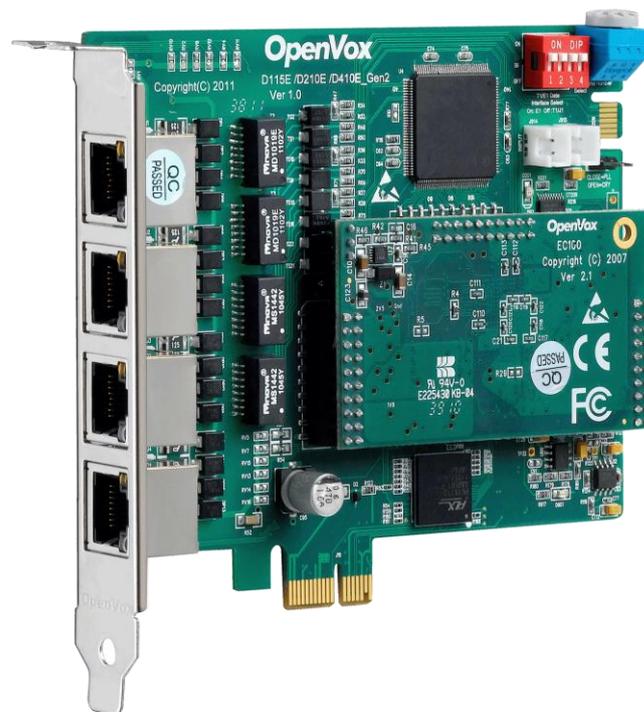




**OpenVox Communication Co.Ltd**



## **D410E/DE410E on DAHDI User Manual**

Version: 2.2





**OpenVox Communication Co.Ltd**

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## General Safety Instructions



### CAUTION

1. The computers that have D410E/DE410E card installed must comply with the country's specific safety regulations.
2. Only service personnel should go to install D410E/DE410E card.
3. Before installing D410E/DE410E card, please unplug the power cord and remove the cover from your PC.
4. For avoiding personal injuries and damages to your machine and D410E/DE410E card, make sure bracket of the card is secured to the PC's chassis ground by fastening the card with a screw.
5. Electrical Surges, ESD are very destructive to the equipment. To avoid it, make sure there is a low impedance discharge path from your computer to chassis ground.
6. To reduce the risk of damage or injury, please follow all steps or procedures as instructed.

## Test Environments

CentOS-5.5

Kernel version: 2.6.18-194. el5

DAHDI: dahdi-linux-complete-current

Asterisk: asterisk-1.8.5.0

Libpri: libpri-1.4.11.5

Hardware: OpenVox D410E/DE410E

## Chapter 1 Overview

### 1.1 What is Asterisk

The Definition of Asterisk is described as follows:

Asterisk is a complete PBX in software. It runs on Linux, BSD, Windows (emulated) and provides all of the features you would expect from a PBX and more. Asterisk does voice over IP in four protocols, and can interoperate with almost all standard-based telephony equipment using relatively cost-effective hardware. Asterisk provides Voicemail services with Directory, Call Conferencing, Interactive Voice Response, Call Queuing. It supports for three-way calling, caller ID services, ADSI, IAX, SIP, H323 (as both client and gateway), MGCP (call manager only) and SCCP/Skinny ([voip-info.org](http://voip-info.org)).

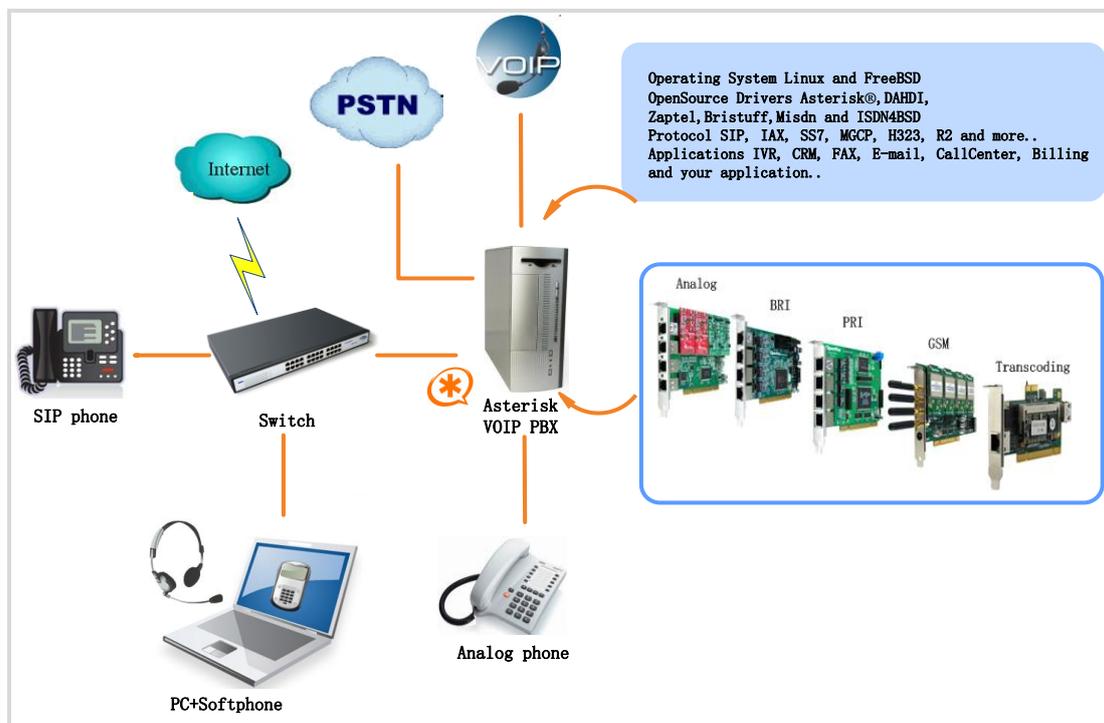


Figure 1 Topology

## 1.2 What is D410E/DE410E

The DE410E is a D410E with an EC module, and they support E1, T1 and J1 environments. It is selectable on a per-card or per-port basis. This feature enables signaling translation between E1 and T1 equipments and allows inexpensive T1 channel banks to connect with E1 circuits.

D410E supports industry standard telephony and data protocols, including Primary Rate ISDN (both N. American and Standard Euro) protocol families for voice, PPP, Cisco, HDLC, and Frame Relay data modes. Both line-side and trunk-side interfaces are supported.

D410E works with Asterisk<sup>®</sup>, Elastix<sup>®</sup>, FreeSWITCH<sup>™</sup>, PBX in a Flash, trixbox<sup>®</sup>, Yate<sup>™</sup> and IPPBX/IVR projects as well as other Open Source and proprietary PBX, Switch, IVR, and VoIP gateway applications.

D410E/DE410E supports industry standard telephony and data protocols, including Primary Rate ISDN (both N. American and Standard Euro) protocol families for voice, PPP, Cisco, HDLC, and Frame Relay data modes. Both line-side and trunk-side interfaces are supported.

### Target Applications

- Voice-over Internet Protocol (VoIP) Services
- Complex IVR Trees
- "Meet-Me" Bridge Conferencing
- Calling Card Platforms

- VoIP Gateways (support SIP, H.323, and IAX)
- Legacy PBX/IVR Services
- Voice/Data Router (replace expensive routers)
- PRI/Switch Compatibility - Network or CPE



## Chapter 2 Hardware Setup

There are some points that should be paid attention to when setting up D410E/DE410E.

### 2.1 Span type setup

Each DIP switch controls one span configuration for E1 or T1 mode. Setting DIP1 to ON means SPAN1 will be E1. Setting DIP1 to OFF means SPAN1 will be T1.

### 2.2 CardID switch setup

If want to install more than one card of D410E/DE410E in a PC, you should take care of the card ID switch. There are two pieces of rules you must obey:

- The first card must be set to 0, which is a card that will be initialized (i.e. installing driver) firstly when the system boot up. And the second should be set to 1, and so forth.
- At most cases, Linux will initialize PCI devices according to their slot order. The slot nearest to the CPU will be initialized firstly and the far end slot will be initialized at last. That is to say, the card which is nearest to the CPU ID should be set to 0 if there is more than one D410E/DE410E on your machine.

### 2.3 Slot compatibility

D410E/DE410E is compatible with PCI-E  $\times 1$  (slot 1) and  $\times 2$ ,  $\times 4$ ,  $\times 8$ ,  $\times 16$  slot, except PCI slot; you should confirm your slot type and insert D410E/DE410E into any type of PCI-E slot as previously described.

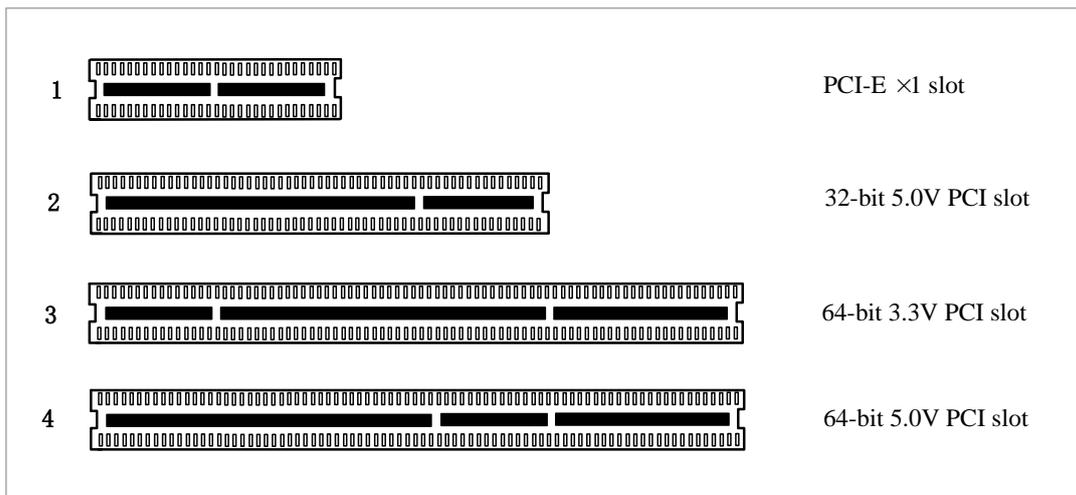


Figure 2 PCI-E and PCI slots

### 2.4 Timing cable

If you have just one card in the system, all channels on that card have already run under the same clock source, so timing cable is unnecessary.

But if there are more than one card, using timing cable has some advantages. Before using the clock line, each card works on its own clock, therefore precision of the clock is limited; each card will send/receive voice data at different speeds. In voice usage, this small issue can be omitted, but in data communication such as Fax/Modem, it will cause big problems. Data loss will cause communication broken or fax broken.

Timing cable will force all cards to work at the same clock source, send data at the same speed, as a result no data will lost.

If you found J914 (input) and J915 (output) interfaces on the card, it means the card supports clock line, for details, please refer to [HERE](#).



## Chapter 3 Software Installation and Configuration

D410E/DE410E supports DAHDI software driver on Linux. To make full use of D410E/DE410E, you should download, compile, install and configure Libpri, DAHDI and Asterisk.

### 3.1 Download

DAHDI software packages are available on OpenVox official website or Digium. Some patches should be added while the driver source is from Digium, therefore, it is recommended that downloading the DAHDI driver package from OpenVox official website.

Gain DAHDI source package from OpenVox:

[http://downloads.openvox.cn/pub/drivers/dahdi-linux-complete/openvox\\_dahdi-linux-complete-current.tar.gz](http://downloads.openvox.cn/pub/drivers/dahdi-linux-complete/openvox_dahdi-linux-complete-current.tar.gz)

Get Asterisk software package from Digium official website:

<http://downloads.asterisk.org/pub/telephony/asterisk/releases/asterisk-1.8.5.0.tar.gz>

Get Libpri software package from Digium official website:

<http://downloads.asterisk.org/pub/telephony/libpri/releases/libpri-1.4.11.5.tar.gz>

Execute the following commands under the directory of /usr/src/ in

generally, the former two below are used for downloading these two packages and the later two are for unzipping them.

```
# wget http://downloads.openvox.cn/pub/drivers/dahdi-linux-complete/openvox_dahdi-linux-complete-current.tar.gz
```

```
# wget http://downloads.asterisk.org/pub/telephony/asterisk/releases/asterisk-1.8.5.0.tar.gz
```

```
# wget http://downloads.asterisk.org/pub/telephony/libpri/releases/libpri-1.4.11.5.tar.gz
```

```
# tar -xvzf openvox_dahdi-linux-complete-current.tar.gz
```

```
# tar -xvzf asterisk-1.8.5.0.tar.gz
```

```
# tar -xzvf libpri-1.4.11.5.tar.gz
```

## 3.2 Installation

### 1. Hardware detection

```
# lspci -vvvv
```

Check the outcome and confirm your system has recognized

D410E/DE410E. If it has been recognized, "communication controller" will be displayed in the output information like that:

```
01:02.0 Communication controller: Digium, Inc. Wildcard TE410P/TE412P quad-span
T1/E1/J1 card 3.3V (rev 02)
  Control: I/O+ Mem+ BusMaster+ SpecCycle- MemWINV- VGASnoop- ParErr-
Stepping- SERR- FastB2B-
  Status: Cap- 66MHz- UDF- FastB2B- ParErr- DEVSEL=medium >TAbort- <TAbort-
<MAbort- >SERR- <PERR-
  Latency: 32
  Interrupt: pin A routed to IRQ 225
  Region 0: Memory at dcdffc00 (32-bit, non-prefetchable) [size=128]
```

**Figure 3 Hardware detection**

If D410E/DE410E is not recognized by the system, you have to power off and take out the card, then try to insert it into another PCI-E slot.

## 2. Software installation

Some dependencies are crucial. If any of them is absent, the software installation process would not go through successfully. Let's run "yum install XX" (XX stands for the dependency's name) to check the availability of dependencies.

```
# yum install bison
# yum install bison-devel
# yum install ncurses
# yum install ncurses-devel
# yum install zlib
```

```
# yum install zlib-devel
# yum install openssl
# yum install openssl-devel
# yum install gnutls-devel
# yum install gcc
# yum install gcc-c++
# yum install libxml2
# yum install libxml2-devel
```



If there is no kernel-devel source in the system, users should run the following command to install the kernel-devel to peer current kernel:

```
# yum install kernel-devel-`uname -r`
```

While if there is no matched kernel-devel found, you should download matched RPM package to install it, or execute the following command to update to the latest and stable kernel version:

```
# yum install kernel kernel-devel
```

After installed, please reboot your machine to apply the new kernel and install the dependencies. If the dependency has been installed, system indicates that nothing to do which means you could go to next one directly. Otherwise, the system will keep on installing it.

Among Libpri, DAHDI and Asterisk, let's install libpri firstly. Please execute those commands under the directory of /usr/src/ in generally:

```
# cd libpri-XX
```

```
# make
```

```
# make install
```

Change to the directory of dahdi-linux-complete-XX (XX represents DAHDI version), then perform commands one by one to install DAHDI.

```
# cd /usr/src/dahdi-linux-complete-XX
```

```
# make
```

```
# make install
```

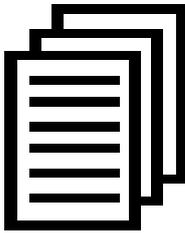
```
# make config
```



**Caution:** If there is something wrong after "make", please refer to [HERE](#). In the url link, the moderator introduces you a method how to patch. After patching, save your changes and exit. Then run "make" again, if successfully done, it is time for you to install Asterisk.

Please operate those commands to install Asterisk.

```
# cd asterisk-1.8.5.0  
  
# ./configure  
  
# make  
  
# make install  
  
# make samples
```



"make samples" will install the standard sample configuration file in the directory `/etc/asterisk`. As a freshman, you should perform "make samples", that is to say, it is unnecessary to perform "make samples" every time. Because once performed, it will cover the old sample configuration files you have installed.

## 3.3 Configuration

### 1. Driver loading

After compiling and installing DAHDI and Asterisk, please load the driver by running:

```
# modprobe dahdi  
  
# modprobe wct4xsp  
  
# dahdi_genconf
```

If there is any error, please trace the cause. Until all errors are clear up, you could execute "dahdi\_genconf" again, and then go to the next step. By running "dahdi\_genconf", it will generate /etc/dahdi/system.conf and etc/asterisk/dahdi-channels.conf automatically. Checking whether the generated files information agrees with your hardware setup, if not, you should modify to your specific requirements. Do not forget to confirm dahdi-channels.conf is included in chan\_dahdi.conf, if not, run command:

```
# echo "#include dahdi-channels.conf" >>
/etc/asterisk/chan_dahdi.conf
```

A part of system.conf which is one of the basic channel configuration files is displayed.

```
# Span 1: TE4/0/1 "T4XXP (PCI) Card 0
Span 1" (MASTER)
span=1,1,0,ccs,hdb3,crc4
# termtype: te
bchan=1-15,17-31
dchan=16
echocanceller=mg2,1-15,17-31

# Span 2: TE4/0/2 "T4XXP (PCI) Card 0
Span 2"
span=2,2,0,ccs,hdb3,crc4
# termtype: te
bchan=32-46,48-62
dchan=47
echocanceller=mg2,32-46,48-62

# Span 3: TE4/0/3 "T4XXP (PCI) Card 0
Span 3"
span=3,3,0,ccs,hdb3,crc4
# termtype: te
bchan=63-77,79-93
dchan=78
echocanceller=mg2,63-77,79-93

# Span 4: TE4/0/4 "T4XXP (PCI) Card 0
Span 4"
span=4,4,0,ccs,hdb3,crc4
# termtype: te
bchan=94-108,110-124
dchan=109
echocanceller=mg2,94-108,110-124

# Global data

loadzone          = us
defaultzone       = us
```

Figure 4 A part of system.conf

## 2. Country mode modification

In order to match your country pattern, you need to change parameters loadzone and defaultzone to your country. For example, your system is in CHINA, you would like them change to:

```
loadzone = cn
```

```
defaultzone = cn
```



Some zonedata is available in the file

../dahdi-XX/tools/zonedata.c, you can refer to it to match

your country mode. Meanwhile, you also need to modify

another parameter which is in file

/etc/asterisk/indications.conf.

```
country=cn
```

A part of file /etc/asterisk/dahdi-channels.conf is showed as below.

(Modification, if it is not agree with the hardware setup)

```
; Span 1: TE4/0/1 "T4XXP (PCI) Card
0 Span 1" (MASTER)
group=0,11
context=from-pstn
switchtype = euroisdn
signalling = pri_cpe
channel => 1-15,17-31
context = default
group = 63

; Span 2: TE4/0/2 "T4XXP (PCI) Card
0 Span 2"
group=0,12
context=from-pstn
switchtype = euroisdn
signalling = pri_cpe
channel => 32-46,48-62
context = default
group = 63
```

Figure 5 A part of dahdi-channels.conf

After modifying the country mode, please execute the following

command:

```
# dahdi_cfg -vvvvvv
```

The command is used for reading and loading parameters in the configuration file `system.conf` and writing to the hardware. A part of outputs are showed in the following figure.

```
[root@localhost asterisk-1.8.5.0]# dahdi_cfg -v
DAHDI Tools Version - 2.4.0

DAHDI Version: 2.4.0
Echo Canceller(s): MG2
Configuration
=====

SPAN 1: CCS/HDB3 Build-out: 0 db (CSU)/0-133 feet (DSX-1)
SPAN 2: CCS/HDB3 Build-out: 0 db (CSU)/0-133 feet (DSX-1)
SPAN 3: CCS/HDB3 Build-out: 0 db (CSU)/0-133 feet (DSX-1)
SPAN 4: CCS/HDB3 Build-out: 0 db (CSU)/0-133 feet (DSX-1)

124 channels to configure.

Setting echocan for channel 1 to mg2
Setting echocan for channel 2 to mg2
Setting echocan for channel 3 to mg2
Setting echocan for channel 4 to mg2
Setting echocan for channel 5 to mg2
Setting echocan for channel 6 to mg2
Setting echocan for channel 7 to mg2
Setting echocan for channel 8 to mg2
Setting echocan for channel 9 to mg2
Setting echocan for channel 10 to mg2
Setting echocan for channel 11 to mg2
Setting echocan for channel 12 to mg2
Setting echocan for channel 13 to mg2
Setting echocan for channel 14 to mg2
Setting echocan for channel 15 to mg2
.....
.....
Setting echocan for channel 120 to mg2
Setting echocan for channel 121 to mg2
Setting echocan for channel 122 to mg2
Setting echocan for channel 123 to mg2
Setting echocan for channel 124 to mg2
```

Figure 6 Channel map

### 3. Asterisk initiation

```
# asterisk -vvvvvvvc
```

If Asterisk is already activate, run "asterisk -r" instead. In the CLI,  
please run the following command:

```
localhost*CLI> dahdi show channels
```

```
1          from-pstn          default          In Service
2          from-pstn          default          In Service
3          from-pstn          default          In Service
4          from-pstn          default          In Service
5          from-pstn          default          In Service
6          from-pstn          default          In Service
7          from-pstn          default          In Service
8          from-pstn          default          In Service
9          from-pstn          default          In Service
10         from-pstn          default          In Service
11         from-pstn          default          In Service
12         from-pstn          default          In Service
13         from-pstn          default          In Service
14         from-pstn          default          In Service
15         from-pstn          default          In Service
17         from-pstn          default          In Service
18         from-pstn          default          In Service
19         from-pstn          default          In Service
20         from-pstn          default          In Service
21         from-pstn          default          In Service
22         from-pstn          default          In Service
23         from-pstn          default          In Service
24         from-pstn          default          In Service
.....
115        from-pstn          default          In Service
116        from-pstn          default          In Service
117        from-pstn          default          In Service
118        from-pstn          default          In Service
119        from-pstn          default          In Service
120        from-pstn          default          In Service
121        from-pstn          default          In Service
122        from-pstn          default          In Service
123        from-pstn          default          In Service
124        from-pstn          default          In Service
```

Figure 7 channels show

If DAHDI channels are found, it means they have been loaded into

Asterisk. You are going to edit dialplan by your requirements.

#### 4. Dialplan edit

Users must make sure that the context "from-pstn" and "from-internal" are in extensions.conf, here a simple example is given:

```
# vim /etc/asterisk/extensions.conf

[from-pstn]
exten => s,1,Answer()
exten => s,n,Playback(cc_welcome)
exten => s,n,Hangup()

[from-internal]
exten => _X.,1,Dial(dahdi/g0/${EXTEN})
exten => _X.,n,Hangup
```

Figure 8 dial plan

#### Additional function

Users should run command "cat /proc/interrupts" to check

D410E/DE410E has independent interrupt. If it shares interrupt with other device, it may cause some problems even cannot work normally. Or you can see if the EC module is working as follows:

```
[root@localhost asterisk-1.8.5.0]# dmesg | grep VPM
VPM450: echo cancellation for 128 channels
wct4xxp 0000:01:02.0: VPM450: hardware DTMF disabled.
wct4xxp 0000:01:02.0: VPM450: Present and operational
servicing 4 span(s)
VPM450: echo cancellation for 128 channels
wct4xxp 0000:01:02.0: VPM450: hardware DTMF disabled.
wct4xxp 0000:01:02.0: VPM450: Present and operational
servicing 4 span(s)
```

Figure 9 EC module show

## Chapter 4 Reference

[www.openvox.cn](http://www.openvox.cn)

[www.digium.com](http://www.digium.com)

[www.asterisk.org](http://www.asterisk.org)

[www.voip-info.org](http://www.voip-info.org)

[www.asteriskguru.com](http://www.asteriskguru.com)

### **Tips**

Any questions during installation, please consult in our forum or look up for answers from the following websites:

[Forum](#)

[wiki](#)

## Appendix A Specifications

### • Weight and size

Weight:	D410E	95g
	EC100	10g
Size:	DE410P	13×10.3×2cm <sup>3</sup>
	EC100	7.6×4.2×1.1cm <sup>3</sup>

### • Interfaces

RJ48 connector

PCI-E ×1, ×2, ×4, ×8, or ×16 slot

Four T1/E1/J1 ports with PCI-E interface for high performance voice and data applications

### • Environments

Storage temperature:	D410P	-65 ~ 125 °C
	EC100	-40 ~ 75 °C

Operation temperature: 0 ~ 50 °C

Humidity: 10 ~ 90% NON-CONDENSING

### • Power consumption

Voltage: 3.3V, 5V

Power: 2.6W Minimum, 3.9W Maximum at 3.3 V or 5 V

- **Hardware and software requirements**

RAM 128 + MB

Linux kernel 2.4.X or 2.6.X

CPU 800+ MHZ