(330h I/O I) O I I BIOS 0 h 5/ 2 B (DMA) O RAM D (hidden O synchronous) 1542 DMA (2 i /) I/O 4 3 d B O Media Vision O I o Symphony A i s I 4 5 2r h 5 r D 1 h d O 3 4 M 5 A O R I c 32r i (brain dameged) d B y O A b i h / M2r i B O I 4 MO A4/ . M b

5.19 SoundBlaster Pro 1 FM s 5 9 d B

SB Pro O OPL-3 FM A r F BP F SB Pro 1 P g s O OPL-2 A r F 5 s I I i P O OPL-3 r A(Ds F 5 s I I i P 2.5 3 LdB O 2rh g

5.20 GUS-MAX 5 F

GUS-MAX O 40A4 O 5 F s I 5 G O 5 s I I i P G b F0n 5 s I I i P O - 5 d 16 bit 5 s s 0 h GUS-MAX G / DE2 5 5 G O s G i MS-DOS G F r V F I r c i F i Linux r) A e 2 P (ctrl-alt-del U G) F0/ G g GUS-MAX(GUS + 16 S I + I A g) 5 G O 6a - Mh + M I i P F 5 5 l G g

5.21 d F 5 s 5 5 l F s

F 5 5 l F G 5 5 l F 9 - 9 (c (P Logitech SoundMan 16 O ProAudioSpectrum 16 4 G) A LdO NetNews O Linux activists N SOUND A c s M N G g

b v N + I 5 5 l F + l g :

-
-
- Hannu Savolainen 5 H F / l h 4

H

Hacker's Guide to Voxware *H k a s H*

5.22 5 s s 0 r 2 F F1 9 2 GG

B 0MH 9 s 5 s G 2 GG9 l G- M 0l ProAudioSpectrum16 G h / O *Hacker's Guide to Voxware* "bidirectional mode" (AP b I) r 2 H F / 5

) Gravis UltraSound 5 G G
5 G r G CPU o G
s CPU r s v r l C G
Sox r C 5 s U U) C r U r U
1 o l C5 l P C . G G
5 s i P l . t 1i x s

5.18 PAS16 ADAPTEC 1542 SCSI

(2 seeker@indirect.com i s i)

Linux G 1542 l 330(G U)) 333 G 1 5 l s 0l PAS G MPU-401 (l s 5 G 330 l G (s G i U M 1542 G U) 330 l G o l i o 1542 l r 333 l P s l 1 1542 PAS-16 16-bit DMA r G 16-bit 44KHz G l 2 U r 1542 K 3 SCSI I G K H H 5 K H i K I o l 3 H K DMA RAM r U l C a MM5 H l a “PARITY ERROR - SYSTEM HALTED” H I (i a C r 3 H K QIC-117 I i r n C D s I -Q i H ” OC© K R I 1542 IaDL b P on/off 4 r D a K H K / o (” 3 l i Y s O 5 i K D on/off 4 r d) 7 G ” H i I i P r AH 3 H ” 5 i K (i 5/ d / Adaptec BBS Internet I 3 i SCSISEL.EXE H 0 i r 7 ” LdB L5/ G BUS ON K C 4 r C / ” OFF K CF 4 r D / 7 F 7 l i ” G0N a 5 i K b 0l L“ DxEY N X a SCSISEL O EEPROM N D r Q N G ” DOS N config.sys G D DOS MQ I i P X N Q C A b 3NB G ” (DOS N Q C A H O 0)DOS r 7PM3 K D “ Linux r N)A e 2 F b H (O G 3 l G FsD a N LdB b 2r7 7 7

5 F ” b 0l D LdB D CF E Symphony N A C C H O 7 E I I/O 5 / N s 0 r CY F ” P X N ” / B.EY B./ 7 F d n 7 B G O ” PAS-16 0 30K O I/O 5 / CY LdB r I O ” s G 7 Media Vision N BBS K O SYMPFIX.EXE H ” Symphony N P 3 s H m i N G CG S C H r CF ” 2 H Ev7 h H m0 i EP O 5 l F ” O I ” E O ” s 2DG- H 7 F 0 2 N b N ”

-
-
-

Young Microsystems G O ” H i MT 7 “ I K4X7 F 30 A0e N t NAG P A C r 7 7 b N H r 4 7 F / l N B N Y s G b ” N 6 “ I I 3 N I G ” C/ MT 7 N r L G- l P ” F1 h 5 H O 7 F / l b CN s (1 r 5) K EvN LdB O ” d N CN B *ProAudio P A* 120 b 5 s I I r 6MHz N AT P K IU1 / O G 7 g PAS16 r H h 6 N Bgt O 25-40MHz N 386/486 5 r CF ” A C 5 (5 7 / 7 5 l F l P G DdG b 12MHz N P T I H (O G

LuCm3 3 K ”Exit soapbox (stage left)”H I 8 H o l F ” 3 l O I 0UL G 7 g) B N N 7 HsF N I 8 H ” ” (F Lu7 F O s

`DSP_BUFFSIZE` `DMA P U`

`I I` `P` `S` configure r 5 5 5 5 I/O I (220h) h configure 0 O 5 r g `sound_config.h U` `F`

`s I I i` `P` `o` `h` `make config` `F` `F` ”Sound card support?” d ”no” (

5.15 5 5

5 Linux O” s s CPU r C Unix OS 5 ? a ” O ”VoxWare” L 0 P e (i 5 / 2 O”

- MIDI U s W a s
-
- (Hacker’s Guide)
-
-

5.16 5 ioctls() s)

l i *Hacker’s Guid to VoxWare H a G i H G G G G HG* draft 2 G” `nic.funet.fi` `/pub/OS/linux/ALPHA/sound` `l / H O` ”hidden” C ” G / H H i O (s G ” G / H ”cd” G 0 0 ” FTP ”dir” s I r H (P ” U k ” k H o

5.17 l l i CPU o 7)

5 6 i s C1 (i l s c (P

- PCM 5 s W s 0 r H FM s 5 r H
-
-
-
- I/O T I ” CPU GHt” c C e g 5 ” I I

5 F ” 8 bit 5 s I I r H i ” I s 386 s G b 5 s W s 0 U k d FM g . 2 r 3 F 8 G k h G 0 ” MOD U k F 8 O h CPU G O r I MW n F ? H 3 G O” 44kHz GHt G F 8 k ? a O” 486/50 5 4 3d T I I MW” 386/25 5 G O 22 kHz 0 e GHt G O H s I F 8 G s G ? (5 s I V i ? h 8 bit 5 s I

5.13 5

1.0c 0 0 1.0c 0 0 2.0 0 5 1 0 5

2.0 0 5 (1994 9 9)

0 Linux 5 9 9 9 2.9 0 0 0 9 2.99.XX 9 404 9 9 5 i L linux activists SOUND c s 2 2 5

5.14 5 4

5 configure i i r local.h n . local.h 1 (O D 5 5 l) s L N 0UL O 0 2 N DL 9 :

```
Symbol
======                  =======
KERNEL_SOUNDCARD                  i    N    /
CONFIGURE_SOUNDCARD           I I i    N    /I
EXCLUDE_PAS             ProAudioSpectrum N
EXCLUDE_SB              SoundBlaster N
EXCLUDE_ADLIB           AdLib N
EXCLUDE_GUS             Gravis UltraSound N
EXCLUDE_MPU401          MPU-401 MIDI   s    U      N   M
EXCLUDE_SBPRO           SoundBlaster Pro N   M
EXCLUDE_SB16            SoundBlaster 16 N   M
EXCLUDE_AUDIO           G            N   M
EXCLUDE_MIDI            MIDI   s    U      N   M
EXCLUDE_YM3812          FM   s      6   (YM3812/OPL-3) N   M
EXCLUDE_SEQUENCER       MIDI     1 s    N   MQ
EXCLUDE_PRO_MIDI        SoundBlaster Pro MIDI N   MQ
EXCLUDE_CHIP_MIDI         s   A C   MIDI N H MQ
SBC_IRQ                 SoundBlaster   H   IRQ H f
SBC_DMA                 SoundBlaster   H   DMA A c M
SB16_DMA                SoundBlaster 16   H   DMA A c M
SB16_MIDI_BASE          SoundBlaster 16 MIDI N  I/O Y      I l
PAS_IRQ                 ProAudioSpectrum   H   IRQ H f
PAS_DMA                 ProAudioSpectrum   H   DMA A c M
GUS_IRQ                 Gravis UltraSound   H   IRQ H f
GUS_DMA                 Gravis UltraSound   H   DMA A c M
GUS_BASE                Gravis UltraSound N  I/O Y      I l
MPU_IRQ                 MPU-401   H   IRQ H f
MPU_BASE                MPU-401   H   I/O Y      I l
```

5.6 Error: `No such device` for sound devices

5 s i r r I/O I 9 9 / 5 I I O I 9 / 5

5.7 Error: `No space left on device` for sound devices

r :ni : /dev/audio d /dev/dsp i O 5/ 9 O 5 s I 9 O . e i 9 / e I 9 I e a s 9 . O I s . 9 a 9 / v i

5.8 E 7 : 8 5

u 7 : 8 5 7 "missing IRQ" d "DMA timeout" i a 9 " IRQ d DMA A M D g M D 5 s I I s Q D 9g " " i I g

5.9 MOD : 8

MOD O CPU Q o I M 9 / m 9 9 . " " 9 O C / C s D O :

-
-
-
- (GUS) C Q o U 5 s I I G

G 9

5.10 5 s 1 7 0 i r s 9 s i

5 s i 1.0c 0 A0 P g s G O " : O 0c " 9 `ioctl()` 1 i ((i `Readme` `soundcard.h` `ultrasound.h` r s (r s

5.11 0 0 O0 5 s 1 0 i SEGV i r 9

Oe 5 1 8 d G7

5.12 5 s i 0 d 8 O

M 0 5 s i 9 0 `Readme` , `CHANGELOG` r H

/dev/sndstat

s

/dev/audio1

2 5

/dev/dsp1

2 5

PC P 2 P :

/dev/pcaudio

/dev/audio 8

/dev/pcsp

/dev/dsp 8

/dev/pcmixer

/dev/mixer 8

5.2 5

Sun o / s o (.au) `/dev/audio` a ((P `cat sample.au > /dev/audio`) 5 s s 5 (Raw samples) `/dev/dsp` `l` `play` `m` `i` `s` `s` `t` `/` `l`

5.3 2

`/dev/audio` `/dev/dsp` `s` `s` `l` `i` `l` `l` `l` `/` `l` `vrec` `m` `i` `r` `s` `s` `t` `d` (duration) r C 85r a 5 5 r C m i l s

5.4 5

2 5 s 5 5 l Gravis UltraSound MPU-401 r SoundBlaster, SoundBlaster Pro, SoundBlaster16, ProAudioSpectrum16 0l o s , 2 G G ProAudioSpectrm16 SoundBlaster r 1 P M s (PAS16 SB (e l 5 G r M-) 1 MM 1 8 o r 1 t G- s c (P GUS + GUS 8 C A o a G LILO m r (P 5/0 s I i s +i 5 s I + I i a r O G- / O + M I ImB0 `Readme.linux` r s /

5.5 Error: `No such file or directory` for sound devices

5 s i r :n. :n. 4 r 2 5 i c f f 5 r 3 5 (/ + 8 Linux CD-ROM G O s 8nC G P U r :n. G)

```
# record 4 seconds of audio from microphone
% dd bs=8k count=4 </dev/audio >sample.au
# play back sound
% cat sample.au >/dev/audio
```

>e % % % % % l % % %s% 4 8 % < % % % % %=% % % % % b k # b % %i% %k 8 o l i % % %e%a%s% FAQ 7 F

4

The Linux Sound User's Guide *L* *G* *G* Linux 7 7 7 7 7 :

- (e.g. `Sox`)
- (e.g. `aumix` or `xmix`)
- / (e.g. `play`)
- MOD (e.g. `tracker`)
- MIDI (e.g. `mp`)

i i O F GUI n 7 F / 7 7 g (e.g. g . (speech synthesis))

5

Usenet e s G 7 7 L o A L (r

5.1 5

/dev/audio

Sun o / F 7 g s 4 G U (It s s G Sun ioctl s U O MMQ F i : u-law (s G s 7 F)

/dev/dsp

s s

/dev/mixer

/dev/sequencer

MIDI, FM, GUS , G

/dev/midi

MIDI MQ (: s I I i G O s a s l F)

N (I N N (
)

2. N I I N 3N
2 (I ((. . I
”dmesg” 3 s I U 3 2):

```
snd2 <SoundBlaster Pro 3.2> at 0x220 irq 5 drq 1
snd1 <Yamaha OPL-3 FM> at 0x388 irq 0 drq 0
```

5 s < <o 8 s 5 < 5 1 M P s
i P 0 < i < a < 8 d < s 0 a < 8 r < 1 s 5 s
i P r 8e i < 0 3 l i a < 8 r m 0 < 8 <i
< 5 s < 8 i 1 1 P 2 - 0 2 ” :

- I/O ” I s I I
- (/ ”)

3. `/dev/sndstat` /
s s /
s

```
% cat /dev/sndstat

Sound Driver:2.5 (Wed Apr 20 19:57:25 EDT 1994 root@fizzbin)
Config options: 1aa2

HW config:
Type 2: SoundBlaster at 0x220 irq 5 drq 1
Type 1: AdLib at 0x388 irq 0 drq 0

PCM devices:
0: SoundBlaster Pro 3.2

Synth devices:
0: Yamaha OPL-3

Midi devices:
0: SoundBlaster

Mixer(s) installed
```

b 7 cat 3 s I ”No such device” (i ” N s I I i
s / 3 s N) ” 2 3N g
N L I ((PCM, Synth, Midi)” s I I ,
s ”O I ” N ”N / g s I s 3N g

4. s I U N
2 s s I U ” s I P /
/ / C/ g N(P ”

```
% cat endoftheworld >/dev/dsp
% cat crash.au >/dev/audio
```

`snd-data-0.1.tar.Z` / s s

5. O 2 N ” 5 s I I / y , , C P ” N h 4 C
3 , 2 :

2. 5 I 5

3. I U N .

4. N

3.1

3 IRQ DMA A M ,etc.. N c Q D I 3N 2 N D N N , M N (N(5 M I SCSI I) IRQ DMA , 3

3.2

(0.99pl14 0 e) 5 I I M 4 l 9 M . 9 DL N C 5 M N 9 3 l `make config` k m i g k m i a m i i g k `/usr/include/sys/soundcard.h` `/usr/include/sys/ultrasound.h` / `/usr/include/linux` k k s / s / l k r / k `drivers/sound` l / k `Readme` s l k i a r g `CHANGELOG` k O A N g s i N E H G H a

3.3 .

. 1

`/usr/src/linux/drivers/sound` N G l / H k `Readme.linux` (`Readme`) N e IU C 9 root N 9 9 3 9 L C Readme.linux i I, M It , r (I r C , L A0 9 (3 3 make-sound.sh 9) k C `sh < make-sound.sh` H k `chmod +x make-sound.sh` H N k r < G `make-sound.sh` r < l s N G k n . G - i + a s i N G k l l i + N G + CNl s Nc `/dev/audio` O a c < H f 14 9 4 C k I, M, 9 0c C i k 5 o C i e 5-N 9 r A i 4 k 9 U k r 99

Linux N 9 S e s 5 s I MQ 4 0c C 9 U k r n C N 9 `/dev/MAKEDEV` / H r H N < G + < M k N s i K m N / H O o K G N N N G l r H N l HV G g

3.4

2 4 3

1. Mk

2

2.1

2 Linux

- Roland MPU-401 MIDI interface
- AdLib
- SoundBlaster (version 1 and 2) 4 I (ThunderBoard, ATI Stereo F/X I)
- SoundBlaster Pro (version 1 and 2)
- SoundBlaster 16
- ProAudioSpectrum 16 (4 Logitech SoundMan 16)
- Advanced Gravis UltraSound (GUS)

e 2 0 0 2 I Gb F I I (o Al l G) 4 G l P (b l s

Sound Galaxy NX Pro s I I i P N `local.h` `#define __SGNXPRO__` l P SoundBlaster 4 I F MG-

Linux M G 2 o N N s I I ImB0N SCSI b F (Nc (P ProAudioSpectrum 16) Soundblaster Pro SoundBlaster 16 N CD-ROM b MxMG- (/ O `/usr/src/linux/drivers/block/README.sbpcdr` /)

2 o N N s I I ImB0N g F C/ r a N M X N C A b

2.2 PC (pcsndrv)

s 2C (s P

PC N FbB T r MxM F s I I MNI i P 4 G , 4 A A DL C A N 0- 2 s CPU r h O2 2LO l l N FbB T N FG 0MB h G h / O pcsndrv ImB0N I - e a s r 4 M/

G N P g s O 0.6 G `sunsite.unc.edu` N `pub/Linux/kernel/misc-patches/pcsndrv-0.6.tar.z` #

2.3

r s 3 D/A 4 4or n , l O h h 2 A r F , G- , d O CPU r C e - N Fb B T MN s I I i P , N r F I, M D/A 4 4or n a N p s b F

3 **Linux**

Linux G s I G r a N DO0 2 N F C

1. s I I N s

1.5

The Linux Sound User's Guide Linux 3 (L 40) Linux 0 3 L i 3 ALPHA 0.1 `tsx-11.mit.edu` `/pub/linux/ALPHA/LDP` 1 / H H The Linux Sound User's Guide 3 Sound-HOWTO O H 4 1 H User's Guide r A4 W 3 H h 3 i s s G

Hannu Savolainen *Hacker's Guide to VoxWare* *r* *G* *HG* draft 2 G `nic.funet.fi` `/pub/OS/linux/ALPHA/sound`

FAQ O 4 usenet `news.announce` 1 `rtfm.mit.edu` `/pub/usenet/news.answers` 1

`PCsoundcards/generic-faq` (PC s A HL FAQ)
`PCsoundcards/soundcard-faq` (comp.sys.ibm.pc.soundcard FAQ)
`PCsoundcards/gravis-ultrasound/faq` (Gravis UltraSound FAQ)
`audio-fmts/part1` (G U F o U) C H D F)
`audio-fmts/part2` (G U F o U) C H D F)

e - FAQ O 4 H a s 0 H d H F F 0 2 (Usenet e 0 WG O s F / O 2 3 4 O F 1 F

`alt.binaries.sounds.*` (s U r F a NG)
`alt.binaries.multimedia` (A a G U r F a N NG)
`alt.sb.programmer` (s i N m i OC)
`comp.multimedia` (A a G OC)
`comp.music` (s e e C / N O d f)
`comp.sys.ibm.pc.soundcard` (IBM PC MQ s I I OCB)

Linux Activists a s 0 H O SOUND A c a s 0 H 2 2 a O `linux-activists-request@joker.cs.hut.fi` a k F / @

Linux N 4 1 F s i P N 3 0 N `Readme`, `Readme.linux`, `CHANGELOG` O s I I i P F M-1 p s q F j 1 i O `/usr/src/linux/drivers/sound` k G g

Linux Software Map(LSM) O Linux MQ U H ' r a / 3 H N G- G G LSM r *sound* *r* *o* *w* *s* *k* *o* *W* *s* *k* *G* LSM O `sunsite.unc.edu:/pub/Linux/docs/LSM.gz` r O a F CON FTP H

1.6

5 2.5a G Linux M 1.1.10 0 e N P s 4 1 F P s 2.5 N 5 s i P r FIN) F F (N(P 0 D 1.0) M N Q A H F , MQ 3 H 2DG G

1

Linux Sound HOWTO Linux H W H L 1 2 Ld(FAQ) (T F 2

O Linux H (H©Ⓞ HL F O O 2 O 2 F

1.1

Hannu Savolainen(`hannu@voxware.pp.fi`) i `Readme` i `@` Hannu O a H Linux AH l i H F o F F n A Matt Welsh's O Linuxdoc-SGML Q 1 n F l 2 G HOWTO l L i) H H 2 G

1.2

Version 1.1

i s ;Linux activists mailing list SOUND channel G N x

Version 1.2

. s ; N g s i F O N arichive site G x

Version 1.3

SGML Q ;Matt Welsh n N Linuxdoc-SGML tools r ;H F A Q 2DG N 2L L O Q 2 H N Q O o

Version 1.4

SGML MQ H PAS16 H ADAPTEC 1542A N Hs 4 - 4 2sE r D 2C

Version 1.5

1.1.x MQ 5 s i P 2.5a P g s C W GUS-MAX D F ; N N H Q

Version 1.6

"no space on device" (i 4X p s r D 2C; "Hacker's Guide" "hidden" G l H " k H N a ; AP 4X k A LdN D 2C N D N Q

1.3 3

3 `comp.os.linux.announce` l anonymous ftp 5 H EP© 5 l k G g e E 5 H O `sunsite.unc.edu:/pub/Linux/docs/HOWTO`

1.4

3 HOWTO 4X F " DsF " 5 " Cm " a s H Ey " l P " CxT G A C F 5 N O l i r 4 F

LuCm A ms " Lu 4X F O LuT O'Mm 5

The Linux Sound HOWTO

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i FAQ F
i usenet e i i