

SONY®

OPEN-R SDK

Installation Guide



20030210-E-004

© 2003 by Sony Corporation

Notes on This Document

Notes on Using This Document

- ❑ The contents provided by this document (PDF files) are intended only for supplying information.
- ❑ The contents provided by this document (PDF files) are subject to change without notice.
- ❑ We are not responsible for errors or omissions in technical or editorial aspects concerning the contents described in this document. We also are not responsible for technical measures, correspondence, execution according to this document, as well as for the results occurred by them such as inevitable, indirect or incidental damages.

Notes on Copyright

- ❑ Sony Corporation is the copyright holder of this document.
- ❑ No information in this document may be duplicated, reproduced or modified. It is also prohibited to publish the contents of this document on the Internet Website or other public media without the express written permission of Sony Corporation.

About Trademarks

- ❑ AIBO and OPEN-R are trademarks or registered trademarks of Sony Corporation.
- ❑ "Memory Stick" is a trademark of Sony Corporation. "TM" is not described in this document.
- ❑ Windows is registered trademark of Microsoft Corporation in the United States and/or other countries.
- ❑ Mac OS is registered trademark of Apple Computer, Inc in the United States and/or other countries.
- ❑ UNIX is a registered trademark of The Open Group in the United States and/or other countries.
- ❑ Linux is a registered trademark of Linus Torvalds.
- ❑ MIPS is a registered trademark of MIPS Technologies, Inc. in the United States and/or other countries.
- ❑ Acrobat and Adobe are registered trademarks of Adobe Systems Incorporated.
- ❑ Other system names, product names, service names and firm names contained in this document are generally trademarks or registered trademarks of respective makers.

Index

Notes on This Document.....	1
Notes on Using This Document.....	1
Notes on Copyright.....	1
About Trademarks.....	1
Index	2
Chapter1 Introduction	3
1.1 Preparation.....	3
1.2 Download files.....	4
Chapter2 Installation	5
2.1 Cygwin.....	5
2.2 CygIPC.....	5
2.3 gcc.....	6
2.4 OPEN-R SDK.....	6
2.5 Sample programs	6
2.6 AIBO Built-in Flash ROM Upgrade	7
Chapter3 Building & running HelloWorld.....	8
3.1 Building	8
3.2 Running.....	9
3.2.1 Execution in a Wireless LAN environment.....	9
3.2.2 How to set up WLANCONF.TXT	10
Chapter4 Remote Processing OPEN-R	12
4.1 Building & running ObjectComm.....	12
4.1.1 Running on AIBO	12
4.1.2 Running on host	12
4.2 Building & running LMasterRSlave	13
4.2.1 Running on AIBO.	13
4.2.2 Distributed execution on AIBO and host	13
4.3 Limitations of Remote Processing OPEN-R	14
Notes on Copyright	16

Chapter1 Introduction

1.1 Preparation

The OPEN-R SDK runs on the following platforms.

- ❑ Windows 2000 professional or Windows XP

Notes

The OPEN-R SDK runs on not only Windows, but also other operating systems. The following environment is needed for using the OPEN-R SDK.

Standard UNIX commands such as sh, cp
perl
GNU make
GNU binutils, gcc and newlib (built for a MIPS cross-development environment)

These tools are compatible with normal UNIX environments. If you are using the Windows cygwin environment, you can download the binary MIPS cross-compilation tools for this environment from our web site. However, if you need to run these tools in another UNIX based environment, please refer to [Notes on 2.3 gcc]. On non-Windows/cygwin platforms, you can use a shell script that we provide to automatically build tool binaries from source code. We confirmed that this script and the OPEN-R SDK tools work on Linux.

The following hardware is necessary to perform software development with the OPEN-R SDK.

- ❑ PC
 - CPU: Pentium 233MHz or above
 - Memory: 64MB or more
 - Free space on a hard disk drive: more than 200MB
- ❑ Memory Stick reader/writer (an internal or external device)
- ❑ AIBO ERS-210, ERS-220, ERS-210A, ERS-220A (Either of these)
- ❑ Wireless LAN environment
 - PC : You can choose either (a) or (b):
 - (a) An IEEE802.11b-compliant wireless LAN card
 - (b) A wired LAN card and an IEEE802.11b-compliant access point
- AIBO : an AIBO wireless LAN card (ERA-201D1)
- ❑ AIBO Programming Memory Stick

Notes

Only AIBO Programming Memory Sticks can be used to run programs built with the OPEN-R SDK.

It is assumed that the user of the OPEN-R SDK is familiar with the following:.

- ❑ C++ Programming
- ❑ How to use GNU development tools
 - gcc/g++, ld, make, etc
- ❑ How to use Cygwin tools
 - Shells, UNIX-like commands, correspondence between UNIX-style paths and Windows-style paths, etc

Notes

It is recommended that you have a tool for reading text files with the UNIX-style newline code (^J only), because all text files in the OPEN-R SDK, including sample programs and header files, have UNIX-style newlines.

1.2 Download files

The following is the list of files for downloading

- ❑ OPEN-R SDK
 - OPEN_R_SDK-1.1.3-r2.tar.gz OPEN-R SDK
 - OPEN_R_SDK-sample-1.1.3-r4.tar.gz Sample programs
 - OPEN_R_SDK-docE-1.1.3-r4.tar.gz Manuals

- ❑ For windows platforms
 - cygwin-packages-1.3.17-bin.exe Cygwin binaries
 - mipsel-devtools-3.2.bin-r1.tar.gz MIPS cross development tools
 - cygipc-1.13-2.tar.gz cygIPC binaries

- ❑ For ERS-210 users
 - upgrade-OPEN_R-1.1.3-r2.tar.gz FlashUpdater for ERS-210

- ❑ Source files
 - cygwin-packages-1.3.17-src.tar.gz Source files of Cygwin
 - binutils-2.13.tar.gz Source files of binutils
 - gcc-3.2.tar.gz Source files of gcc
 - newlib-1.10.0.tar.gz Source files of newlib
 - cygipc-1.13-2-src.tar.gz Source files of cygIPC

- ❑ Script
 - build-devtools-3.2-r1.sh Shell script for building the
binutils, gcc, newlib
 - build-devtools-3.2-macosx-r1.sh Shell script for building tools
on Mac OS X

Notes

Each file name includes a version number. When the content of the file is changed, the version number in the file name is also changed.

Chapter2 Installation

2.1 Cygwin

If you are using a Windows environment, you should first install Cygwin. Cygwin is the UNIX environment that works on Windows. Install Cygwin with the following steps.

- 1 Double-click `cygwin-packages-1.3.17-bin.exe`.
- 2 Specify the folder to Unzip to, and click [Unzip]. This process creates the directory `cygwin-packages-1.3.17`. Execute `setup.exe` in this new directory.
- 3 The version number of `setup.exe` will be displayed. Click [Next->].
- 4 Choose [Install from Local Directory]. Click [Next->].
- 5 Specify the directory where Cygwin will be installed. You should leave this as “`C:\cygwin`”, unless you have a need to install it elsewhere. Select [Unix] for the text file type and click [Next->].
- 6 Specify the directory where `setup.exe` exists. Click [Next->].
- 7 The window for selecting packages will be displayed. Leave it as the default and click [Next->]. Then, installation starts.

Notes

This package only includes the minimum set of tools necessary for using the OPEN-R SDK. You can install additional tools by re-executing `setup.exe` and choosing [Install from Internet] at step 4. However, please note that if you choose to update existing packages, the OPEN-R SDK may not be fully compatible with these updated packages.

In the rest of this document, we will unpack packages in cygwin's path by using its `tar` command. In this explanation, whenever you see cygwin's path referred to (for example, `/usr/local`), it indicates cygwin's `/usr/local`, NOT `c:\usr\local` (from the root of your hard drive).

2.2 CygIPC

- 1 Install CygIPC with the following steps. (`/xxx` is your directory where the downloaded file is placed)

```
cd /
tar zxvf /xxx/cygipc-1.13-2.tar.gz
```

2.3 gcc

Install gcc with the following steps.

- 1 Unpack the package. (/xxx is your directory where the downloaded file is placed)

```
cd /usr/local
tar zxvf /xxx/mipsel-devtools-3.2-bin-r1.tar.gz
```

A /usr/local/OPEN_R_SDK directory is created. The following tools and libraries targeting 'mipsel-linux' are installed under the directory OPEN_R_SDK.

```
GNU binutils-2.13
GNU gcc-3.2
newlib-1.9.10
```

Notes

Linux is a target name here, but this does not mean that Linux works on an AIBO.

For non-Windows platforms, follow this procedure instead:
Place the following files into the same directory as the one that build-devtools-3.2-r1.sh is in, and execute build-devtools-3.2-r1.sh in this directory.

```
binutils-2.13.tar.gz
gcc-3.2.tar.gz
newlib-1.9.10.tar.gz
```

2.4 OPEN-R SDK

Install the OPEN-R SDK with the following steps.

- 1 Unpack the package. (/xxx is your directory where the downloaded file is placed)

```
cd /usr/local
tar zxvf /xxx/OPEN_R_SDK-1.1.3-r2.tar.gz
```

The directory /usr/local/OPEN_R_SDK/OPEN_R, RP_OPEN_R will be created.

- 2 To install Remote Processing OPEN-R, run the setup-rp-openr script.

```
/usr/local/OPEN_R_SDK/OPEN_R/bin/setup-rp-openr
```

2.5 Sample programs

Install the sample programs with the following steps.

- 1 Unpack the package. (/mydir is a given directory, and /xxx is your directory where the downloaded file is placed)

```
cd /mydir
tar zxvf /xxx/OPEN_R_SDK-sample-1.1.3-r4.tar.gz
```

The directory sample will be created and the sample programs are installed in the directory.

2.6 AIBO Built-in Flash ROM Upgrade

To run your program created with the OPEN-R SDK, it is necessary for AIBO ERS-210 to update the version of the flash ROM.

However, upgrading the flash ROM is not necessary for ERS-220, ERS-210A, and ERS-220A. In case a sticker indicating "OPEN-R Ver 1.1.2" or "OPEN-R Ver 1.1.3" is attached to the core unit, this procedure is not necessary.

Upgrade the flash ROM with the following steps.

- 1 Move to a given directory and unpack the package. (/mydir is a given directory, and /xxx is your directory where the downloaded file is placed)

```
cd /mydir
tar zxvf /xxx/upgrade-OPEN_R-1.1.3-r2.tar.gz
```

The directory upgrade will be created.

- 2 The steps of upgrading the flash ROM is described in README_E.txt under the directory upgrade.

Chapter3 Building & running HelloWorld

You should now build and run one of the included sample programs to confirm the success of the installation. “HelloWorld” consists of OPEN-R objects, which correspond to HELLO.BIN and POWERMON.BIN, and simply prints the message “HelloWorld” to the wireless console. (Note: Whenever you see the word “object” in this manual, it indicates an “OPEN-R object”.) The “HelloWorld” directory contains the following sub-directories:

- ❑ HelloWorld/HelloWorld
It contains the source code of the “HelloWorld” object.
- ❑ HelloWorld/MS
It contains files that should be placed on the AIBO Programming Memory Stick. Initially, only a file OBJECT.CFG exists later, the executable files will be copied here.

3.1 Building

Build the sample program with the following steps.

- 1 Build the executable file. (/mydir is the directory where you installed the sample programs.)

```
cd /mydir/sample/HelloWorld
make
make install
```

The executable files are created and copied to the directory MS.

Notes

- 1 If you install the OPEN-R SDK into a directory other than /usr/local/, specify the path of OPEN_R_SDK directory as follows.
(/mydir is the directory where you installed OPEN-R SDK.)

```
make OPENRSDK_ROOT=/mydir/OPEN_R_SDK
```

- 2 The file name must comply 8+3 format (xxxxxxx.xxx).
The file is also gzipped. Gzipping is not mandatory, but it saves space on your AIBO Programming Memory Stick.

3.2 Running

3.2.1 Execution in a Wireless LAN environment

Set up the wireless LAN environment with the following steps.

- 1 Copy the following two OPEN-R directories to a blank AIBO Programming Memory Stick. (/mydir is the directory where you installed the sample programs.)

```
/usr/local/OPEN_R_SDK/OPEN_R/MS/WCONSOLE/memprot/OPEN-R  
/mydir/sample/HelloWorld/MS/OPEN-R
```

- 2 Edit WLANCONF.TXT on the AIBO Programming Memory Stick and setup the wireless LAN parameters for AIBO. Refer to [3.2.2 How to set up WLANCONF.TXT] for details.
- 3 Insert an AIBO wireless LAN card and an AIBO Programming Memory Stick into AIBO. Then boot AIBO.
- 4 To connect your PC to AIBO's wireless console, start the following telnet program on your PC. The AIBO wireless console uses a TCP port number 59000 and telnet protocol. (You can alternatively use other third-party telnet programs if you prefer.)

```
> telnet (IP address of AIBO) 59000
```

If the characters [!!! Hello World!!!] are displayed after a series of system information is displayed, your AIBO is working normally in the OPEN-R SDK environment.

- 5 Press the pause button to shutdown AIBO.

Notes

There are two ways to connect your PC to AIBO: with a wireless access point, or with an additional wireless LAN adapter in ad-hoc mode. To make sure AIBO is successfully connected to your network, you can execute the following console command after booting AIBO

```
ping (IP address of AIBO)
```

3.2.2 How to set up WLANCONF.TXT

There are two wireless LAN configuration files for AIBO, WLANDFLT.TXT and WLANCONF.TXT. WLANDFLT.TXT contains the default configuration for AIBO's wireless LAN card, and should not be edited. WLANCONF.TXT is a file that contains your custom configuration. When AIBO boots, it looks for WLANCONF.TXT first and uses the information in that file if it is found. If not, it uses the information in WLANDFLT.TXT instead.

Copy WLANDFLT.TXT in /OPEN-R/SYSTEM/CONF/ of an AIBO Programming Memory Stick to WLANCONF.TXT, and edit it.

In OPEN-R SDK 1.1.3 r2, DNS server support is available. This new feature is commented out by default.

The following is the default setting of WLANCONF.TXT.

```
HOSTNAME = AIBO
ETHER_IP = 10.0.1.100
ETHER_NETMASK = 255.255.255.0
IP_GATEWAY = 10.0.1.1
ESSID = AIBONET
WEPENABLE = 1
WEPKEY = AIBO2
APMODE = 2
CHANNEL = 3
#DNS_SERVER_1=10.0.1.1
#DNS_SERVER_2=10.0.1.2
#DNS_SERVER_3=10.0.1.3
#DNS_DEFDNAME=example.net
```

Here are the descriptions of the above items.

HOSTNAME	Specifies the name of AIBO which is used in a wireless network.. Specify a maximum of 8 alphanumeric characters.
ETHER_IP	Specify an IP address which AIBO uses.
ETHER_NETMASK	Specify an IP subnet mask.
IP_GATEWAY	Specify an IP address for a gateway. In case a gateway does not exist in your network, set it to the same IP address as ETHER_IP in this case.
ESSID	Specifies the name of your wireless network. Specify a maximum of 32 alphanumeric characters.
WEPENABLE	Specify if WEP (a wireless coded system) is used or not. If you are using WEP encryption, use 1. Otherwise, use 0 (zero).
WEPKEY	Specify a WEP (a wireless coded key) key. This is just 5 alphanumeric characters. If you specified "0" for WEPENABLE, this setting is not relevant.
APMODE	Specify an AIBO wireless LAN mode. If you connect AIBO using Ad Hoc Demo Mode, use 0 (zero). If you connect AIBO with Infrastructure Mode, use 1. If you want AIBO to automatically detect the correct setting, use 2. Note: if both types of network are present, AIBO defaults to Infrastructure Mode.
CHANNEL	Specify the channel when Ad Hoc Demo Mode is used. Use 1 to 11 for this.
DNS_SERVER_1,2,3	Specify IP addresses of up to three DNS servers.
DNS_DEFDNAME	Specify default domain name.

Notes

- 1 In case you directly connect your PC with a wireless LAN card inserted to AIBO without an access point (IBSS Peer-to-peer Mode or Ad Hoc Demo Mode),

Set the values in ESSID, WEPENABLE and WEPKEY to the same ones in your PC. In case you connect with IBSS Peer-to-Peer Mode, set APMODE = 1. In case you connect with Ad Hoc Demo Mode, set APMODE = 0 and set the value in CHANNEL to the same one in your PC.

- 2 In case you connect your PC to AIBO via an access point, set each value in ESSID and WEPKEY to the same values as those in the access point. Set APMODE = 1 to work with Infrastructure Mode.

Chapter4 Remote Processing OPEN-R

Notes

For communication between AIBO and remote host through a wireless LAN, it is necessary to boot AIBO before accessing it from the remote host.

4.1 Building & running ObjectComm

4.1.1 Running on AIBO

- 1 Build the executable file. (/mydir is the directory where you installed the sample programs)

```
cd /mydir/sample/ObjectComm
make install
```

- 2 Copy these two OPEN-R directories to a blank AIBO Programming Memory Stick.

```
/usr/local/OPEN_R_SDK/OPEN_R/MS/WCONSOLE/nomemprot/OPEN-R
/mydir/sample/ObjectComm/MS/OPEN-R
```

- 3 Insert the AIBO Programming Memory Stick into AIBO, then boot it. Subsequent operations (usage of wireless console, how to shutdown AIBO, etc.) are the same as before.

4.1.2 Running on host

- 1 Run ipc-daemon.

```
/usr/local/bin/ipc-daemon
```

- 2 Build the executable file.

```
cd /mydir/sample/ObjectComm/RP/host
make install
```

- 3 Run start-rp-openr

```
/usr/local/OPEN_R_SDK/RP_OPEN_R/bin/start-rp-openr
[pid:29444,msqid:196610,oid:0x00030002] oserviceManager
[pid:29445,msqid:229379,oid:0x00038003] tcpGateway
[pid:29446,msqid:262148,oid:0x00040004]
MS/OPEN-R/MW/OBJS/SUBJECT.BIN
[pid:29447,msqid:294917,oid:0x00048005]
MS/OPEN-R/MW/OBJS/OBSERVER.BIN
SampleSubject::Ready() : ASSERT READY
SampleObserver::Notify() !!! Hello world !!!
SampleSubject::Ready() : ASSERT READY
SampleObserver::Notify() !!! Hello world again !!!
```

```
SampleSubject::Ready() : ASSERT READY
```

- 4 Type ctrl-c to terminate the program.

4.2 Building & running LMasterRSlave

4.2.1 Running on AIBO.

- 1 Build the executable file.

```
cd /mydir/sample/LMasterRSlave
make install
```

- 2 Copy the following two OPEN-R directories to a blank AIBO Programming Memory Stick.

```
/usr/local/OPEN_R_SDK/OPEN_R/MS/WCONSOLE/nomemprot/OPEN-R
/mydir/sample/LMasterRSlave/MS/OPEN-R
```

- 3 Insert the AIBO Programming Memory Stick into AIBO. Then boot AIBO. Subsequent operations (usage of wireless console, how to shutdown AIBO, etc.) are the same as before.

4.2.2 Distributed execution on AIBO and host

- 0 Run ipc-daemon (for Cygwin only)

```
/usr/local/bin/ipc-daemon
```

Procedures for AIBO

- 1 Build the executable file.

```
cd /mydir/sample/LMasterRSlave/RP/robot
make install
```

- 2 Copy the following OPEN-R directories to a blank AIBO Programming Memory Stick.

```
/usr/local/OPEN_R_SDK/OPEN_R/MS/WCONSOLE/nomemprot/OPEN-R
```

- 3 Edit the following file according to your wireless setup.

```
/OPEN-R/SYSTEM/CONF/WLANCONF.TXT
```

- 4 Insert the AIBO Programming Memory Stick into AIBO, then boot it. Subsequent operations (usage of wireless console, how to shutdown AIBO, etc.) are the same as before.

Procedures for host

1 Build the executable file.

```
cd /mydir/sample/LMasterRSlave/RP/host
make install
```

2 Edit the following file.

```
MS/OPEN-R/MW/CONF/HOSTGW.CFG
```

Change 10.0.1.100 to the IP address of your AIBO.

```
!ROBOT_PROXY 59001 10.0.1.100
TCPGateway.Sensor.OSensorFrameVectorData.S 59001 10.0.1.100
TCPGateway.Effector.OCommandVectorData.O 59003 10.0.1.100
```

3 Run start-rp-openr

```
/usr/local/OPEN_R_SDK/RP_OPEN_R/bin/start-rp-openr
```

4 Type ctrl-c to terminate the program.

Notes

SystemV IPC resources may sometimes remain unreleased after termination of the program. You can examine information about the SystemV IPC resources by using the `ipcs` command. Run the `rp-openr-ipcrm` script to release any remaining SystemV IPC resources.

```
/usr/local/OPEN_R_SDK/RP_OPEN_R/bin/rp-openr-ipcrm
```

4.3 Limitations of Remote Processing OPEN-R

- ❑ The configuration of the system objects on AIBO is limited to 'nomemprot' when executing a program distributed between AIBO and a remote host. Therefore, please use the following directory as the OPEN-R directory to be copied to an AIBO Programming Memory Stick.

```
/usr/local/OPEN_R_SDK/OPEN_R/MS/WCONSOLE/nomemprot/OPEN-R
```

- ❑ Description using [RobotDesign] as shown below is not supported in OBJECT.CFG and CONNECT.CFG on the host.

```
#
# OBJECT.CFG
#
[ERS-210]
/MS/OPEN-R/MW/OBJS/ERS-210.BIN
```

[ERS-220]

/MS/OPEN-R/MW/OBJS/ERS-220.BIN

❑ Unavailable OPEN-R API for a host program

```
OPENR::ControlPrimitive()  
OPENR::NewSoundVectorData()  
OPENR::DeleteSoundVectorData()  
OPENR::NewCdtVectorData()  
OPENR::DeleteCdtVectorData()  
OPENR::SetCdtVectorData()  
OPENR::Shutdown()  
OPENR::ObservePowerStatus()  
OPENR::UnobservePowerStatus()  
OPENR::FindDesignData()  
OPENR::DeleteDesignData()  
OPENR::Fatal()
```

❑ ANT (Aperios Network Toolkit) class library is not available for a host program.

Notes on Copyright

□ Copyrights of newlib

The OPEN-R SDK uses newlib-1.9.0. It is a collection of software from several sources. Each has own copyrights:

(1) University of California, Berkeley

Copyright (c) 1990 The Regents of the University of California.
All rights reserved.

Redistribution and use in source and binary forms are permitted provided that the above copyright notice and this paragraph are duplicated in all such forms and that any documentation, advertising materials, and other materials related to such distribution and use acknowledge that the software was developed by the University of California, Berkeley. The name of the University may not be used to endorse or promote products derived from this software without specific prior written permission.

THIS SOFTWARE IS PROVIDED ``AS IS" AND WITHOUT ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, WITHOUT LIMITATION, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

(2) DJ Delorie

Copyright (C) 1991 DJ Delorie, 24 Kirsten Ave, Rochester NH 03867-2954

This file is distributed under the terms listed in the document "copying.dj", available from DJ Delorie at the address above.
A copy of "copying.dj" should accompany this file; if not, a copy should be available from where this file was obtained. This file may not be distributed without a verbatim copy of "copying.dj".

This file is distributed WITHOUT ANY WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.

(3) David M. Gay at AT&T

The author of this software is David M. Gay.
Copyright (c) 1991 by AT&T.

Permission to use, copy, modify, and distribute this software for any purpose without fee is hereby granted, provided that this entire notice is included in all copies of any software which is or includes a copy or modification of this software and in all copies of the supporting documentation for such software.

THIS SOFTWARE IS BEING PROVIDED "AS IS", WITHOUT ANY EXPRESS OR IMPLIED WARRANTY. IN PARTICULAR, NEITHER THE AUTHOR NOR AT&T MAKES ANY REPRESENTATION OR WARRANTY OF ANY KIND CONCERNING THE MERCHANTABILITY OF THIS SOFTWARE OR ITS FITNESS FOR ANY PARTICULAR PURPOSE.

(4) Advanced Micro Devices

Copyright 1989, 1990 Advanced Micro Devices, Inc.

This software is the property of Advanced Micro Devices, Inc (AMD) which specifically grants the user the right to modify, use and distribute this software

provided this notice is not removed or altered. All other rights are reserved by AMD.

AMD MAKES NO WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, WITH REGARD TO THIS SOFTWARE. IN NO EVENT SHALL AMD BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES IN CONNECTION WITH OR ARISING FROM THE FURNISHING, PERFORMANCE, OR USE OF THIS SOFTWARE.

So that all may benefit from your experience, please report any problems or suggestions about this software to the 29K Technical Support Center at 800-29-29-AMD (800-292-9263) in the USA, or 0800-89-1131 in the UK, or 0031-11-1129 in Japan, toll free. The direct dial number is 512-462-4118.

Advanced Micro Devices, Inc.
29K Support Products
Mail Stop 573
5900 E. Ben White Blvd.
Austin, TX 78741
800-292-9263

(5) C.W. Sandmann

Copyright (C) 1993 C.W. Sandmann
This file may be freely distributed as long as the author's name remains.

(6) Eric Backus

(C) Copyright 1992 Eric Backus

This software may be used freely so long as this copyright notice is left intact. There is no warrantee on this software.

(7) Sun Microsystems

Copyright (C) 1993 by Sun Microsystems, Inc. All rights reserved.

Developed at SunPro, a Sun Microsystems, Inc. business. Permission to use, copy, modify, and distribute this software is freely granted, provided that this notice is preserved.

(8) Hewlett Packard

(c) Copyright 1986 HEWLETT-PACKARD COMPANY

To anyone who acknowledges that this file is provided "AS IS" without any express or implied warranty:

permission to use, copy, modify, and distribute this file for any purpose is hereby granted without fee, provided that the above copyright notice and this notice appears in all copies, and that the name of Hewlett-Packard Company not be used in advertising or publicity pertaining to distribution of the software without specific, written prior permission. Hewlett-Packard Company makes no representations about the suitability of this software for any purpose.

(9) Cygnus Solutions

Copyright (c) 1994, 1997 Cygnus Solutions.
All rights reserved.

Redistribution and use in source and binary forms are permitted provided that the above copyright notice and this paragraph are duplicated in all such forms

and that any documentation, advertising materials, and other materials related to such distribution and use acknowledge that the software was developed at Cygnus Solutions. Cygnus Solutions may not be used to endorse or promote products derived from this software without specific prior written permission.

THIS SOFTWARE IS PROVIDED ``AS IS" AND WITHOUT ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, WITHOUT LIMITATION, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.