.<br>By default: local<br>***Example:***<br>Seq: group radius-1.domain group 192.168.0.102 local<br>With these settings, the provisioning process will initially be checked on the radius-1.domain server.<br>In case of unavailability of this server, the process of granting access will be checked on the server 192.168.0.102.<br>If this server is not available, the provision of access will be based on the users initiated on the multiplexer (base local).<br>After the first available server in the sequence «Seq», further viewing of this sequence stops.<br>**Available from firmware version 1.0.9 FOR LPOS.4SR36.** |
| ***Remove*** | Delete the login record. |

#### 3.2.11.2 /AAA/Servers/server submenu

Access grant server settings. To create a new entry, press ***«ESC+C»*** and enter the name of the server settings group.

```
/AAA/Servers LPOS                                    Advanced  ESC+h - Help
|>..
| 192.168.0.102
| radius-1.domain

Filter: <Press any letter key to start filtering items>

LOG:29.12.16 10:59:48.390 : [SID=5] /AAA/Servers/192.168.0.102/Secret modified
```

```
/AAA/Servers/radius-1.domain LPOS                    Advanced  ESC+h - Help
|>..
| Hosts             radius-1.domain
| Type              Radius
| AuthPort          1812
| AcctPort          1813
| Secret            RadiusSecretWord
| Remove            Remove

Filter: <Press any letter key to start filtering items>

Auto Refresh: disabled
```

```
/AAA/Servers/192.168.0.102 LPOS                      Advanced  ESC+h - Help
|>..
| Hosts             192.168.0.102, 192.168.0.112
| Type              TACPlus
| AuthPort          49
| AcctPort          49
| Secret            TacacsSecretWord
| Remove            Remove

Filter: <Press any letter key to start filtering items>

LOG:29.12.16 10:59:48.390 : [SID=5] /AAA/Servers/192.168.0.102/Secret modified
```

| | |
|---|---|
| ***Hosts*** | A comma-separated list of host names or IP addresses of the provisioning servers.<br>Example: radius-1.domain, 192.168.0.40 |
| ***Type*** | Type of access server.<br>***TACPlus*** – server to provide access via TACACS+ (RFC 1492);<br>***Radius*** – a server to provide access via RADIUS (RFC 2865). |
| ***AuthPort*** | Port for authentication and authorization.<br>Commonly used ports:<br>***49*** for TACACS+,<br>***1812*** for RADIUS |
| ***AcctPort*** | Port for accounting. |

| | |
|---|---|
| | Commonly used ports:<br>***49*** for TACACS+,<br>***1813*** for RADIUS. |
| ***Secret*** | Shared key |
| ***Remove*** | Remove the entry on access source. |

### 3.3 SNMP agent

The multiplexer is equipped with SNMP agent. Using SNMP, you can view current device modes, interface status, local and remote error statistics, and change these settings.

Topgate series multiplexer supports SNMP v1, v2c, v3.

You can enable or disable these protocols by setting the *Enabled* parameter to *Yes* in the appropriate menu item «**3.2.4.11/System/SNMP/v1 submenu**».

| | |
|---|---|
| ***Enabled*** | Enable/disable snmp of the corresponding version.<br>***Yes*** – enabled;<br>***No*** – disabled. |

Then, you need to set the snmp community names. To perform this, go to the menu item «**3.2.4.8/System/SNMP/auth submenu**».

| | |
|---|---|
| ***ReadCommunity*** | Configure the SNMP community name to read («public» by default). |
| ***WriteCommunity*** | Configure the SNMP community name to write («public» by default). |

#### 3.3.1 The base of management information (MIB)

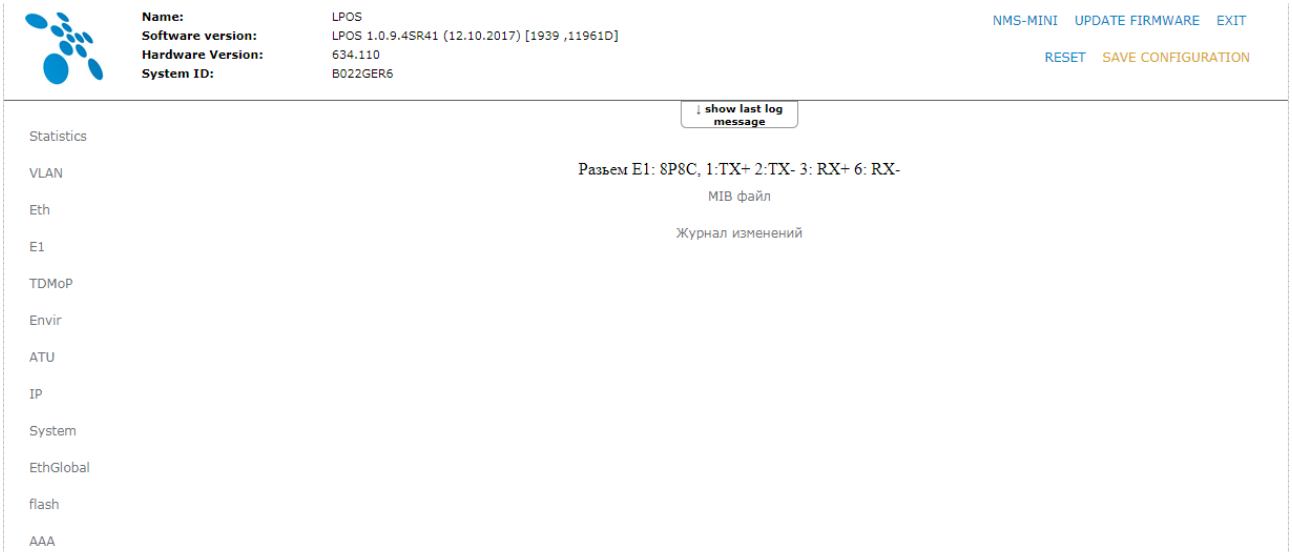
A base of management information (MIB) is implemented in the multiplexer):

**EMUX-MIB** is a specialized base of management information that contains the state of the E1 interfaces and the optical interface. The files with specification EMUX-MIB is available on the website *http://eltex-co.com.*

MIB file for SNMP operation is also available for download in the Web-interface of each device.

### 3.4 Management via Web-interface

When you log in to the device via the Web interface, the main menu is displayed.




Main menu of Web-interface

### 3.4.1 Navigating among menu items

To enter a certain menu item, click on this menu item with the left mouse button.

To access the main menu, click on the company logo in the upper left corner of the Web-interface.

### 3.4.2 Changing parameter value

Changing the value of the parameters available for editing is carried out either by entering directly the required values, or by selecting from the options.

After making changes, the «APPLY X CHANGES» button will appear in the WEB interface at the bottom of the page, where X is the number of changes made in the current menu.

To apply the changes, click this button.

### 3.4.3 Adding new items

In some sections of the menu, for example, in sections ATU, VLAN, AAA/Servers, you can add new items. To add new elements, you must enter the value of the element(s) in the input field. For example, in the ATU menu, you enter the MAC address in HH-HH-HH-HH-HH format to communicate with Ethernet ports. In the VLAN menu, enter VLANID or VLAN group, for example: 10,20-25. After entering the values of the new elements, click «Add element».

# 4 Recommendations for Troubleshooting

The multiplexer is a complex microprocessor device, so Troubleshooting, if they are not associated with obvious reasons – an faulty configuration, a power cable break, mechanical damage to the connector, etc. – is possible only at the manufacturer or in its representative offices.

If you have any questions related to the operation of the multiplexer, please contact the technical support of the manufacturer.

This section describes how to detect and troubleshoot problems that occur during the operation of the multiplexer.

## 4.1 Diagnosis of error conditions

Diagnosis of error conditions can be made on the basis of the analysis of LED indicators on the front panel. In more complex cases, you must connect to the multiplexer and run console diagnostic commands. In addition, the multiplexer is equipped with a operating log, which records information on all events occurring with the multiplexer. Each log entry has a timestamp. The user can view the event log using telnet, a local terminal, or a browser via HTTP.

### 4.1.1 LED indication

LED indicators on the front panel of the multiplexer reflect the current status of the E1, Ethernet interfaces, as well as the status of the multiplexer as a whole. In general, the green indicator on the E1 connector indicates data transmission, and the yellow one indicates an error condition. The status of copper Ethernet connections is displayed traditionally: the green light indicates that the cable is connected and the connection is established, and the yellow light indicates data transmission. The optical connection status is displayed in green when there is a signal at the receiver input and in red when there is no signal.

### 4.1.2 Console commands

To display the error counters of topgate device user interfaces, the following console command is implemented in the multiplexer:

***stat***

Shows statistics for various modules of the device. Statistics are stored in RAM, is saved 1 time in 15 minutes. Available from 96 intervals with statistics. The syntax of the command is described in «**3.1.3System commands/stat**».

### 4.1.3 Event log

All interface state changes are logged in the system log with the event timestamp. You can use the following command to view the log:

***log***

To display the time stamps correctly in the multiplexer, the current date and time must be set correctly.

## 4.2 Troubleshooting

The table 4.2 contains the main types of error states and ways to solve them.

| State | Probable cause | Recommended action |
|---|---|---|
| No power to the multiplexer, all LED indicators are off | The power cable is faulty | Check the cable by measuring the voltage on the connector. |
| No power to the multiplexer, all LED indicators are off | Supply voltage beyond acceptable range | Select a power supply with a supply voltage in the specified range (the multiplexer will be in the "off" state if the idling voltage of the power |

| | | |
|---|---|---|
| | | supply is higher than the maximum permissible value) |
| No Telnet or FTP connection to the multiplexer | The Ethernet cable is faulty | Check the cable by connecting the multiplexer with a known good (proven) cable. |
| No Telnet or FTP connection to the multiplexer | The IP address or mask in the multiplexer is set incorrectly | Set the correct address using the serial port |
| No Telnet or FTP connection to the multiplexer | The management computer is on a different network segment and the default gateway is not configured correctly | Perform the connection of management computer and the multiplexer in a single network segment |
| No Telnet or FTP connection to the multiplexer | The address of the management computer is not among the addresses of trusted multiplexer nodes | Add the address of the management computer to the list of trusted hosts using the serial port |
| No connection to the multiplexer via serial port | Incorrectly set baud rate, stop bit number, parity, flow control | Parameters of the serial port of the computer – 115000 kbps, 8 bits, no parity, no flow control. |
| E1 equipment connected to the multiplexer is not synchronized with the multiplexer, there is no transmission E1, yellow led lights | The lack of physical connection | Check the cabling and physical connections |
| E1 equipment connected to the multiplexer is not synchronized with the multiplexer, there is no transmission E1, yellow led lights | Incorrect configuration | Check the configuration of the multiplexer E1 interface and, if necessary, other parameters of the multiplexer<br>Check the physical E1 connection using test loops |
| Slip and bit error in the E1 thread | Many packets are lost in the Ethernet network, for example, the Ethernet interface is in HalfDuplex mode, this can cause packet loss due to collision and rollbacks | Check E1 connection using loops<br>Check the setting of the jitter buffer and time extrapolation in accordance with the documentation<br>Check the configuration of the Ethernet interface, in particular the Duplex mode<br>Check the transmission network on packet loss |
| Echo in voice path | A large delay in the packet transmission, or over-enhanced jitter buffer | Try to reduce the size of the Jitter buffer (up to 8ms)<br>Try to reduce network delay. |

## 4.3 Diagnostic test

Diagnostic tests are often necessary to identify and solve faults.

### 4.3.1 Check access to the multiplexer

To check network connectivity, use the Windows ping command with the IP address of the remote device.

**Example 1**. Network connectivity check by sending ICMP packets to a multiplexer with IP address 192.168.111.21.

*C:\>ping 192.168.111.21*

```
Pinging 192.168.111.21 with 32 bytes of data:
Reply from 192.168.111.21: bytes=32 time<1ms TTL=64
Reply from 192.168.111.21: bytes=32 time<1ms TTL=64
Reply from 192.168.111.21: bytes=32 time<1ms TTL=64
Reply from 192.168.111.21: bytes=32 time<1ms TTL=64
Ping statistics for 192.168.111.21:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

A *Loss* parameter of *0%* indicates full connectivity between devices. Non-zero value indicates possible problems (electromagnetic interference on the cable, incorrect setting, etc.).

The data transfer time from the multiplexer to any other device can be determined using the ping command on the multiplexer. The message *«Echo request time out»* indicates that there is no connectivity between the multiplexer and the remote device.

**Example 2.** Determine the delay in data transfer between local and remote multiplexers. The IP address of the remote multiplexer is 192.168.0.22.

```
LPOS > ping 192.168.0.22
Echo reply 0.231ms
```

**Example 3.** Check network connectivity by sending ICMP packets to the multiplexer with an IP address of 192.168.0.225 located in the 32 VLAN.

```
LPOS > ping 192.168.0.225 -v 32 -t 3
Echo reply 0.281ms
Echo reply 0.248ms
Echo reply 0.236ms
Ping statistics:
        Packets: Sent 3, Received 3, Lost 0 (0% loss)
Approximate round trip times:
                Minimum 0.236ms, Maximum 0.281ms, Average 0.255ms
```

### 4.3.2 Check the status of the Ethernet interface

The submenu «**3.2.3 /Eth**» is used to check the status of the interface of topgate series multiplexers.

Each interface displays information about connection establishment, duplex mode and speed of operation.

### 4.3.3 Check the status of the E1 interface

To check the status of the interface of topgate series multiplexers, use the submenu «**3.2.1 /E1**».

Displays information about the status of the virtual interface connection and its configuration.

### 4.3.4 Check the status of the TDMoP interface

«**3.2.2 /TDMoP**» submenu is used to check the interface status of topgate series multiplexers.

Displays information about the status of the virtual interface connection and its configuration.

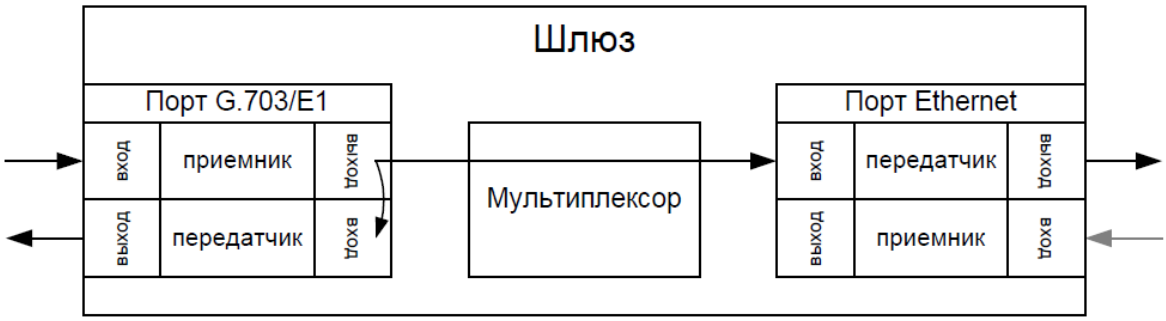
### 4.3.5 Installation of diagnostic loops

The test mode allows you to check both the hardware of the local multiplexer and various segments of the network formed by data lines, as well as local and remote equipment. You can isolate individual sections of the path by including test loops in E1 interfaces. The multiplexer makes it possible to include two types of diagnostic loops – local and remote – in each of the E1 interfaces.

In local loop mode, the multiplexer connects the output of the E1 interface receiver to the input of its transmitter. The signal coming to the E1 interface is transmitted to the remote multiplexer, and the signal received from the remote multiplexer and related to this E1 interface is ignored.

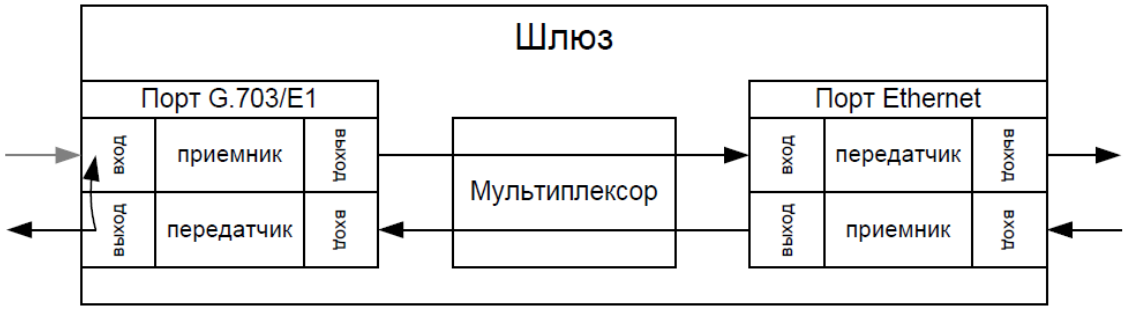
To enable the local loop on the port, the *Loop* parameter must be set to *Yes* in the menu «**3.2.2.1/TDMoP/port/config submenu**».

Scheme of signal transmission in local loop mode




To enable the remote loop on the port, the *Loop* parameter must be set to *Yes* in the menu «**3.2.1.1/E1/port/config submenu**».

The scheme of the signal transmission in the remote loop.




### 4.4 Connection quality monitoring and error statistics

To display E1 and TDMoP interfaces statistics on the multiplexer, the menu items «**3.2.1.2E1/port/statistics submenu**», «**3.2.2.2/TDMoP/port/state submenu**», «**3.2.2.3/TDMoP/port/statistics submenu**».

#### 4.4.1 Reset statistics

To reset the error counters on the topgate series multiplexers, press the «*ESC+R*» key combination, after going to the desired menu item, the counters of which must be reset.

### 4.5 Frequently asked question

**1. How the multiplexer processes the error conditions of E1?**

the multiplexer processes E1 and Ethernet error states in the following way:

The E1 errors:

Mode without defining a frame structure:

In the case of LOS (signal loss) state on the local side, the multiplexer will send idle packets to the remote multiplexer approximately twice per second, and the remote multiplexer will generate an AIS signal.

All other states sent by the E1 device (including information regarding timeslot 0) will be transparently transmitted by the multiplexer to the remote multiplexer, which in turn will transmit them to the line.

Mode with defining and control of frame structure:

In the case of LOF/AIS detected on the local side, the multiplexer will signal on the appropriate state, simultaneously transparently transmitting the data stream to the remote multiplexer, which in turn will transmit it to the line, signaling the presence of an error state.

Ethernet errors:

In case of data network failure (no reception of packets carrying E1 stream), during the MaxTimeout, extrapolated E1 stream will be transmitted to the line, and after this time – AIS.

**2. How can I guarantee E1 traffic priority over other Ethernet/IP data?**

The multiplexer implements three options to specify the priority of packets carrying E1 traffic:

VLAN ID (layer 2)

DSCP (layer 3)

UDP port of the destination (layer 4).

Each QoS capability is based on different OSI layers and can be configured for each E1 stream individually. Note that the multiplexer marks only TDMoP traffic with the appropriate tags, based on which all other network nodes (switches, routers...) must give it priority in transmission. When deciding which mechanism to use, please ensure that the selected option is supported by your existing network equipment and that it is correctly configured to provide prioritization.

**VLAN ID**

The multiplexer is compatible with IEEE 802.1p&Q standard. This allows the user to set VLAN ID and VLAN priority. This adds four bytes to the MAC layer (Layer 2) of the Ethernet frame. These bytes contain information about the VLAN ID, and VLAN priority, which can be 0-7. The built-in multiplexer switch requires a priority of 6 or 7 to ensure absolute priority, but if additional hardware prioritization capabilities are used, any number can be used. In this case, the multiplexer marks only E1 packets, and the additional switches are responsible for giving priority according to the VLAN information. It is necessary that E1 traffic have the highest priority on the local Ethernet network.

**DSCP**

DSCP (Differentiated Service Code Point) – the six highest bits of the DS field located in the IP header (layer 3) are used to select the phased behavior option. Details are described in RFC791, RFC1349, RFC2474. The multiplexer switch allows you to set the following DSCP values in the IP packet header: 0-63, af[1..4][1..3], cs[1..7], default, ef.

**UDP destination port**

To send TDMoP traffic, the multiplexer uses UDP (layer 4) and the value of the destination port in the UDP header is always set to a decimal value of 41000. Hosts can be configured to provide prioritization according to this field.

Hosts can be used to prioritize TDMoP traffic according to the UDP destination port field.

## 3. Does the allocation of sufficient bandwidth guarantee the proper functionality of the multiplexer?

The bandwidth alone is not enough to guarantee a stable E1 transmission, a number of other problems may occur in networks loaded with additional traffic (for example, Intranet or Internet traffic):

Fluctuation of the delay time. E1-carrying traffic packets can be delayed at different times (although all traffic will eventually pass due to the fact that there is sufficient bandwidth). This may be due to overloaded networks, Queuing mechanisms, etc. The multiplexer can compensate some fluctuation (up to 2 seconds), but a large fluctuation will cause problems.

Incorrect order - packages may arrive in a different order as to how they were sent. The multiplexer restores the order of packets, but if the jitter buffer is small, information may be lost.

Packet loss - packets could be ignored on some nodes in the network (routers/switches) due to insufficient processing speed, busy transmit or receive queue, buffer overflow, etc. Usually these problems are solved by allocating a high priority to E1 traffic in relation to other traffic.

In a situation where network nodes do not provide prioritization for E1 traffic, the operation of the multiplexer deteriorates, although sufficient bandwidth is provided.

If you encounter problems, contact technical support for advice on how to test the multiplexer and network operation

## 4. What are the requirements to a packet network for the transmission of the G.703/E1 stream?

*1. Delay time effects.*

There is no echo canceller in the current version. Therefore, if subscribers use analog terminals, the transit time of more than 10 ms will lead to the appearance of a characteristic «metal» tone of voice, and more than 20-30 ms – to a full-fledged echo. The noticability depends on the type of terminal devices and acoustic environment.

*2. Packet loss.*

Spontaneous packet loss can be corrected by the device through a proprietary reliable protocol. However, this takes time, and if a significant transit delay causes a repeated packet to arrive late, it will not be used.

*3. Variation of the delay time.*

The jitter buffer on the receiving multiplexer compensates for variations in packet transmission time, and the jitter buffer size must be greater than the maximum allowable deviation of the transmission time from the average packet transmission time plus 1 ms.

## 5. What is the minimum bandwidth required to transmit the 1st structured and unstructured G.703 stream over an IP network and over an Ethernet network? What does it depend on?

Both streams has nominal bit rate 2048 kbps. Denote E1 = 2 048 000 bps.

If, for example, n bytes of payload are used in packets, then each packet needs a header, XX bytes for the 802.3 packet, and YY bytes for the UDP packet. Therefore, the used band is larger.

The lengths of the component parts of the packet headers are as follows (in bytes):

```
MAC    = 14 (DA = 6, SA = 6, EtherType = 2)
VLAN   =  4
TDMoP  = 14
IP     = 20
UDP    =  8
```

Header for 802.3 packet (MAC + VLAN + TDMoP), XX = 32 bytes = 256 bits
A header for a packet with IP/UDP YY = 60 bytes = 480 bits
The number of Ethernet packets per second for E1 stream transmission, Cnt = 2 048 000/N

```
E1 = 2048000 (E1 bit rate, bit/s)
N = 2048 (payload, bits)
XX = 256 (header length without IP/UDP, bits)
YY = 480 (header length with IP/UDP, bits)
Cnt = 1000 (The number of Ethernet packets per second)
```

Bandwidth for 802.3 packets (***without IP/UDP headers***) in bits =
Cnt * XX + Cnt * N = 1000 * 256 + 1000 * 2048 = 2 304 000 bit/s or ***2304 kbps***

Bandwidth for packets ***with IP/UDP headers*** in bits =
Cnt * YY + Cnt * N = 1000 * 480 + 1000 * 2048 = 2 528 000 bit/s or ***2528 kbps***

Summary tables of bandwidth for a single E1 stream in kbps for different cases are given below:

**Bandwidth for E1 stream with IP/UDP headers, maxPayload = 1458 bytes**

| kbps | TimeSlot | 32 | 16 | 8 | 4 | 2 | 1 | fps |
|---|---|---|---|---|---|---|---|---|
| **FrameSize (0.5 ms)** | | | | | | | | |
| **1** | | 3008 | 1984 | 1472 | 1216 | 1088 | 1024 | 2000 |
| **2** | | 2528 | 1504 | 992 | 736 | 608 | 544 | 1000 |
| **5** | | 2240 | 1216 | 704 | 448 | 320 | 256 | 400 |
| **10** | | 2144 | 1120 | 608 | 352 | 224 | 160 | 200 |
| **20** | | - | 1072 | 560 | 304 | 176 | 112 | 100 |
| **63** | | - | - | - | 271 | 143 | 79 | 31,75 |

**Bandwidth for E1 stream without IP/UDP headers, maxPayload = 1486 bytes**

| kbps | TimeSlot | 32 | 16 | 8 | 4 | 2 | 1 | fps |
|---|---|---|---|---|---|---|---|---|
| **FrameSize (0.5 ms)** | | | | | | | | |
| **1** | | 2560 | 1536 | 1024 | 768 | 640 | 576 | 2000 |
| **2** | | 2304 | 1280 | 768 | 512 | 384 | 320 | 1000 |
| **5** | | 2150 | 1126 | 614 | 358 | 230 | 166 | 400 |
| **10** | | 2099 | 1075 | 563 | 307 | 179 | 115 | 200 |
| **20** | | - | 1050 | 538 | 282 | 154 | 90 | 100 |
| **63** | | - | - | - | 264 | 136 | 72 | 31,75 |

**6. What is the delay introduced by the device and what does it depend on?**

Packet delay in the input device. Occurs at the time of filling the package with data from E1 - FrameSize.

Delay in the jitter buffer in the output device. On average, it is equal to the size of the buffer that the user sets based on the network parameters - JBSize.

**7. What types of alarms are sent by the gateway? CAS, CCS? Any? Are there any restrictions? PRI ISDN, SS7, proprietary out of band?**

Any. In the current version, the channel is completely transparent.

**8. How does synchronization transfer occur? Who can/should be the source of synchronization in the network? Can the gateway be a clock source?**

In the current version, synchronization is restored programmatically on each E1 output port, based on the characteristics of the stream received via ethernet or from another E1 port.

**9. Is the FAS, CRC4 structure supported?**

The FAS/NFAS structure can be analyzed if the «Unframed» parameter is set to «No» in the E1 stream settings. In this case, the absence of such structure will be perceived as an error. The CRC4 structure can be analyzed if the corresponding options are set in the «CRC4» parameter in the E1 stream settings.

**10. What is the maximum frame length processed by the built-in switch?**

It can be set to 1518 untagged / 1522 tagged, 1632, 2048, 10240. The default value is 1518/1522. It depends on the hardware version of the device.

**11. How is the width of the WAN channel divided among the E1 streams and the rest of the traffic? Dynamically, statically, what does it depend on?**

The switch has four levels of queues. The packets carrying E1 have the priority specified by the parameters «VLANPri», «DSCP» in the submenu «**3.2.2.1/TDMoP/port/config submenu**». By default, the scheduling discipline is strict priority, that is, if there is at least one packet with E1 data, it will be routed to the output port before all other packets. This discipline ensures that if voice data can in principle be delivered through aggregate interfaces, it will be delivered under any conditions.

The discipline of frame output scheduling can be changed by the «*Scheduling*» parameter in the «**3.2.10/EthGlobal menu**» submenu. You can schedule round robin queues with different relationships, and ensure that parts or all of your custom Ethernet packets have priority equal to or greater than E1. However, this is beyond the needs of the average user. Except that it might be interesting to narrow channels which are trying to pass multiple E1 streams. Different priorities will allow to achieve alternate degradation of streams with narrowing of the channel, rather than destruction of all streams at the same time.

**12. Is the synchronization for each port transmitting E1 streams fully independent? Are there any restrictions?**

Completely independent.

**13. What is the effect of setting Unframed = Yes/No?**

The stream with parameter Unframed = Yes, is passed without control of content. The only thing that worries the multiplexer – the presence of at least some signal and the implementation of the rules of coding AMI/HDB3. The stream with parameter Unframed = No, is checked for the presence of FAS/NFAS.

The absence of a frame sequence is considered as an error. With a framed stream (Unframed = No), you can use compression by setting the Compression = Yes parameter in «**3.2.2.1 /TDMoP/port/config**».

**14. How to determine the optimal jitter buffer size? What is the effect of changing the size of the output queue?**

It should be more than a fluctuation of transit time in the network. For example, if the transit time for a hundred packets varies from 2.5 to 6.5 ms, the buffer must be at least 4 ms so that no packet is lost. It is better if the buffer is even larger so that the mechanism of re-request of lost packets can work.

The recommended size of the jitter buffer in ms can be found in the «*RecommendedJB*» parameter in the «**3.2.2.3/TDMoP/port/statistics submenu**».

It is not always possible to satisfy this condition. For example, in a Wi-Fi channel, the vast majority of packets are delivered for milliseconds, and a small portion, say 0.1%, is delayed for a second or more. It is impractical to set the buffer to two seconds due to unacceptable delay and echo. It should be set to, for example, 10 ms, and come to terms with the fact that a small part of the packages will be lost and there will be loss. They practically do not degrade the quality of voice transmission and almost do not affect the operation of faxes and modems.

Thus, in all cases where the delay time variance is greater than one millisecond, the buffer size is a trade-off between the delay and the number of packets lost.

**15. How to determine the optimal size of data in a package? What is affected by the change?**

The larger a package is, the less overhead for the transfer of a header. The greater the delay on packeting. More loss of useful information when one packet goes missing.

**16. What is the maximum number of ports that can be stacked?**

Stacking is no longer supported.

**17. What port number is used by the device when transmitting over a packet network?**

UDP - 41000 dst, 41001 src

**18. Why do I need a built-in terminal server and how to use it?**

For example, on the website the gateway is installed together with the PBX in which the control ports are only RS-232. The server is useful to manage this PBX through the IP-network as well. Its RS-232 port will appear on the corresponding IP port of our gateway.

**19. We want to transmit E1 data via radio-Ethernet. Whether the gateway will always work in this scheme. How should it be configured for optimal performance, and what limitations are possible?**

According to our ideas, you need to have a band that is a couple of times higher than the E1 data channel load. The distribution of packet delay time should be concentrated in the interval 0..10 ms in order to avoid a strong echo. In this case, the jitter buffer should be set to, for example, 15 ms. The packets that stay longer than that will be discarded. Therefore, the share of such packets in the channel should be small. Looking at the statistics of E1, it is possible to estimate what proportion of packages is not included in the jitter buffer.

In addition, another parameter – maximum gap interpolation – specifies the time during which, in the absence of packets at the input, the gateway will try to feed the previous level to E1 port to avoid clicks and interference in the channel. After this interval, the gateway decides that the connection is still broken, and will issue AIS.

In those Wi-Fi channels that we met, every few minutes the transmission is suspended for ~800 ms, and occasionally for ~1600 ms. Therefore, the maximum gap interpolation parameter should be set to 2000 ms.

### 4.6 Technical support

Technical support can be obtained from the distributor from whom the multiplexer was purchased. For more information, please contact the manufacturer.

# 5 Installing and updating the software

**Starting with version 1.0.9 FOR LPOS.4SR2, the default MAC address has been changed. Therefore, when you upgrade an older version of firmware to LPOS 1.0.9.4SR2 and above, you must restart the E1 streams.**

## 5.1 Firmware installation

Multiplexers ToPGATE firmware belongs to the class: operating systems, embedded software of telecommunication equipment and is intended for installation in topgate multiplexers. In this regard, the initial installation of the software is made at the manufacturer according to a separate instruction.

## 5.2 Device update, via Telnet, SSH or *terminal*

1. To update the firmware of the multiplexer, you need to connect to it via FTP in passive mode (by default login is *admin*, password is *admin*). After connecting, you will see the contents of the */mnt/flash* directory.
2. Next you need to copy to this folder the firmware file *LPOS_X.YSRZ.bin*. On the device, it will not appear in the folder where you copied the file.
3. Connect to the device using *telnet, ssh* or *terminal*, enter the credentials (default login – *admin*, password – *admin)*. Next, you need to go to the command mode of the device control, if the *menu* is opened by default. To do this, use the keyboard shortcut «*ESC+Q*» or *«CTRL+C»*. Then type the command *systemupdate*. Wait for the firmware update to complete.
4. Next, you need to reboot the device. To do this, enter the *reset* command.
5. After the device is rebooted, it will be loaded with the new software.

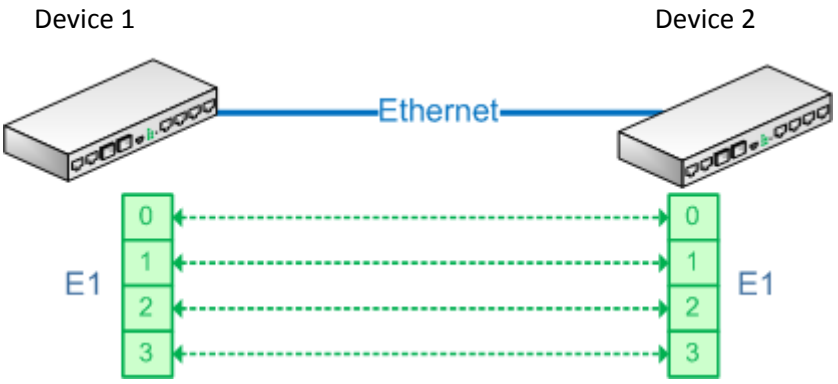
## 5.3 Device update via web-interface

1. Access the device through the Web-interface, for example, at http://192.168.0.24, enter the credentials (by default login – *admin*, password – *admin)*.
2. Click the «UPDATE FIRMWARE» link.
3. Select the operating system image file and wait for it to load on the device.
4. Click «APPLY» to update the system.
5. Restart the system for the updates to take effect by clicking the «RESTART» link.

# 6 Example of configuration

## 6.1 Point-to-point

For the transmission of four E1 streams between the two multiplexers.




Connection: Point-to-point

**Device 1 (ip 192.168.0.21):**

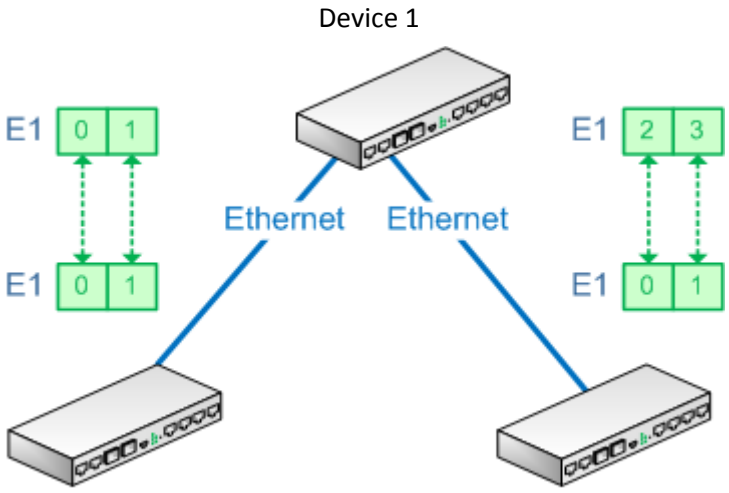
```
set IP/current-config/NetworkAddr 192.168.0.21
set IP/current-config/NetworkMask 255.255.255.0
set IP/current-config/DefaultGateway 192.168.0.1
set TDMoP/[0-3]/config/RemoteIP 192.168.0.22
set TDMoP/[0-3]/config/VLANID 0
set TDMoP/[0-3]/config/DSCP af11
set TDMoP/1/config/RemoteChannel 1
set TDMoP/2/config/RemoteChannel 2
set TDMoP/3/config/RemoteChannel 3
set TDMoP/[0-3]/config/AdminStatus Connect
save-config
```

**Device 2 (ip 192.168.0.22):**

```
set IP/current-config/NetworkAddr 192.168.0.22
set IP/current-config/NetworkMask 255.255.255.0
set IP/current-config/DefaultGateway 192.168.0.1
set TDMoP/[0-3]/config/RemoteIP 192.168.0.21
set TDMoP/[0-3]/config/VLANID 0
set TDMoP/[0-3]/config/DSCP af11
set TDMoP/1/config/RemoteChannel 1
set TDMoP/2/config/RemoteChannel 2
set TDMoP/3/config/RemoteChannel 3
save-config
```

## 6.2 Point-to-multipoint

To transfer four E1 streams among three multiplexers using a point - to-multipoint topology.




Connection: Point-to-multipoint

**Device 1 (ip 192.168.0.21):**

```
set IP/current-config/NetworkAddr 192.168.0.21
set IP/current-config/NetworkMask 255.255.255.0
set IP/current-config/DefaultGateway 192.168.0.1
set TDMoP/[0,1]/config/RemoteIP 192.168.0.22
set TDMoP/[1,3]/config/RemoteChannel 1
set TDMoP/[2,3]/config/RemoteIP 192.168.0.23
set TDMoP/[0-3]/config/AdminStatus Connect
save-config
```

**Device 2 (ip 192.168.0.22):**

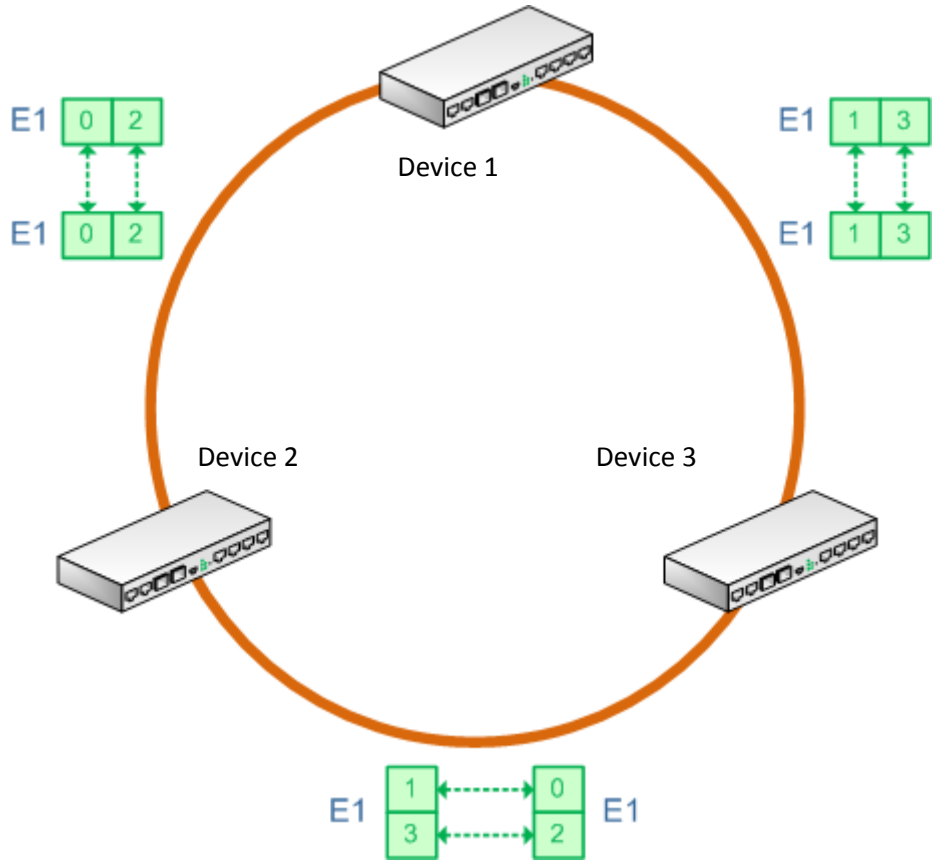
```
set IP/current-config/NetworkAddr 192.168.0.22
set IP/current-config/NetworkMask 255.255.255.0
set IP/current-config/DefaultGateway 192.168.0.1
set TDMoP/[0,1]/config/RemoteIP 192.168.0.21
set TDMoP/1/config/RemoteChannel 1
save-config
```

**Device 3 (ip 192.168.0.23):**

```
set IP/current-config/NetworkAddr 192.168.0.23
set IP/current-config/NetworkMask 255.255.255.0
set IP/current-config/DefaultGateway 192.168.0.1
set TDMoP/[0,1]/config/RemoteIP 192.168.0.21
set TDMoP/0/config/RemoteChannel 2
set TDMoP/1/config/RemoteChannel 3
save-config
```

### 6.3 Optical ring

Example of a network of three multiplexers on an optical ring




Connection: Optical ring

**Device 1 (ip 192.168.0.21):**

```
set Eth/[0,1]/config/Reservation RSTP
set IP/current-config/NetworkAddr 192.168.0.21
set IP/current-config/NetworkMask 255.255.255.0
set IP/current-config/DefaultGateway 192.168.0.1
set TDMoP/[0,2]/config/RemoteIP 192.168.0.22
set TDMoP/2/config/RemoteChannel 2
set TDMoP/[1,3]/config/RemoteIP 192.168.0.23
set TDMoP/1/config/RemoteChannel 1
set TDMoP/3/config/RemoteChannel 3
set TDMoP/[0-3]/config/AdminStatus Connect
save-config
```

**Device 2 (ip 192.168.0.22):**

```
set Eth/[0,1]/config/Reservation RSTP
set IP/current-config/NetworkAddr 192.168.0.22
set IP/current-config/NetworkMask 255.255.255.0
set IP/current-config/DefaultGateway 192.168.0.1
set TDMoP/[0,2]/config/RemoteIP 192.168.0.21
set TDMoP/[2,3]/config/RemoteChannel 2
set TDMoP/[1,3]/config/RemoteIP 192.168.0.23
set TDMoP/[1,3]/config/AdminStatus Connect
save-config
```

**Device 3 (ip 192.168.0.23):**

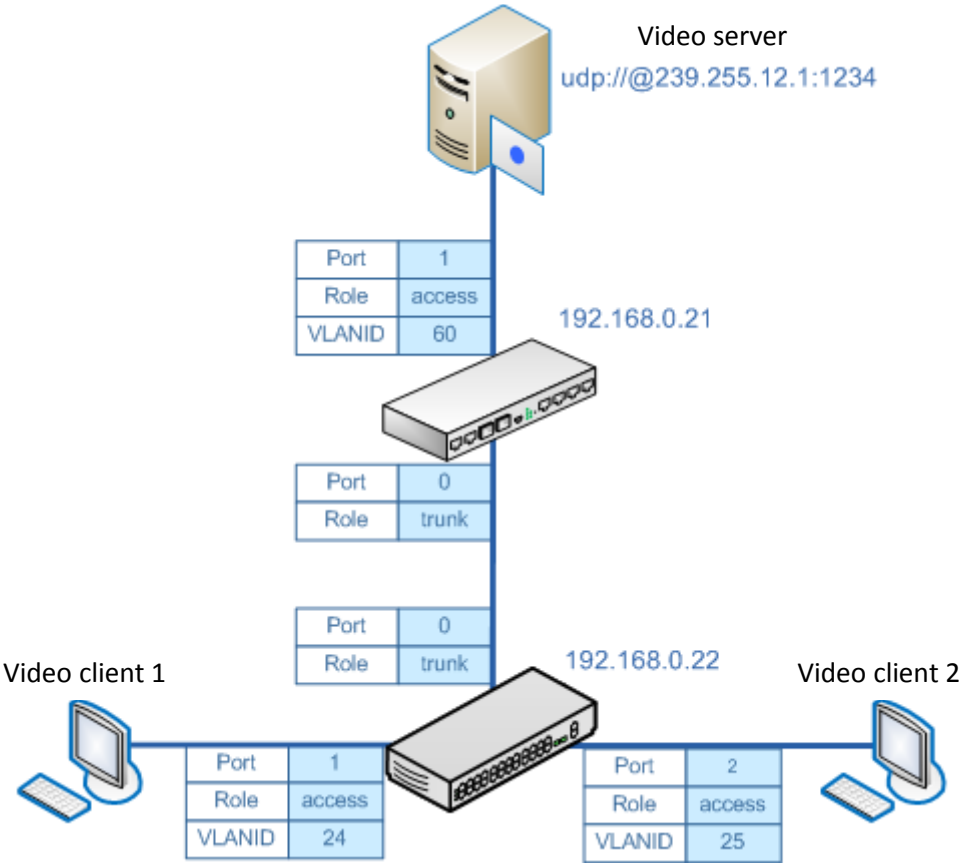
```
set Eth/[0,1]/config/Reservation RSTP
set IP/current-config/NetworkAddr 192.168.0.23
set IP/current-config/NetworkMask 255.255.255.0
```

```
set IP/current-config/DefaultGateway 192.168.0.1
set TDMoP/[1,3]/config/RemoteIP 192.168.0.21
set TDMoP/[0,1]/config/RemoteChannel 1
set TDMoP/[2,3]/config/RemoteChannel 3
set TDMoP/[0,2]/config/RemoteIP 192.168.0.22
save-config
```

### 6.4 Multicast VLAN Replication (MVR)

MVR allows to receive multicast traffic of one group by several clients in different VLANS. Clients will remain isolated from each other.

The network, built of 2 topgate multiplexers, provides IP-TV service (video server) for users (Video clients). Consider multicast broadcast is implemented in the 60 VLAN. Video server - source. Video clients are receivers. User traffic goes in 24, 25 VLAN. The diagram of this network and configuration of topgate series multiplexers are shown below.




Transmission of multicast traffic in a single VLAN (MVR)

**Device 192.168.0.21:**

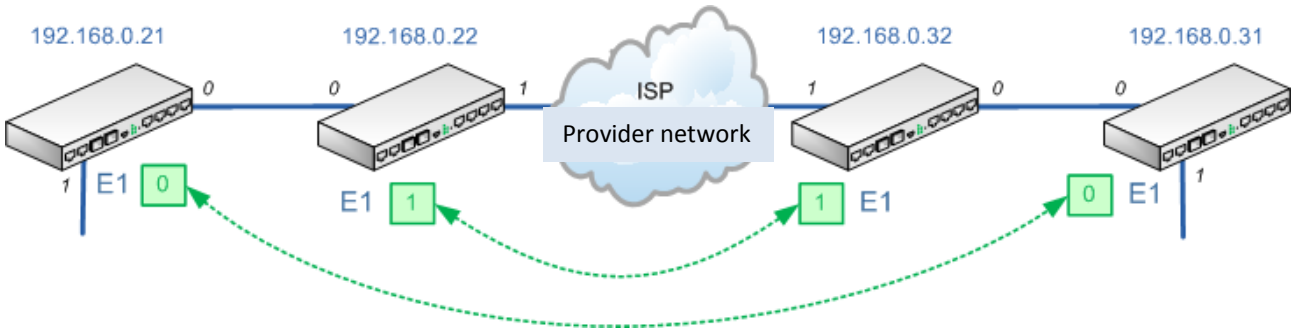
```
set Eth/0/VLAN/DefVLAN 60
set Eth/0/VLAN/Tagged 24-25
set Eth/0/VLAN/Role trunk
set Eth/1/VLAN/DefVLAN 60
set Eth/1/VLAN/Role access
set IP/IGMP/config/Ports 0,1
set IP/IGMP/config/MVRVlan 60
set IP/IGMP/config/MVRUpstream 1
set IP/IGMP/config/MVRDownstream 0
set IP/IGMP/config/FastLeave 0
set IP/IGMP/config/Mode MVR
```

```
set IP/stored-config/NetworkAddr 192.168.0.21
set IP/stored-config/DefaultGateway 192.168.0.1
save-config
```

**The device 192.168.0.22:**

```
set Eth/0/VLAN/DefVLAN 60
set Eth/0/VLAN/Role trunk
set Eth/1/VLAN/DefVLAN 24
set Eth/1/VLAN/Role access
set Eth/2/VLAN/DefVLAN 25
set Eth/2/VLAN/Role access
set IP/IGMP/config/Ports 0,1,2
set IP/IGMP/config/MVRVlan 60
set IP/IGMP/config/MVRUpstream 0
set IP/IGMP/config/MVRDownstream 1,2
set IP/IGMP/config/FastLeave 1,2
set IP/IGMP/config/Mode MVR
set IP/stored-config/NetworkAddr 192.168.0.22
set IP/stored-config/DefaultGateway 192.168.0.1
save-config
```

### 6.5 Double tagging (QinQ)




Transmission of traffic through the provider's network with double tagging

**Task:** Forward client traffic through the provider with the addition of the second 555 provider tag (S-Tag).

1. E1 traffic in Vlan 32 between devices:
   192.168.0.21 and 192.168.0.31
   192.168.0.22 and 192.168.0.32
2. User traffic is in Vlan 24
3. Client equipment management traffic is in Vlan 100
4. Do not forward the explicitly not registered VLANs.

**Device 192.168.0.21:**

```
set E1/0/config/Unframed Yes
set Eth/0/VLAN/DefVLAN 24
set Eth/0/VLAN/Tagged 100
set Eth/0/VLAN/Role trunk
set Eth/1/VLAN/DefVLAN 24
set Eth/1/VLAN/Role access
set IP/stored-config/NetworkAddr 192.168.0.21
set IP/stored-config/DefaultGateway 192.168.0.1
set IP/stored-config/DefaultVlanID 100
set TDMoP/0/config/RemoteIP 192.168.0.31
set TDMoP/0/config/AdminStatus Connect
set VLAN/[1,24]/Cpu NotMember
```

```
set VLAN/[1,24,32,100]/Auto Disabled
set VLAN/32/Cpu Member
save-config
```

**The device 192.168.0.22:**

```
set E1/1/config/Unframed Yes
set Eth/0/VLAN/DefVLAN 555
set Eth/0/VLAN/Tagged 32,100,555
set Eth/0/VLAN/Role QinQCustomer
set Eth/0/VLAN/QinQTag Global
set Eth/cpu/VLAN/DefVLAN 555
set Eth/1/VLAN/Tagged 32,100,555
set Eth/1/VLAN/Role QinQProvider
set Eth/1/VLAN/QinQTag Global
set EthGlobal/MTU 1632
set EthGlobal/QinQTag 88A8
set IP/stored-config/NetworkAddr 192.168.0.22
set IP/stored-config/DefaultGateway 192.168.0.1
set IP/stored-config/DefaultVlanID 100
set TDMoP/1/config/RemoteIP 192.168.0.32
set TDMoP/1/config/RemoteChannel 1
set TDMoP/1/config/AdminStatus Connect
set VLAN/1/Cpu NotMember
set VLAN/[1,32,100,555]/Auto Disabled
set VLAN/[32,555]/Cpu Member
save-config
```

**Device 192.168.0.31:**

```
set E1/0/config/Unframed Yes
set Eth/0/VLAN/DefVLAN 24
set Eth/0/VLAN/Tagged 32,100
set Eth/0/VLAN/Role trunk
set Eth/1/VLAN/DefVLAN 24
set Eth/1/VLAN/Role access
set IP/stored-config/NetworkAddr 192.168.0.31
set IP/stored-config/DefaultGateway 192.168.0.1
set IP/stored-config/DefaultVlanID 100
set TDMoP/0/config/RemoteIP 192.168.0.21
set VLAN/[1,24]/Cpu NotMember
set VLAN/[1,24,32,100]/Auto Disabled
set VLAN/32/Cpu Member
save-config
```

**Device 192.168.0.32:**

```
set E1/1/config/Unframed Yes
set Eth/0/VLAN/DefVLAN 555
set Eth/0/VLAN/Tagged 32,100,555
set Eth/0/VLAN/Role QinQCustomer
set Eth/0/VLAN/QinQTag Global
set Eth/1/VLAN/Tagged 32,100,555
set Eth/1/VLAN/Role QinQProvider
set Eth/1/VLAN/QinQTag Global
set Eth/cpu/VLAN/DefVLAN 555
set EthGlobal/MTU 1632
set EthGlobal/QinQTag 88A8
```

```
set IP/stored-config/NetworkAddr 192.168.0.32
set IP/stored-config/DefaultGateway 192.168.0.1
set IP/stored-config/DefaultVlanID 100
set TDMoP/1/config/RemoteIP 192.168.0.22
set TDMoP/1/config/RemoteChannel 1
set VLAN/1/Cpu NotMember
set VLAN/[1,32,100,555]/Auto Disabled
set VLAN/32/Cpu Member
save-config
```

## 7 Maintenance service

Periodic maintenance of the equipment is not required.

## 8 Manufacturer's guarantee

The multiplexer underwent the pre-sale run for 48 hours. The manufacturer guarantees the compliance of the multiplexer with the technical characteristics under the user's conditions of operation, transportation and storage.

The warranty period is specified in the manufacturer's warranty card.

The manufacturer shall repair or replace the multiplexer or its modules free of charge during the warranty period.

If within the warranty period:

- the user has violated the operating conditions or the multiplexer has been supplied with supply voltage;
- the multiplexer suffered mechanical damage;
- interfaces multiplexer damaged external threat exposure,

that repair is carried out at the expense of the user.

Delivery of the faulty multiplexer in repair is carried out by the user.

Warranty service is terminated if the user has made an independent repair of the multiplexer (including replacement of the built-in fuse).

## APPENDIX A. RAPID DEPLOYMENT OF MULTIPLEXERS

### Rapid deployment

Connection of topgate series multiplexer (hybrid multiplexer) is recommended to be performed by the following algorithm:

1. Install the device on a table, or mount on a wall, or place in a rack 19”.
2. Connect the earth bonding point located on the rear panel of the device to an external protection ground.
3. Connect the power cable to the earth bonding point located on the back or front panel of the multiplexer.
4. Supply voltage to the multiplexer. (After the power is turned on, the equipment is automatically self-tested.)
5. Configure the multiplexer.

The process of installation in a rack 19” and configuration of ToPGATE series multiplexer for the transmission of E1 streams in point-to-point mode over UDP/IP are described below.

### 1. Installation, mounting

ToPGATE series multiplexer is designed for table installation, for fixing to the wall or placing in the rack or cabinet with width of 19”.

For mounting the multiplexer in a 19” wide rack or cabinet, an optional mounting bracket can be supplied, except for the ToPGATE SFP model.

The topgate series multiplexer must be installed in a clean, dry, heated room. Before installation, it is necessary to make an external inspection of the kit in order to detect mechanical damage of the case and jointing elements.

When installing the multiplexer, there must be at least 5 cm of free space on the front panel side to connect the interface cables and at least 5 cm on the rear panel side for ventilation and power connection.

The ambient temperature should be between +5 and +30 °C at humidity up to 80%, without condensation.

ToPGATE-SFP multiplexer is made in SFP form factor (Small Form Factor Pluggable) for quick and easy connection to a standard SFP port of any Gigabit switch.

ToPGATE multiplexers (1E1-1FG, 2E1-1F) are designed in a metal case with dimensions of 82x26x85.5 mm.

To mount ToPGATE multiplexers (1E1-1FG, 2E1-1F) in a 19” wide rack or cabinet, a mounting bracket is supplied, which is attached to the multiplexer on one side (either left or right).

ToPGATE multiplexer (4E1-2FG) is designed in a metal case with dimensions of 215x105x44 mm.

To mount the ToPGATE multiplexer (4E1-2FG) on the room wall, special cross-shaped mounting cutouts (holes) are made on the lower wall of the device.

For mounting the ToPGATE multiplexer (4E1-2FG) the rack width is 19” comes with mounting bracket.

ToPGATE multiplexer (8E1-2FG) is designed in a metal case with dimensions of 215x150x44 mm.

To mount the ToPGATE multiplexer (8E1-2FG) on the room wall, special cross-shaped mounting cutouts (holes) are made on the lower wall of the device.

For mounting the ToPGATE multiplexer (8E1-2FG) the rack width is 19” comes with mounting bracket.

ToPGATE multiplexer (16E1-2FG) is designed in a metal case with dimensions of 430x150x44 mm.

To mount the ToPGATE multiplexer (16E1-2FG) on the room wall, special cross-shaped mounting cutouts (holes) are made on the lower wall of the device.

For mounting the ToPGATE multiplexer (16E1-2FG) the rack with width of 19” comes with mounting bracket.

**2. Power on (power supply)**

Connection of ToPGATE multiplexer (hybrid multiplexer) is recommended to be performed by the following algorithm:

1. Connect the earth bonding point located on the rear panel of the device to an external protection ground. The ToPGATE multiplexers (SFP, 1E1-1FG, 2E1-1F) does not have earth bonding point.


The rear panel of the multiplexer ToPGATE (4E1-2FG)


The rear panel multiplexers ToPGATE (8E1-2FG)


The rear panel of multiplexers ToPGATE (16E1-2FG, 24E1-FG)

2. 2. Connect the power cable to the earth bonding point located on the rear panel of the multiplexer.

The ToPGATE-SFP multiplexer does not require a separate power supply, because it is powered by a Gigabit Ethernet switch via SFP port to which the device is connected.

Power supply ToPGATE multiplexer (1E1-1FG,2E1-1F) is performed via DC voltage of 12V (the power converter 220V AC to 12V DC is included). Upon a request, the device migght be supplied with support for DC source - 48V.

220V AC to 12V DC Converter


Rear panel of ToPGATE multiplexer (1E1-1FG, 2E1-1F)

Power supply of ToPGATE multiplexer (4E1-2FG, 8E1-2FG, 16E1-2FG, 24E1-2FG) is performed either from a DC voltage source 36..72 V or from 220 V AC line.


The rear panel of the multiplexer ToPGATE (4E1-2FG)


The rear panel of the multiplexer ToPGATE (8E1-2FG)


The rear panel of the multiplexer ToPGATE (16E1-2FG, 24E1-2FG)

3. Supply power to the ToPGATE series multiplexer.

**3. Access to management**

By default, the ToPGATE multiplexer has an IP address of *192.168.0.24* and a mask of *255.255.255.0*, starting from the software version of *LPOS 1.0.9.3SR5*. On older (lower) software versions, the default IP address is *192.168.0.201*.

To access ToPGATE via Ethernet, you need to connect a management computer located in the same subnet as ToPGATE. The device must respond to the *ping* command. The *Telnet* client must be installed on the management computer.

To access a ToPGATE device (SFP), it must be connected to a Gigabit switch on the same subnet as ToPGATE (SFP). Then, you must connect the management computer to a switch that is on the same subnet. The device must respond to the *ping* command. The *Telnet* client must be installed on the management computer.

To connect to devices on the management computer, you must run the command *telnet 192.168.0.24* if the software version is *LPOS 1.0.9.3SR5* or higher. If the version is below *LPOS 1.0.9.3SR5*, the host computer must run *telnet 192.168.0.201*.

ToPGATE multiplexer, except ToPGATE (SFP), also has a serial interface miniUSB for management. When using the serial interface, you need to install special drivers that can be downloaded from web sites on the

Internet, and terminal program (e.g. HyperTerminal).

After connecting to the device, you will be prompted to enter your login and password. By default, login is *admin*, password is *admin*. After entering the login and password, the ToPGATE configuration menu will be disolayed.

## 4. Configuration steps

For the proper operation of ToPGATE series multiplexer on the network, they must be properly configured. This section describes the configuration steps that you can use to run the multiplexers quickly.

### 4.1. Changing access passwords

Use the *passwd* terminal command to set a new password for the *admin* user. The password can contain up to 18 Latin letters and numbers. For security reasons, choose a password of sufficient length.

Change the *admin* password.

***LPOS >*** *passwd*
*Enter old password*
*Enter new password*
*Enter new password again*

### 4.2. Management IP interface

You should specify the IP address, mask, and default gateway to the multiplexer. With this data, the device will be available on your network.

To do this, go to the *IP* menu. Next, select *stored-config***.** Set the device's IP address (*NetworkAddr*), mask (*NetworkMask*), and gateway (*DefaultGateway*), and then press «*ESC+S*» to save the configuration. The device will be loaded next time with these parameters.

To change these settings without saving and restarting the device, you must set the same parameters (*NetworkAddr, NetworkMask, DefaultGateway*) in the *current-config* tab. However, after reboot the device will be loaded with the parameters specified in the *stored-config* item**.**

### 4.3. G.703 access interfaces

For each E1 stream transmission between two interfaces of the ToPGATE multiplexers, a virtual circuit should be configured, and its configuration is performed on both multiplexers.

Describe the virtual circuits between the G.703 interfaces. You can connect an arbitrary G.703 interface of one ToPGATE multiplexer to arbitrary interfaces of other ToPGATE multiplexers on the network.

Connection is made with UTP or STP cable, two pairs are used (transmission: 1, 2; reception: 3, 6).

1. Go to *TDMoP* menu;
2. Select the port to which you connect the TDM equipment;
3. Go to the *config* tab;
4. Set *AdminStatis* parameter to the connection mode – *Connect*;
5. Specify the IP address of the remote device – *RemoteIP*;
6. Specify the channel number on the remote device to which you want to connect – *RemoteChannel*;
7. Repeat steps 1-6 on the opposite topgate multiplexer;

## 5. Using configuration files

All the settings of the topgate series multiplexer are saved in the file *«/mnt/flash/system.cfg»*. These settings are made at the start of the device. The contents of this file can be displayed in the terminal window with the *show system.cfg* command, or in the menu by pressing *«ESC+M»*. The generated file can

be recorded to the *«mnt/flash»* directory through the network via FTP for fast configuration. To implement this:

1. Connect to the device via FTP in passive mode using login – *admin*, password – *admin*;
2. Copy the generated *system.cfg* file to folder *«/mnt/flash»*;
3. Restart the multiplexer by turning the power off and on, either by running the *reset* console command, or by selecting *SysReset* in the */System/global* menu, press *«Enter»* and type the *reset* value. The *SysReset* parameter is available in the menu only in advanced mode, to enable this mode, press *«ESC+A»*;

**6. Restoring access to the device**

If you need to access the ToPGATE multiplexer (1E1-1FG, 2E1-1F, 4E1-2FG, 8E1-2FG, 16E1-2FG, 24E1-2FG), i.e. restore the default IP address, password, etc., turn off the device. Find a small hole on the rear panel of ToPGATE (1E1-1FG, 2E1-1F) or front panel of ToPGATE (4E1-2FG, 8E1-2FG, 16E1-2FG, 24E1-2FG). With a thin object, such as a toothpick, press the button in the hole. Hold down the button to turn on the power of the device. Hold down the button for 2-3 seconds more. Press *«ESC+Q»* to exit the menu to the command line mode and run the *mnt* command**.** Then, run the *menu* command**.** Next, you need to perform the whole configuration procedure. The device is accessed via IP address *192.168.0.24.* To save the configuration, press *«ESC+S»* in the menu.

If you need to access the ToPGATE-SFP multiplexer, i.e. return the factory default IP address, password, etc., disconnect the device (remove it from the switch). For ToPGATE-SFP-1E1, install the plug in the form of RJ-45 supplied in the delivery package. For

ToPGATE-SFP-2E1, set the DIP switch on the device to «RST». Connect ToPGATE-SFP to the switch with the SFP cage. Press «ESC+Q» to exit the menu to the command line mode and run the mnt command. Then, run the menu command. Next, you need to perform the whole configuration procedure. The device is accessed via IP address 192.168.0.24. To save the configuration, press «ESC+S» in the menu. Remove ToPGATE-SFP from the switch and, for ToPGATE-SFP-1E1, remove the plug from it.

For ToPGATE-SFP-2E1, set the DIP switch on the device to «RST».

**7. Configuration examples**

This section provides configuration files for some typical topgate multiplexer applications.

**7.1. Point-to-point**

Suppose you want to configure port 0 of multiplexer ToPGATE with IP address *192.168.0.224* on 1 port of the multiplexer ToPGATE with an IP address of *192.168.0.229*.

Multiplexer *192.168.0.224*:

```
#TDMoP{
    #0{
        #config{
        Set
        RemoteIP=192.168.0.229;
        Set RemoteChannel=1;
        Set AdminStatus=Connect;
        }
    }
}
#System{
    #global{
```

```
        Set Name=LPOS;
        }
    }
    #IP{
        #stored-config{
        Set NetworkAddr=192.168.0.224;
        }
    }
```

Multiplexer *192.168.0.229*:

```
    #TDMoP{
        #1{
            #config{
            Set
            RemoteIP=192.168.0.224;
            Set AdminStatus=Connect;
            }
        }
    }
    #System{
        #global{
        Set Name=LPOS;
        }
    }
    #IP{
        #stored-config{
        Set NetworkAddr=192.168.0.229;
        }
    }
```

### 7.2. Chain

Point-to-multipoint connection.

Suppose you need to configure 0 port of ToPGATE multiplexer with IP address *192.168.0.229* to 0 port of ToPGATE multiplexer with IP address *192.168.0.224* and 1 port of ToPGATE multiplexer with IP address *192.168.0.229* to 0 port of ToPGATE multiplexer with IP address *192.168.0.225*.

Multiplexer *192.168.0.229*:

```
#TDMoP{
    #0{
        #config{
        Set
        RemoteIP=192.168.0.224;
        Set AdminStatus=Connect;
        }
    }
    #1{
        #config{
        Set
        RemoteIP=192.168.0.225;
        Set AdminStatus=Connect;
        }
    }
}
#System{
    #global{
    Set Name=LPOS;
    }
}
#IP{
    #stored-config{
    Set NetworkAddr=192.168.0.229;
    }
}
```

Multiplexer *192.168.0.224*:

```
#TDMoP{
    #0{
        #config{
        Set
        RemoteIP=192.168.0.229;
        Set AdminStatus=Connect;
        }
    }
}
#System{
    #global{
    Set Name=LPOS;
    }
}
#IP{
```

```
        #stored-config{
        Set NetworkAddr=192.168.0.224;
        }
    }
```

Multiplexer *192.168.0.225*:

```
    #TDMoP{
        #0{
            #config{
            Set
            RemoteIP=192.168.0.229;
            Set RemoteChannel=1;
            Set AdminStatus=Connect;
            }
        }
    }
    #System{
        #global{
        Set Name=LPOS;
        }
    }
    #IP{
        #stored-config{
        Set NetworkAddr=192.168.0.225;
        }
    }
```

## APPENDIX B - PIN ASSIGNMENT OF THE CONNECTORS

E1 Interfaces


| | | |
|---|---|---|
| 1 | TD+ | (transmission) |
| 2 | TD- | (transmission) |
| 3 | TD+ | (reception) |
| 4 | not used | |
| 5 | not used | |
| 6 | TD- | (reception) |
| 7 | not used | |
| 8 | not used | |

E1 interfaces (for ToPGATE-SFP 2E1 only)


| | | | |
|---|---|---|---|
| 1 | TD+ | (transmission) | E1 port number 0 |
| 2 | TD- | (transmission) | E1 port number 0 |
| 3 | RD+ | (reception) | E1 port number 0 |
| 4 | TD+ | (transmission) | E1 port number 1 |
| 5 | TD- | (transmission) | E1 port number 1 |
| 6 | RD- | (reception) | E1 port number 0 |
| 7 | RD+ | (reception) | E1 port number 1 |
| 8 | RD- | (reception) | E1 port number 1 |

Ethernet interface


| | | |
|---|---|---|
| 1 | TD+ | (transmission) |
| 2 | TD- | (transmission) |
| 3 | TD+ | (reception) |
| 4 | not used | |
| 5 | not used | |
| 6 | TD- | (reception) |
| 7 | not used | |
| 8 | not used | |