



Synway AST Series

User Manual

Version 1.12.0.0

Synway Information Engineering Co., Ltd

www.synway.net

Contents

Contents	i
Copyright Declaration	ii
Software License Agreement	iii
Revision History	iv
Preface	v
Chapter 1 Overview	1
1.1 FXM	1
1.2 TEJ	2
1.3 CDC	3
1.4 BRI	4
Chapter 2 Hardware Installation	5
Chapter 3 Driver Installation & Configuration	7
3.1 By Script	7
3.1.1 Based on Zaptel	7
3.1.2 Based on Dahdi	8
3.1.3 Configure Boards Order	8
3.1.4 Automatic Configuration	10
3.2 Manually	11
3.2.1 Manual Installation	11
3.2.1.1 Based on Zaptel	11
3.2.1.2 Based on Dahdi	13
3.2.2 Manual Configuration	15
3.2.2.1 Configure Zaptel	15
3.2.2.2 Configure Dahdi	16
3.3 Driver Uninstallation	17
Chapter 4 Driver Debugging	18
Chapter 5 All Manuals for You	20
Appendix A FAQ	22
Appendix B Technical/Sales Support	31

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Revision History

Version	Date	Comments
Version 1.0.0.0	2009-2	Initial publication
Version 1.1.0.0	2009-7	Add relative content on Dahdi driver
Version 1.2.0.0	2009-8	Add relative content about the new board model FXM3201P
Version 1.3.0.0	2009-9	Add relative content about the new board models FXM3201E, TEJ101E, TEJ201E
Version 1.4.0.0	2009-11	Add relative content about the new board models FXM3200P, FXM3200E, TEJ101P, TEJ201P
Version 1.5.0.0	2009-12	Add relative content about the new board models TEJ200E, TEJ100E, TEJ200P, TEJ100P
Version 1.6.0.0	2010-2	Significant revision
Version 1.7.0.0	2010-5	Add relative content about the new board models FXM3211P, FXM3210P, TEJ401E, TEJ801E, TEJ400E, TEJ800E.
Version 1.8.0.0	2011-3	Add relative content about the new board models TEJ400P, TEJ401P, TEJ800P, TEJ801P, TEJ400P(SSW), TEJ401P(SSW), TEJ800P(SSW), TEJ801P(SSW), TEJ100P(SSW), TEJ101P(SSW), TEJ200P(SSW), TEJ201P(SSW).
Version 1.9.0.0	2011-11	Newly support Dahdi-2.4
Version 1.10.0.0	2012-1	Add relative content about the new board models BRI1611P and BRI1610P. Newly support Dahdi-2.5.
Version 1.11.0.0	2012-4	Newly support Dahdi-2.6
Version 1.12.0.0	2012-6	Newly support FXM3211E, FXM3210E boards

Note: Only major revisions to this manual itself recorded herein.

Preface

Thank you for choosing the Synway AST series boards which are designed to fully support open source IP PBX platform, such as Asterisk, Trixbox, Elastix, FreeSwitch and so on. Synway AST series includes three subseries.

Subseries	Board Model	Description
Synway BRI	BRI1611P	Use of digital trunks (2B+D)
	BRI1610P	
Synway FXM	FXM-8A/PCI	Use of modular structure and analog lines
	FXM-16A/PCIe	
	FXM3201P	
	FXM3201E	
	FXM3200P	
	FXM3200E	
	FXM3211P	
	FXM3210P	
	FXM3211E	
	FXM3210E	
Synway TEJ	TEJ-1A/PCI	Use of digital trunks (E1/T1/J1)
	TEJ-2A/PCI	
	TEJ-4A/PCI	
	TEJ101E	
	TEJ201E	
	TEJ101P	
	TEJ201P	
	TEJ100E	
	TEJ200E	
	TEJ100P	
	TEJ200P	
	TEJ401E	
	TEJ801E	
	TEJ400E	
	TEJ800E	
	TEJ401P	
	TEJ801P	
	TEJ400P	
	TEJ800P	
	TEJ401P(SSW)	
	TEJ801P(SSW)	
	TEJ400P(SSW)	
	TEJ800P(SSW)	
	TEJ101P(SSW)	
	TEJ201P(SSW)	
	TEJ100P(SSW)	
	TEJ200P(SSW)	
Synway CDC	CDC-1522A/PCI	CODEC board
	CDC-2522A/PCI	
	CDC-3522A/PCI	

The Synway FXM, TEJ and CDC series boards are respectively perfect substitutes for the AEX and TDM series analog voice cards, the TE series digital trunk cards, and the TC400B CODEC

card from Digium Inc.

Since the FXM, BRI and TEJ boards integrate the capability of echo cancellation, there is no need to get it from extra modules or devices. Compared with similar products from other companies, they are higher in integration and stronger in echo cancellation. Therefore, for use of FXM, BRI or TEJ boards, it is not necessary to purchase the VPMADT032 module (to enable echo cancellation) from Digium Inc.

The Synway AST driver program, as a link between the board hardware and open source IP PBX platform, is only used to set up the open source IP PBX platform, but not applicable to secondary development. This manual, as the help file for hardware installation, software installation, test and configuration of the Synway AST products, aims at those installation and maintenance technicians as well as the salesmen who are using the AST boards to set up open source IP PBX application systems.

This document consists of the following chapters.

Chapter 1 illustrates the IP PBX application models and scenarios set up by the Synway AST series boards.

Chapter 2 introduces how to install the Synway AST series boards.

Chapter 3 tells how to install and configure the board driver.

Chapter 4 introduces the way of driver debugging.

Chapter 5 introduces multiple IP PBX platforms and recommends reference manuals for the installation, configuration and testing of the SynAST driver on these platforms.

Appendix A provides answers to some problems that may occur when using the Synway AST series boards.

Appendix B shows the contact way of technical support and sales department in Synway.

Although Synway has scrupulously checked through this manual, but cannot guarantee the absence of errors and omissions. We sincerely apologize for any consequent inconvenience brought to you and will be very grateful if you kindly give your advice regarding amendments to this book.

Chapter 1 Overview

The driver for the Synway AST series boards (hereinafter referred to as 'AST'), which is compatible and must be used with the Zaptel/Dahdi driver, can smoothly and seamlessly support open-source IP PBX platforms.

When using the AST board to establish an open-source IP PBX platform, all that you should do is configure and operate the open-source IP PBX platform, without secondary development by using AST. See Figure 1-1 below for the set-up of the open-source IP PBX application system with the AST board.

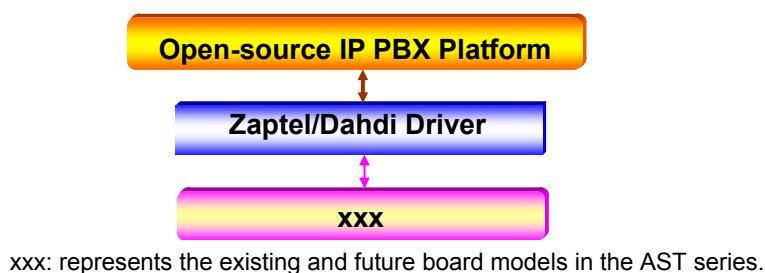
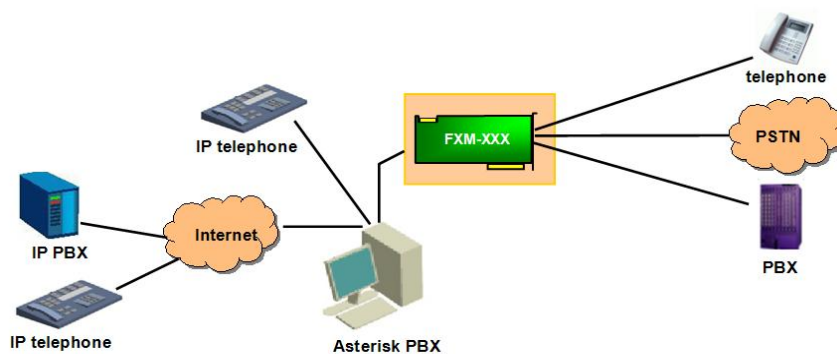


Figure 1-1 AST Driver Set-up

1.1 FXM

The Synway FXM series boards (hereinafter referred to as 'FXM') are analog voice boards newly developed for open source IP PBX system. FXM are high-performance and cost-effective, which support FXO (Foreign Exchange Office), FXS (Foreign Exchange Station) and FXC (composite module) and allow various configurations by using these three different modules to provide all features and functionalities of common voice boards. The FXM boards improve I/O speed by using DMA technique for data reading and writing on the basis of PCI bus, resulting in reduced CPU usage and increased board density per server. Figure 1-2 below is a typical application model with FXM.



xxx: represents the existing and future board models in the FXM series.

Figure 1-2 Application Model

1.2 TEJ

The Synway TEJ series boards (hereinafter referred to as 'TEJ') are digital trunks boards newly developed for open source IP PBX system. The TEJ are high-performance, cost-effective digital telephony interface boards and support E1, T1 and J1 environments. The environments are selectable on a per-board basis via software configuration. The TEJ boards improve I/O speed by using DMA technique for data reading and writing based on PCI bus, resulting in reduced CPU usage and increased board density per server.

The excellent combination of the TEJ driver and the Asterisk platform brings the following features to the TEJ series boards.

Supported Data Modes: Cisco HDLC, HDLC, PPP, Multi-link PPP, Frame Relay.

Supported Voice Modes:

- PRI CPE and PRI NET
 - NI1
 - NI2
 - EuroISDN
 - 4ESS(AT&T)
 - 5ESS(Lucent)
 - DMS100
- E&M
 - Wink
 - Feature Group B
 - Feature Group D
- FXO and FXS
 - Ground Start
 - Loop Start
 - Loop Start with Disconnect Detect

The TEJ series connect Asterisk Server with PSTN, Channel Bank or PBX via T1, E1 or J1 interface. The boards and the corresponding drivers can be used to establish a professional telephony network environment. Figure 1-3 and Figure 1-4 below are typical application models with TEJ.

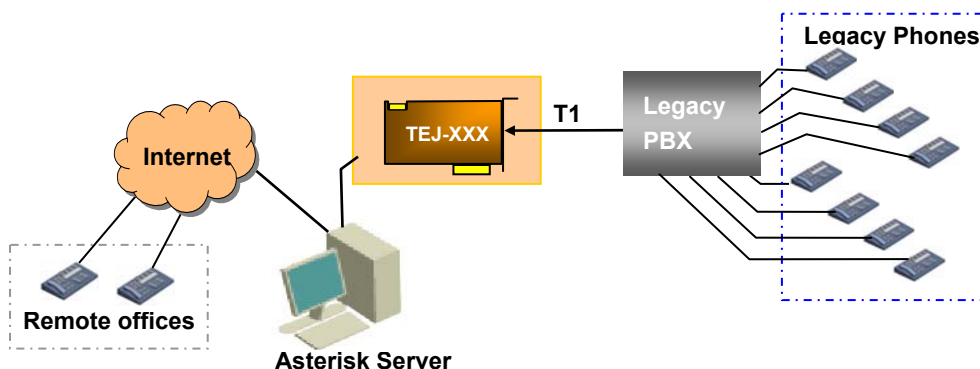
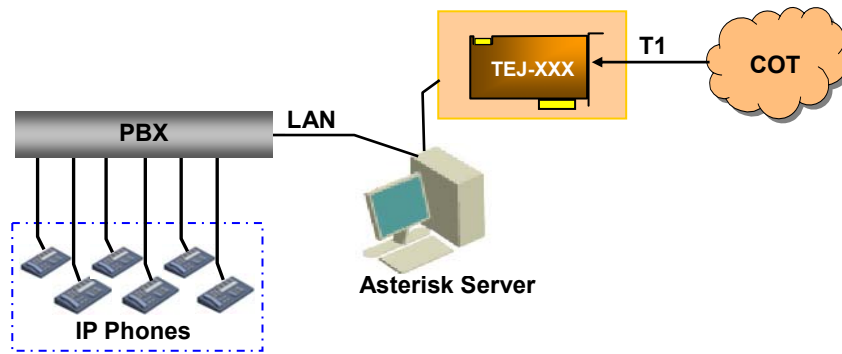


Figure 1-3 Application Model I: Traditional Telephony System



Note: XXX in Figure 1-3 and Figure 1-4 represents the existing and future board models in the TEJ series.

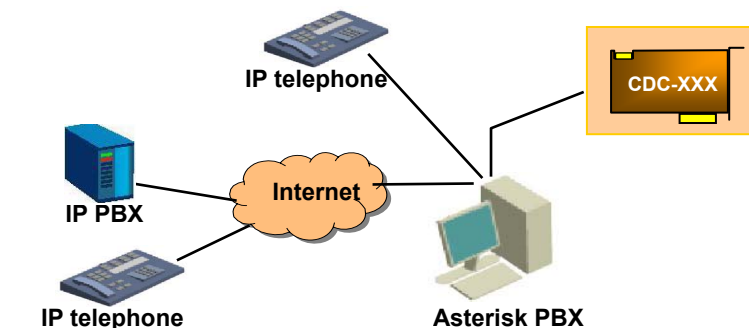
Figure 1-4 Application Model II: VoIP Telephony System

1.3 CDC

The Synway CDC series boards (hereinafter referred to as 'CDC') are CODEC boards newly developed for open source IP PBX system. They are multi-channel boards with PCI 2.2 bus, supporting the hardware-based transformations between voice codecs. With the burst data transmission rate up to 132 MB/s and the PNP (plug and play) feature which eliminates the need for jumper leads, this series can be used on 3.3V/5V PCI slot and PCI-X slot.

Asterisk, in software and with Digium G.729a licensing, is capable of transforming the G.729A codec into other codecs for the purposes of call origination or termination, bridging disparate calls, or VoIP to TDM connectivity. These transformations in software are very expensive, in terms of MIPS, and require a substantial amount of CPU time to accomplish. The Synway CDC series uses the PCI-based DMA technique for data reading and writing, minimizing the CPU cost. It is fully compatible with the API functions of Asterisk and supports the transformations among G.711 A-Law, μ -Law and G.729A, which ideally cover the shortage of Asterisk. Besides, the CDC board has many DSPs on it to provide powerful voice processing, which brings a nearly real-time voice effect to users.

Figure 1-5 below is a typical application model with CDC.

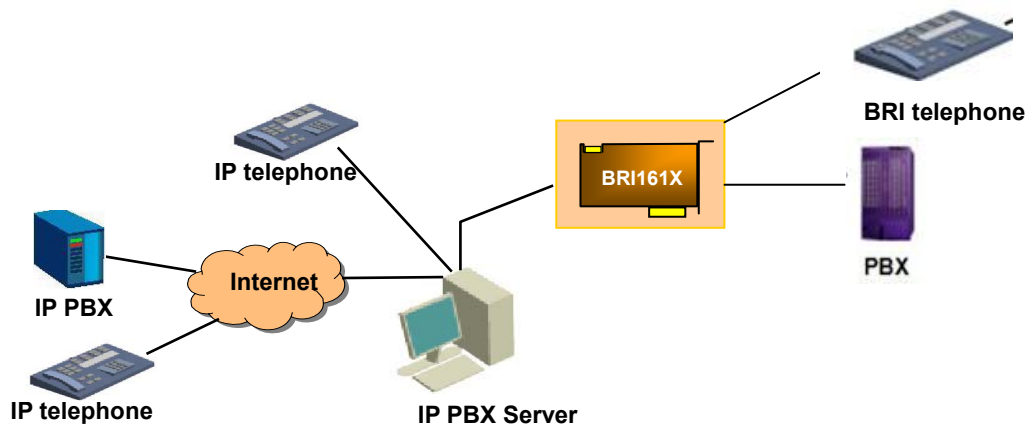


Note: XXX represents the existing and future board models in the CDC.

Figure 1-5 Application Model

1.4 BRI

The Synway BRI series boards (hereinafter referred to as 'BRI') are digital trunk voice boards newly developed for open source IP PBX system. They are high-performance, cost-effective digital telephony interface boards. They use the DMA technique for data reading and writing based on PCI bus, improving the I/O speed and reducing the CPU cost.



Note: X represents the existing and future board models in the BRI.

Figure 1-6 Application Model

Chapter 2 Hardware Installation

Refer to the board model to find the relevant hardware manual. Install the board successfully before going to the next chapters for software installation. The hardware manual provided for your reference is under the directory 'doc/Hardware' of the installation package. Table 2-1 shows the corresponding relationship between the board model and the hardware manual.

Subseries	Board Model	Hardware Manual
BRI	BRI1610P	AST_BRI001
	BRI1611P	
FXM	FXM-8A/PCI	AST_FXM001
	FXM-16A/PCIe	
	FXM3201P	AST_FXM002
	FXM3201E	
	FXM3200P	
	FXM3200E	
	FXM3211P	AST_FXM003
	FXM3211E	
	FXM3210P	
	FXM3210E	
	FXM3210E	
	FXM3210E	
TEJ	TEJ-1A/PCI	AST_TEJ001
	TEJ-2A/PCI	
	TEJ-4A/PCI	
	TEJ101E	AST_TEJ002
	TEJ201E	
	TEJ101P	
	TEJ201P	
	TEJ100E	
	TEJ200E	
	TEJ100P	
	TEJ200P	
	TEJ401E	
	TEJ801E	AST_TEJ003
	TEJ400E	
	TEJ800E	
	TEJ401P	
	TEJ801P	
	TEJ400P	
	TEJ800P	
	TEJ401P(SSW)	AST_TEJ004
	TEJ801P(SSW)	
	TEJ400P(SSW)	
	TEJ800P(SSW)	
	TEJ101P(SSW)	
	TEJ201P(SSW)	
	TEJ100P(SSW)	

	TEJ200P(SSW)	
CDC	CDC-1522A/PCI	AST_CDC001
	CDC-2522A/PCI	
	CDC-3522A/PCI	

Table 2-1 Board Model and Corresponding Hardware Manual

Chapter 3 Driver Installation & Configuration

SynAST is the driver software for the Synway AST series boards. Its compilation, installation and configuration are all related closely to zaptel/dahdi and open source IP PBXs. So we suggest those who are familiar with the installation and configuration of open-source IP PBXs use the script in the installation package to complete the driver installation and configuration (see Section 3.1), and suggest others refer to [Chapter 5 All Manuals for You](#).

3.1 By Script

Note:

- Do not forget to install the kernel header file linux-headers while you are installing the LINUX operating system. Besides, if the Synway AST series boards are installed in the Elastix or Tribox system, make sure the Asterisk services are closed before you start the installation. You may check by the command asterisk -r. If the Asterisk services are still running, close them by the command #amportal stop to ensure the normal installation of the driver.
- So far our driver supports the Dahdi Version 2.6 and below.
- The BRI boards only support dahdi-2.4.x and above. Zaptel is not supported.
- Don't forget to power on the board before using the BRI boards.

3.1.1 Based on Zaptel

First prepare the SynAST driver and zaptel software packages.

```
#cd /opt                                # enter the directory to source codes

#tar -zxvf SynAST-1.12.0.0.tar.gz        # decompress the synast driver

#tar -zxvf zaptel-1.4.12.tar.gz          # decompress the zaptel driver

#cd SynAST-1.12.0.0                     # enter the directory to the synast driver

#cd zaptel                              # enter the directory to the 'synway ast for zaptel' driver

#./Setup install                         # install the driver

Would you like to install SynAST AST package now? y    # enter 'y' to install

Please enter working zaptel directory [q](exit install) :

                                                # enter the full path to zaptel source codes

Would you like to open hardware echocan on boards? y

                                                # enter 'y' to enable the echo cancellation in hardware, enter 'n' to disable it

The following options will appear if there are TEJ series boards installed in the PC.

SELECT TEJ MODE [t, e, j] :e            # select the tej mode, or the driver will be installed in e1 mode
```

```
SELECT TEJXAPCI [75, 120]ohm      # set the impedance of the TEJ pci board, 75 for coaxial
                                   cables, 120 for twisted-pair cables

SELECT TEJ201E [75, 120]ohm      # set the impedance of the tej201e board, 75 for coaxial
                                   cables, 120 for twisted-pair cables
```

3.1.2 Based on Dahdi

First prepare the SynAST driver and dahdi software packages.

Note: To publish a dahdi version, there are two ways: one is to publish driver and tools together, and the other is to publish driver and tools separately. Here is a version for which driver and tools are published together. For how to install those versions for which driver and tools are published separately, see [Appendix A FAQ](#).

```
#cd /opt                          # enter the directory to source codes

#tar -zxvf SynAST-1.12.0.0.tar.gz  # decompress the synast driver

#cd SynAST-1.12.0.0               # enter the directory to the synast driver

#cd dahdi                         #enter the directory to the 'synway ast for dahdi' driver

#./Setup install                  # install the driver

Would you like to install SynAST AST package now? y      # enter 'y' to install

Please enter working dahdi directory [q](exit install) :

                                   # enter the full path to dahdi source codes

Would you like to open hardware echocan on boards?y

                                   # enter 'y' to enable the echo cancellation in hardware, enter 'n' to disable it

The following options will appear if there are TEJ series boards installed in the PC.

SELECT TEJ MODE [t, e, j] :e      # select the tej mode, or the driver will be installed in e1 mode

SELECT TEJXAPCI [75, 120]ohm      # set the impedance of the TEJ pci board, 75 for coaxial
                                   cables, 120 for twisted-pair cables

SELECT TEJ201E [75, 120]ohm      # set the impedance of the tej201e board, 75 for coaxial
                                   cables, 120 for twisted-pair cables
```

3.1.3 Configure Boards Order

If you have multiple boards and the order changes after the system restart, you may reset the board order by the following steps.

Step 1: Execute the command './Setup config' and you will see the following prompts. Enter q to exit.

```
*****
```

1:Adjust card order of same type

2:Adjust card order of different type

Please choose number(q):

Step 2: Follow the instructions. Enter 1 to rearrange the loading boards of the same type. Enter q to exit.

Would you like to configure the cards order now? (y/n) y

Card Type	Serialno
fxm8apci	no1
fxm8apci	no2
tejxapci	no3
tejxapci	no4

Adjust Card Type [fxm8apci,tejxapci] (q): fxm8apci # [] in this line automatically lists only the same models of 2 or more than 2 boards. Enter q to exit.

Adjust Card Order (Comma separated): no2, no1 # Upon executing this command, the two fxm8apci boards will be loaded in a no2, no1 sequence.

Step 3: Enter 2 to rearrange the loading boards of different types.

Card_Type

fxm8apci

tejxapci

1st Launch : # Enter the first board type to be loaded and press the enter key. Then type in the second board type to be loaded according to the prompts. Repeat this step for several times until you enter all board types.

Note: If users do not configure the order of loading, the boards will be loaded according to the following order: fxm8apci, fxm16apci, fxm32, tejxapci, tej21, tej84. The boards of the same type will be loaded according to Serialno from small to large. Also, users can modify either the file '/tmp/synast_cardlist' or '/tmp/card_order' to rearrange the loading boards. If the above files do not exist, execute the command 'touch /tmp/synast_cardlist' or 'touch /tmp/card_order' to create. The file '/tmp/synast_cardlist' can be used to configure the loading order

for boards of the same type, and the file format is 'Card Type: Serialno'. The board with the serial number listed in the front is loaded earlier. The file '/tmp/card_order' can be used to configure the loading order for boards of different types. Enter the board types by sequence, one for each line and without indent. Only upon executing the command './SynAST_driver_init' or restarting the system does this modification go into effect.

3.1.4 Automatic Configuration

There are two scripts for automatic configuration `astcfg_dahdi` and `astcfg_zaptel` in the driver installation package. They can achieve the same purpose respectively as `zapconf` and `dahdi_genconf`. You can use the following commands to configure the board.

If based on zaptel:

#>astcfg_zaptel asterisk

The following prompts appear:

Please select signaling

1 : ISDN

2 : SSI_unicall

3 : SS1_openr2

4 : SS7

Choose Number :

Enter one of the above numbers to configure the corresponding signaling.

Note:

- 1. The configuration based on Zaptel only supports ISDN and SS1_unicall, so you are only allowed to enter the number 1 or 2,***
- 2. SS7 configuration in Asterisk only supports no more than 4 signaling slots and regards the 16th Time Slot as the signaling time slot by default.***
- 3. When there is only analog board in the system, the prompts will be skipped and the analog board will be configured automatically.***

If based on dahdi:

#>astcfg_dahdi asterisk

The prompts and operations are the same as those for `astcfg_zaptel`; however, the configuration based on Dahdi supports all the four signaling protocols mentioned above.

3.2 Manually

Note: Do not forget to install the kernel header file linux-headers while you are installing the LINUX operating system.

3.2.1 Manual Installation

3.2.1.1 Based on Zaptel

Step1: Install the zaptel driver

```
#cd /opt                                # enter the directory to the package of zaptel source codes
#tar -zxvf zaptel-1.4.12.tar.gz          # decompress the source codes
#cd zaptel-1.4.12                        # enter the directory to zaptel source codes
#./configure
#make                                    # compile the driver
#make install                            # install the driver
#modprobe zaptel                         # load the driver
```

Step2: Install the SynAST driver

```
#cd /opt                                # enter the directory to the package of SynAST source codes
#tar -zxvf SynAST-1.12.0.0.tar.gz        # decompress the source codes
#cp -rf /opt/SynAST-1.12.0.0/zaptel/srcs/fxm/fxm8apci /opt/zaptel-1.4.8

# copy the fxm8apci driver to the zaptel directory. You should
# copy a driver that corresponds to your used AST board (see
# the table below to find each board model and its
# corresponding driver) to replace the part 'fxm/fxm8apci' of this
# command. If the zaptel version is above 1.4.11, where you
# should copy to is /opt/zaptel-[version]/kernel.

#cd /opt/zaptel-1.4.8/fxm8apci           # enter the directory to SynAST source codes in zaptel. If the
#                                         zaptel version is above 1.4.11, execute the command #cd
#                                         /opt/zaptel-[version]/kernel/fxm8apci.
```

Note: While using a zaptel above version 1.4.11 on CDC boards, you need to follow the path '/opt/zaptel-[Version]/kernel/cdcx522apci/Makefile' to open the file 'Makefile' and add the sentence 'EXTRA_CFLAGS+= -DZAP1412' to behind 'EXTRA_CFLAGS:=-DSTANDALONE_ZAPATA -DBUILDING_TONEZONE'. To enable the echo cancellation in hardware, modify the file '/opt/zaptel-1.4.8/fxm8apci/Makefile', changing it from EXTRA_CFLAGS:=-DSTANDALONE_ZAPATA -DBUILDING_TONEZONE -D__TONE_DETECT__ to 'EXTRA_CFLAGS:=-DSTANDALONE_ZAPATA -DBUILDING_TONEZONE -D__TONE_DETECT__ -D HWEC_OPEN'.

```
#make
```

```
# compile the driver
```

```
#insmod fxm8apci.ko
```

```
# load the driver
```

Note: When using other AST series boards except FXM-8A/PCI, you should refer to Table 3-1 to find the corresponding driver file and use the filename to replace the parts 'fxm' and 'fxm8apci' in the above commands. When using CDC series boards, you should first use 'modprobe zttranscode' to load the 'zttranscode.ko' module before loading the driver 'cdc522apci.ko' for CDC boards, as the use of CDC boards relies on the 'zttranscode.ko' module.

Subseries	Board Model	Directory to Source Codes	Driver File	Remark
FXM	FXM-8A/PCI	fxm8apci	fxm8apci.ko	Follow the above example.
	FXM-16A/PCle	fxm16apcie	fxm16apcie.ko	Use the name of the driver file which corresponds to the board model you use to replace the parts 'fxm' and 'fxm8apci' in the above commands.
	FXM3201P	fxm32	fxm32.ko	
	FXM3201E			
	FXM3200P			
	FXM3200E			
	FXM3211P			
	FXM3210P			
FXM3211E				
FXM3210E				
TEJ	TEJ-1A/PCI	tejxapci	tejxapci.ko	
	TEJ-2A/PCI			
	TEJ-4A/PCI			
	TEJ101E	tej21	tej21.ko	
	TEJ201E			
	TEJ101P			
	TEJ201P			
	TEJ100E			
	TEJ200E			
	TEJ100P			
	TEJ200P			
	TEJ101P(SSW)			
	TEJ201P(SSW)			
	TEJ100P(SSW)			
	TEJ200P(SSW)			

	TEJ401E TEJ801E TEJ400E TEJ800E TEJ401P TEJ801P TEJ400P TEJ800P TEJ401P(SSW) TEJ801P(SSW) TEJ400P(SSW) TEJ800P(SSW)	tej84	tej84.ko	
CDC	CDC-1522A/PCI CDC-2522A/PCI CDC-3522A/PCI	cdc522apci	cdc522apci.ko	

Table 3-1 Board Model and Corresponding Driver

3.2.1.2 Based on Dahdi

Step1: Install the dahdi driver

```
#cd /opt                                # enter the directory to the package of dahdi source codes
#cd dahdi                              # enter the directory to dahdi source codes
#make                                  # compile the driver
#make install                          # install the driver
#modprobe dahdi                       # load the driver
```

Step2: Install the SynAST driver

Note: To publish a dahdi version, there are two ways: one is to publish driver and tools together, and the other is to publish driver and tools separately. Here is a version for which driver and tools are published together. For how to install those versions for which driver and tools are published separately, see [Appendix A FAQ](#).

Here we take the TEJ84 driver with DAHDI2.6 for example to show the manual installation.

```
#cd /opt                                # enter the directory to the package of SynAST source codes
#tar -zxvf SynAST-1.12.0.0.tar.gz      # decompress the source codes
#cp -rf /opt/SynAST-1.12.0.0/dahdi/srcs/tej/tej84/opt/dahdi/linux/drivers/dahdi
                                         # copy the tej84 driver to the dahdi directory
#cd /opt/dahdi/linux/drivers/dahdi/tej84
                                         # enter the directory to SynAST source codes in dahdi
```

As in manual installation, the driver will not write the configuration items generated by

the script to the Kbuild file automatically, you need to add the following options to the Kbuild file manually:

EXTRA_CFLAGS+= -DDAHD26

EXTRA_CFLAGS+= -DE1MODE

EXTRA_CFLAGS+= -DHWEC_OPEN

Explanations:

The first item designates the version of DAHDI. For example, -DDAHD26 indicates DAHDI version 2.6; -DDAHD25 indicates DAHDI version 2.5 and so on.

The second item designates the digital trunk transmission mode. -DE1MODE indicates E1; -DT1MODE indicates T1; -DJ1MODE indicates J1. This item is not applicable to analog boards.

The third item determines whether to enable echo cancellation or not. Filling in this item means to enable echo cancellation; leaving it null means to disable echo cancellation.

#make # compile the driver

#insmod tej84.ko # load the driver

Note: When using other AST series boards except FXM-8A/PCI, you should refer to Table 3-2 to find the corresponding driver file and use the filename to replace the parts 'tej' and 'tej84' in the above commands. When using CDC series boards, you should first use 'modprobe dahdi_transcode' to load the 'dahdi_transcode.ko' module before loading the driver 'cdc522apci.ko' for CDC boards, as the use of CDC boards relies on the 'dahdi_transcode.ko' module.

Subseries	Board Model	Directory to Source Codes	Driver File	Remark
BRI	BRI1611P BRI1610P	bri16	bri16.ko	Follow the above example.
FXM	FXM-8A/PCI	fxm8apci	fxm8apci.ko	Follow the above example.
	FXM-16A/PCle	fxm16apcie	fxm16apcie.ko	Use the name of the driver file which corresponds to the board model you use to replace the parts 'fxm' and 'fxm8apci' in the above commands.
	FXM3201P FXM3201E FXM3200P FXM3200E FXM3211P FXM3210P FXM3211E FXM3210E	fxm32	fxm32.ko	

TEJ	TEJ-1A/PCI TEJ-2A/PCI TEJ-4A/PCI	tejxapci	tejxapci.ko	
	TEJ101E TEJ201E TEJ101P TEJ201P TEJ100E TEJ200E TEJ100P TEJ200P TEJ101P(SSW) TEJ201P(SSW) TEJ100P(SSW) TEJ200P(SSW)	tej21	tej21.ko	
	TEJ401E TEJ801E TEJ400E TEJ800E TEJ401P TEJ801P TEJ400P TEJ800P TEJ401P(SSW) TEJ801P(SSW) TEJ400P(SSW) TEJ800P(SSW)	tej84	tej84.ko	
CDC	CDC-1522A/PCI CDC-2522A/PCI CDC-3522A/PCI	cdc522apci	cdc522apci.ko	

Table 3-2 Board Model and Corresponding Driver

3.2.2 Manual Configuration

Here we take the FXM-16A/PCIe and TEJ-4A/PCI boards for the example, to show you how to configure systems. Please read the section applicable to your driver environment. To use the CDC series boards, there is no need for extra configuration but to load the module.

3.2.2.1 Configure Zaptel

Step1: Follow the table below to modify the configuration file.

Board Config Model File	TEJ-4A/PCI		FXM-16A/PCIe (top 4 slots: trunk; bottom 4 slots: station)
/etc/	E1 Mode	T1/J1 Mode	

zaptel.conf	ISDN	SS1	ISDN	SS1	
	loadzone=us defaultzone=us				
	span=1,1,0,ccs,hdb3 bchan=1-15 dchan=16 bchan=17-31 span=2,1,0,ccs,hdb3 bchan=32-46 dchan=47 bchan=48-62 span=3,1,0,ccs,hdb3 bchan=63-77 dchan=78 bchan=79-93 span=4,1,0,ccs,hdb3 bchan=94-108 dchan=109 bchan=110-124 Note: For the configuration to support channel bank, span=1,0,0,cas,hdb3 fxols=1-15,17-31	span=1,1,0,cas,hdb3 cas=1-15,17-31:1111 span=2,1,0,cas,hdb3 cas=32-46,48-62:1111 span=3,1,0,cas,hdb3 cas=63-77,79-93:1111 span=4,1,0,cas,hdb3 cas=94-108,110-124:1111	span=1,1,0,esf,b8zs bchan=1-23 dchan=24 span=2,1,0,esf,b8zs bchan=25-47 dchan=48 span=3,1,0,esf,b8zs bchan=49-71 dchan=72 span=4,1,0,esf,b8zs bchan=73-95 dchan=96	span=1,1,0,esf,b8zs e&m=1-23 span=2,1,0,esf,b8zs e&m=25-47 span=3,1,0,esf,b8zs e&m=49-71 span=4,1,0,esf,b8zs e&m=73-95	#fxo module fxsks=1 fxsks=2 fxsks=3 fxsks=4 fxsks=5 fxsks=6 fxsks=7 fxsks=8 #fxs module fxoks=9 fxoks=10 fxoks=11 fxoks=12 fxoks=13 fxoks=14 fxoks=15 fxoks=16

Table 3-3 Zaptel Configuration

Step2: Apply the configuration result.

```
#ztcfg -vv
```

Note: If a device has multiple AST boards on it, the on-board channels are numbered according to the order in which the board drivers are loaded; if the AST boards are of the same model, the channels are numbered by the distance from near to far between the on-board PCI/PCIe slots and the CPU. You are allowed to get the information about span number by executing the command '#cat /proc/zaptel/[span number to be checked]'.

3.2.2.2 Configure Dahdi

Step1: Follow the table below to modify the configuration file.

Board Model Config File	TEJ-4A/PCI				FXM-16A/PCIe (top 4 slots: trunk; bottom 4 slots: station)	BRI1611 (one NT Module & one TE module)
	E1 Mode		T1/J1 Mode			
/etc/ dahdi/ system.conf	ISDN/SS7	SS1	ISDN/SS7	SS1		
	loadzone=us defaultzone=us					
	span=1,1,0,ccs,hdb3 bchan=1-15	span=1,1,0,cas,hdb3 cas=1-15,17-31:1111	span=1,1,0,esf,b8zs bchan=1-23	span=1,1,0,esf,b8zs e&m=1-23	#fxo module fxsks=1	span=1,1,0,ccs,ami bchan=1-2

dchan=16	span=2,1,0,cas,hdb3	dchan=24	span=2,1,0,esf,b8zs	fxsks=2	hardhdlc=3
bchan=17-31	cas=32-46,48-62:1111	span=2,1,0,esf,b8zs	e&m=25-47	fxsks=3	echocanceller=mg2,1-2
span=2,1,0,ccs,hdb3	span=3,1,0,cas,hdb3	bchan=25-47	span=3,1,0,esf,b8zs	fxsks=4	span=2,2,0,ccs,ami
bchan=32-46	cas=63-77,79-93:1111	dchan=48	e&m=49-71	fxsks=5	bchan=4-5
dchan=47	span=4,1,0,cas,hdb3	span=3,1,0,esf,b8zs	span=4,1,0,esf,b8zs	fxsks=6	hardhdlc=6
bchan=48-62	cas=94-108,110-124:1111	bchan=49-71	e&m=73-95	fxsks=7	echocanceller=mg2,4-5
span=3,1,0,ccs,hdb3		dchan=72		fxsks=8	span=3,3,0,ccs,ami
bchan=63-77		span=4,1,0,esf,b8zs		#fxs module	bchan=7-8
dchan=78		bchan=73-95		fxoks=9	hardhdlc=9
bchan=79-93		dchan=96		fxoks=10	echocanceller=mg2,7-8
span=4,1,0,ccs,hdb3				fxoks=11	span=4,4,0,ccs,ami
bchan=94-108				fxoks=12	bchan=10-11
dchan=109				fxoks=13	hardhdlc=12
bchan=110-124				fxoks=14	echocanceller=mg2,10-11
Note: For the configuration to support channel bank, span=1,0,0,cas,hdb3 fxols=1-15,17-31				fxoks=15	
				fxoks=16	

Table 3-4 Dahdi Configuration

Step2: Apply the configuration result.

```
#dahdi_cfg -vv
```

Note: If a device has multiple AST boards on it, the on-board channels are numbered according to the order in which the board drivers are loaded; if the AST boards are of the same model, the channels are numbered by the distance from near to far between the on-board PCI/PCle slots and the CPU. You are allowed to get the information about span number by executing the command '#cat /proc/dahdi/[span number to be checked]'.

3.3 Driver Uninstallation

Close the Asterisk service and then go into the driver installation package to execute the following command.

```
/Setup remove
```


Chapter 4 Driver Debugging

Command 'ts_monitor' for Recording on TS0 & TS16

This command facilitates the driver debugging. After the automatic installation of the driver, you can enter the command 'ts_monitor' with the corresponding parameters to record or transcode the data over TS0 and TS16 of digital boards.

Below are the corresponding parameters:

ts_monitor <TS num> <t or r> <filename>

span num: The span number of the board to be recorded, which is numbered from 1 and can be obtained by dahdi_tool. The span numbers of different types of boards¹, however, do not accumulate. If there are several types of boards using the same span number in the driver, you are required to select the board type in later options (See below for detailed information).

TS num: Timeslot number, 0 or 16. Note that not from all types of boards can you get the data on TS0 (The driver of the first-generation digital boards TEJxA series cannot get the data on TS0 due to hardware limitations). If you are not sure whether the board can obtain the data on TS0 or not, choose TS0 first and let the program to check automatically. It will output a corresponding prompt if it fails to get the data on TS0.

t or r: Data direction, t indicates Asterisk's sending out data via board; r indicates Asterisk's receiving data via board. To TS0, this command is only effective for data receiving.

filename: The name of the file storing the obtained data. Enter a legal file name (The application will automatically add the extension '.pcap' to the file) and save the file under the current directory.

After inputting the command 'ts_monitor' and the corresponding parameters, press the enter key and you will see a list of loaded boards as the example here below (provided all types of boards have been loaded). Choose the board type according to your requirements.

- 1: TEJxA //First-generation digital boards, i.e. TEJ1A, TEJ2A and TEJ4A series boards.
- 2: TEJ10x, TEJ20x //Second-generation digital boards with 1 or 2 E1.
- 3: TEJ40x, TEJ80x //Second-generation digital boards with 4 or 8 E1.

Once the board type is selected, the recording will start immediately (This option will not appear if only one type of boards are loaded). During the recording, the application will dynamically show the size of the recorded file. If the file size is always 0 or null, it is probably due to a wrong span number or the driver failure.

By default, the command 'ts_monitor' is automatically compiled by the script and is added to the

¹ Different types of boards mean the boards using different drivers. There are three drivers for the Synway TEJ series boards:

tejxapci.ko for TEJxA series (including TEJ1A, TEJ2A and TEJ4A);

tej21.ko for TEJ10X and TEJ20X series (1 or 2 E1 TEJ boards with PCI or PCIe interface);

tej84.ko for TEJ40X and TEJ80X series (4 or 8 E1 TEJ boards with PCI or PCIe interface).

directory '/sbin/' as part of the system commands. If you want to compile it manually, execute the gcc command as described below.

gcc ts_monitor.c -o ts_monitor

It is expected that the file ts_monitor.c is under the current directory when you use the gcc command for compiling. If ts_monitor.c does not exist under the current directory, you need to designate its path or copy it to the current directory. This file is under both dahdi and zaptel directories in the driver package, i.e. the directories where the 'Setup' command lies. You can copy the compiled file to the directory '/sbin/' as part of the system commands, or use the command './ts_monitor' with the corresponding parameters to execute the command 'ts_monitor' under the current directory.

Note:

1. If you forget what the parameters are, you can just input the command 'ts_monitor' and press the enter key. Then follow the instructions.
2. At present the command 'ts_monitor' only supports the recording of ISDN signaling.

Chapter 5 All Manuals for You

Except this manual, we provide all the documents shown below in Table 5-1 which involve the installation, configuration and test of several IP PBX platforms the Synway AST series boards support. Please choose what you need for your actual performance. All manuals we provide are put under the directory '/doc/Software' in the installation package. See Table 5-1 for details.

IP PBX	Applicable Manual	Remark
Asterisk	Platform(Asterisk)_InstManual.pdf	Applicable to installing any version of Asterisk with the Synway AST series boards.
	FXM3201P based Asterisk System Installation and Setup Manual.pdf	Specific to installing the Asterisk-1.6.0.10 system with the Synway FXM3201P board.
Trixbox	Platform(Trixbox)_InstManual.pdf	Applicable to installing any version of Trixbox with the Synway AST series boards.
	Trixbox 2.8.0.3 Installation Manual.pdf	Specific to installing Trixbox 2.8.0.3 system with the Synway TEJ-1A/PCI and FXM3201P boards.
Elastix	Elastix 1.5.2 Installation Manual.pdf	Specific to installing the Elastix 1.5.2 system with the Synway TEJ-1A/PCI and FXM3201P boards.
FreeSwitch	Platform(FreeSwitch)_InstManual.pdf	Applicable to installing any version of FreeSwitch with the Synway AST series boards.
	FXM3201P based FreeSWITCH System Installation and Setup Manual.pdf	Specific to installing the FreeSWITCH-1.0.4 system with the Synway FXM3201P board.
Yate	Platform(Yate)_InstManual.pdf	Applicable to installing any version of Yate with the Synway AST series boards.
CallWeaver	Platform(CallWeaver)_InstManual.pdf	Applicable to installing

		any version of CallWeaver with the Synway AST series boards.
AsteriskNOW	Platform(AsteriskNow)_InstManual.pdf	Applicable to installing any version of AsteriskNow with the Synway AST series boards.
	AsteriskNOW 1.5.0 Installation Manual.pdf	Specific to installing the AsteriskNOW 1.5.0 system with the Synway TEJ-1A/PCI and FXM3201P boards.

Table 5-1 IP PBX and Applicable Installation Manual

Note: Once you come across some problems in installing, read [Appendix A FAQ](#) in this file first.

Appendix A FAQ

Q1: Why do noises appear while using the FXM-8A/PCI or FXM-16A/PCIe board?

It may be due to the incomplete downloading of the firmware after Zaptel/Dahdi installation. Please make sure the network is well connected when you execute the command `./Setup install`.

Q2: Why do the indicators on the TEJ boards always flash with the circuitry already connected?

It may be due to the incorrect configuration of the board impedance. You can test by pulling the corresponding jumper cap out or plug it into the board.

Q3: How to determine the board arrangement when there are more than one AST board?

If zaptel is configured automatically, you may check `/etc/zaptel.conf` or `/etc/dahdi/system.conf` to see the board arrangement.

If zaptel is configured manually, you may execute the command `#cat /var/log/messages | grep "Launching card"` to check the board arrangement.

If the board arrangement is determined by their serial number, pay attention to the time when you execute the command.

Q4: How to install the SynAST driver in a dahdi version for which driver and tools are published separately?

Please download the driver and tools of dahdi separately.

1. By Script

```
#cd /opt                                # enter the directory to source codes

#tar -zxvf SynAST-1.12.0.0.tar.gz        # decompress the SynAST driver

#cd SynAST-1.12.0.0                      # enter the directory to the SynAST driver

#cd dahdi                                # enter the directory to the 'synway ast for dahdi' driver

#./Setup install                          # install the driver

Would you like to install SynAST AST package now? y    # enter 'y' to install

Please enter working dahdi directory [q](exit install) : /opt/dahdi_driver

                                                # enter the directory to dahdi_driver source codes

Please enter dahdi_tools source directory [q](exit install):

                                                # enter the directory to dahdi_tools source codes

SELECT TEJ MODE [t, e, j] :e    # select the tej mode, or the driver will be installed in e1 mode

SELECT TEJXAPCI [75, 120]ohm    # set the impedance of the TEJ pci board, 75 for coaxial
                                # cables, 120 for twisted-pair cables
```

SELECT TEJ201E [75, 120]ohm *# set the impedance of the tej201e board, 75 for coaxial cables, 120 for twisted-pair cables*

2. Manually

```
#cd /opt      # enter the directory to the package of SynAST source codes

#tar -zxvf SynAST-1.12.0.0.tar.gz      # decompress the source codes

#cp -rf /opt/SynAST-1.12.0.0/dahdi/srcs/fxm/fxm8apci /opt/dahdi_driver/drivers/dahdi
                                 # copy the fxm8apci driver to the dahdi_driver directory.

#cd /opt/dahdi/linux/drivers/dahdi/fxm8apci
                                 # enter the directory to SynAST source codes in dahdi

#make      # compile the driver

#insmod fxm8apci.ko      # load the driver

#cd /opt/dahdi_tools      # enter the directory to dahdi tools

#./configure

#make      # compile dahdi_tools

#make install      # install dahdi_tools
```

Q5: How to solve the problem that the system reports error in loading channel_unical.so when you start Asterisk after restarting ISDN in a system ever installed with SS1?

1. Enter the Asterisk directory previously installed with SS1 and execute the following command:

```
#make uninstall
```

2. Enter the Asterisk directory to be installed with ISDN and execute the following command:

```
#make install
```

Q6: How to determine the use of Zaptel or Dahdi for Asterisk?

For Asterisk-1.4.21 and versions below, use Zaptel; for Asterisk-1.4.22 and versions above, use Dahdi.

Q7: How to solve the problem that the system fails to detect the hangup at remote end as the volume of the recorded busy tone is quite low?

Modify the file main/dsp.c under the Asterisk directory, changing the previous content '#define DEFAULT_THRESHOLD 512' to '#define DEFAULT_THRESHOLD 448'. The value can be reduced again if the problem is not solved yet.

Q8: How to solve the problem that the zaptel driver fails to be installed in the system of Ubuntu 8.10, kernel 2.6.27-7-server?

Use the dahdi driver.

Q9: How to solve the problem that when using China SS1 to make a call outside, errors occur in R2 connection and consequently lead to call failure?

1. First visit the website <http://bbs.openvox.cn/viewthread.php?tid=697&extra=&page=1> to download the three patches mfc2.c, mfc2.h, unicall.h.
2. Use mfc2.c to replace astunicall-1.4.18-0.2/unicall-0.0.5pre1/libmfc2-0.0.3/mfc2.c
3. Use mfc2.h to replace astunicall-1.4.18-0.2/unicall-0.0.5pre1/libmfc2-0.0.3/mfc2.h
4. Use unicall.h to replace astunicall-1.4.18-0.2/unicall-0.0.5pre1/libunicall-0.0.3/unicall.h
5. Execute the command `mkdir /usr/include/zaptel`
6. Execute the command `cp astunicall-1.4.18-0.2/zaptel-1.4.9.2/kernel/zaptel.h /usr/include/zaptel`
7. Install following the file readme under astunicall-1.4.18-0.2.

Q10: How to solve the problem that the configuration files zaptel.conf and zapata.conf cannot be found under dahdi?

/etc/dahdi/system.conf under dahdi corresponds to /etc/zaptel.conf under zaptel. The configuration files system.conf and zaptel.conf, although differ in name, are the same in content.

/etc/asterisk/chan_dahdi.conf under dahdi corresponds to /etc/asterisk/zapata.conf under zaptel. The configuration files chan_dahdi.conf and zapata.conf, although differ in name, are the same in content.

Q11: How to solve the failure of FXM boards to receive the calling party number?

If you are using a version of **zaptel**, please uninstall it first. Then install a **dahdi** version and operate as follows (take the FXM-8A/PCI board for example).

Execute the command 'echo 32 > /sys/module/fxm8apci/parameters/ringdebounce'. Then test if the board can well receive the calling party number. If the reception still fails, change 32 in this command to 16 or 8 and retest.

Note: If the file /sys/module/fxm8apci/parameters/ringdebounce does not exist, modify the command to 'echo 32 >/sys/module/fxm8apci/ringdebounce'.

Q12: How to use the function of FXM series boards to adjust recording and playback volumes?

This volume adjustment function is valid to all channels on the same kind of boards. The value range of the parameter x is 1~255 which represents the DB value of $20\log(x/10)$.

To adjust the recording volume for FXM-8A-PCI, execute the command:

`echo x > /sys/module/fxm8apci/parameters/recvolume;`

To adjust the playback volume for FXM-8A-PCI, execute the command:

`echo x > /sys/module/fxm8apci/parameters/playvolume;`

To adjust the recording volume for FXM-16A-PCIe, execute the command:

```
echo x > /sys/module/fxm16apcie/parameters/recvolume;
```

To adjust the playback volume for FXM-16A-PCIe, execute the command:

```
echo x > /sys/module/fxm16apcie/parameters/playvolume
```

To adjust the recording volume for FXM-32, execute the command:

```
echo x > /sys/module/fxm32/parameters/recvolume
```

To adjust the playback volume for FXM-32, execute the command:

```
echo x > /sys/module/fxm32/parameters/playvolume
```

Q13: How to solve the problem that TEJ digital boards cannot be configured through the WEB interface while using Elastix 1.6-11?

Use the file Span.pm in the driver installation package to replace

```
/usr/lib/perl5/site_perl/5.8.8/Dahdi/Span.pm.
```

Q14: How to deal with the compile errors for dahdi-linux-complete-2.3.0+2.3.0 software package?

Compile errors may occur while compiling dahdi-linux-complete-2.3.0+2.3.0 software package in the LINUX system under PAE mode or the 64bit LINUX system. To fix these errors, delete the line XPP in the file linux/drivers/dahdi/Kbuild under the directory of dahdi-linux-complete-2.3.0+2.3.0,

Q15: When the SynAST driver is compiled under the environment of dahdi-linux-complete-2.1.0.4+2.1.0.2, why will the following prompts pop up:

```
rmdir: /usr/include/zaptel: No such file or directory
```

```
make[1]:[install-include] Error 1 (ignore)
```

Such problem comes from the file 'Makefile' of dahdi-linux-complete-2.1.0.4+2.1.0.2 itself and has nothing to do with the SynAST driver.

Q16: How to upgrade Linux kernel?

Take the upgrade to linux-2.6.35 for example.

```
#wget http://www.kernel.org/pub/linux/kernel/v2.6/linux-2.6.36.tar.bz2
```

Download the kernel source file from the Internet. Skip this step if the file already exists in your local computer.

```
#tar -xjf linux-2.6.36.tar.bz2 -C /usr/src/kernels
```

```
#cd /usr/src/kernels/linux-2.6.36
```

```
#make mrproper
```

```
#make menuconfig
```

Save the default configuration and exit.

```
# Use an edition tool (e.g. vi) to edit the config. file, adding contents or modifying it to:
```

```
#CONFIG_SYSFS_DEPRECATED_V2=y
```



```
#make -j2

#make -j2 all

# Go back to check whether 'CONFIG_SYSFS_DEPRECATED_V2=y' is still there after
# executing 'make all', as we ever came across the loss of this option.

#make -j2 modules_install

#make -j2 install

# Compile /boot/grub/menu.lst Modify: default=0

#Reboot
```

Copy the file include/generated/autoconf.h under the kernel directory to include/linux after the compilation is completed; or compiling errors may occur on dahdi.

Q17: How to deal with the compile errors during dahdi-2.4.1 installation in GoAutodial2.1 system?

Delete the line XPP from the file 'Kbuild' under the directory of dahdi-2.4.1 so as to prevent the compilation of the XPP module.

Q18: How to check if the echo cancellation feature is enabled or not after you finish loading the driver?

```
#cat /sys/module/fxm32/parameters/echokey
```

If it returns 0, echo cancellation is disabled; if it returns 1, echo cancellation is enabled.

Q19: How to adjust recording and playback volumes for a single station or analog trunk channel on FXM-32 boards?

Operate as follows:

```
echo n > /sys/module/fxm32/parameters/playvolume (playback volume)
```

```
echo n > /sys/module/fxm32/parameters/recvolume (recording volume)
```

$n = \text{Channel Number} \times 1000 + \text{Gain}$

When the channel number is 0, modify the gains of all channels simultaneously (the same as the original definition); when the channel number is equal to or greater than 1, modify the gain of Channel n only.

For example:

When $n=1007$, modify the gain of the first channel (i.e. Channel 0) to 7, not changing the gain of other channels.

When $n=3128$, modify the gain of the third channel (i.e. Channel 2) to 128, not changing the gain of other channels.

When $n=16$, modify the gains of all channels to 16.

The value range of gain is 1~255, with that of channel number is 1~max_ch. The 'max_ch' mentioned herein refers to the actual maximum number of channels.

Q20: How to confirm the CDC series boards have been able to run normally in Asterisk system?

First use the command 'lsmod' to see if the driver of the CDC series boards has been loaded, then start the Asterisk software and input 'show translations' or 'core show translations'(according to different versions of Asterisk) after '*CLI>'. If the following information appears, it indicates the CDC boards can be normally used.

```
*CLI>show translations
```

```
g729      -   3   1   1           3   3   2   5   -   -   18   3
```

Q21: How to adjust the gain increase, gain decrease and echo switch for the interface chips on FXM32 series boards?

1. Load the driver.
2. Execute the command '#cat /proc/devices' to obtain the major device number of fxm320x, e.g. the major device number is 253.
3. Create a device file.

```
#mknod /dev/fxm320x c 253 0
```

Here we assume the major device number is 253. It varies on actual conditions.

4. Operate in user applications as follows.

Define the following macros:

```
#define SYNWAY_IOC_MAGIC 'S'

#define SHFXM_MODIFY_VOICE_TX          _IOW(SYNWAY_IOC_MAGIC, 1, int)
#define SHFXM_MODIFY_IMPEDANCE        _IOW(SYNWAY_IOC_MAGIC, 2, int)
#define SHFXM_MODIFY_VOICE_RX         _IOW(SYNWAY_IOC_MAGIC, 3, int)
#define SHFXM_MODIFY_EC                IOW(SYNWAY_IOC_MAGIC, 4, int)
#define SHFXM_MODIFY_CODEEC_VOICE_TX  _IOW(SYNWAY_IOC_MAGIC, 5, int)
#define SHFXM_MODIFY_CODEEC_VOICE_RX  _IOW(SYNWAY_IOC_MAGIC, 6, int)
```

Declare the following struct:

```
Struct shfxm_cmd_ops
{
    int card;
    int channel;
```

```

        int value;

};

```

The meanings of the parameters in the above struct are:

card: The board number (count from 0);

channel: The channel number on a certain board (count from 0, with the maximum number of 31);

value: The value to be set

Note: If you want to adjust the gain increase or decrease (IOCTL is set to SHFXM_MODIFY_CODEC_VOICE_TX, SHFXM_MODIFY_CODEC_VOICE_RX), the value mentioned herein indicates the value of register to be set (Attention that the set values of FXS and FXO ports are quite different. As to an FXO port, the registers you need to adjust are Register 38, Register 39, Register 40 and Register 41 of the Si3050 Chip. As to an FXS port, the registers you need to adjust are Indirect Register 13 and Indirect Register 14 of the Si3215 Chip. For more information about these registers refer to the corresponding 'DataSheet'). If you want to adjust the impedance (IOCTL is set to SHFXM_MODIFY_IMPEDANCE), the value mentioned herein indicates the value of the register for impedance adjustment. For more information, see the corresponding 'DATASHEET'. If IOCTL is set to SHFXM_MODIFY_EC, value=1 means the echo cancellation switch of this channel is enabled, and value=0 means the echo cancellation switch of this channel is disabled.

The adjustment range and corresponding values for FXS ports are as follows:

Outgoing: The adjustment range is [0x0, 0x7FF].

If it is set to 0x0, the corresponding value will be $-\infty$.

If it is set to 0x400, the corresponding value will be 0.

If it is set to 0x7FF, the corresponding value will be 6dB.

Incoming: The adjustment range is [0x0, 0x7FF].

If it is set to 0x0, the corresponding value will be $-\infty$.

If it is set to 0x400, the corresponding value will be 0.

If it is set to 0x7FF, the corresponding value will be 6dB.

The adjustment range and corresponding values for FXO ports are as follows:

The setting format is 'abbacc'.

a=0 means to adjust gain increase; a=1 means to adjust gain decrease.

To adjust gain increase, the value range of 'bb' is [0, 12]; to adjust gain decrease, the value range of 'bb' is [0, 15].

To adjust gain increase, the value range of 'cc' is [0, 12]; to adjust gain decrease, the value range

of 'cc' is [0, 15].

Once the value of bb increases 1, the gain increases or decreases by 1dB. Therefore, by adjusting the value of bb, you can get the maximum gain increase of 12dB or gain decrease of 15dB.

Once the value of cc increases 1, the gain increases or decreases by 0.1dB. Therefore, by adjusting the value of cc, you can get the maximum gain increase of 1.2dB or gain decrease of 1.5dB.

Q22: How to adjust the gain increase, gain decrease, echo switch and loopback switch on TEJ201P and TEJ101P series boards?

1. Load the driver.
2. Execute the command '#cat /proc/devices' to obtain the major device number of tej201p, e.g. the major device number is 253.

3. Create a device file.

```
#mknod /dev/tej201 c 253 0
```

Here we assume the major device number is 253. It varies on actual conditions.

4. Operate in user applications as follows:

Declare the following struct:

```
struct bshtej_cmd_ops {  
    unsigned char card;  
    unsigned char channel;  
    unsigned char value;  
};
```

The meanings of the parameters in the above struct are:

card: The board number (count from 0);

channel: The channel number on a certain board (count from 1, with Timeslot 1 and Timeslot 16 unavailable for settings);

value: The value to be set.

Note: If you want to adjust the gain (IOCTL is set to BSHTej_MODIFY_VOICE_TX, BSHTej_MODIFY_VOICE_RX), the value mentioned herein indicates the gain value to be set. If IOCTL is set to BSHTej_MODIFY_EC, value=1 means the echo cancellation switch of this channel is enabled, and value=0 means the echo cancellation switch of this channel is disabled. If IOCTL is set to BSHTej_REMOTE_LOOPBACK, value=1 means the remote loopback feature is enabled, and value=0 means the remote loopback feature is disabled.

```
#define SYNWAY_TEJ_IOC_MAGIC 'S'

#define BSHTej_MODIFY_VOICE_TX      _IOW(SYNWAY_TEJ_IOC_MAGIC,5,unsigned long)
#define BSHTej_MODIFY_VOICE_RX      _IOW(SYNWAY_TEJ_IOC_MAGIC,6,unsigned long)
#define BSHTej_MODIFY_EC            _IOW(SYNWAY_TEJ_IOC_MAGIC,7,unsigned long)
#define BSHTej_REMOTE_LOOPBACK      _IOW(SYNWAY_TEJ_IOC_MAGIC,8,unsigned long)

#define DEV_BSHTej201 "/dev/tej201"
```

Then, use a system call ('open') to open the device file, and use another system call ('ioctl') to adjust some parameters in the driver. The meanings of the parameters in `ioctl(fd,cmd,arg)` are as follows.

fd: The return value of 'open'.

cmd: BSHTej_MODIFY_VOICE_RX,TX, to adjust volume; or

BSHTej_MODIFY_EC, to enable or disable the echo cancellation; or

BSHTej_REMOTE_LOOPBACK, to open the remote loopback feature.

arg: The pointer which points to the struct `bshtej_cmd_ops`

Q23: How to adjust the value of 'Loop Current' for FXS modules on FXM32 series boards?

`#insmod fxm32.ko loopcurrent=val` (The unit is mA and the value range of val is 20~41. Once the value is out of this range, it will be reset to the default value of 20mA.)

Q24: How to enable the residual echo cancellation?

`#insmod fxm32.ko offline = val` (val=1 indicates the feature is enabled; val=0 indicates the feature is disabled. The default value is 0.)

Q25: How to switch between A-law and μ -law for DSP serial ports on BRI boards?

`#insmod bri16.ko alawulaw=val` (val=1 represents A-law; val=0 represents μ -law. The default value is 1.)

Appendix B Technical/Sales Support

Thank you for choosing Synway. Please contact us should you have any inquiry regarding our products. We shall do our best to help you. However, our technicians and salesmen are mainly responsible for maintaining our boards and providing relative technical support. If there are problems about Asterisk, please keep touch with Digium Inc. for help.

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