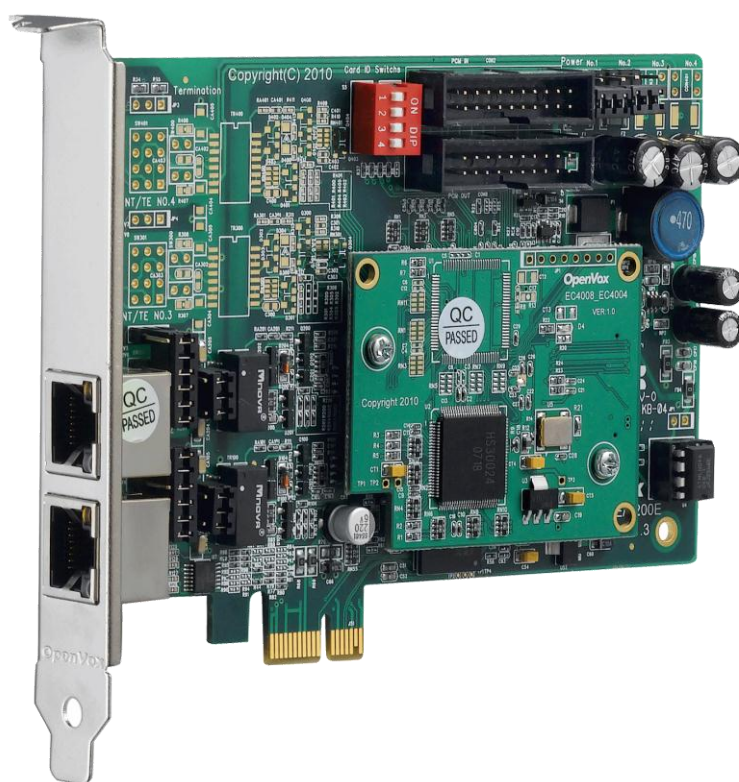




OpenVox Communication Co.Ltd



B200E /BE200E on DAHDI User Manual

Version: 2.2





OpenVox Communication Co.Ltd

Most Advanced Asterisk Cards

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General Safety Instructions



CAUTION

1. The computers that have B200E/BE200E card installed must comply with the country's specific safety regulations.
2. Only service personnel should install B200E/BE200E card.
3. Before you install B200E/BE200E card, please unplug the power cord from the computer and remove the cover from your PC.
4. For avoiding personal injuries and damage to your computer and B200E/BE200E card, make sure bracket of the card is secured to the PC's chassis ground by fastening the card with screws.
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

Rocky-9.1

Kernel version: 5.14.0

DAHDI: dahdi-linux-complete-current

Asterisk:20

Libpri: 1.6.1

Hardware: OpenVox B200E/BE200E



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 equipments using relatively cost-effective hardware. Asterisk provides Voicemail services with Directory, Call Conferencing, Interactive Voice Response, and Call Queuing. It supports 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).

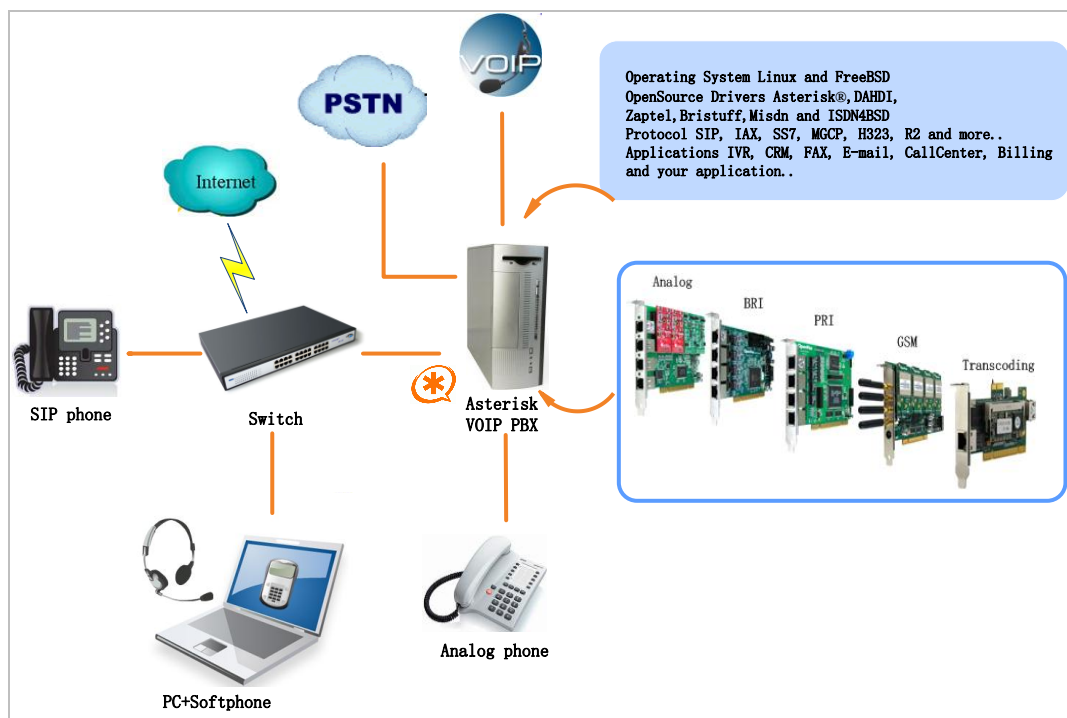


Figure 1 Topology

1.2 What is B200E/BE200E

OpenVox B200E/BE200E is a PCI Express 1.0 compliant card which supports 2 BRI S/T interface, and BE200E is B200E with a hardware echo cancellation module. It takes full advantage of Siemens® technology based hardware echo cancellation module to deliver the superior voice quality over the 2 BRI ports that can be configured for TE or NT mode individually by jumpers. This port configuration is detected by the driver automatically.

B200E/BE200E S/T BRI interface card delivers superior voice quality in the telephony systems with advanced Siemens® technology based hardware echo canceller. It can provide 4 simultaneous voices calls over 2 ISDN BRI line, turns your legacy ISDN BRI equipments into powerful Voice over IP devices and provides a soft migration path from ISDN technology to the new Voice over IP world. B200E/BE200E is designed for building Open Source systems based on Asterisk such as ISDN PBX and VoIP gateway.

The B200E/BE200E and drivers comply with fully GPLed for the Linux kernel bring powerful ISDN BRI connectivity to your Linux machine.

B200E/BE200E works well with Asterisk®, Elastix®, FreeSWITCH™, PBX in a Flash, trixbox®, Yate™ and IPPBX/IVR projects as well as other Open Source and proprietary PBX, Switch, IVR, and VoIP gateway applications.

Target applications

- High Performance ISDN PC Cards
- ISDN PABX for BRI
- VoIP Gateways
- ISDN LAN Routers for BRI
- ISDN Least Cost Routers for BRI
- ISDN Test Equipment for BRI

Main features

- Supports PCI Express 1.0 or above
- 2 RJ-45 interfaces on a single PCI bracket
- ITU-T I.430 and TBR 3 certified and S/T ISDN supporting TE/NT mode
- 32 bit bus master DMA data exchanges across PCI interface at 132Mbytes/sec for minimum host processor intervention
- DTMF detection on all B-channels
- Multiparty audio conferences bridge
- Full software and hardware compatible with Junghanns.NET ISDN, mISDN driver, DADHI and so on.
- RoHS compliant
- Certificates: CE, FCC, A-Tick
- trixbox™ Officially Certified
- Elastix® Officially Certified



Chapter 2 Hardware Setup

There are some points should be paid attention to when setting up B200E/BE200E.

2.1 Power supply

The board is powered by PCI Express 1.0 or above slot, which provides +3.3V or 12V on PCI-E slots, so there is no need for external power source.

2.2 Slot compatibility

B200E/BE200E is compatible with PCI-E $\times 1$, $\times 2$, $\times 4$, $\times 8$ and $\times 16$ slot.

You should confirm your slot type firstly and then insert B200E/BE200E into the PCI-E slot as previously described. Some slots are described like that.



Figure 2 PCI-E and PCI slots

2.3 Setting Card ID

If want to install more than one card of B200E/BE200E in a PC, you should take care of the card ID switch. The state of ON stands for "1" and OFF represents "0", Card ID is calculated by binary. For instance, the four switches should be all set to OFF if there is only one card, which means their corresponding binary value is "0000" and . There two pieces of rules you must obey to set Card ID:

- The ID of the first card must be set to 0, and the second should be set to 1, and so forth.
- The first Card is a card that will be initialized (i.e. installing driver) firstly when the system boot up. 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 are more than one B200E/BE200E on your machine.

2.4 Adjusting Termination of S/T Interface (100 ohm)

You are able to set a port to NT or TE mode, please refer to figure 3 for visualized information.

- If a port works on NT mode, you should set jumper to CONNECT (ON).
- If a port works on TE mode, theoretically it should be set to OPEN



(OFF), but it might connect to some non-standard ISDN terminal equipments that do not have terminal resistors, for such equipments, you should set it to CONNECT(ON).

2.5 Power Feeding Connector

These jumpers control whether supply power for the external ISDN terminal. Users should adjust accordingly from the following:

- If the port works on TE mode, user MUST set the jumper to OPEN(OFF)
- If this port works on NT mode, and the ISDN terminal requires ISDN power supply, users should set the jumper to CONNECT (ON).

While ISDN terminal does not require ISDN power supply, users should set the jumper to OPEN (OFF).

2.6 Power Supply

- Power Feeding Input

If one of the eight power feeding connectors is CONNECT (ON), users should connect a D-type connector from PC power supply to this jack, the D-type connector is used to provide power to CDROM and 3.5”HDD.

- Power Supply Selection

Some latest model PCs do not provide +5V on PCI slots. If use those kinds of PCs, users have to set the jumper to 3.3V.



➤ PCM IN/PCM OUT

The above feature is applied to connect two BRI cards.

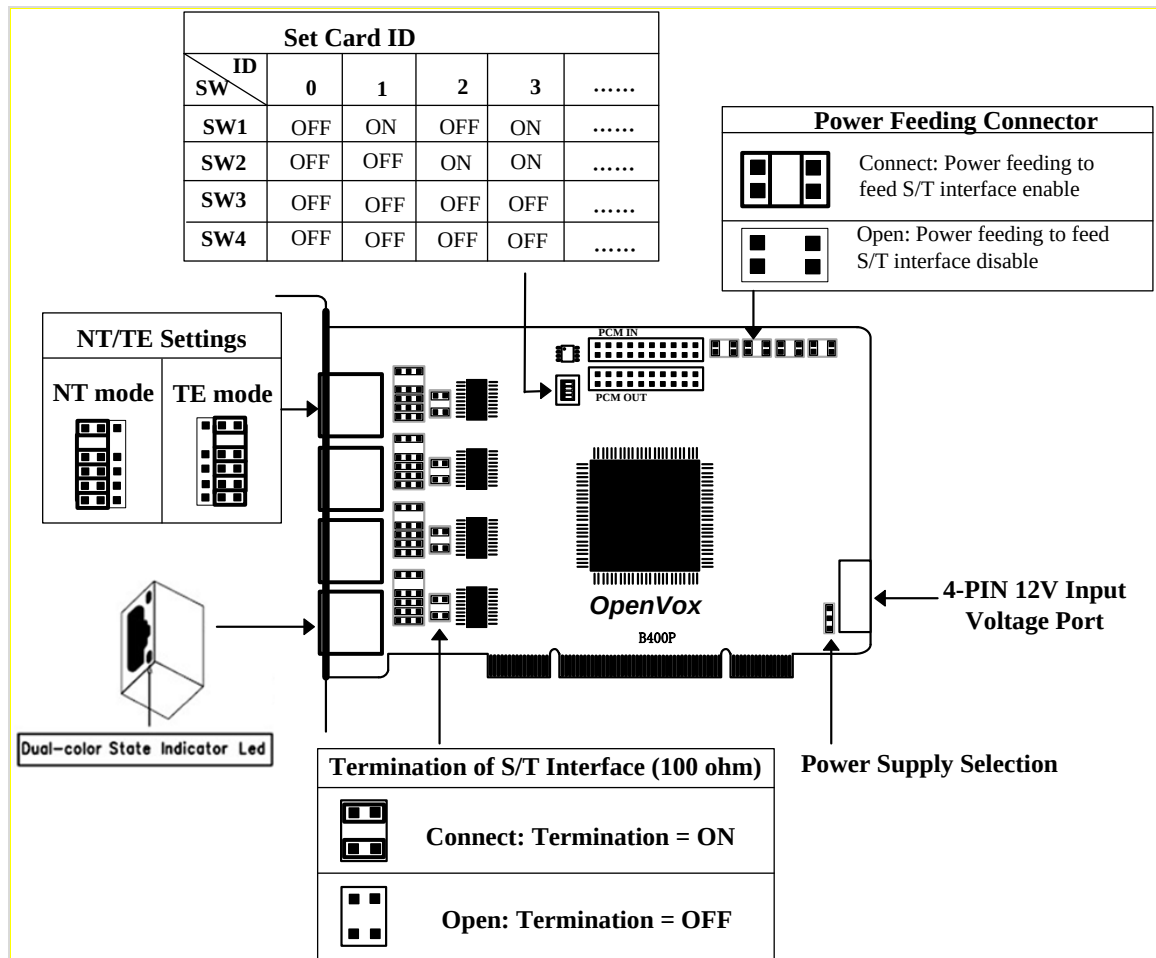


Figure 3 Jumper settings

2.7 Hardware setup procedure

- Power off your PC, remember to unplug the AC power cable
- Set card ID as previously stated if there are more than one BRI card and set the switches appropriately.
- Insert B200E/BE200E into a PCI-E slot vertically

- Plug the hard disk power supply cable (D style) to power feeding input jack if it is need to provide power by external equipments, please refer jumper setting section for more details.
- Plug ISDN lines into RJ-45 interfaces which set as TE mode and ISDN phone lines into RJ-45 interface which set as NT mode
- Fix the board by a screw
- Plug back the AC power cable, and power on PC



Caution: During the above processes, an ESD wrist strap is needed. Once power is on, you must not attempt to install or take down the board. After hardware setup appropriately, it is time to install software.



Chapter 3 Software Installation and Configuration

B200E/BE200E supports DAHDI software driver on Linux. To make full use of B200E/BE200E, you should download, compile, install and configure DAHDI, Libpri and Asterisk. Let's make specific versions for an example to state how to install software.

3.1 Download

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

Get DAHDI source package from OpenVox:

http://www.openvoxtech.com/pub/drivers/dahdi-linux-complete/openvox_dahdi-linux-complete-current.tar.gz

Get Libpri and Asterisk software packages from Digium official website:

<http://downloads.asterisk.org/pub/telephony/libpri/libpri-1-current.tar.gz>

<http://downloads.asterisk.org/pub/telephony/asterisk/asterisk-20-current.tar.gz>

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



generally to download and decompress these packages:

```
# wget http://downloads.asterisk.org/pub/telephony/libpri/libpri-1-current.tar.gz

# tar -zxvf libpri-1-current.tar.gz

# wget http://www.openvoxtech.com/pub/drivers/dahdi-linux-complete/openvox_dahdi-linux-complete-current.tar.gz

# tar -zxvf dahdi-linux-complete-current.tar.gz

# wget http://downloads.asterisk.org/pub/telephony/asterisk/asterisk-20-current.tar.gz

# tar -zxvf asterisk-20-current.tar.gz
```



3.2 Installation

1. Hardware detection

lspci -vvvv

Check the outcome and confirm your system has recognized B200E/BE200E. If it has been recognized, "ISDN controller" will be displayed in the output information like that:



```

02:09.0 ISDN controller: Cologne Chip Designs GmbH ISDN network
Controller [HFC-4S] (rev 01)
    Subsystem: Cologne Chip Designs GmbH Device e884
    Control: I/O+ Mem+ BusMaster- SpecCycle- MemWINV- VGASnoop-
ParErr- Stepping- SERR+ FastB2B- DisINTx-
    Status: Cap+ 66MHz- UDF- FastB2B- ParErr- DEVSEL=medium
>TAbort- <TAbort- <MAbort- >SERR- <PERR- INTx-
    Interrupt: pin A routed to IRQ 217
    Region 0: I/O ports at dff0 [size=8]
    Region 1: Memory at feafb000 (32-bit, non-prefetchable)
[size=4K]
    Capabilities: [40] Power Management version 2
        Flags: PMEClk- DSI+ D1+ D2+ AuxCurrent=0mA
PME (D0+,D1+,D2+,D3hot+,D3cold-)
        Status: D0 NoSoftRst- PME-Enable- DSel=0 DScale=0 PME+
    Kernel driver in use: wcb4xxp
    Kernel modules: wcb4xxp

```

Figure 4 Hardware detection

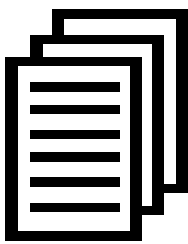
If B200E/BE200E is not recognized by the system, you have to power off and take out the card to insert it into another PCI-E slot.

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 autoconfig
# yum install automake
# 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
# yum install chkconfig
```



If there is no kernel source in the system, you should also install it by running like:

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

If the dependency has been installed, system will indicate that nothing to do, which means you could go to next one directly. Otherwise, the system will keep on installing it.

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 install-config
# systemctl enable dahdi
```

if successfully done, it is time for you to install Libpri and Asterisk.

Please execute those commands to install Libpri and Asterisk:

```
# cd libpri-XX
# make
# make install

# cd asterisk-XX
# contrib/scripts/install_prereq install
# ./configure --libdir=/usr/lib64 --with-jansson-bundled=yes
# make
```

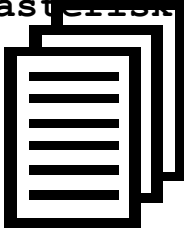


```
# make install
```

```
# make samples
```

```
#      systemctl      enable
```

asterisk "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, Libpri and Asterisk, please load the driver by running commands:

```
# modprobe dahdi
```

```
# modprobe wcb4xxp
```

```
# dahdi_genconf
```

```
# dahdi_cfg -vvv
```



OpenVox B200E/BE200E has great adaptive ability that it can be set as TE/NT mode automatically without any parameters. When the driver module "wcb4xxp" loaded, B200E/BE200E card can be configured for TE or NT mode individually by jumpers. This port configuration is detected by the driver automatically. You can see the messages when execute a command below:

```
# dmesg|grep wcb4xxp
```

```
[root@localhost Dahdi]# dmesg|grep wcb4xxp
wcb4xxp 0000:02:0a.0: probe called for b4xx...
wcb4xxp 0000:02:0a.0: Identified OpenVox B200P (controller rev 1)
at 0001dffb, IRQ 209
<6>wcb4xxp 0000:02:0a.0: Hardware echo cancellation enabled.
wcb4xxp 0000:02:0a.0: Port 1: TE mode
wcb4xxp 0000:02:0a.0: Port 2: NT mode
wcb4xxp 0000:02:0a.0: Did not do the highestorder stuff
wcb4xxp 0000:02:0a.0: new card sync source: port 2
wcb4xxp 0000:02:0a.0: new card sync source: port 2
wcb4xxp 0000:02:0a.0: Failed to create device attributes.
wcb4xxp 0000:02:0a.0: Driver unloaded.
wcb4xxp 0000:02:0a.0: probe called for b4xx...
```

Meanwhile, if the patch is applied correctly, you can see the message "Hardware echo cancellation enabled" which means the Hardware Echo Cancellation Module is working fine.



After running "modprobe dahdi" or "modprobe wcb4xxp", there is not any information displayed if loaded normally and successfully. "wcb4xxp" is the driver module name of B200E/BE200E.

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 that 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 configuration files is displayed as follows:

```
# Autogenerated by /usr/sbin/dahdi_genconf on Thu Sep 29 15:01:02 2011
# If you edit this file and execute /usr/sbin/dahdi_genconf again,
# your manual changes will be LOST.
# Dahdi Configuration File
#
# This file is parsed by the Dahdi Configurator, dahdi_cfg
#
# Span 1: B4/0/1 "B4XXP (PCI) Card 0 Span 1" (MASTER) RED
span=1,1,0,ccs,ami
# termtype: te
bchan=1-2
hardhdlc=3

# Span 2: B4/0/2 "B4XXP (PCI) Card 0 Span 2" RED
span=2,2,0,ccs,ami
# termtype: te
bchan=4-5
hardhdlc=6

# Global data

loadzone      = us
defaultzone   = us
```

Figure 5 A part of system.conf

2. Country mode modification

In order to match your country mode, it is 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 agreed with the hardware setup. Here is an example that assumes port 1& 2 are set to TE mode, port 3& 4 are set to NT mode.)

```
; Autogenerated by /usr/sbin/dahdi_genconf on Thu Sep 29 15:01:02 2011
; If you edit this file and execute /usr/sbin/dahdi_genconf again,
; your manual changes will be LOST.
; Dahdi Channels Configurations (chan_dahdi.conf)
;
; This is not intended to be a complete chan_dahdi.conf. Rather, it is intended
; to be #include-d by /etc/chan_dahdi.conf that will include the global settings
;

; Span 1: B4/0/1 "B4XXP (PCI) Card 0 Span 1" (MASTER) RED
group=0,11
context=from-isdn
switchtype = euroisdn
signalling = bri_cpe_ptmp
channel => 1-2
context = default
group = 63

; Span 2: B4/0/2 "B4XXP (PCI) Card 0 Span 2" RED
group=0,12
context=from-internal
switchtype = euroisdn
signalling = bri_net_ptmp
channel => 4-5
context = default
group = 63
```

Figure 6 A part of dahdi-channels.conf

3. Asterisk initiation

Execute a command to start Asterisk:

asterisk -vvvvvvvc

If Asterisk is already activate, run "asterisk -r" instead.

In the CLI, please run the following commands

"dahdi show channels" and "pri show spans":

```
*CLI> dahdi show channels
Chan Extension Context Language MOH Interpret Blocked State
pseudo default default default In Service
1 from-isdn default default In Service
2 from-isdn default default In Service
4 from-internal default default In Service
5 from-internal default default In Service
*CLI> pri show spans
PRI span 1/0: Up, Active
PRI span 2/0: Up, Active
```

Figure 7 channels and spans show

It is successful installation if you can see the span is up and active and not "In Alarm". Otherwise, please check the configuration files and physical connections.

4. Dialplan edit

You should make sure that the context "from-isdn" and "from-internal" are in extensions.conf. Here a simple example is given:

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

[from-isdn]
exten => _X.,1,Dial(SIP/100,,r)
exten => _X.,n,Hangup()

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

exten => _0XX,1,Dial(dahdi/${EXTEN:1},,r)
exten => _0XX,n,Hangup()
```

Figure 8 dialplan



After saving your dialplan, please run "`asterisk -r`", then execute "`reload`" in the CLI. Now you are able to make calls. The above dialplan achieves that:

- If there is a call from the ISDN line, Asterisk will transfer to SIP extension 100 directly, then the SIP phone rings.
- If SIP extension 100 dials any phone number, Asterisk will transfer to the destination phone through the first channel.
- If SIP extension 100 dials a channel number, Asterisk will transfer to the destination ISDN phone which connects the channel. For example, if the SIP phone dials 001, Asterisk will get through to the ISDN phone which connects the first DAHDI channel.

When calls are running, you can check the status of Hardware Echo Cancellation Module. In time slots which are active, EC module status is ON, otherwise it's OFF. The status of EC looks like as follows:

```
*CLI> dahdi show channel 1
Channel: 1
File Descriptor: 9
Span: 1
Extension:
Dialing: no
Context: from-isdn
Caller ID: 10086
Calling TON: 33
Caller ID subaddress:
Caller ID name: 10086
Mailbox: none
Destroy: 0
InAlarm: 0
Signalling Type: ISDN BRI Point to MultiPoint
Radio: 0
Owner: DAHDI/i1/10086-1
Real: DAHDI/i1/10086-1
Callwait: <None>
Threeway: <None>
Confno: -1
Propagated Conference: -1
Real in conference: 0
DSP: yes
Busy Detection: no
TDD: no
Relax DTMF: no
Dialing/CallwaitCAS: 0/0
Default law: alaw
Fax Handled: no
Pulse phone: no
Gains (RX/TX): 0.00/0.00
Dynamic Range Compression (RX/TX): 0.00/0.00
DND: no
Echo Cancellation:
    128 taps
    currently ON
Wait for dialtone: 0ms
PRI Flags: Call
PRI Logical Span: Implicit
Actual Confinfo: Num/0, Mode/0x0000
Actual Confmute: No
Hookstate (FXS only): Onhook
*CLI>
```

Figure 9 EC status



Chapter 4 Reference

www.openvoxtech.com

www.digium.com

www.asterisk.org

www.voip-info.org

www.asteriskguru.com

Appendix A Specifications

• Weight and size

Weight: 112g (BE200E) 20g (EC module)

Size: 14.0 × 9.9 × 1.8cm (5.51 × 3.90 × 0.71 inch)

• Interfaces

PCI Express 1.0 or above

Local Loop Access: RJ-45 ports used on certain ISDN S/T/U interfaces

• Environment

Temperature: 0 ~ 50 °C (Operation)

 - 40 ~ 125 °C (Storage)

Humidity: 10 ~ 90% NON-CONDENSING

• Power consumption

Voltage: 3.3V/38V (only NT mode)

Power Dissipation: 0.97W Minimum, 4.7W Maximum

• Hardware and software requirements

RAM 128 + MB

Linux kernel 2.4.X or 2.6.X

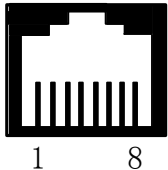
CPU 800+ MHZ

Appendix B PIN Assignments

Basic Rate ISDN lines can use straight ("flat") modular cable if necessary.

However, twisted-pair are more common.

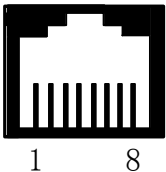
- ISDN U-interface

8-pin RJ45 port	PIN	Color	Description
	1	White/Orange	N/A
	2	Orange	N/A
	3	White/Green	N/A
	4	Blue	U interface
	5	White/Blue	U interface
	6	Green	N/A
	7	White/Brown	-48VDC Power (optional)
	8	Brown	-48VDC Return (optional)

The U-Interface is most commonly used in North American Basic Rate ISDN systems. The U-Interface is an 8-conductor, modular, RJ-45 jack. The center two pins (pin 4 and 5) are used for the 2-wire loop. The wiring of pin 4 and pin 5 **are not** polarity sensitive (e.g. 4 and 5 may be crossed). Optional -48 VDC power may be utilized on RJ-45 pins 7 and 8. This can be used to power the NT-1 and TE equipments if sufficient power is

available. In most cases, power is **not provided** from the telephone company.

● BRI S-Interface

8-pin RJ45 port	PIN	Color	Description
	1	White/Orange	N/A
	2	Orange	N/A
	3	White/Green	Receive+
	4	Blue	Transmit +
	5	White/Blue	Transmit -
	6	Green	Receive -
	7	White/Brown	-48VDC Power(optional)
	8	Brown	-48VDC Return (optional)

The BRI S-Interface is a 4-wire interface, with separate Transmit and Receive pairs. It can be operated in four modes:

- Point-to-Point Mode allows one logical terminal that may be up to 1 KM from the NT-1
- Short Passive Bus Mode allows connection of up to 8 terminals in parallel on the S/T bus. The terminals can be within 100 to 200 meters from the NT-1.

- Extended Passive Bus Mode allows connection to 8 terminals at distances of up to 500 meters from the NT-1.
- Star Bus Mode allows interconnection of up to 8 terminals to a central NT-1. Each terminal can be up to 1 KM from the NT-1.
- ✧ The NT-1 unit has configurable jumpers to apply a 100-ohm termination to the S-Interface signal pairs. Usually, these jumpers will be in. Rules of termination is similar to that of the SCSI-bus: the NT-1 will have 100-ohm terminators applied, and the farthest TE1/TA device will have 100-ohm terminators.
- ✧ Optional power to the NT-1 can be applied from pins 7 and 8 of the S-Interface RJ-45 jack. This is usually not used.
- ✧ Many NT-1 units provide "phantom-power" (sealing current) between the transmit (4,5) and receive (3,6) leads. In these cases, the Transmit (4,5) leads will be negative with respect to the Receive (3,6) leads. This is often selectable in the NT-1.

Whenever possible, it is recommended that this option be disabled.

As a general rule-of-thumb, most PC cards, routers, and other data communications equipment do not require power from the S/T interface. ISDN telephones usually require power from the S/T interface.
- ✧ Most NT-1 units will ship with a wall-mount transformer power supply for the NT-1.

