

**ELF2-AE**  
**External E1 access device for the Asterisk(tm) open-source PBX**  
**User's manual**  
**Release 1.0**

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ELF2-AE USER'S MANUAL  
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**Attention! It is not recommended to use this product on physical lines without lightning protectors.**

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## Description

ELF2-AE is an external E1 access interface device for the Asterisk(tm) software PBX. ELF2-AE uses Ethernet link and TDMoE protocol to deliver data from the E1 interface to the Asterisk server. ELF2-AE is fully compatible with zaptel and uses standard zaptel TDMoE driver. From the point of view of the Asterisk ELF2-AE device looks like an ordinary E1 span.

## Operating modes of ELF2-AE & Zaptel/Asterisk system

Switching modes:

EuroISDN (PRI or PRA), Q.931/Q.921, AT&T, 4ESS, DMS 100, Lucent 5E, Network or CPE, National ISDN 2, MFC-R2, SS7;

CAS Voice modes:

Feature Group D, E&M Wink, A-Law and Linear Modes;

Data modes:

SyncPPP, Frame Relay, X.25, Cisco HDLC, Multi-link PPP;

Note: above features are supplied "as is" without support.

## Technical specification

Parameter	Value
Dimensions	Stand alone 140x110x35 mm Rack mountable 4U height
Weight (without power source)	0.35 kg
Maximal power consumption	5 w
Ambient temperature	from +5°C to +45°C
Storage temperature	from -40°C to +70°C
Humidity	80% or less
Power voltage (on DC socket)	15V +- 20%
Types of interfaces:	
WAN	E1
LAN	Ethernet 10Base-T
Console	RS-232, 38000 bit/s, 8N1

**Table 1. General parameters.**

E1 socket type	RJ45, 8 pins
line type	Symmetrical twisted pair, 120 Ohm
impulse voltage	3 V +- 10%
data rate	2048 kbit/s +- 50 ppm
Coding	AMI/HDB3
signal attenuation	-40 db, ~ 2 km line length.
Standarts	ITU G.703, G.704, G.706, G.732, G.823
Impulse form	rec. G.703
jitter	rec. G.823
frame structure	rec. G.704

**Table 2. E1 port parameters.**

## Installation

### ***Panels Controls, Connectors, and Indicators of ELF2-AE***

There are following controls on the front panel:

- Reset button
- Power led
- Ethernet link led (Link2)
- E1 led (E1-a)
- Console socket RJ-11



**Figure 1. The front panel of ELF2-AE**

There are following sockets on rear panel:

- Ethernet socket, RJ-45 (Ethernet2)
- E1 socket RJ-45 (E1-A)
- DC input socket



**Figure 2. The rear panel of ELF2-AE**

### **Sockets description**

Contact	Net
1	TX+
2	TX-
3	RX+
4	
5	
6	RX-
7	
8	

**Table 3. Ethernet socket.**

Contact	Net
1	RX+
2	RX-
3	
4	TX+
5	TX+
6	
7	GND
8	GND

**Table 4. Socket E1.**

Contact	Net	Direction
1	RXD	input
2	TXD	output
3	GND	
4	GND	
5		
6		

**Table 5. Console socket.**

### ***Console attaching***

The console port is connected to the serial port of PC by adapter cable RJ-11  $\leftrightarrow$  DB-9. Device is controlled by terminal program with parameters: 38400, 8b, 1s, np, flow control=off (use Teraterm (under Windows) or minicom (under Linux) programs for example).

### ***The main configuration menu***

After the power on or reset ELF2-AE device shows the main configuration menu on the terminal window. Physical port parameter are configured by modification of parameters in hierarchical menus. The configuration can be saved in the ELF2-AE nonvolatile memory.

**ELF2-AE monitor v.0.13 18/09/2006 Updates: <http://parabel-labs.com>**

**Firmware: ELF2-AE {0xA}, Revision: 0x3**

**E1/A Cfg : Line code = HDB3, Clock=Line, CRC4=On**

**E1/A status: LOS=Off, LOF=Off, LOM=Off, LOC=Off, RAIS=Off, FrErr=0/0**

**TDMoE {status : SkipEr=0, SlipEr=0, RxNuErr=0 <> mac: 00555555552**

***1. Configuration >>***

***2. Status >>***

***3. Test >>***

***8. Start bootloader***

***9. Reset***

**Figure 3. The main menu of configurator.**

There is the following information in the upper screen part:

- Software release number
- The main configuration settings and E1 line status
- TDMoE line status.

The following menu items resided in the lower screen part (Figure ) are:

Configuration, Status, Test, Start bootloader, Reset.

Press keys 1-9 to choose submenu, press key 0 to abandon submenu.

Other keys can be used to refresh status information and redraw the menu.

### ***Monitoring E1 ports.***

Status of E1 ports is presented in the **E1 status** string in the screen head.

Status fields legend is presented in the Table6.

Field	Meaning	Values	Comment
LOS	Lost Of Signal	On	No E1 signal carrier
		Off	E1 signal present, no alarm
LOF	Lost Of Frame	On	No G.704 frame detected
		Off	G.704 frame present
LOM	Lost Of Multiframe	On	CAS multiframe absent
		Off	CAS multiframe present
LOC	Lost Of CRC4	On	CRC4 frame absent
		Off	CRC4 frame present
FrErr	Frame Errors	XX/YYYY	XX – 8 bit counter of frame errors YYYY – 16 bit counter of CRC4 errors

**Table 6. E1 status description.**

To reset error counters choose **Status/Clear** menu item.

### ***Monitoring of TDMoE line status.***

There are three counters in the TDMoE status line:

**SkipEr** – When the asterisk server exceeds the packets rate and overrun the device RX buffer, ELF2-AE drops the packet and increment this counter.

**SlipEr** – When the asterisk server delays the packet on the critical time, ELF2-AE puts to the E1 timeslots the copy of the previous frame and increments this counter.

**RxNuEr** – Every packet of TDMoE protocol has a sequential number field and this counter is incremented in case of presence of sequence violation in the input TDMoE stream.

Normally these counters should not be incremented or incremented once per dozens of minutes or longer periods due to the statistical nature of jitter on TDMoE line. High counter increment rate is the consequence of the troubles on the Ethernet line or incorrect configuration.



## ***E1 port settings***

**Configuration/E1/Line code** - select HDB3 or AMI line code.

**Configuration/E1/Clock source** – select “Internal” to use internal generator as a clock source for E1 framer or “Line” to synchronize with signal from line.

**Configuration/E1/CRC4** – turn on or turn off CRC4 generation in the transmit direction

## ***Ethernet port settings***

**Configuration/Common/MAC** – Choose to change EFL2-AE MAC address.

**Configuration/Common/Full duplex** – Select “On” to switch on Full duplex mode.

**Configuration/Common/Promiscuous** - Select “On” to set promiscuous mode on Ethernet port.

## ***Common settings***

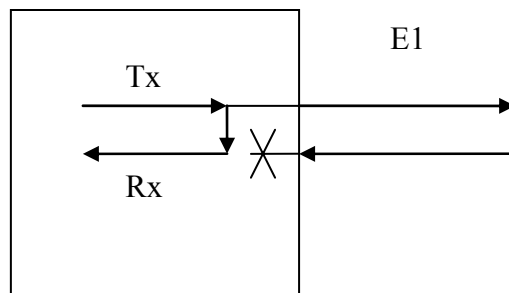
**Configuration/Factory** - Load factory defaults.

**Configuration/Restore** - Load configuration settings saved in nonvolatile memory.

**Configuration/Save** - Save current configuration settings in nonvolatile memory.

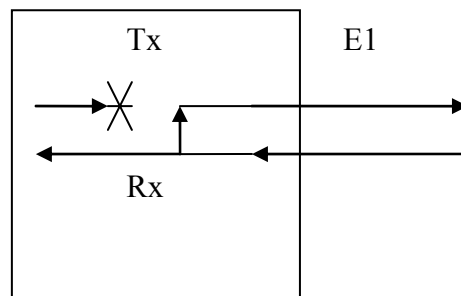
## ***E1 testing***

**Test/E1-x/Loop** – turn on internal loopback on the corresponding E1 port (Figure ).



**Figure 4. Lloop mode**

**Test/E1-x/Rloop** – turn on remote loopback on the corresponding E1 port (Figure).



**Figure 5. Rloop mode**

**Test/E1/TAOS** – send all ones on E1 port

**Test/E1/Freq** – measure and print E1 carrier frequency (relative to internal oscillator)

## Span configuration in zaptel.conf

To configure zaptel to work with the ELF2-AE devices it's necessary to use dynamic span directive in zaptel.conf file.

`dynamic = eth, <address>, <numchans>, <timing>`

**addres** – MAC addres of the corresponding ELF2-AE device connected to the asterisk server.

**numchans** – dynamic span can contain variable number of timeslots. For E1 link emulation it's necessary to set this parameter to 30 to work in CAS mode or to 31 to work in CCS mode on E1.

**timing** – Choose 1 to use this span as source for the internal timing of the dynamic span subsystem, choose 2 to make the it the second priority choice for the span subsystem clock source. The number used for each port should be different. Choose 0 to exclude this span from the timing source candidates list. Please read the paragraph Timing to choose the correct values.

*If unsure set this variable to non-zero values. You must have ztdummy.ko module installed in kernel or physical zaptel hardware device installed and running for the proper working of the dynamic span subsystem.*

## ELF2-AE Quick start.

### **ELF2-AE & Zaptel starting process**

To install ELF2-AE device you have to download build and install zaptel drivers. ELF2-AE requires at least zaptel-1.4. To start system properly you must load modules in the following order.

#Load zaptel core

**modprobe zaptel**

<http://parabel-labs.com>

#Load virtual zaptel device (provides timing if no other (hardware)clock source) driver, you must  
#load this module then you don't have real zaptel hardware installed.

**modprobe ztdummy**

#Load ztdynamic subsystem driver

**modprobe ztdynamic**

#Load TDMoE driver

**modprobe ztd-eth**

After loading of the modules, apply the configuration from zaptel.conf by executing **ztcfg** command.

### ***Sample zaptel.conf file***

---

*#Configuring external E1 interfaces (TDMoE). Set CCS mode on E1, set ELF2-AE MAC to  
#00:55:55:55:55:50, allow usage of this span as TDMoE subsystem timing source.*

***dynamic=eth,eth0/00:55:55:55:55:50,31,1***

*#Using ALAW for timeslots 1-31*  
***alaw=1-31***

*#Configure timeslots to work in CCS mode*

**bchan=1-15**  
**dchan=16**  
**bchan=17-31**

*#Select corresponding tonezone*  
***loadzone=us***  
***defaultzone=us***

---

### ***ELF2-AE & Zaptel shutdown process***

To stop ztdynamic subsystem you have to act in a following order:

Execute **ztcfg -s** to stop zaptel spans.

Remove zaptel modules from kernel.

**rmmod ztd\_eth**

**rmmod ztdummy**

**rmmod ztdynamic**

**rmmod zaptel**

**<http://parabel-labs.com>**

## Timing

*Statements:*

*ELF2-AE starts packets transmission after receiving of the initial TDMoE packet from the Asterisk server. The subsequent ELF2-AE packets are sent to the MAC address obtained from that initial packet.*

To understand the timing of the dynamic spans subsystem lets assume that we have one ELF2-AE device connected to the Asterisk server and a timing variable for the corresponding span in `zaptel.conf` is set to one.

After the power on or reset ELF2-AE doesn't send any data to the server. After the start up of the dynamic span `zaptel` receive no data and put span in a `RED_ALARM` state. Since all the external sources of synchronization are invalid `zaptel` starts to use the internal ones (`ztdummy` or `zaptel` hardware timer) and initiate sending of packets to ELF2 device. ELF2 discovers the first packet recognizes MAC address of the asterisk server and starts own transmission. `Zaptel` receives the TDMoE packet from the ELF2 then puts the span in a normal state and starts to use the span as a source for the synchronization.

## Hot plug scenario

It's possible to hot-plug the ELF2-AE device. To replace the device you need to set the correct MAC address using the configuration menu and just connect the Ethernet cable.

You can also add new E1 spans to the server without the rebooting the system. For this you need to add new line describing new device parameters to `zaptel.conf` file and run `ztcfg`.

The procedure of the device replacement:

1. New device is configured to use the same MAC address as an old one.
2. Disconnect an old device from the asterisk server.  
(Asterisk server periodically sends TDMoE packets to the MAC address of an old device)
3. Connect new ELF2-AE device.
4. New ELF2-AE device acquires the first TDMoE packet recognizes server MAC address and starts own transmission.
5. The process is finished.

## Asterisk cluster scenario

ELF2-AE device can be used for building reliable redundant asterisk clusters. Using ELF2-AE it's possible to accomplish seamless transition from the active to the backup server.

The procedure of transition:

1. The active server fails or is stopped and the transmission of TDMoE packets to ELF2 device is finished.
2. Cluster software activates the backup server.
3. The backup server with the same span parameters starts to send TDMoE packets to ELF2-AE device.
4. ELF2-AE obtains the MAC address of the backup server and starts to send data to new address.
5. The transition is finished.

## Order codes

ELF2-AE	1 E1 channel, stand alone form factor
ELF2-AE-4U	1 E1 channel, rack mountable form factor

## Warranty

Parabel Ltd. provides exchange/repair warranty for a period of two years, effective from the date of purchase.

## Delivery

- ELF2-AE
- Console cable
- Power source AC 220V (for the stand alone version)