

**Quasar E1**  
**Multi-Channel Interface Board**

**User's manual**

**Version 1.4**

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**Attention! It is not recommended to use this product on physical lines without lightning protectors and going outside one building.**

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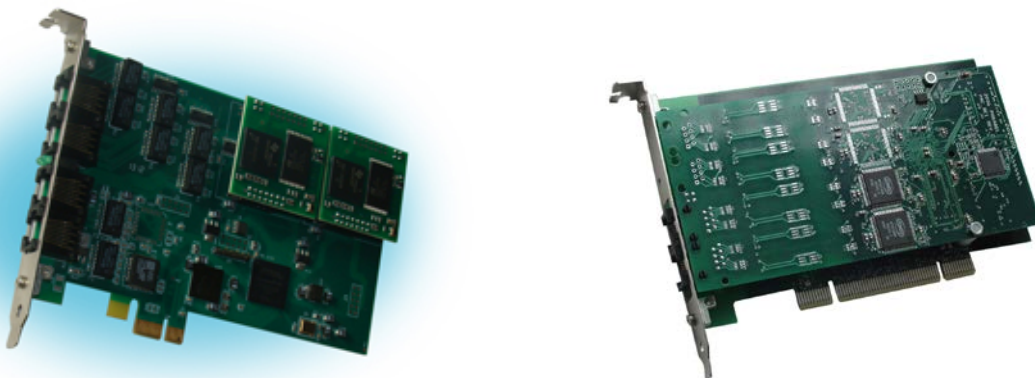
## 1. Introduction

Quasar-E1 interface board (hereinafter referred to as adapter) is intended for connection of E1 interfaces to the servers running under Asterisk soft PBX. The adapter is configured as a computer board of PCI or PCI-Express format. The adapter is controlled by a special driver developed for the Linux OS. The Quasar-E1 adapter possesses the following features:

- **Quantity of E1 channels used: 4 or 8**
- **Hardware echo cancellation option**
- **Total access embedded hardware timeslots switcher with 256x256 channels matrix**
- **DMA mode for data transfer to PC without CPU**
- **Automatic selection of the synchronization channel**
- **Automatic E1 sensitivity adjustment of the receiver (up to -40dB) for 0 port**
- **PCI-e, PCI 2.2 (3V or 5V variant) or PMC form factor**

Adapter hardware versions are given in the following table.

<b>Quasar-8PMC</b>	<b>8 E1 ports, PMC</b>
<b>Quasar-4PMC</b>	<b>4 E1 ports, PMC</b>
<b>Quasar-8PCI</b>	<b>8 E1 ports, PCI</b>
<b>Quasar-4PCI</b>	<b>4 E1 ports, PCI</b>
<b>Quasar-8PCX</b>	<b>8 E1 ports, PCIe</b>
<b>Quasar-4PCX</b>	<b>4 E1 ports, PCIe</b>
<b>Quasar-8PCX-EC</b>	<b>8 E1 ports, PCIe, echo canceller</b>
<b>Quasar-4PCX-EC</b>	<b>4 E1 ports, PCIe, echo canceller</b>
<b>Quasar-8PCI-EC</b>	<b>8 E1 ports, PCI, echo canceller</b>
<b>Quasar-4PCI-EC</b>	<b>4 E1 ports, PCI, echo canceller</b>



## 2. Design of the adapter

The adapter consists of the following functional units (see the figure below):

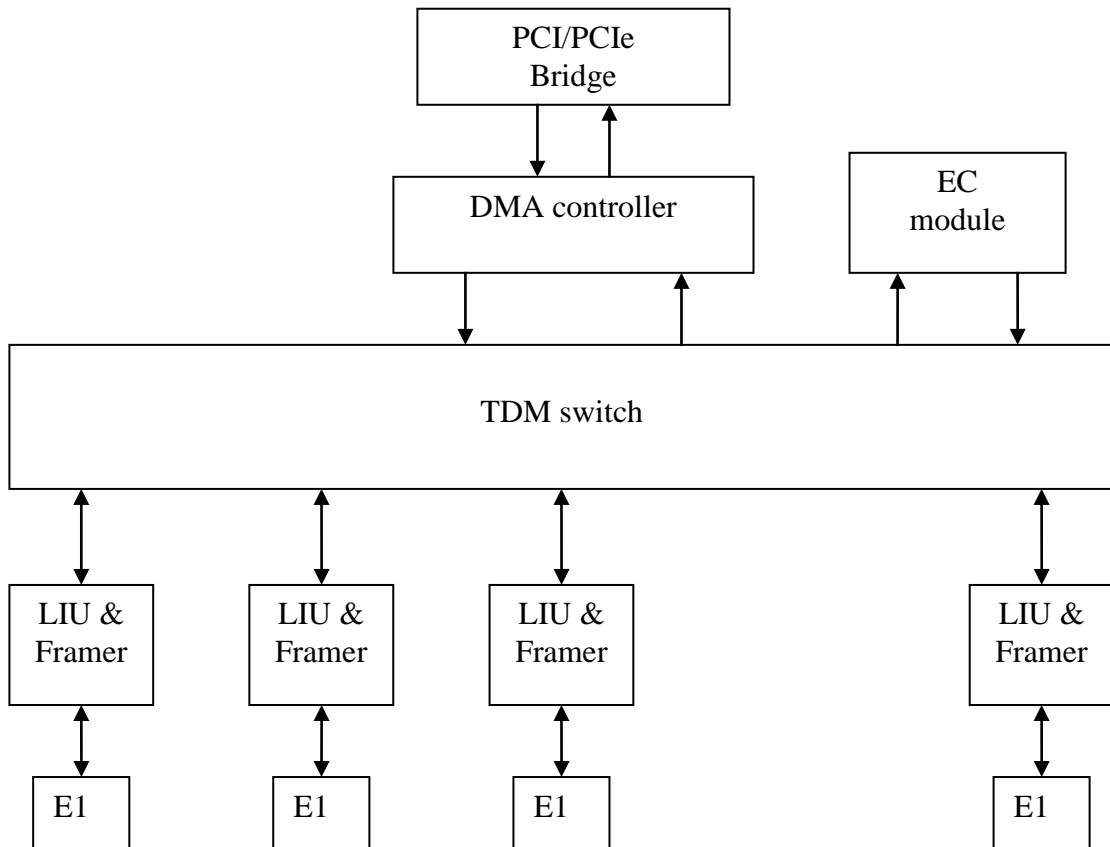
LIU & Framer – G.703 transceiver chip and G704 framer

TDM switch – E1 timeslots cross connector (256x256 timeslots)

DMA controller enables data transfer between the adapter and PCI bus

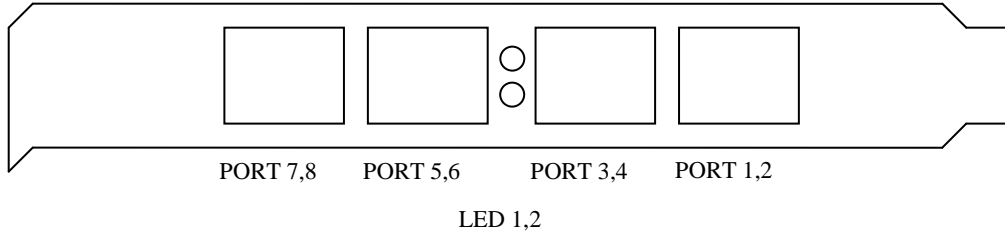
PCI bridge – bridge chip for PCI/PCIe bus

EC module – hardware echo cancellation module



### 3. Installation and connection of the adapter board

There are face panel of the Quasar-E1 adapters and E1 ports pinout table.

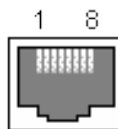


Port\Pin	1	2	3	4	5	6	7	8
Port 1,2	TX1+	TX1-	RX1+	TX2+	TX2-	RX1-	RX2+	RX2-
Port 3,4	TX3+	TX3-	RX3+	TX4+	TX4-	RX3-	RX4+	RX4-
Port 5,6	TX5+	TX5-	RX5+	TX6+	TX6-	RX5-	RX6+	RX6-
Port 7,8	TX7+	TX7-	RX7+	TX8+	TX8-	RX7-	RX8+	RX8-

Notes.

1. RX – receiver (input), TX – transmitter (output)
2. Ports 5,6,7,8 are absent for 4-channel configuration

Type of the connector used is RJ-45



LED1,2 – mode indicators

LED 1,2 = off - firmware is not loaded

LED 1,2 = on – firmware is loaded, no driver

LED1=on LED2 = off – ready



## 4. Software

### 4.1. Introduction

The adapter operation depends on the following software components:

1. **DAHDI package** (earlier - Zaptel). This component provides low-level procedures with telephone equipment. Supply of the DAHDI package with the adapter is not obligatory, so the download from the public Internet resources is acceptable (see “Useful links” at the end of the Manual). The compatibility with the original DAHDI package is guaranteed, no patches needed.
2. **Quasar.ko driver**. It is a logical part of the DAHDI package. This component provides adapter specific functions. The driver is supplied in the source code presentation. The driver must be compiled before loading into a system. The corresponding software should be available on the server to do it.
3. **The /etc/dahdi/system.conf configuration file**. Parameters of the E1 ports and selected timeslots are specified in the file. The file is modified by a user with the help of any text editor installed in the system. Configuration file syntax is out of scope of this document. Nevertheless, the commands relative to the adapter configuration are presented here.
4. **The dahdi\_cfg configuration utility**. The utility based on the configuration file transmits some parameters to the driver. After any changes in the configuration file, the utility should be restarted.

## 4.2. System requirements

Before the driver installation the following software must be installed in the system:

- binutils, make and gcc compiler
- Kernel header files
- DAHDI package in source codes

Learn DAHDI and Asterisk documentation before installation and operation of the driver.

## 4.3. Driver installation

The driver is packed in the `/Quasar/driver/quasar-x.x.x.tar.bz2` tar archive located on the CD included into the delivery set. Drivers of the 3.0.0 version and later work with the DAHDI package. As every version has its own requirements for driver installation, a user should strictly follow the instructions of README file packed in the same archive.

The final step of the driver compilation is loading `quasar.ko` module on a system. Before loading it in the system, please ensure the adapter is successfully recognized by the Linux PCI subsystem. To check it, run the `lspci` utility. After utility start the list of PCI devices will appear on the screen. The following device must be in the list:

**Network controller: Altera Corporation Device**

If the system recognizes the adapter, then the driver will be successfully loaded. The list of the loaded modules (`lsmod` utility) confirms the successful load. The `quasar` module must be presented in the list. The module as well reports on successful load in the `/var/log/messages` log.

## 4.4. Configuration of E1 ports

E1 ports of the adapter are described in the `/etc/dahdi/system.conf` configuration file. The **span** key word defines parameters of the given port.

```
span = <span_num>,<timing>,<LBO>,< framing>,<coding>[,crc4]
```

where

**span\_num** – E1 port number (from 1 to the maximum port number in the board)

**timing** – should the port be used as a synchronization source

0 – port is E1 master

1 and more – E1 slave port. The port is among the adapter synchronizing sources.

The greater the number, the less the port priority is.

**LBO** – ignored parameter, set 0.

**Framing** – telephony signaling, acceptable values are `ccs`, `cas`.

**Coding** – line coding, acceptable values are `ami` or `hdb3`

**Crc4** – allow `crc4` verification and generation (an optional parameter)

## 4.5. Select timeslots for data transmission

The Quasar-E1 adapter can be used not only for voice-communication link, but for E1 data transmission. Both the functions can be exercised with different channels, but on one board. Note, the DAHDI package should be compiled with HDLC subsystem support. This is determined with CONFIG\_DAHDI\_NET parameter.

31 timeslots are used for each E1 port (Timeslot 0 is responsible for the frame format, it is not involved into data transmission). The timeslots enumeration in the system is continuous – numbers from T1 to T31 are referred to port 1, port 2 covers range from 32 to 62, and so on. To switch demanded E1 timeslots to the network interface, nethdlc keyword is used:

```
nethdlc=<S>-<E>
```

where

**S** – number of the initial timeslot,

**E** – number of the final timeslot

For example.

```
nethdlc=2-13
```

For the given configuration 12 timeslots of the first port, starting with 2 and ending with 13, will be configured as one data transmission channel.

To register timeslots, a comma can be also used. For example, the same group of timeslots can be written as:

```
nethdlc=2,3-13
```

The group of timeslots described with the nethdlc enumeration forms a network interface with hdlc0 name in the Linux network subsystem. hdlc1 corresponds to the next given command, and so on. The data link protocol of this interface can be configured with the help of sethdlc command. For example, command

```
sethdlc hdlc0 cisco
```

specifies cisco-compatible hdlc protocol on the channel. For further information see sethdlc documents.

## 4.6. ecfg utility

The ecfg utility allows adjustment of parameters of the E1 interfaces. It can be used as a simple E1 analyzer. The ecfg program can be used for configuration of some parameters which are not subject to the DAHDI configuration utilities.

The utility uses a /dev/quasar special file for interfacing the driver. The previous parameters adjusted by DAHDI are easily overridden with the utility. The utility runs independently and does not update data in the DAHDI structures.

### 4.6.1. Main menu

The ecfg utility is launched in the Linux command string with the following parameters:

```
# ecfg -b M -i N
```

Where,

M – board number [0,1, ...]

N – E1 port number, 0 or 1

E1 parameters are configured by means of modifying the parameters in hierarchical menus. When configuration completed, the settings can be kept in a file. Configuration is saved in the /etc/ecfg/quasarM\_N.cfg file, where M and N – numbers of the board and port. When ecfg is launched, the main menu will be displayed on the screen containing information on software version, board and port numbers, status of the given E1 port.

```
Quasar monitor v.1.14 26/08/2008 Updates: http://parabel.ru/  
PMC/chan=0/0, conf. file="/etc/emcfg/quasarm0_0.cfg"  
HW/FW/REV version=10/10/e, driver version=2.0.3
```

```
Line status: LOS=On , AIS=Off  
Frame status: LOF=On , Sa4..8=00000, RAIS=Off  
CAS Multiframe: CAS LOM=Off, XYXX=0000  
CRC4 Multiframe: CRC4 err=Off, LOC=On , E bit=On  
Err counters: HDB3=0, FAS=0, CRC4=0  
ABCD status: 00000000 00000000 00000000 00000000
```

```
1. Configuration >>  
2. Status >>  
3. Test >>  
0. Quit
```

Press 1-9 keys to select submenu, or press 0 to exit the submenu. Other keys can be used to refresh status information.

#### 4.6.2. E1 port settings

##### *Line coding and synchronization*

**Configuration/Line code** - select HDB3 or AMI line code

**Configuration/Clock source** – select internal synchronization, master (Internal) or line synchronization, slave (line)

##### *Framing parameters*

**Configuration/Framing/Receive** – turn on/off framer on receiving. If “off” chosen, the input data should be treated as raw G.703 unstructured stream.

**Configuration/Framing/Xmit** - turn on/off framing on transmitting. If “on”, then the zero timeslot will be filled with the specification G.704 synchronization marks.

**Configuration/Framing/RAI** - control over the RAI signal. The field can take the on, off, auto values. If “auto”, then basic frame synchronization is lost, the E1 framer will automatically transmit the RAI alarm signal to the far-end point.

**Configuration/Framing/(Inter)National bits** – set National & International bits (Sa4-Sa8, Si0, Si1)

##### *Multiframe parameters*

**Configuration/Multiframe/CRC4 multiframe** – turn CRC4 on/off

**Configuration/Multiframe/CAS** – turn on/off CAS multiframe

**Configuration/Multiframe/CAS/Remote CAS Alarm** – control over the CAS alarm signal (Y bit). Turn CAS alarm “on”, “off”

**Configuration/Multiframe/CAS/X1, X2, X3** – provides manual control of X1-X3 CAS multiframe bit state

**Configuration/Multiframe/CAS/ts16 ABCD(1-7)**

**Configuration/Multiframe/CAS/ts16 ABCD(8-15)**

**Configuration/Multiframe/CAS/ts16 ABCD(16-23)**

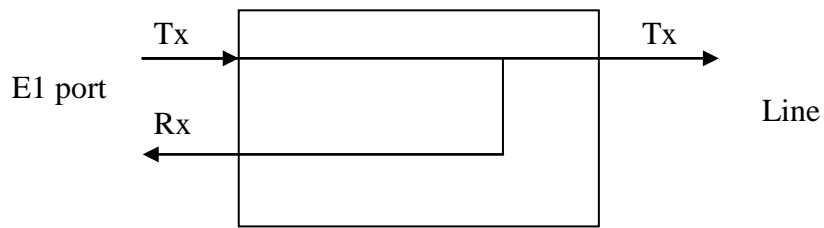
**Configuration/Multiframe/CAS/ts16 ABCD(24-31)** – allows setting 4 bits of ABCD signaling for the appropriate timeslot, the field is 0 .. F.

##### *Status submenu*

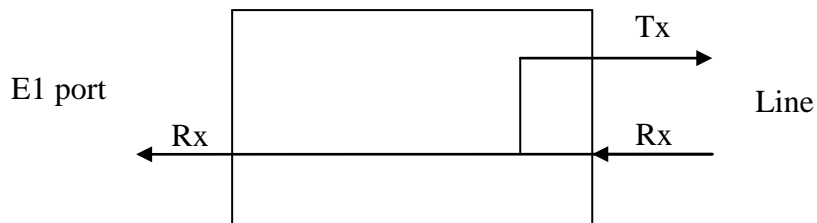
**Status/Reset** – reset statistics

*Test submenu*

**Test/Loopback/LLOOP** - turns on a local loop for E1 port

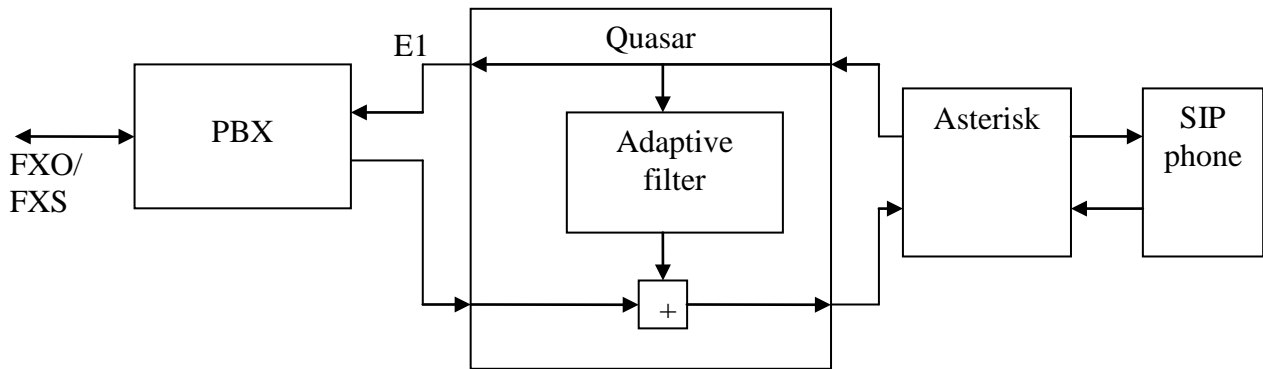


**Test/Loopback/RLOOP** – turns on a remote loop for E1 port



## 5. Hardware echo cancellation

Echo cancellation module is available in the –EC adapters. The module is intended to remove the echoed signal generated by analog terminals FXO / FXS when connected via E1 to the external PBX (see the figure).



**Рис. 1. Design of the echo cancellation module**

Echo effect results from not ideal analog telephone line and and when there are significant delays in the signal transmission from one subscriber to another (more than 30 ms). EC module removes the echoed signal from the signal in the “E1 -> Asterisk” direction and passes unchanged signal in the “Asterisk -> E1” direction. Thus the remote subscriber (the SIP phone on the Figure) can not hear his/her own signal returned.

The EC module possesses the following specifications:

- Suppression of the linear component of the echo at the -30 .. -40 db level
- Echo cancellation depth is 32 ms
- Automatic shut-off of EC when fax, modem signals are detected

Usage of the Quasar-E1 models with built-in echo canceller significantly reduces the computational load on the server with Asterisk. Software echo cancellation in Asterisk must be switched off by configuration of parameters in the `/etc/asterisk/chan_dahdi.conf` file:

```
echocancel=no
echocancelwhenbridged=no
echotraining=no
```

Hardware-based echo canceller is enabled by default at loading of the `quasar.ko` module without a parameter. Its mandatory shutdown is possible when the `noec=1` parameter is specified to the module.



## 6. Adapter technical specifications

Parameter	Description
Connector type	RJ45, 8 contacts
Cable type	symmetrical twisted pair, 120 ohm
Nominal pulse voltage	3 V +- 10%
Data transmission rate	2048 kbit/s +- 50 ppm
Coding	AMI/HDB3
Signal attenuation, no more than	-40 db for port 1, -6 db for ports 2..8
Conformance to standards	ITU-T G.703, G.704, G.706, G.732, G.823
Pulse form	ITU G.703
Range of phase jitter	ITU G.823
Frame structure	ITU G.704
Control	PCI 3v or 5v, PCI express
Dimensions	130 x 120 x 20 mm

## 7. Delivery set

- Adapter board
- CD with driver and user's manual
- Guarantee card
- Package box, dimensions: 26x17x3 cm

Weight is less than 0.5 kg.

## 8. Useful links

<http://www.asterisk.org/downloads>

Revisions.  
1.4 – EC