Eddy™ means real-time

Eddy DK

Programmer Guide

Ver 2.20
2008. 06. 27

Serial Communication Experts
SystemBase
Since 1987

Revision History

Revision Date	Document Version	Pages	Description
Nov ,6 , 2007	2.0a	All	Initial release by shlee
Mar,19 , 2008	2.0b	9-4	Typo corrections by shlee
Apr, 02, 2008	2.0c	All	LemonIDE Windows by shlee
May, 23, 2008	2.1a	All	Added 8M Flash version by shlee
June, 27, 2008	2.20	All	Added SNMP V1/V2/V3

Table of Contents

Chpater1. Introduction

This chapter briefly explains about this manual and introduces the related documents and support.

1.1 About this document

This manual explains about how a programmer can develop a customized application for Eddy module and how this application can be uploaded and executed on the module. To help programmers with this work, information on Eddy's operating system and API functions for convenient source writing is supplied.

After reading this document, a programmer can write his or her own application and execute it on the module.

1.2 Who should read this document?

This document is designed for programmers who wish to develop a new application using Eddy-DK. It is strongly recommended that the programmer read this document before starting any programming work. If you are an administrator or an end user who just needs to apply the module into practical applications, you do not need to read this document. User's Guide will be helpful in that case. This manual deals with the complete process of writing source codes and making a firmware that can be uploaded and executed on Eddy module.

1.3 Document organization

Chapter 1. Introduction is a preface with general information and introductory notices.

Chapter 2. Getting Started gives brief information needed before starting programming work.

Chapter 3. Writing Application explains about the process of writing a customized application and related work..

Chapter 4. Compiling Application deals with the process of compiling your application with Makefile.

Chapter 5. Creating Firmware helps you converting a compiled application into a firmware that can be accepted by Eddy module.

Chapter 6. Library explains about the library and API functions you can use while programming and application.

Chapter 7. Eddy Software shows how to implement simple TCP/IP and serial routines using example source codes that are included in the development kit.

Chapter 8. Handling HTML & CGI provides a guide for integrating your own applications with Eddy's web interface.

Chapter 9. Appendix provides programming notes and a list of default utilities.

1.4 Eddy-DK Related Documents

The following table summarizes documents included in the Eddy-DK document set.

Table 1-1 Eddy-Serial DK Related Documents

Document Name	Description
User Guide	Integration, configuration, and management of Eddy for the administrator
Programmer's Guide	Programmer's application development guide, including in-depth approach to compiling, linking, and creating firmware API reference is also included with a list of available functions for customized application programming
Portview User Manual	Guide for SystemBase device server management application Portview
COM Port Redirector User Manual	Guide for SystemBase COM Port Redirector

If you need brief information on Eddy or embedded device servers in general, please visit our corporate website at http://www.sysbas.com/. You can view and/or download documents related to Eddy as well as latest software and firmware updates. Available resources are as follows:

Document Name	Description
Eddy Spec Sheet	Specifications for Eddy products
Eddy White Paper	An introductory reading for anyone new to embedded device server. Deals with background, history, market environment, and technology
Eddy Application Notes	Application instruction of Eddy described with diagram and image.

All documents are updated promptly, so check for the recent document update. The contents in these documents are subject to change without any notice in advance.

1.5 Technical Support

There are three ways you can get a technical support from SystemBase.

First, visit our website http://www.sysbas.com/ and go to 'Technical Support' menu. There you can read FAQ and ask your own question as well.

Second, you can e-mail our technical support team. The mail address is tech@sysbas.com. Any kind of inquiries, requests, and comments are welcome.

Finally, you can call us at the customer center for immediate support. Our technical support team will kindly help you get over with the problem.
The number to call is 82-2-855-0501 (Extension number 225). Do not forget to dial the extension number after getting a welcome message.

Homepage: http://www.sysbas.com/
Tel: +82-2-855-0501
Fax: +82-2-855-0580
1601, DaeRyung Post Tower 1, 212-8, Guro-dong, Guro-gu, Seoul, Korea

Chpater2. Getting Started

This chapter explains about packaging and installation, and discusses key features of Eddy-DK.

2.1 What can you do with Eddy-DK?

Eddy-DK is designed to help programmers to develop a customized application that can be applied to Eddy module easier and faster. It has been a time-consuming and burdensome work to port an operating system and develop an application on a new hardware. Eddy module and Software Development Kit makes this work easy.

Eddy-DK is different with other device servers in which it can run customized applications. Users can upload most existing socket/serial communication applications that are running on the Linux environment. This openness allows users to apply wide variety of functions into the module with relatively less restrictions.

Eddy-DK supports IDE (LemonIDE) and SDK environment to help programmers to execute their own applications on the module. Programmers can easily write applications using the Linux environment, with the help of SDK and example source codes. Cross-compiler running on the standard Linux environment helps your applications to run on the Eddy module. Embedded Linux on Eddy can provide stable and rapid environment for your applications

2.2 Eddy-DK Package Contents

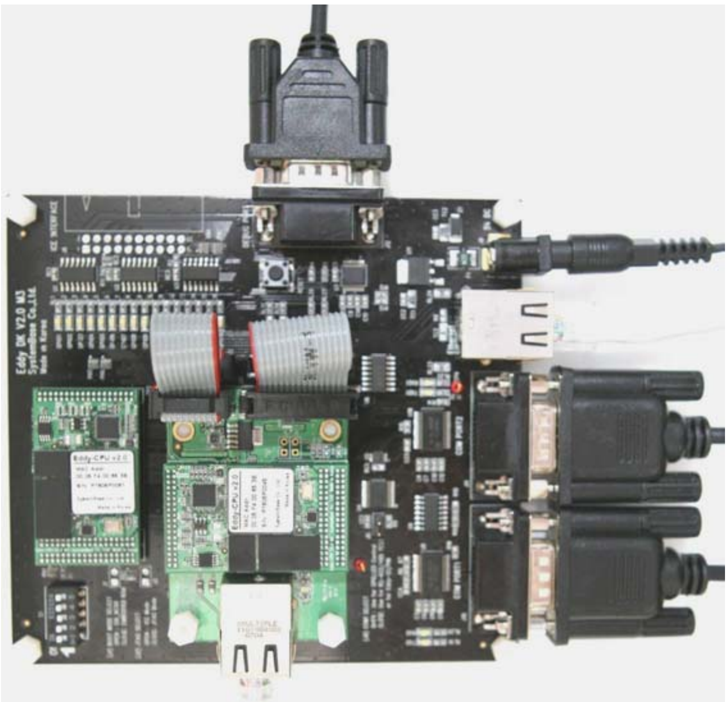
Eddy-DK includes Eddy module.

Eddy-DK package contains as follows. Make sure following contents are included in the Eddy Serial DK Package.

- 1EA, Eddy-DK board
- 2EA , Serial cable
- 1EA , LAN cable
- 1EA , Power adaptor
- 1EA, Jumper cable
- 1EA, 10Pin flat cable
- 1EA, 16Pin flat cable
- 1EA , CD (SystemBase SDK, LemonIDE, compile environment, utilities, manuals)

2.3 Eddy-DK Board

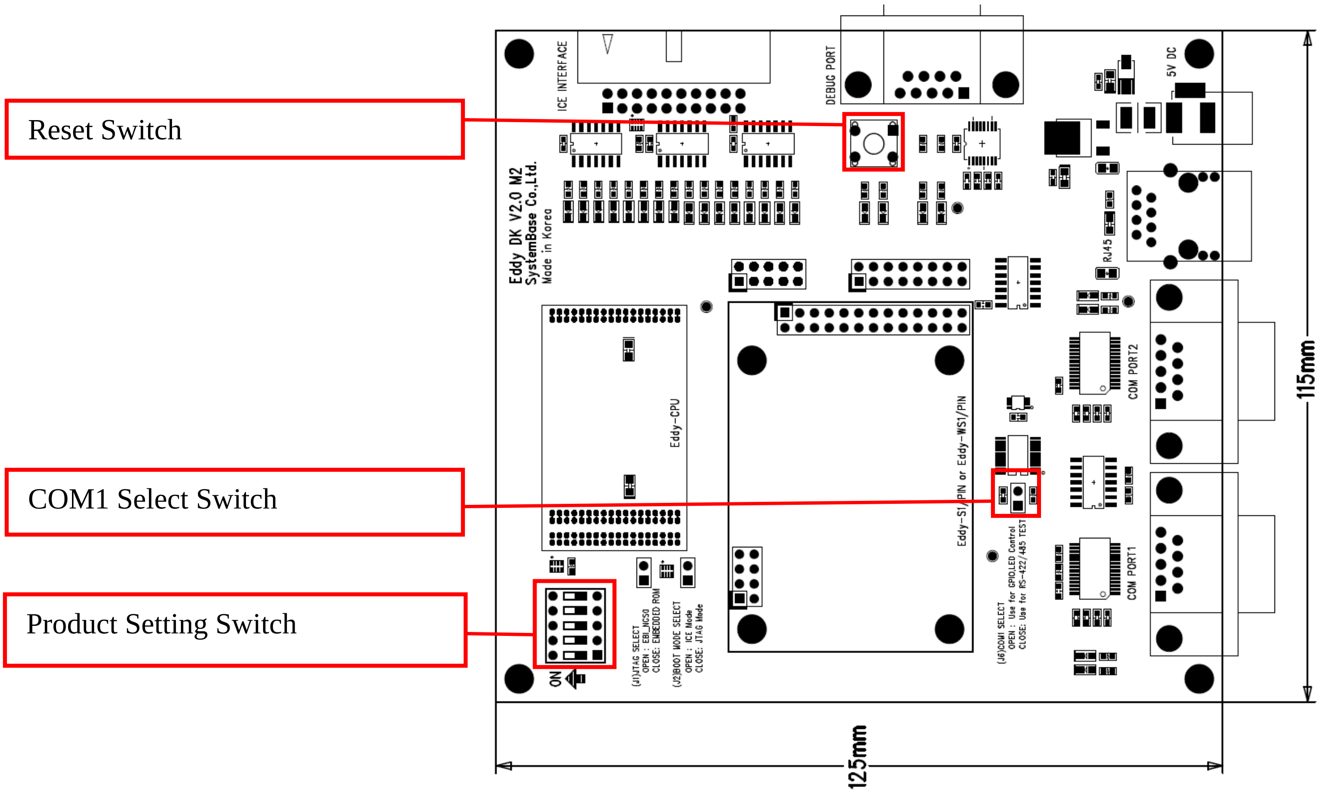
2.3.1 Locations of modules



NOTE

1) Only ONE Eddy module can be loaded and tested with Eddy Serial DK at a time. Do not load two or more modules simultaneously.
2) Ensure that the input power supply for Eddy Serial DK is 5.0 V with 400 mA(or higher).

2.3.2 Description on switches



2.3.2.1. Reset Switch

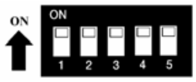
Reboots the system.

2.3.2.2. Product Setting Switch

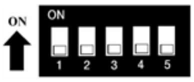
This switch is used when Eddy-CPU is mounted on the development board.to determine its behavior.

Product setting switch can be adjusted to make Eddy-CPU mounted development board operate as Eddy-CPU, Eddy-S1/PIN,Eddy-S1/DB9.

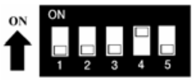
This feature is to provide usage of Debug port, Status LED and RJ45 port on the development board for easier testing and debugging.



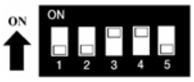
Set as shown on the left and it will operate as Eddy-CPU.



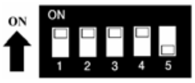
Set as shown on the left and it will operate as Eddy-S1/PIN.



Set as shown on the left and it will operate as Eddy-S1/DB9.



Set as shown on the left and it will operate as Eddy-S2M/PIN



Set as shown on the left and it will operate as Eddy-DK-C .

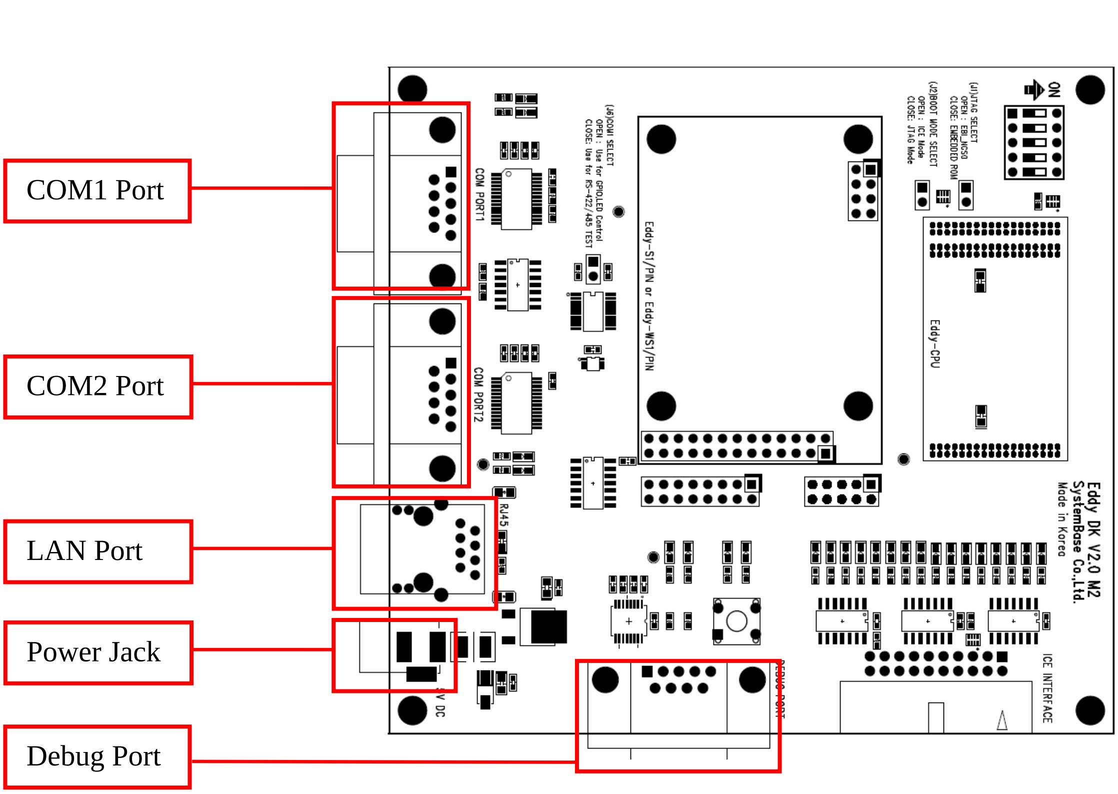
(Eddy-DK-C mode is to provide RS422/485 testability to Eddy-CPU module. Eddy-CPU module within its logic supports only RS232. In order to test Eddy-CPU on RS422/485 mode, mount Eddy-CPU to development board and set Product Setting Switch to Eddy-DK-C.)

2.3.2.3. COM1 Select Switch

If you set Product Setting Switch to Eddy-DK-C model, you can use COM PORT 1 for RS232 and RS422/RS485. Set Product Setting Switch to Eddy-DK-C, connect this jumper, and select RS422 or RS485 in web environment setting. However you have to be careful because it will operate in RS232 regardless of the web environment setting if the jumper is not connected.

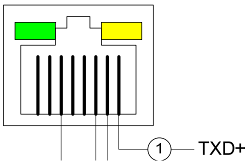
This jumper allows you to use RS422/RS485 when the Product Setting Switch is set as Eddy-DK-C; if you set the switch to other models do not connect this jumper.

2.3.3 Power and Communication Port



2.3.3.1. LAN Port

Lan Port automatically recognizes Cross/ Direct.(auto MDIX)



Pin	Signal	Description
1	TXD+	Transmit Data +
2	TXD-	Transmit Data -
3	RXD+	Receive Data +

6	RXD-	Receive Data -

LED	Description
Left Green	Upon 100Base-TX link, it lights. When the data is sent or received, it blinks.
Right Yellow	Upon 10Base-T link, it lights. When the data is sent or received, it blinks.

2.3.3.2. Serial Port

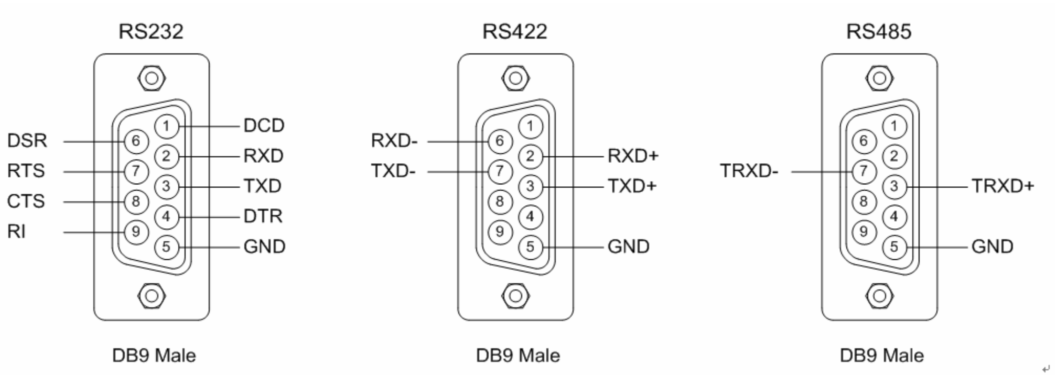


Figure 2-1 Serial port pin description

RS232

Pin	Signal	Description
1	DCD	Data Carrier Detection (Input)
2	RXD	Receive Data (Input)
3	TXD	Transmit Data (Output)
4	DTR	Data Terminal Ready (Output)
5	GND	Ground
6	DSR	Data Set Ready (input)
7	RTS	Request to Send (Output)
8	CTS	Clear to Send (Input)
9	RI	Ring Indicator (Input)

RS422 Full Duplex

Pin	Signal	Description
2	RXD+	Receive differential data positive (Input)
3	TXD+	Transmit differential data positive (Output)
6	RXD-	Receive differential data negative (input)
7	TXD-	Transmit differential data negative (Output)

RS485 Half Duplex

Pin	Signal	Description
3	TRX+	Transmit/Receive differential data positive
7	TRX-	Transmit/Receive differential data negative

-When Eddy-CPU is mounted on the development board.
COM1 & COM2 function differs based on 'Product Setting Switch' settings.

When 'Product Setting Switch' is set to 'Eddy-CPU', COM1 & COM2 ports will operate as RS232 ports..
When 'Product Setting Switch' is set to 'Eddy-S1/PIN', only COM1 port can be used as RS/232.
When 'Product Setting Switch' is set to 'Eddy-S1/DB9', only COM1 port can be used as RS/232.
When 'Product Setting Switch' is set to 'Eddy-DK-C, COM1 will operate as RS 422/485 port and COM2 as RS232 port.

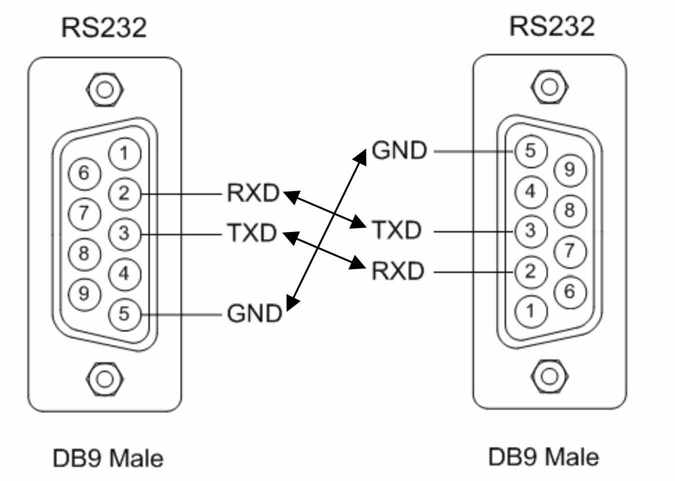
- When Eddy-S1/PIN is mounted on the development board
Only COM1 port can be used as RS232 port regardless of 'Product Setting Switch' settings.

- When Eddy-S1/PIN-C is mounted on the development board
Only COM1 port can be used as RS422/485 port regardless of 'Product Setting Switch' settings.

2.3.3.3. Debug Port

You can check debug message or status information with debug port.

Please note that 'Debug Port' can be used only when Eddy-CPU is mounted on the development board. 'Product Setting Switch' can be set to any mode.In other words, Debug Port will operate as long as Eddy-CPU is mounted on the development board regardless of settings on Product Setting switch.



Environment Setting

Debug port is configured as follows so user has to set his or her PC serial port connected to debug port as follows.

Speed : 115200 bps

Data bit : 8 bit

Parity bit : Non Parity

Stop bit : 1 bit

2.3.3.4. Power Jack

Contact	Polarity
Center	+5VDC ± 5%(Min. 400mA)
Outer	Ground

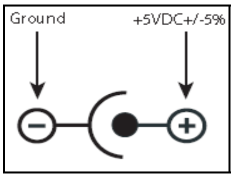
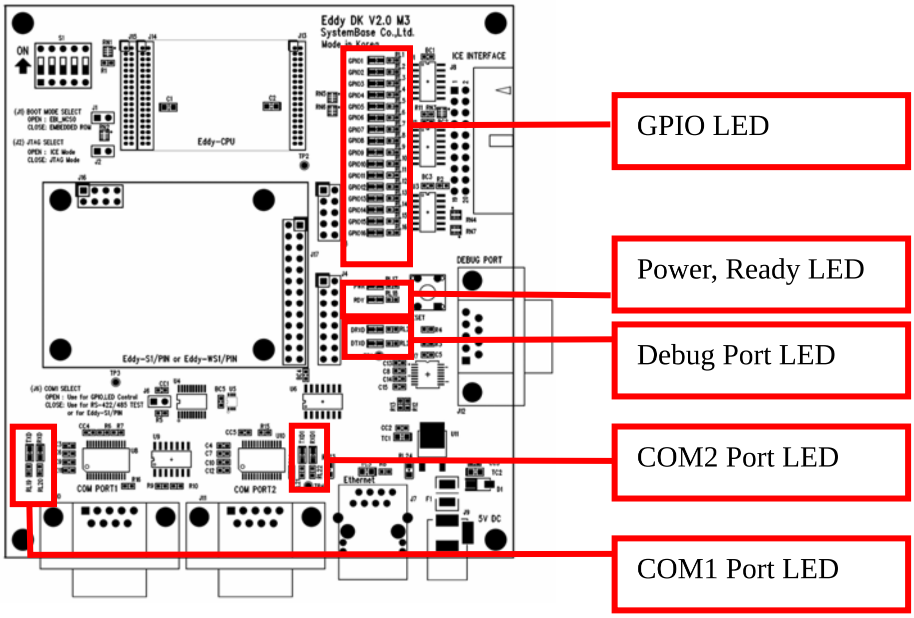


Figure 2-2 Power connector

2.3.4 LED Description

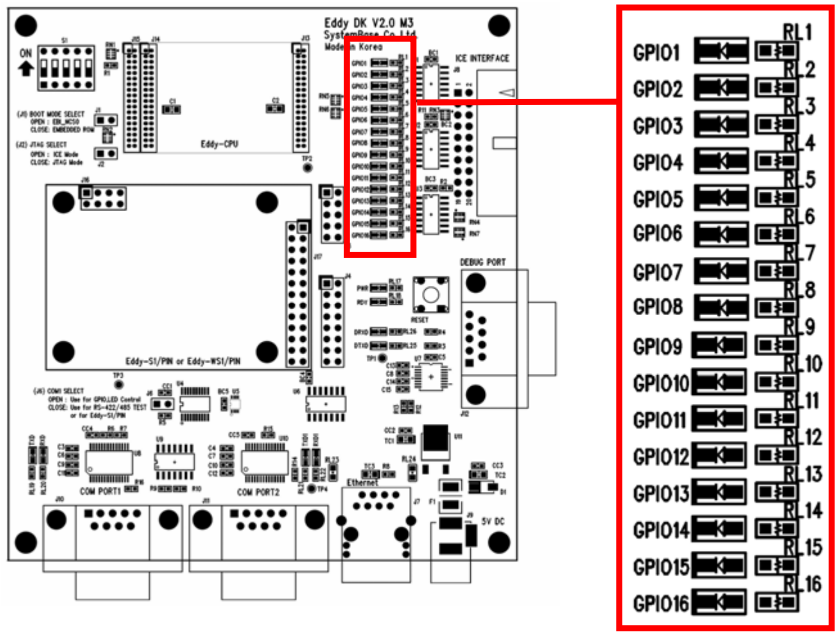


2.3.4.1. GPIO LED

GPIO ports provided by Eddy are maximum 16.

Not all Eddy modules provide GPIO port. Number of port can be limited or sometimes no port is provided at all due to different characteristics of each module, such as using port for internal use.(Active High : 3.3V DC, Active Low : 0 V)

Model	Input		Output	
	Ports	Available port range	Ports	Available port range
Eddy-CPU	12	GPIO 5 ~16 GPIO 1~4 are used internally	16	GPIO 1 ~ 16
Eddy-DK-C (When Eddy-CPU is mounted and Product Setting Switch is set to Eddy-DK-C)	GPIO 1~4 are used internally to support RS422/485 and hence GPIO ports 5~16 is available to the user			
	12	GPIO 5 ~16	12	GPIO 5 ~16
Eddy-S1/Pin, Eddy-S1/Pin-C	GPIO 1~12 are used internally			
	4	GPIO 13 ~16	4	GPIO 13 ~16
Eddy-S1/DB9, Eddy-S1/DB9-C	0	None	0	None
Eddy-S1/DB9-PoE, Eddy-S1/DB9-PoE-C	0	None	0	None
Eddy-WS1-TTL, Eddy-WS1-TTL-C	4	GPIO 13 ~16	4	GPIO 13 ~16
Eddy-WS1-PiN, Eddy-WS1-PiN-C	4	GPIO 13 ~16	4	GPIO 13 ~16
Eddy-WS1-DB9, Eddy-WS1-DB9-C	0	None	0	None



2.3.4.2. Power, Ready LED

Ready LED: Indicates that the system is operating normally. (Normal: LED blinks)

Power LED: Indicates that the 5 V power is being supplied. (Supplying power: Red LED ON)

2.3.4.3. Debug Port LED

DTXD Debug Port Transmit LED: Shows transmission status of the Debug Port.

DRXD Debug Port Receive LED: Shows reception status of the Debug Port.

2.3.4.4. COM1 Port LED

TXD COM1 Port Transmit LED: Shows transmission status of COM1 Port.

RXD COM1 Port Receive LED: Shows reception status of COM1 Port.

2.3.4.5. COM2 Port LED

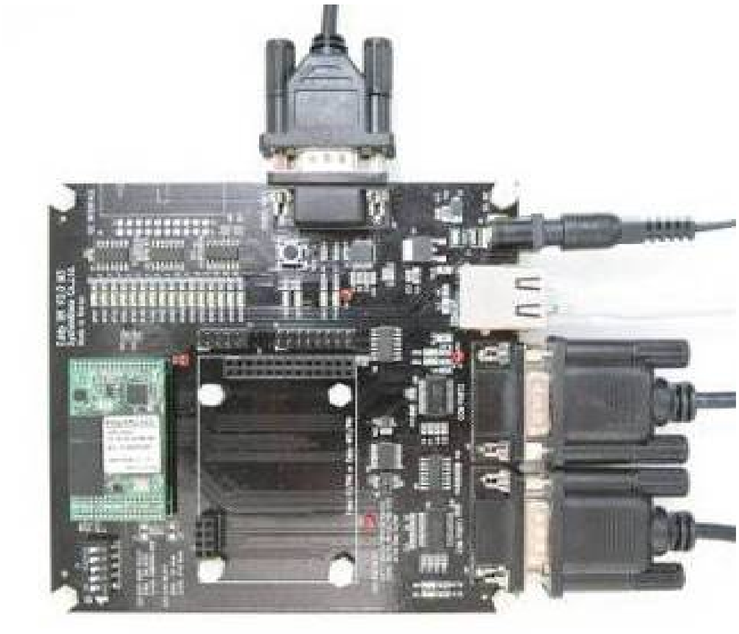
TXD COM2 Port Transmit LED: Shows transmission status of COM2.

RXD COM2 Port Receive LED: Shows reception status of COM2 Port.

Debug Port LED, COM1 Port LED, COM2 Port LED is only supporting in Eddy-CPU and Eddy-DK-C

2.4 Hardware installation

2.4.1 Eddy-CPU Installation



Place Eddy CPU module firmly on to Eddy-DK board as shown above.

Connect LAN cable to the LAN port.

Connect DB9 serial cable to COM 1, COM2, and Debug Port.

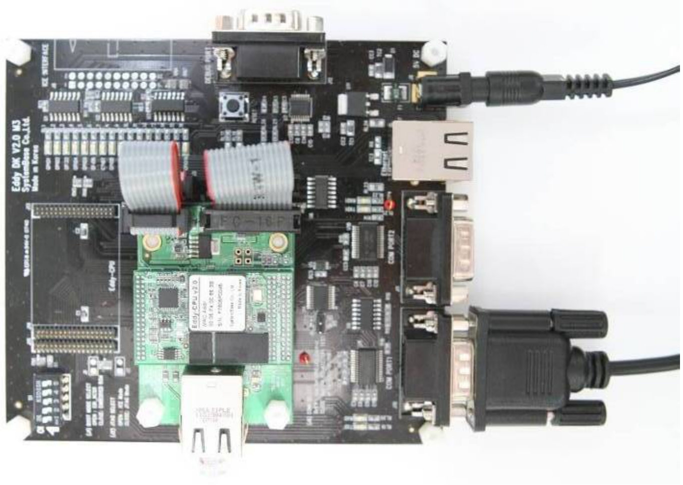
Configure Product Setting Switch1 to Eddy-CPU mode (Please see 2.3.2.2. Product Setting Switch)

After checking that the input power is 5 V, supply the power to the Eddy-DK board.

Check the Power LED condition to make sure the operation is normal.

If Eddy CPU module is in initialized state, all GPIO LEDs should be ON. If all LEDs are not ON, check and see whether GPIO and Product Setting Switch settings are set properly.

2.4.2 Eddy-S1/PIN Installation



Place Eddy-S1/PIN module firmly on to Eddy-DK board as shown above.

Connect LAN cable to the LAN port of Eddy-S1/PIN.

Connect DB9 serial cable to COM 1.

Connect Jumper cable to COM1 Select Switch

After checking that the input power is 5 V, supply the power to the Eddy-DK board

Check the Power LED condition to make sure the operation is normal.

If Eddy CPU module is in initialized state, all of the GPIO13 to GPIO16 LEDs should be ON.

2.5 Features and functions of Eddy-DK

RS232/422/485 serial interface

Supports the RS232 serial interface that is most widely used in many industries.

Easy and quick system integration

Signal lines easily connectable via pin units.

Users can program and execute their own application in GUI environment using LemonIDE.

User programs can be made into firmware and executed.

DK and API provided

Libraries and APIs provided for easy use of Eddy hardware functions.

32-bit ARM9 CPU / 4MB Flash / 32MB SDRAM

Powerful 32-bit ARM9 CPU operating in 180 MHz with sufficient memory size for any application.

10/100Mbps LAN port

Simple & Easy Network Connectivity via stable LAN ports.

COM port redirection supported

Compatible with the serial port based control programs. TCP/IP programming is not necessary for new applications.

2.5.1 Eddy module Main Memory Map

4M Flash Memory Version

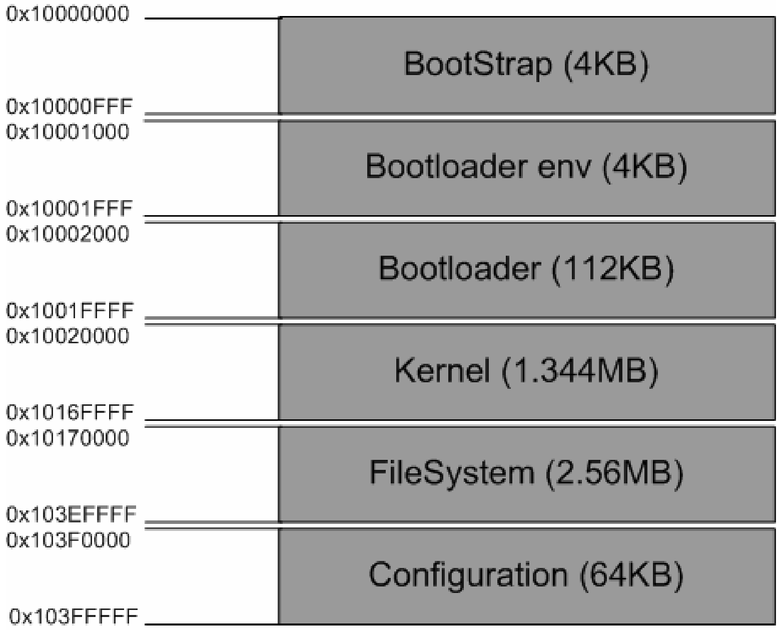


그림 2-3 4MB Flash Memory Map

8M Flash Memory Version

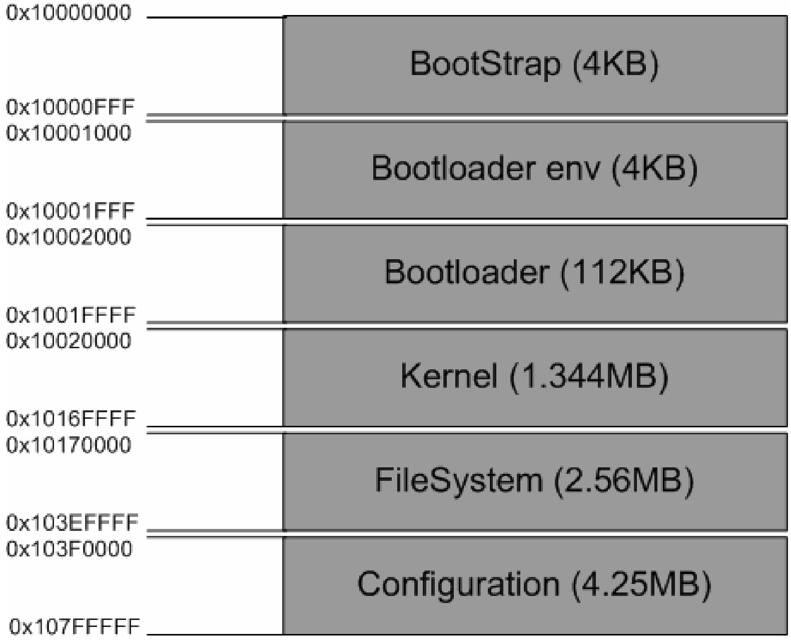


그림 2-4 8M Flash Memory Map

2.5.2 Eddy Flash Memory Map

Start address (size)	Item	Description
0x10000000 (4Kbyte)	BootStrap	Initialize hardware and calls bootloader from flash memory to the RAM and execute the bootloader.
0x10002000 (112Kbyte)	Bootloader	The Eddy boot loader is stored.
0x1001E000 (1.344Mbyte)	Kernel	Lemonix OS kernel is stored.
0x1012E000 (2.56MByte)	Filesystem	Various execution files are stored.

0x103AE000(64Kbyte)
0x103AE000(4.25Mbyte)
	4MB: Configuration
	8MB: Configuration
	& User Memory
		Information for system operating environment is stored, and user can write the user's data as remained size,
		So user who use the 8M flash version can used about 4MB flash memory.

2.5.3 Eddy directory structure

The Eddy file system consists of the following directories:

Name	Description	Access authority
/bin, /sbin, /lib, /etc	Executables and system utilities	Read & Write
/dev	Device file	Read & Write
/tmp	Tmp file system area of 15M bytes. The size of this area is flexible; when application run by Eddy requires more memory, this area can be reduced. We recommend user to use this area for uploading file through FTP.	Read & Write
/usr	Various program needed for the system and web files	Read & Write
/flash	This is flash area which stores files that have to be remained even if the power is reset, such as environment setting. This area provides 64 KB (4MB flash version) or 4.25MB(8MB flash version)..	Read & Write

The Eddy's entire folders are open for read & write. All loaded files are deleted after reboot except the data stored in /flash.

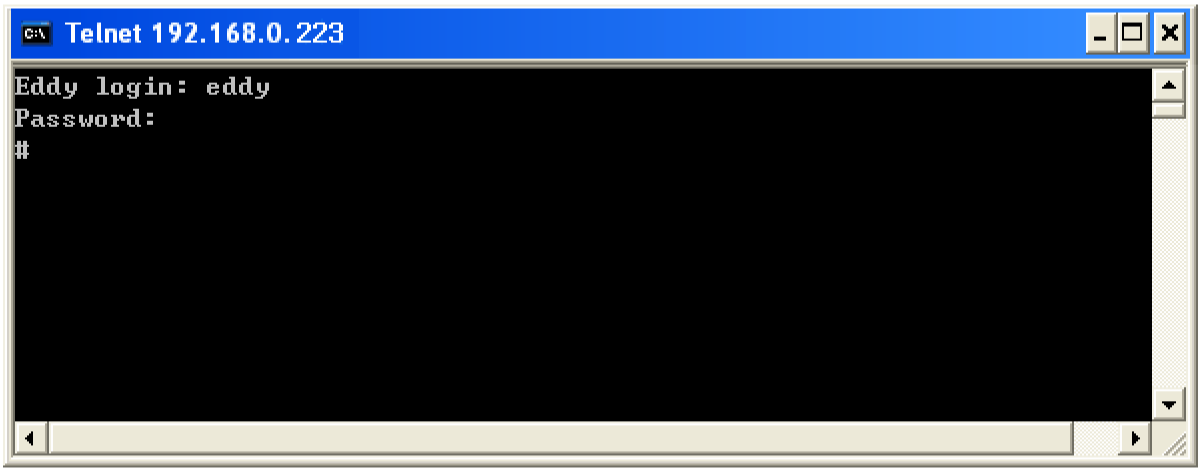
2.5.4 Booting Eddy

Eddy user manual provides a step-by-step guide for booting the module. Only Eddy-DK-related topics are explained in this guide.

Provide power supply to the Eddy module and connect via Telnet
Default IP address: 192.168.0.223

Open your telnet client and enter Eddy's IP address to connect. You need to enter appropriate username and password to login. Please note that this username and password is used as authentication method for Web as well. This means if username or/and password has been modified from the telnet interface, modified values have to be entered to connect to web, and vice versa.

Factory default username: **eddy**
Factory default password: **99999999**



```
Eddy login: eddy
Password:
#
```

Chpater3. Development environment

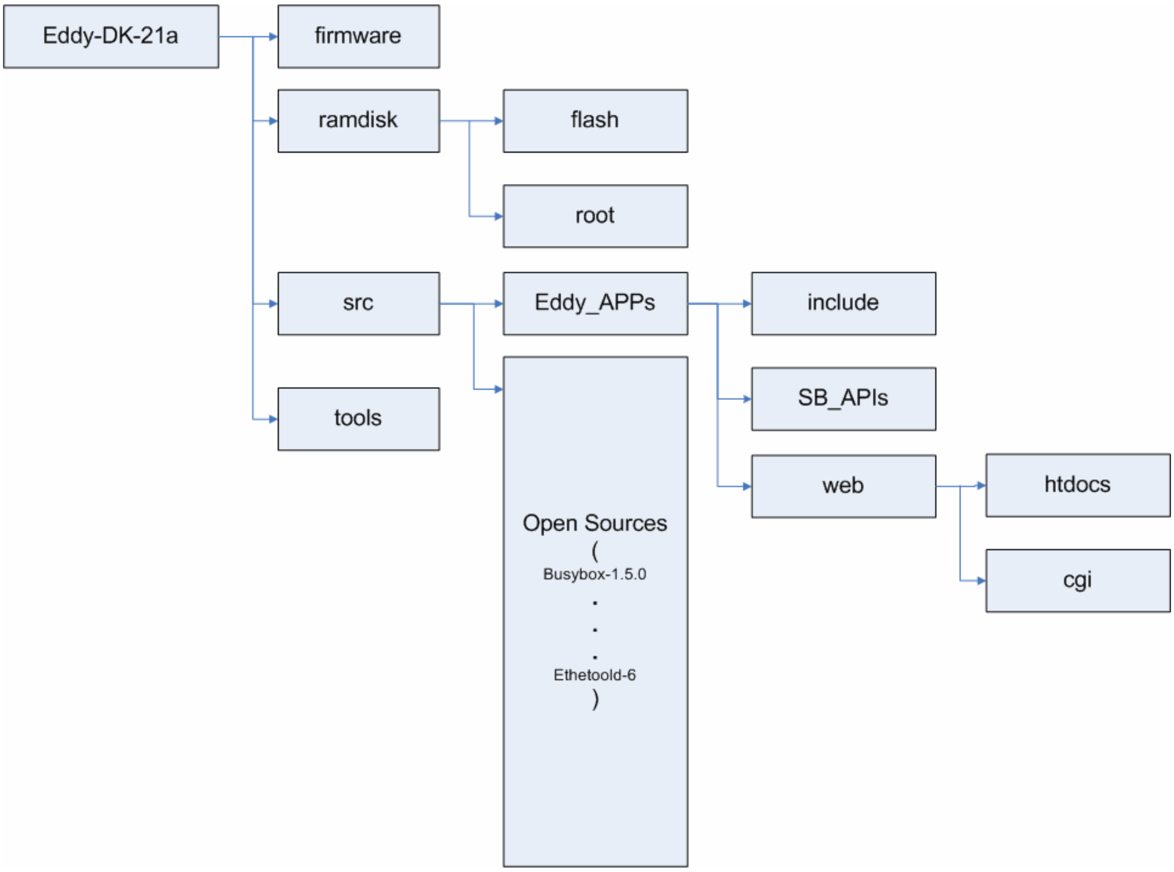
This chapter explains about the process of application programming and other important notes.

SDK's directory structures are as follows.

Note

All material regarding Eddy including documentation, reference sources and utilities are periodically updated to www.embeddedmodule.com without prior notice. Visit and download latest updates at this site.

3.1 Source code directory structure



Firmware directory
Kernel image, file system image, and configuration image are stored.

Ramdisk directory
flash: Configuration information is stored.
root: Information for the file system is stored.

Tools directory
Tools used for creating image files is stored.

Src
Directory where source codes of the applications included in Eddy are stored..
Detailed description of src directory is at Chapter4. Compiling Application.

- Eddy-APPs : Source code of the application run by Eddy is stored.
- Other folders contain open sources needed by Eddy.

3.2 Language

Eddy-DK application has to be written with C language. All example source codes are written in C language. You can program application with more than one file if you program with C language. If you are accustomed to programming with ANSI C, Eddy application programming shouldn't be any problem.

3.3 Development environment

You need a Windows or Linux host system to use Eddy-DK.
Tested OS versions are as follows.

Windows	Linux
Windows XP SP2 Windows 2000 Windows 2003	Red Hat 9.0 Fedora Core 4, 5, 6 SUSE Linux Enterprise Server 10.2 Ubuntu Linux 6.x, 7.x Debian Linuv 4.0 CentOS 4.5 Asianux edition 3

3.4 Installing to Windows Host

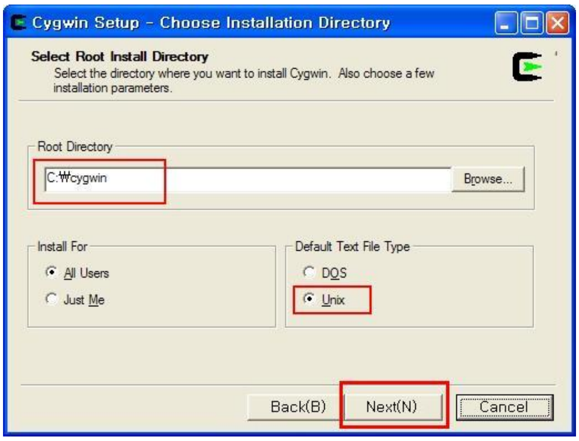
This chapter will describe how to install Eddy development environment on a Windows host.
Explanation on this manual is based on Windows XP.
In order to use Eddy's integrated development environment, LemonIDE, refer to "LemonIDE_User_Guide" for detailed instructions.

3.4.1 Installing Cygwin

In order to execute LemonIDE on Windows hosts, libraries from Linux system is required.

Cygwin is a virtual Linux program which enables Linux environment to be compatible on Windows hosts and LemonIDE requires Cygwin to be running on Windows host for proper operations.

Run Setup.exe from SDK/Windows/Cygwin directory of the CD which is provided with Eddy DK and follow the instructions below.



Cygwin Setup - Choose Installation Directory

Select Root Install Directory

Select the directory where you want to install Cygwin. Also choose a few installation parameters.

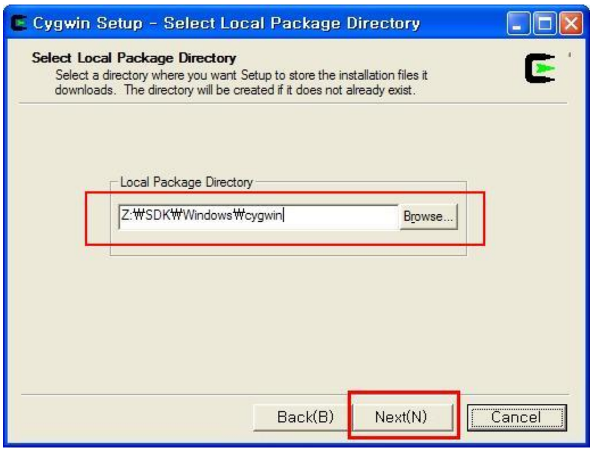
Root Directory: C:₩cygwin [Browse...]

Install For: ● All Users ○ Just Me

Default Text File Type: ○ DOS ● Unix

[Back(B)] [Next(N)] [Cancel]

Select directory which Cygwin is installed.
Set root directory to c:\cygwin”



Cygwin Setup - Select Local Package Directory

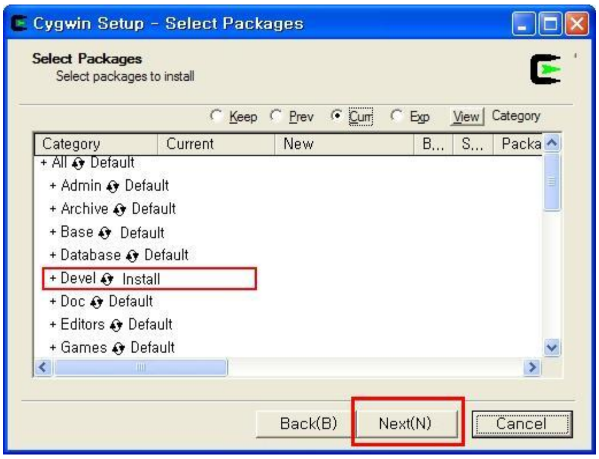
Select Local Package Directory

Select a directory where you want Setup to store the installation files it downloads. The directory will be created if it does not already exist.

Local Package Directory: Z:₩SDK₩Windows₩cygwin [Browse...]

[Back(B)] [Next(N)] [Cancel]

Select directory where Cygwin install package is located.
Set directory to DK CD’s “SDK\Windows\cygwin



Cygwin Setup - Select Packages

Select Packages

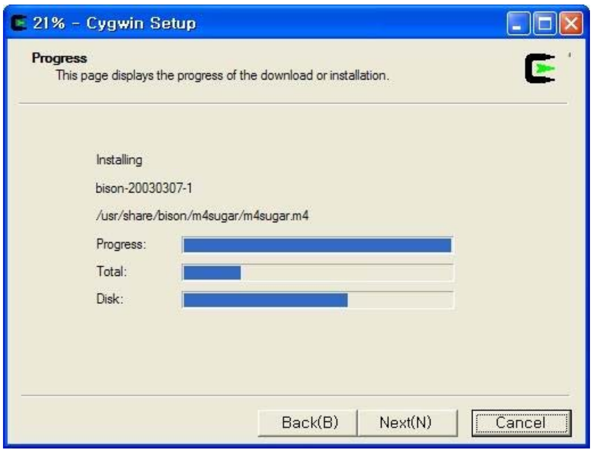
Select packages to install

○ Keep ○ Prev ● Curr ○ Exp [View] Category

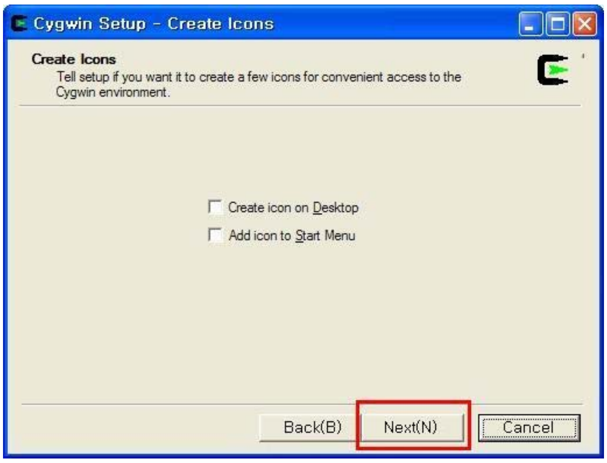
Category	Current	New	B...	S...	Packa
+ All ↻ Default					
+ Admin ↻ Default					
+ Archive ↻ Default					
+ Base ↻ Default					
+ Database ↻ Default					
+ Devel ↻ Install					
+ Doc ↻ Default					
+ Editors ↻ Default					
+ Games ↻ Default					

[Back(B)] [Next(N)] [Cancel]

Select package to install.
As shown on the left, install “Devil” package only. Click Default on the left and will change to install.


21% - Cygwin Setup
Progress
This page displays the progress of the download or installation.
Installing
bison-20030307-1
/usr/share/bison/m4sugar/m4sugar.m4
Progress:
Total:
Disk:
Back(B)
Next(N)
Cancel

Cygwin package being installed.


Cygwin Setup - Create Icons
Create Icons
Tell setup if you want it to create a few icons for convenient access to the Cygwin environment.
□ Create icon on Desktop
□ Add icon to Start Menu
Back(B)
Next(N)
Cancel

Finish setup once Cygwin installation is completed.

3.4.2 Configuring Windows Environment Variables

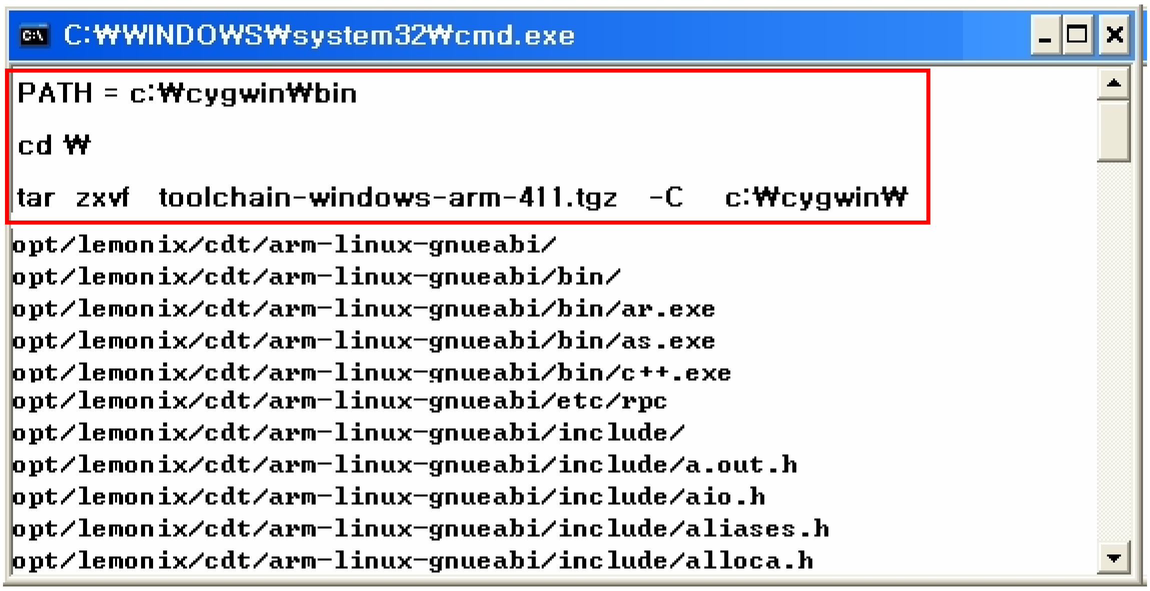
Path will be added in order to reference required Eddy libraries in Windows environment.
Select Desktop → My Computer → Right click → Properties → Advanced → Environment Variables. Select Path from System Variable and add the following line.

```
;c:\cygwin\bin
```

3.4.3 Installing Toolchain

Toolchain compiles source codes written in Windows environment in order that it is compatible and executable on its target, Eddy. Toolchain install file, “toolchain-windows-arm-411.tgz”, can be found under SDK/Windows folder in Eddy DK’s CD. Copy this file to “C:”, C drive’s root directory, and unzip the file by executing Windows command line program “CMD” as shown below.
Toolchain will be installed to **“c:\cygwin\opt\lemonix\cdt”.**

Note that command is case sensitive.



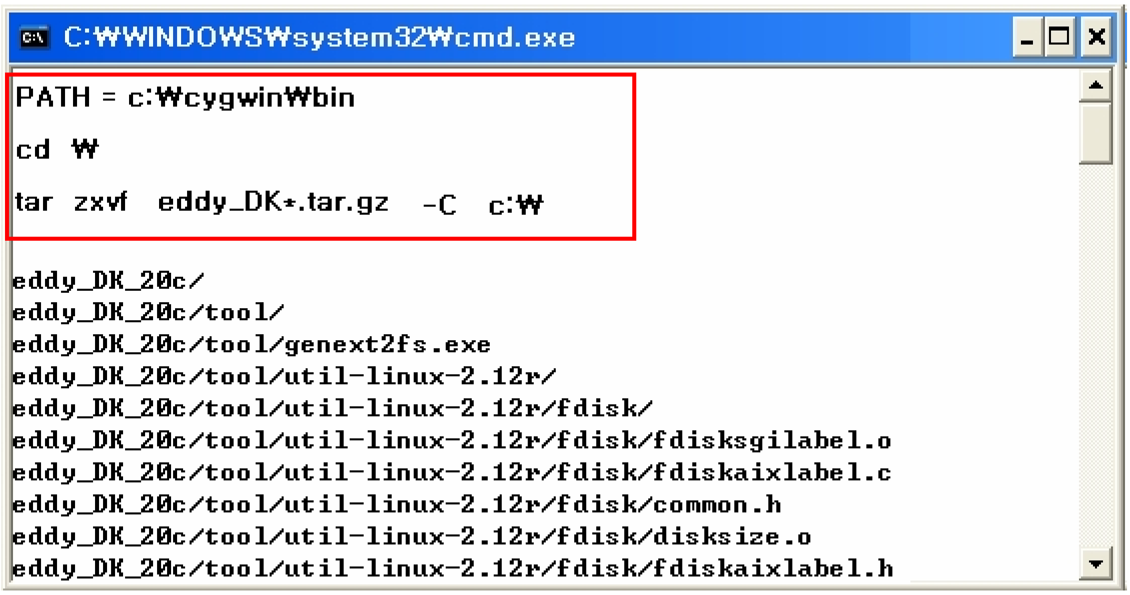
```
PATH = c:₩cygwin₩bin
cd ₩
tar  zxvf  toolchain-windows-arm-411.tgz  -C   c:₩cygwin₩
opt/lemonix/cdt/arm-linux-gnueabi/
opt/lemonix/cdt/arm-linux-gnueabi/bin/
opt/lemonix/cdt/arm-linux-gnueabi/bin/ar.exe
opt/lemonix/cdt/arm-linux-gnueabi/bin/as.exe
opt/lemonix/cdt/arm-linux-gnueabi/bin/c++.exe
opt/lemonix/cdt/arm-linux-gnueabi/etc/rpc
opt/lemonix/cdt/arm-linux-gnueabi/include/
opt/lemonix/cdt/arm-linux-gnueabi/include/a.out.h
opt/lemonix/cdt/arm-linux-gnueabi/include/aio.h
opt/lemonix/cdt/arm-linux-gnueabi/include/aliases.h
opt/lemonix/cdt/arm-linux-gnueabi/include/alloca.h
```

3.4.4 Installing Eddy DK Source

Eddy DK Source will be installed. DK Source file, “eddy_DK_2xx.tar.gz”, can be found under SDK folder in Eddy DK’s CD. Copy this file to “C:”, C drive’s root directory, and unzip the file by executing Windows command line program “CMD” as shown below.

DK Source will be installed to **c:\eddy_DK_2xx”.**

Note that command is case sensitive.



```
PATH = c:₩cygwin₩bin
cd  ₩
tar  zxvf  eddy_DK*.tar.gz  -C   c:₩

eddy_DK_20c/
eddy_DK_20c/tool/
eddy_DK_20c/tool/genext2fs.exe
eddy_DK_20c/tool/util-linux-2.12r/
eddy_DK_20c/tool/util-linux-2.12r/fdisk/
eddy_DK_20c/tool/util-linux-2.12r/fdisk/fdisksgilabel.o
eddy_DK_20c/tool/util-linux-2.12r/fdisk/fdiskaixlabel.c
eddy_DK_20c/tool/util-linux-2.12r/fdisk/common.h
eddy_DK_20c/tool/util-linux-2.12r/fdisk/disksize.o
eddy_DK_20c/tool/util-linux-2.12r/fdisk/fdiskaixlabel.h
```

3.5 Installing to Linux Host

This chapter will describe how to install Eddy development environment on a Linux host.

Explanation on this manual is based on Fedora Core 5.

In order to use Eddy's integrated development environment, LemonIDE, refer to "LemonIDE_User_Guide" for detailed instructions.

3.5.1 Installing Toolchain

Toolchain compiles source codes written in Linux environment in order that it is compatible and executable on its target, Eddy. Toolchain install file, "lemonide_linux_10x.tar.gz", can be found under SDK/linux folder in Eddy DK's CD. Toolchain will be installed to **/opt/lemonix.**

Note that command is case sensitive.

Note Carry out all install procedures with super user privileges.
Example below assumes that CDROM is mounted on /mnt/cdrom

If CDROM is mounted on a different location, path displayed below will bear difference.

```
# cd /
# tar -zxvf /mnt/cdrom/SDK/linux/lemonide*.tar.gz -C /
```

3.5.2 Installing Eddy DK Source

Install Eddy DK's entire source. Eddy DK Source file, "eddy_DK_2xx.tar.gz", can be found under SDK/linux folder in Eddy DK's CD.

Install Eddy DK Source as shown below. An eddy_DK_2xx folder will be created after installation.

```
# pwd
/home/shlee
# tar -zxvf eddy_DK_2*.tar.gz
```

Unzip the file and Eddy_DK_2xx folder will be created and installation is completed. Below displays contents of Eddy_DK_2xx folder.

```
[root@localhost eddy-DK_2xx]# ls -al
Total 32
drwxr-xr-x   6 shlee work 4096 Nov 26 14:43 .
drwxrwxr-- 26 shlee work 4096 Nov 30 21:25 ..
drwxr-xr-x   4 shlee work 4096 Noc 26 14:46 src
-rwxr-xr-x   1 shlee work 2822 Nov 26 14:43 Env.sh
-rwxr-xr-x   1 shlee work   171 Nov 26 14:43 Make.check
drwxr-xr-x   2 shlee work 4096 Nov 29 17:50 firmware
drwxr-xr-x   5 shlee work 4096 Nov 29 17:50 ramdisk
drwxr-xr-x   4 shlee work 4096 Nov 26 14:47 tool
```

3.6 Removing Development Environment

Development Environment can be removed by simply deleting the folder where installed files are located.

3.6.1 Removing Windows Development Environment

Remove folders where DK Source and Cywin is installed to remove Eddy Development Environment.

3.6.2 Removing Linux Development Environment

```
# rm - rf eddy_DK_xx          ; Removal of Eddy DK Source
# rm   -rf /opt/lemonix       ; Removal of Eddy ToolChain
```

Chpater4. Compiling Application

4.1 Source Code

This manual will use a sample source code that's included in the Eddy- DK to introduce compile process.

Program sources introduced here are actual codes that are used in Eddy. However some sources are not provided for the security reasons.

Provided program sources can be categorized into Open Source and Eddy-oriented Application Source.

Open Sources are as follows.

Folder name	Description
busybox-1.5.0	Linux Utility containing basic command used in shell
dropbear-0.50	SSH (Secure Shell) server
gdbserver	Remote debugging program used in LemonIDE. Source code is not provided; only executable files are provided.
mtd-util	Management program for mtd area
openssl-0.9.7c	OpenSSL library, one kind of SSL
matrixssl-1-8-3	Matrixssl program, one kind of SSL
thttpd-2.25b	HTTP server
vsftpd-2.0.5/	FTP server
ddns-1.8	DDNS server
ethtool-6	Test program for Ethernet based network
netkit-ftp-0.18	ftp client
target-agent	Program which upload and execute user program in accordance with LemonIDE. Source code is not provided.
net-snmp-5.4.1	SNMP program

When you want to make new application program, we recommend you to refer to the files in the Eddy_APPs folder. In this chapter we will explain with Eddy_APPs directory.

Source files inside Eddy_APPs are as follows.

File name	Description
def.c	Eddy environment setting program
eddy.c	Program which is first run after booting Eddy. This program makes Eddy to operate as it is configured in environment setting.
pinetd.c	Program which is at the highest hierarchy of Eddy; this executes and monitors the programs of lower hierarchy.
tcp_client.c	Program which connects to the server and exchange data between the serial port and the socket.
tcp_server.c	Program which waits for the socket connection and exchange data between the serial port and the socket.
upgrade.c	Program for firmware updating
ddns_agent.c	Program which gives Eddy IP information to DDNS server
detect.c	Program which work together with portview's detector. Refer to the portview manual.
loopback.c	Loopback test program for the serial port.
portview.c	Agent of Portview, which is a NMS program for windows, provided by SystemBase.
tcp_broadcast.c	This supports maximum of five client connection with multi TCP server function, and broadcast serial data to all client.
tcp_multiplex.c	This supports maximum of five client connection with multi TCP server function, and transfer serial data to each client.
udp.c	UDP server and client program which exchange data between UDP socket and the serial port.
gpio.c	Example program for GPIO port
rt-test.c	Test program for Delay Time
/include	Directory containing header files needed for applications.
/SB_APIs	Directory containing library provided by Eddy
/web	Directory containing CGI source and htm code of web run at Eddy

4.2 Writing a Makefile

In order to compile an application, Makefile should be created or modified and all compile information should be correctly defined.

The following shows a Makefile of the sample program at /src/Eddy_APPs/.

The figure below shows part where the environment setting values needed at compiling process are configured. It contains environment values needed when running Make command. When the user wants to compile, add the name at “TARGET” inside red box marked below.

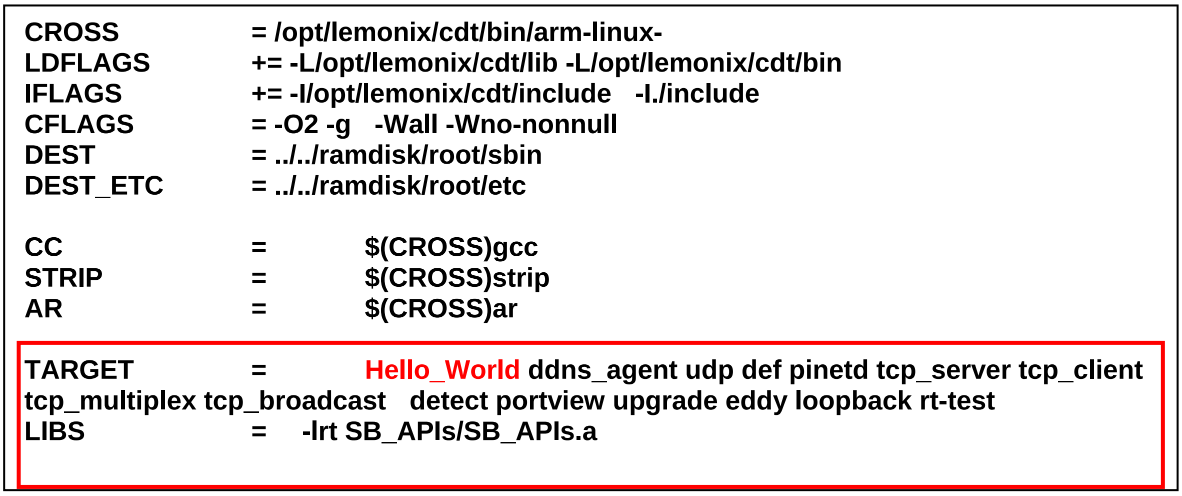
For example, you can add Hello_World.

First you can make Hello_World.c as follows.

```
#include <stdio.h>

int main()
{
        printf("hello world !!!\n");
        return 0;
}

```



```
CROSS              = /opt/lemonix/cdt/bin/arm-linux-
LDFLAGS            += -L/opt/lemonix/cdt/lib -L/opt/lemonix/cdt/bin
IFLAGS             += -I/opt/lemonix/cdt/include   -I./include
CFLAGS             = -O2 -g   -Wall -Wno-nonnull
DEST               = ../../ramdisk/root/sbin
DEST_ETC           = ../../ramdisk/root/etc

CC                 =          $(CROSS)gcc
STRIP              =          $(CROSS)strip
AR                 =          $(CROSS)ar

TARGET             =          Hello_World ddns_agent udp def pinetd tcp_server tcp_client
tcp_multiplex tcp_broadcast   detect portview upgrade eddy loopback rt-test
LIBS               =     -lrt SB_APIs/SB_APIs.a
```

The figure below shows part that is executed when running make command.

It shows that Hello_World is added also as an example.

```
all : $(TARGET)

udp : udp.o
            rm -f $@
            $(CC) $(CFLAGS) $(LDFLAGS) $(IFLAGS) -o $@ $ $@.o   $(LIBS)
            $(STRIP) $@

def : def.o
            rm -f $@
            $(CC) $(CFLAGS) $(LDFLAGS) $(IFLAGS) -o $@ $ $@.o   $(LIBS)
            $(STRIP) $@

Hello_World : Hello_World.o
            Rm -f $@
            $(CC) $(CFLAGS) $(LDFLAGS) $(IFLAGS) -o $@ $ $@.o
            $(STRIP) $@
```

Next shows part that is executed when running make clean command and make release command.
Make clean command deletes object files inside the current folder.
Make release command moves executable files to where it is set as DEST in environment setting.

```
clean:
            rm   *.bak *.o

release:
            cp   -f $(TARGET) $(DEST)
            cp   -f sb_default_config $(DEST_ETC)
```

4.3 Compile

Written source codes will be compiled to work on Eddy.

4.3.1 Compiling on Windows

Compiling on Windows environment is simple. Type in “make” command through cmd(command prompt) in directory where Makefile is located. As shown below, if successfully compiled, execution file named Hello_World will be created. Of course, as this file was cross-compiled, it can not run on Windows environment. Upload this file to Eddy with a FTP to execute this file on Eddy, (Files uploaded with FTPs are not permanently saved on Eddy.). This will be further explained on next chapter, Chpater 5 Creating Firmware.

```
C:\eddy_DK_2xx[\src/Eddy_APPs> make   hello_world
/opt/lemonix/cdt/bin/arm-linux-gcc   -O2 -g   -Wall -Wno-nonnull    -c -o Hello_World.o Hello_World.c
/opt/lemonix/cdt/bin/arm-linux-gcc   -L/opt/lemonix/cdt/lib -L/opt/lemonix/cdt/bin   Hello_World.o    -o Hello_World
C:\eddy_DK_2xx[\src/Eddy_APPs>
C:\eddy_DK_2xx[\src/Eddy_APPs> ls
Hello_world   SB_APIs          def.c       eddy       kt.c          pinetd        portview.o          tcp_client.c
tcp_client         tcp_multiplex.o    . . .
```

4.3.2 Compiling on Linux

To compile a source file on Linux environment, type in “make” command in directory where Makefile is located. As shown below, if successfully compiled, execution file named Hello_World will be created. Of course, as this file was cross-compiled, it can not run on Linux environment. Upload this file to Eddy with a FTP to execute this file on Eddy, (Files uploaded with FTPs are not permanently saved on Eddy.). This will be further explained on next chapter, Chpater 5 Creating Firmware.

```
[shlee@localhost Eddy_APPs]$make
/opt/lemonix/cdt/bin/arm-linux-gcc   -O2 -g   -Wall -Wno-nonnull    -c -o Hello_World.o Hello_World.c
/opt/lemonix/cdt/bin/arm-linux-gcc   -L/opt/lemonix/cdt/lib -L/opt/lemonix/cdt/bin   Hello_World.o    -o Hello_World
[shlee@localhost Eddy_APPs]$ ls
Hello_World*    SB_APIs/          def.c*       eddy*       kt.c          pinetd*       portview.o          server*
tcp_client*         tcp_multiplex.o   tcps*    upgrade*    . . .
```

4.3.3 Compiling with LemonIDE

LemonIDE is an IDE(Integrated Development Environment) based on Eclipse platform and provides an intuitive GUI interface. LemonIDE can be used in both Windows and Linux environments. Source coding, compile, remote debugging and creating a firmware image can all be carried out with LemonIDE. Refer to “LemonIDE_User_Guide” for detailed information on LemonIDE.

4.4 Uploading and executing an application via FTP

In order to execute user's application on the Eddy, you can create a firmware and write it on the Eddy’s flash memory. This is not a good idea for the frequent debugging purpose since it's a time consuming process. Therefore, during the development process, it is better to simply upload your application to the RAM file system through FTP Server. The uploaded file will run directly on the module, making it a simple and quick solution for the frequent debugging. But when Eddy is reset or restarted, the program will be lost. In order to permanently store the program, you have to create a firmware.

Power on Eddy and connect via Telnet. (See Eddy User Guide for details)

```
Eddy login: eddy
Password: 99999999
# cd /tmp                                  ;   after connection, move to   /tmp
```

Now connect via FTP to upload sample program to Eddy.
ID and password used for connecting to Eddy's ftp server are same as ones used for telnet connection.
The following example shows how the application 'Hello_World' is uploaded on to /tmp directory on Eddy.
Please make sure that the transfer mode is set as binary. Use "put <filename>" command for uploading.
Below example displays how to access and upload a program to Eddy using an FTP on Linux environment.
On Windows, use FTP in cmd(command prompt) to upload a program.

```
[shlee@localhost Eddy_APPs]$ ftp 192.168.0.223
Name (192.168.0.223:shlee): eddy
331 Please specify the password.
Password:
230 Login successful.
ftp> cd /tmp
ftp> bin
ftp> put Hello_World
8914 bytes sent in 0.00027 seconds (3.3e+04 Kbytes/s)
ftp> bye
[shlee@localhost Eddy_APPs]$
```

When the transfer is finished you can see the files at telnet terminal.
Uploaded files needs execute permission in order to run.
You can do so by issuing 'chmod' command
After changing to executable mode, run "./Hello_World".

```
# ls
Hello_World         login.id           thttpd.log         login.pw
thttpd.pid          utmp      .  .  .
#
# chmod 777 Hello_World
#
# ls
Hello_World         login.id           thttpd.log         login.pw
thttpd.pid          utmp      .  .  .
#
# ./Hello_World
hello world !!!
```

Chpater5. Creating Firmware

In the previous chapter we explained how to make and compile application program with sample program. This chapter introduces methods to create a firmware that permanently saves the application into the Eddy module.

5.1 How to create a firmware

Firmware image can be created in Eddy_DK_2xx/ramdisk folder.
Makefile in Eddy_DK_2xx/ramdisk can be altered so that execution file is added to release part to using “Make release” command, or execution file can be copied to ramdisk/root/sbin using cp command.

Copy the execution file to Eddy_DK_2xx/ramdisk/root/sbin.
Below displays “Hello_World” sample program copied to Eddy_DK_2xx/ramdisk/root/sbin.

```
[shlee@localhost Eddy-DK_20a]$ ls
Env.sh*   Make.check*   firmware/   ramdisk/   src/   tool/
[shlee@localhost Eddy-DK_20a]$ cd ramdisk/root/sbin/
[shlee@localhost sbin]$ ls
Hello_World   com_redirect*   fdisk@   halt@   ifconfig@   insmod@   loopback*   mdev@   pinetd*
reboot@   setconsole@   swapon@   tae*   tcp_server*   vconfig@  def*   freeramdisk@   hdparm@
ifdown@   klogd@   losetup@   mkswap@   pivot_root@   rmmod@   start-stop-daemon@
switch_root@   tcp_broadcast*   udhcpc@  detect*   fsck@   help@   ifup@   kt*   lsmod@
modprobe@   portview*
[shlee@localhost sbin]$ pwd
/home/eddy_project/Eddy-DK_20a/ramdisk/root/sbin
[shlee@localhost sbin]$
```

To create a firmware image, move to Eddy_DK_2xx/ramdisk to make changes on Makefile.

Makefile resides under “Ramdisk”(/DK Source/ Ramdisk) which is registered as a project.

Version information, amount of Ramdisk to be used, application information to be copied can be configured in Makefile. Following is Makefile provided in DK.

Note

DK Source is distributed in Linux compatible format.

Thus some commands in Makefile may not be recognized in Windows environment. In such cases, add .exe to unrecognized utilities in Makefile as shown below.

```
../tool/genext2fs   → ../tool/genext2fs.exe
../tool/mkimage     → ../tool/mkimage.exe
../tool/mkfs.jffs2  → ../tool/mkfs.jffs2.exe
```

```
IMAGE=ramdisk
FW_NAME       =      eddy-fs-20a.bin     → Firmware image name and version info.
CONFIG_NAME   =      eddy-cf-20a.bin     → Default operating environment info. of Eddy

FIRMWARE_DIR  =      ../firmware        → Directory to save firmware image to be created
## Check environments
#include ../Make.check

config:
        @echo -n "Checking ramdisk skeleton files..."
        @if [ ! -f "$(ROOT_FS_SKEL)" ] ; then \
                  echo "fail"; \
                  exit 0;\
        fi
        @echo "ok"; \

install:
        #@echo "Making ramdisk image..."
        #$(TOOL) -b 8192 -d root -D device_table.txt ramdisk
        #../tool/genext2fs   -U -b 5110 -d root -D device_table.txt ramdisk
        #../tool/genext2fs   -U -b 7158 -d root -D device_table.txt ramdisk
        #../tool/mkcramfs    -q -D device_table.txt root ramdisk
        ../tool/genext2fs.exe   -U -b 10240 -d root -D device_table.txt ramdisk   → Configures ramdisk
size to 10,240 K and register device of Eddy/dev, referring to Device_table.txt.
        gzip -vf9 ramdisk
```

```
            test -f ramdisk.gz
            ../tool/mkimage.exe -A arm -O linux -T ramdisk -C gzip -a 0 -e 0 -n $(FW_NAME) -d ./ramdisk.gz
                    $(FW_NAME)
            test -f $(FW_NAME)
            mv $(FW_NAME) $(FIRMWARE_DIR)/
cfg:
            ../tool/mkfs.jffs2.exe -q -l -o $(CONFIG_NAME) -d flash -p – f   → Create image of Eddy's
initial execution configuration file residing under Flash folder.
            test -f $(CONFIG_NAME)
            mv   $(CONFIG_NAME) $(FIRMWARE_DIR)/

release: → Register application to be copied to Eddy so it can be copied to proper directory

            cp -f ../src/busybox-1.5.0/busybox                    root/bin
            cp -f ../src/dropbear-0.50/dropbear                   root/usr/local/sbin
            cp -f ../src/dropbear-0.50/dropbearkey                root/usr/local/sbin
            cp -f ../src/ethtool-6/ethtool                        root/usr/local/sbin
            cp -f ../src/thttpd-2.25b/thttpd                      root/usr/local/sbin
            cp -f ../src/net-snmp-5.4.1/agent/snmpd               root/usr/local/sbin
            cp -f ../src/net-snmp-5.4.1/agent/snmpd.conf          root/etc
            cp -f ../src/netkit-ftp-0.18/ftp/ftp   root/usr/local/bin
            .
```

Makefile options are as follows.

Make	release	; copy module in release to ramdisk area
Make	cfg	; create firmware image of Eddy enviromental files in ramdisk/flash
Make	install	; create a firmware image of Eddy's Filesystem

If changes to Makefile are complete, use "make install" command to create firmware image.

Firmware will be created in "FIRMWARE_DIR" directory defined in Makefile.

On Windows, use cmd(command prompt) to carry out procedures explained on Linux.

```
[shlee@localhost ramdisk]$ make install
#@echo "Making ramdisk image..."
../tool/genext2fs   -U -b 10240 -d root -D device_table.txt ramdisk
gzip -vf9 ramdisk
ramdisk:              79.9% -- replaced with ramdisk.gz
test -f ramdisk.gz
../tool/mkimage -A arm -O linux -T ramdisk -C gzip -a 0 -e 0 -n eddy-fs-20a.bin -d ./ramdisk.gz eddy-fs-20a.bin
Image Name:    eddy-fs-20a.bin
Created:       Thu Nov  1 13:39:02 2007
Image Type:    ARM Linux RAMDisk Image (gzip compressed)
Data Size:     2104223 Bytes = 2054.91 kB = 2.01 MB
Load Address: 0x00000000
Entry Point:   0x00000000
test -f eddy-fs-20a.bin
cp eddy-fs-20a.bin ../firmware/
[shlee@localhost ramdisk]$ cd ../firmware/
[shlee@localhost firmware]$ ls
eddy-fs-20a.bin
[shlee@localhost firmware]$
```

As shown in the picture above, a new firmware file “eddy-fs-20a.bin” has been created. Now you have to upload the firmware image to Eddy via Web or FTP, save it to Eddy’s flash memory, and reset Eddy. Then Eddy will run with uploaded firmware settings.

5.2 Firmware update via FTP server

Upload created firmware file to Eddy and save it in Flash Memory.
Firmware upgrade can be carried out by 1) through a FTP, 2) through a Web browser and 3) through a bootload. Upgrading firmware procedures through a Web browser is described in “Eddy-Serial-User_Guide”. And upgrading firmware procedures through bootload is described in “9.1 System Recovery” of this manual.

This chapter will introduce upload method using a FTP.
On Windows, FTP can be used in cmd(command prompt) to carry out upload process.
Upload the created firmware eddy-fs-20a.bin to the /tmp directory of Eddy, using an FTP. (See Chapter 4.4 for more information)

```
[shlee@localhost firmware]$ ftp 192.168.0.223
Connected to 192.168.0.223.
Name (192.168.0.223:shlee): eddy
331 Please specify the password.
Password:
230 Login successful.
ftp〉 cd /tmp
250 Directory successfully changed.
ftp〉 bin
200 Switching to Binary mode.
ftp〉 put eddy-fs-20a.bin
local: eddy-fs-20a.bin remote: eddy-fs-20a.bin
227 Entering Passive Mode (192,168,0,223,195,50)
150 Ok to send data.
226 File receive OK.
2104287 bytes sent in 0.47 seconds (4.3e+03 Kbytes/s)
ftp〉 by
221 Goodbye.
[shlee@localhost firmware]$
```

Use Telnet to check eddy-fs-20a.bin is in the /tmp directory.

Use “upgrade eddy-fs-20a.bin” command to update the firmware.

```
# pwd
/tmp
# ls   eddy-fs-20a.bin
eddy-fs-20a.bin
#
# upgrade eddy-fs-20a.bin
FileSystem Erase ... 2388341 Bytes
FileSystem Write ... eddy-fs-20a.bin, 2388341 Bytes
.........................................................................................................
Flash Write OK
.........................................................................................................
Flash Verify OK
Update Complete
please reboot the system!
```

In order for the updated firmware to take effect, you need to reboot the module.

After rebooting you can see sample program running as shown below.

```
Eddy login: eddy
Password:
# cd /sbin
# ls
Hello_World        ifconfig        nameif           switch_root
com_redirect       ifdown            pinetd           sysctl
…
hwclock            modprobe           swapon
#  ./Hello_World
hello world !!!
```

Chpater6. Library Introduction

This chapter introduces useful libraries and API functions that are applicable with Eddy-Serial DK.

6.1 Introduction

All the functions introduced in this chapter are all APIs included in SB_APIs.a of /src/Eddy_APPs/SB_APIs directory. You also need to mention this library in the Makefile. All sample source codes accompanied with Eddy-DK use this library, and you can see the source codes and Makefile for more information.

6.2 Makefile

Library is in /src/Eddy_APPs/SB_APIs/ directory, as a form of SB_API.a.

You need to specify in the Makefile in order to use this library, so please refer to the Makefile inside /src/Eddy_APPs/ folder.

6.3 System functions

Timer and delay functions needed for making application program.

SB_SetPriority

Function	Specifies priority level of task.	
Format	Void SB_SetPriority (int Priority_Level);	
Parameter	Priority_level	Low (1) ~ High (99)
Returns	None	
Notice	Configures the priority level of task execution to the system. The lowest level is 1, whereas the highest level is 99. It is recommended to set level below 50; when a certain task's level is set above 50, that task will be executed prior to others, possibly affecting other tasks' operation.	

SB_GetTick

Function	Returns time measured after Eddy has been booted in msec.	
Format	Unsigned long SB_GetTick (Void);	
Parameter	None	
Returns	0 ~ 4,294,967,295	
Notice	Returned value is system tick counter in msec unit. After it reaches the maximum value 0xffffffff of unsigned long type, it starts from zero again – which is about period of 50 days.	

SB_msleep

Function	Delays in msec unit.	
Format	void SB_msleep (int msec);	
Parameter	msec	Configure delay time in msec unit.
Returns	none	
Notice	Precisely delays in msec unit.	

SB_AliveTime

Function	Returns time measured after Eddy has been booted in day, hour, minute, and second.	
Format	void SB_AliveTime (int *day, int *hour, int *min, int *sec);	
Parameter	*day	Days Eddy has been operationg (0 ~)
	*hour	Hour (0 ~ 23)
	*min	Minute (0 ~ 59)
	*sec	Second (0 ~ 59)
Returns	None	
Notice		

6.4 Eddy Environment Function

Environment functions related with Eddy File System which gives information such as Eddy's version, environment configuration, version, etc.

SB_GetModel

Function Reads model type of Eddy.

Format int SB_GetModel (Void));

Parameter None

Returns

0x00 ~ 0x1f	Eddy’s model number
0x1f	EDDY_CPU
0x00	EDDY_S1_PIN
0x01	EDDY_S1_PIN_C
0x02	EDDY_S1_DB9
0x03	EDDY_S1_DB9_C
0x04	EDDY_S1_POE
0x05	EDDY_S1_POE_C
0x06	EDDY_S2_M
0x07	EDDY_S2_M
0x08	EDDY_WS1_TTL
0x09	EDDY_WS1_TTL_C
0x0a	EDDY_WS1_PIN
0x0b	EDDY_WS1_PIN_C
0x0c	EDDY_WS1_DB9
0x0d	EDDY_WS1_DB9_C
0x1e	EDDY_DK

Notice Eddy provides various models with CPU module. It returns 0x1f when the user id developing hardware to mount Eddy-CPU, whereas it returns model number when the user is using model provided by SystemBase.

(Please refer to src/include/sb_define.h)

SB_GetVersion

Function Reads version of O/S, file system, and bootloader ported to Eddy in string type.

Format void SB_GetVersion (int type, char *version);

Parameter

type	Specifies version the function will read.
	‘B’: Eddy’s bootloader version
	‘K’: Eddy’s O/S version
	‘F’: Eddy’s file system version
Version	Pointer where version information string will be stored.

Returns None

Notice Version information will be read like “1.0a.”

BootLoader and O/S will be provided by SystemBase; therefore these cannot be changed. In case file system is programmed by the user, the version can be set by the user.

When the parameter type other than ‘B’ ,’K’, ‘F’ are called, the function will return “0.00” as version information.

SB_ReadConfig

Function Reads Eddy’s operating environment configuration file.

Format void SB_ReadConfig (char *FileName, Struct SB_CONFIG *cfg);

Parameter FileName File name including the path file is located.

/etc/sb_config,

/etc/sb_default_config

/flash/sb_config

*cfg Point of the buffer where the environment configuration file is read and saved.

Returns None

Notice Environment configuration file managed by Eddy is located at /etc, /flash. “/etc/sb_config” file is temporary environment configuration file where the modified configuration is applied when the configuration is changed via web or telnet. Every eddy application will refer to this file for the operation.

“/etc/sb_default_config” is configuration file used for Eddy’s factory default configuration which will be applied to Eddy’s environment configuration when factory default command from web or telnet is given.

“/Flash/sb_config” is changed to “/etc/sb_config” when the configuration is changed via web or telnet. This file stores modified information even when the Eddy’s power is reset, and helps Eddy to operate as configured by Eddy reading this information when Eddy is first booted.

(Please see /Eddy_APPs/include/sb_config.h)

SB_WriteConfig

Function Saves Eddy’s operating environment configuration information into file.

Format void SB_WriteConfig (char *FileName, Struct SB_CONFIG *cfg);

Parameter FileName File name including path where the saved file will be located at

/etc/sb_config,

/flash/sb_config

*cfg Struct buffer point which stores the environment configuration information to be saved

Returns None

Notice

SB_GetSharedMemory

Function	Reads pointer of registered shared memory.	
Format	void *SB_GetSharedMemory (int Key_ID, int Buffer_Size);	
Parameter	Key_ID	ID of registered shared menory
	Buffer_Size	Size of shared memory used
Returns	*buffer_address	Memory address of shared memory Returns -1 upon failure.

Notice

Portview is Windows application developed by SystemBase which can remotely monitor Eddy’s operating condition. In contrast, SNMP server, which provides basically same function as Portview, is industry’s standard monitoring protocol S/W developed by 3Com, Cysco, etc. and sold in hundreds of thousands of U.S. dollars.

To be compatible with both of the applications, each application in Eddy uses shared memory to store information and send the information to Portview and SNMP.

Note that PortView and SNMP Agent has to be set in the environment configuration.

SB_SetSharedMemory

Function	Requests shared memory to be used and read memory pointer.	
Format	void *SB_SetSharedMemory (int Key_ID, int Buffer_Size);	
Parameter	Key_ID	ID of shared memory to be registered
	Buffer_Size	Size of shared memory to be used
Returns	*buffer_address	Memory address of shared memory Returns -1 upon failure.

Notice

In Eddy this function is used for PortView and SNMP agent.

User can use this function to access shared memory for other purpose.

SB_SetReadyLed

Function	Contols Ready LED.	
Format	void *SB_SetReadyLed (int OnOff);	
Parameter	OnOff	0: Turn off Ready LED. 1: Turn on Ready LED.

Returns	None
Notice	Contols Ready LED mounted at each Eddy model.

6.5 Serial functions

These functions are used to handle internal serial port and UART.

SB_OpenSerial

Function	Opens serial port.	
Format	int SB_OpenSerial (int Port_No);	
Parameter	Port_No	Serial port number 0: First serial port 1: Second serial port (Only available for Eddy-CPU, Eddy-DK)
Returns	-1 ~ N	Opened serial port handle -1: Open error N: Opened serial port handle
Notice	Eddy provides maximum two serial ports; however for normal model where Eddy-CPU is mounted, Eddy only provides one serial port. DK board has two on-board serial ports. User can use both of the serial ports if the user sets DIP switch on DK board to make it recognized as Eddy-CPU or Eddy-DK.	

SB_InitSerial

Function	Initialize data communication configuration of serial port.	
Format	Void SB_InitSerial (int Handle, char Speed, char LCR, char Flow);	
Parameter	Handle	Serial port handle acquired from OpenSerial
	Speed	Baud rade

0	:	150 BPS,	1	:	300 BPS
2	:	600 BPS	3	:	1200 BPS:
4	:	2400 BPS	5	:	4800 BPS
6	:	9600 BPS	7	:	19200 BPS
8	:	38400 BPS	9	:	57600 BPS
10	:	115200 BPS	11	:	230400 BPS
12	:	460800 BPS	13	:	921600 BPS

LCR X X P P S D D (8 bis binary)

P P : Parity Bits

0 0 : None, 0 1 : Odd, 1 0, 1 1: Even

S : Stop Bits

0 : 1 bits, 1 : 2 bits

D D : Data Bits

0 0 : 5 bits, 0 1 : 6 bits

1 0 : 7 bits, 1 1 : 8 bits

FlowControl Types of flow control

0: no flow control

1: RTS/CTS flow control

2: Xon/Xoff flow contorl

Returns None

Notice

SB_SetSerialInterface

Function Configures interface type of serial port.

Format Void SB_SetSerialInterface (int Interface);

Parameter Interface Interface ID of RS422/RS485

: RS422 (point to Point)

: RS422 (MultiDrop)

: RS485 (None_Echo)

4. : RS485 (Echo)

Returns None

Notice This function is needed only for serial model named “-C”, that is RS-422/486 combo model; it is not needed when the user is developing new hardware using Eddy-CPU.

DK board has two on-board serial ports. User can use the first serial port for either RS422 or RS485 if the user sets DIP switch on DK board to make it recognized as Eddy-DK.

SB_SendSerial

Function	Send data to the serial port.	
Format	Void SB_SendSerial (int handle, char *data, int length);	
Parameter	handle	Handle which opened serial port or socket
	data	Pointer of the data to be sent
	length	Length of the data to be sent
Returns	None	
Notice	When the transmit buffer is full, this function will retry up to 10 time in 20 msec period; it will return after transmission is completed.	

SB_ReadSerial

Function	Reads data from the serial port.	
Format	int SB_ReadSerial (int handle, char *data, int length, int wait_msec);	
Parameter	handle	Handle which opened the serial port.
	data	Buffer pointer where the read data will be saved.
	length	Size(length) of the buffer memory
	wait_msec	Time it will wait for next data reception from reading receive buffer
Returns	0 ~ n	Size of the read data
Notice	When wait_msec is set to 0 this function will only read data from serial receive buffer; when set larger than 0, it will read data from serial receive buffer, wait for time specified in msec unit, and then continue reading data from serial port as one packet. The maximum size of the data is same as buffer's size, i.e. length. You can use value obtained from SB_GetDelaySerial function or value manually calculated for wait_msec.	

SB_GetMsr

Function	Reads MSR register value from serial port	
Format	Char SB_GetMsr (int handle);	
Parameter	handle	Handle which opened the serial port.
Returns	Value	MSR Register 값 Bit 7 6 5 4 3 2 1 0 Bit0: CTS change Bit1: DSR change Bit2: RI change Bit3: DCD change Bit4: CTS (0:Low, 1:High) Bit5: DSR (0:Low, 1:High)

		Bit6: RI (0:Low, 1:High)
		Bit7: DCD (0:Low, 1:High)
Notice		

SB_SetRts

Function	Controls RTS signal line of the serial port.	
Format	Void SB_SetRts (int handle, int value);	
Parameter	handle	Handle which opened the serial port.
	Value	0: off Set RTS signal to low. 1: on Set RTS signal to high.
Returns	None	
Notice		

SB_SetDtr

Function	Controls DTR signal line of the serial port.	
Format	Void SB_SetDtr (int handle, int value);	
Parameter	handle	Handle which opened the serial port.
	Value	0: off Set DTR signal to low. 1: on Set DTR signal to high.
Returns	None	
Notice		

SB_GetDelaySerial

Function	Calculate and return input delay time for three bytes data with given serial communication speed in msec unit.	
Format	Void SB_GetDelaySerial (int bps);	
Parameter	Bps	Serial communication speed
Returns	int	Input delay time
Notice	This function can be used to calculate wait_msec of SB_ReadSerial function. When the communication speed is faster than 230400 bps, this function will return 1 since Eddy's minimum delay is 1 msec.	

6.6 Ethernet functions

These functions deal with the network-related information of Eddy.

These functions are optimized socket API for Eddy, and user can use other API for development by using his or her own POSIX compatible standard socket API.

SB_GetIp

Function	Reads IP address assigned to Eddy.	
Format	Unsigned int SB_GetIp (char *interface);	
Parameter	Interface	Network interface name. “eth0” for Eddy Serial model “eth1” for Eddy WiFi model.
Returns	Unsigned int	Read IP address and returns in unsigned int type.

Notice	Note that it returns operating IP address, not the IP address configured in Eddy. When Eddy is operating as a DHCP Client, this function read network IP address assigned from DHCP server.
	Please see below for transforming IP address into string type.
	struct in_addr addr;
	addr.s_addr = SB_GetIp ();
	printf ("IP Address : %s ", inet_ntoa(addr));	

SB_GetMask

Function	Reads subnet mask address assigned to Eddy.	
Format	Unsigned int SB_GetMack (char *interface);	
Parameter	Interface	Interface name to be read “eth0” for Eddy Serial model “eth1” for Eddy WiFi model
Returns	Unsigned int	Returns mask address in unsigned int type
Notice	Please see SB_GetIp also	

SB_GetGateway

Function	Reads gate address assigned to Eddy.	
Format	Unsigned int SB_SetGeteway(void);	
Parameter	None	
Returns	Unsinged int	Returns gate address in unsigned int type
Notice	Please see SB_GetIp also	

SB_ConnectTcp

Function	Make connection to the server specified as TCP socket.	
Format	Int SB_ConnectTcp (char *IP_Address, int Socket_No, int Wait_Sec, Int Tx_Size, int Rx_Size);	
Parameter	IP_Address	IP address to connect in string type
	Socket_No	Socket number of the server to connect
	Wait_Sec	Wait time for connection (in second)
	Tx_Size	Tx buffer size of the socket (in K bytes)
	Rx_Size	Rx buffer size of the socket (in K bytes)
Returns	-1 ~ N	Handle number of the connected socket -1: Connection failure N: Handle number of the connected socket
Notice	If the connection is not made when this function is called, it will try to re-connect for time specified in wait_sec and return. Tx,Rx_Size are size of the socket buffer size. These can be set from 1 to 64. If it is set to number smaller than 1, size will 4kbytes as default; number larger than 64 will set size of the buffer to 64kbytes as default.	

SB_ListenTcp

Function	Wait for connection to TCP socket	
Format	Int SB_ListenTcp (int Socket_No, Int Tx_Size, int Rx_Size);	
Parameter	Socket_No	TCP socket number to wait for connection
	Tx_Bytes	Tx buffer size of the socket (in K bytes)
	Rx_Bytes	Rx buffer size of the socket (in K bytes)
Returns	-1 ~ N	Handle number of the TCP socket waiting for connection -1: Socket connection waiting failure N: Handle number of the TCP socket waiting for connection
Notice	As a non-blocking function, this function requests connection and returns without waiting for connection. SB_AcceptTcp will handle waiting for connection. Tx,Rx_Size are size of the socket buffer size. These can be set from 1 to 64. If it is set to number smaller than 1, size will 4kbytes as default; number larger than 64 will set size of the buffer to 64kbytes as default.	

SB_AcceptTcp

Function	Waits for network connection of TCP socket handle.	
Format	Int SB_AcceptTcp (int Socket_No, int wait_msec);	
Parameter	Socket_No	TCP socket handle number to wait for connection. (Return value of SB_ListenTcp)
	wait_msec	Connection standby time (in msec)
Returns	-1 ~ N	New handle number of connected TCP socket. -1: Socket error 0: Waiting for connection N: New handle number of connected TCP socket.
Notice	When new handle number is given after connection is made, previous handle that has been waiting will be closed inside this function.	

SB_AcceptTcpMulti

Function	Grants network multiple connection of TCP socket handle waiting for connection.	
Format	Int SB_AcceptTcpMulti (int Socket_No, int wait_msec);	
Parameter	Socket_No	TCP socket handle number waiting for connection. (Return value of SB_ListenTcp)
	wait_msec	Connection standby time (in msec)
Returns	-1 ~ N	New handle number of connected TCP socket. -1: Socket error 0: Waiting for connection N: New handle number of connected TCP socket.
Notice	When new handle number is given after connection is made, it will not close previous handle waiting for connection, granting maximum of 1024 socket connection.	

SB_ReadTcp

Function	Read data from connected TCP socket.	
Format	Int SB_ReadTcp (int Handle, char *Buffer, int Buffer_Size);	
Parameter	Handle	Handle number of connected TCP socket
	Buffer	Buffer point where packet data to be read will be saved
	Buffer_Size	Size of the buffer to save
Returns	-1 ~ N	Size of the data read. -1: Socket error

		0: No data was read
		N: Length of the data read
Notice	When return code is -1, it means the connection is lost with the client so user has to close TCP socket handle.	

SB_CloseTcp

Function	Close TCP socket handle.	
Format	Int SB_CloseTcp (int Handle);	
Parameter	Handle	TCP socket handle number to close
Returns	None	
Notice	This function shuts down socket handle to finish communication and closes.	

SB_BindUdp

Function	Binds UDP socket.	
Format	Int SB_BindUdp (int Socket_No);	
Parameter	Socket_No	UDP socket number to bind
Returns	Handle	Handle number bound to UDP socket
		-1: Bind failure
		N: Handle number bound to UDP socket
Notice		

SB_ReadUdp

Function	Reads data transmitted to UDP socket bound in network.	
Format	Int SB_ReadUdp (int Handle, char *Buffer, int Buffer_Size);	
Parameter	Handle	Handle number bound to UDP socket
	Buffer	Buffer point where packet data to be read will be saved
	Buffer_Size	Size of the buffer to save
Returns	-1 ~ N	Size of the data read.
		-1: Socket error
		0: No data was read
		N: Length of the data read
Notice	When client sends data to bound UDP socket, this function remembers client’s IP address and socket number for SB_SendUdpServer to use.	

SB_SendUdpServer

Function	Transmits data to UDP socket. (Server mode)	
Format	Int SB_SendUdpServer (int Handle, char *Buffer, int Data_Size);	
Parameter	Handle	Handle number bound to UDP socket
	Buffer	Buffer point where packet data to be sent is saved
	Data_Size	Size of the buffer to send
Returns	None	
Notice	This function can be called after confirming client's network information by sending data to UDP socket bound to Eddy from network; that is, user has to call SB_ReadUdp first. When data transmission has to be made first, user has to use SB_SendUdpClient function.	

SB_SendUdpClient

Function	Transmit data to UDP socket (Client mode)	
Format	Int SB_SendUdpClient (int Handle, char *Buffer, int Data_Size, Char *IP_Address, int Socket_No);	
Parameter	Handle	Handle number bound to UDP socket.
	Buffer	Buffer point where packet data to be sent is saved.
	Data_Size	Size of the buffer to send.
	IP_Address	IP address to send data to.
	Socket_No	Socket number to send data to.
Returns	None	
Notice	This function can be used when user already knows destination network information to send data to using UDP socket. When data transmission has to be made first, user has to use SB_SendUdpClient function..	

6.7 GPIO Functions

The following functions are used to control maximum 16 different GPIO ports that have been installed.

Using each GPIO port user can sense 3.3V voltage or control output.

SB_SetGpioMode

Function	Configures data communication direction of GPIO port.

Format void SB_SetGpioMode (int GpioNo, int Mode);

Parameter GpioNo GPIO port number (0 ~ 15)

Mode Input/output direction

0 : Input (Senses 3.3V input voltage)

1 : Output (Controls 3.3V output voltage)

Returns None

Notice There are maximum of 16 GPIO ports provided by Eddy.
Number of GPIO ports varies according to the model.
Eddy-CPU provides 16 GPIO, whereas Eddy-S1/Pin provides 4, and none from others.

SB_SetGpioValue

Function Drives 3.3V output to specified GPIO port.

Format Void SB_Set_GpioValue (int GpioNo, int value);

Parameter GpioNo GPIO port number

value GPIO configuration value

0 : low (Stop driving 3.3 V to output)

1 : high (Drive 3.3V to output)

Returns None

Notice I/O mode (direction) of GPIO port specified in GpioNo has to be in output mode.

SB_GetGpioMode

Function Reads I/O mode setting of specified GPIO port.

Format int SB_GetGpioMode (int GpioNo);

Parameter GpioNo GPIO port number

Returns 0, 1 GPIO mode value read

0: input (Configured as input mode)

1: Output (Configured as output mode)

Notice

SB_GetGpioValue

Function Reads current status of specified GPIO port.

Format int SB_GetGpioValue (int GpioNo);

Parameter GpioNo GPIO port number

Returns	0, 1	GPIO value read 0 : low (3.3V is not present at the port) 1 : high (3.3V is present at the port)
Notice	I/O mode (direction) of GPIO port specified in GpioNo has to be in input mode.	

6.8 Debugging Function

Eddy can debug operating condition of each application via Telnet in real time.

The following functions are used to print debug log message to Telnet window when SB_DEBUG of each application is set ON.

SB_LogDataPrint

Function Print each byte of data in hex or ascii code.

Format void SB_LogDataPrint (char *RTx, char *buff, int data_len);

Parameter	*RTx	Description message of data
	*Buff	Buffer address of data to be printed is saved/
	Data_len	Size of data.
Returns	None	

Notice Prints messages to telnet which logged in first.
The message include Eddy's tick counter of 1msec unit and printed in following form.

```
SB_LogDataPrint (“Send”,   “\t12345\n”,   8);
[191020202]     Send    8      =   08,1,2,3,4,5,0d,0a
--------------     -------    ------       -----------------------
Tick Counter      RTx        data_Len      buff
```

Debugging of each application in Eddy can be configured as follows by using Def command. (Please see def.c)

```
# def   po   <1/2/all> debug   <on/off>
```

SB_LogMsgPrint

Function Prints in the same format as Printf.

Format void SB_LogMsgPrint (const char *Format, . . .);

Parameter	*Format	Format of Printf
Returns	None	

Notice Prints messages to telnet which logged in first.
The message include Eddy's tick counter of 1msec unit and printed in following form.

```
SB_LogMsgPrint (“%s means Real-Time\n”, “Eddy”);
[191020202]     Eddy means Real-Tile
```

Debugging of each application in Eddy can be configured as follows by using

Def command. (Please see def.c)

```
# def    po    <1/2/all> debug    <on/off>
```

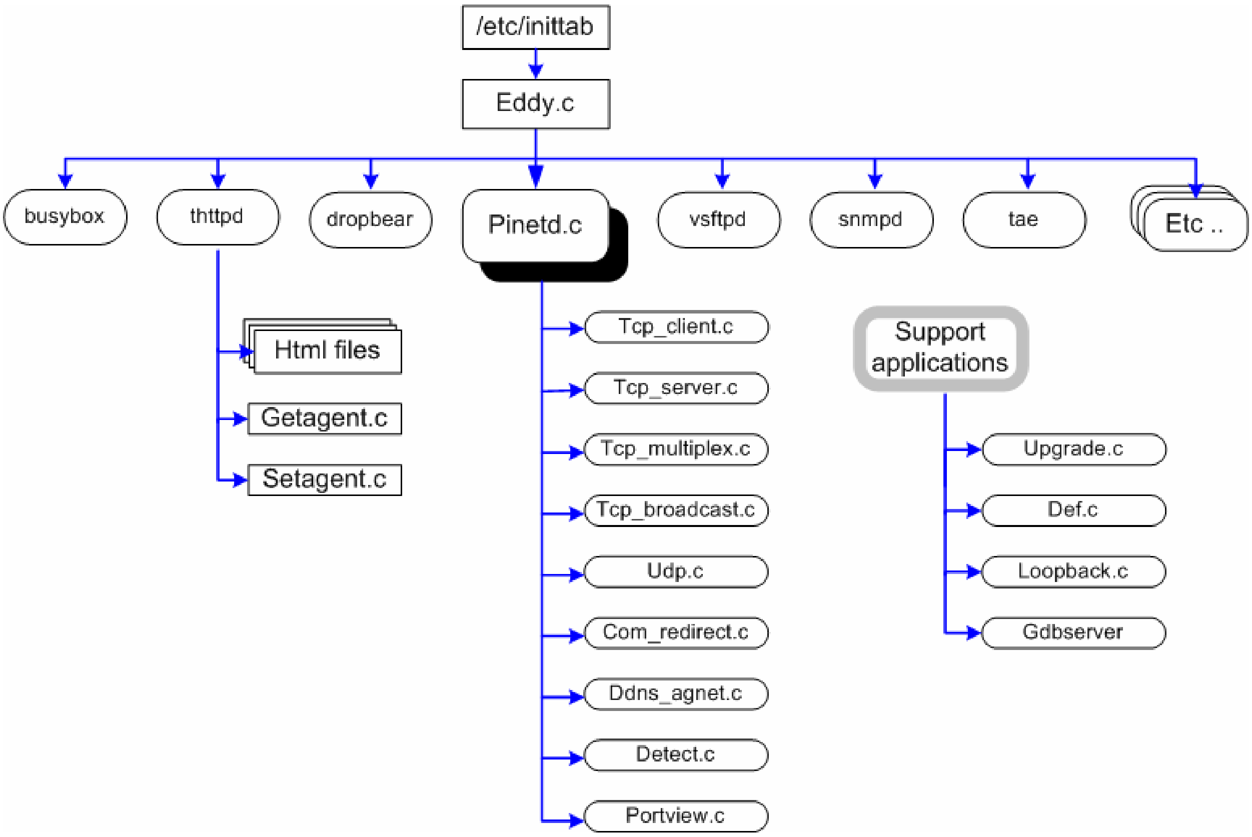
Chpater7. Eddy Software

This chapter explains software structure ported to Eddy-DK.

Source codes for all application except Com_redirect, gdbserver, tae, SB_APIs library are disclosed. These codes may be used as development guide when programming one's own firmware.

7.1 Software Structure Diagram

Eddy.c is the first program that is executed upon boot up. Environment configuration information configured either by web or def.c is then read. All provided Eddy applications were developed by using libraries explained in Chapter 6.



7.2 Main Applications

eddy.c and pinetd.c are introduced in this chapter. These two programs play the most important role in Eddy. Other applications can be divided into applications that are run and monitored by pinetd.c and applications that are manually run by users. Please see “4.1 Source Code” for simple functional description of each application.

7.2.1 eddy.c Application

Program run at first after Eddy is booted, this reads sb.config which is environment file saved at /flash.

When environment file is not present at /flash, it will use /etc/sb_default_config file to reset environment configuration to factory setting.

This also copies environment configuration file of /flash to /etc directory so each application can refer to it.

This initializes network with configuration information of Sb_config file, and runs various daemon program.

7.2.2 Pinetd.c Application

Daemon program in the highest hierarchy of program run by Eddy.c, this checks model of Eddy and configures system environment according to the characteristics of each model.

This reads Sb_config environment file to run and monitor each program.

This periodically monitors Eddy’s operating status and blinks readyLed so that user can check the status.

This also periodically monitors reset switch to read user’s request for reset of factory reset.

7.2.3 Other Applications

The following shows applications run according to the protocol of each serial port defined in Sb_config.

Tcp_server, tcp_client, com_redirect, tcp_broadcast, tcp_multiplex, udp (udp_server/client)

The following shows applications run to handle external network service regardless of serial ports.

Portview, detect, ddns_agent

The following shows application which user can manually run by connecting via telnet.

Def, upgrade, loopback,

Chpater8. Handling HTML & CGI

This chapter describes the HTML documents and CGI modules that are used for configuration. Provided CGI source and HTML documents are used by Eddy's default firmware. Take a look at these sources and modify them as you want.

8.1 WEB Configuration

HTML sources run by Eddy are located at src/Eddy_APPs/web/htdocs.

CGI sources supporting information needed by HTML is located at src/Eddy_APPs/web/cgi.

getagent.c

This reads environment configuration file of /etc/sb_config and transfers configuration value to HTML page to show configuration information with browser.

setagent.c

This reads configuration value modified by user in HTML page and saves to configuration file of /etc/sb_config.

8.2 Example HTML code

The following example is part of main.html source.

For users cannot program using variables as they would do in C language, HTML processes by using symbols linked with CGI to receive value as shown below.

Shown in red are symbol link which transfers value from getagent.c.

(network.html source abstract)

```
<tr bgcolor="#FFFFFF">
<td class="content">IP Address</td>
<td class="content"><input type="text" size="16" maxlength="16" name="N_IP" value="[v,n_ip]" >

<tr bgcolor="#FFFFFF">
<td class="content">Subnet Mask</td>
<td class="content"><input type="text" size="16" maxlength="16" name="N_MASK" value="[v,n_mask]"
>

<tr bgcolor="#FFFFFF">
<td class="content">Gateway</td>
<td class="content"><input type="text" size="16" maxlength="16" name="N_GW" value="[v,n_gw]" >

<tr bgcolor="#FFFFFF">
<td class="content">DNS</td>
```

```
<td class="content"><input type="text" size="16" maxlength="16" name="N_DNS" value="[v,n_dns]" >

<tr bgcolor="#FFFFFF">
<td class="content">Telnet Service</td>
<td class="content"><select name="N_TELNET">
        <option [v, n_telnet_di] value="0">Disable</option>
        <option [v, n_telnet_en] value="1">Enable</option>
</select>

<tr bgcolor="#FFFFFF">
<td class="content">Telnet Service</td>
<td class="content"><select name="N_WEB">
        <option [v, n_web_di] value="0">Disable</option>
        <option [v, n_web_en] value="1">Enable</option>
</select>
```

As shown above there are name and value part for each record to link with CGI.

Name stores information modified by user in HTHM so that it can save modified value when the user click on submit button at the lower part of HTML page. Value reads value to getagent.c to display on HTML page and lets user to modify the value she or he wants.

8.3 Example CGI Code

Eddy-Serial DK has two CGI programs: getagent.cgi and setagent.cgi.

“getagent.c” reads /etc/sb_config file to HTML document to display configuration information, and “setagent.c” saves user-modified information from HTML document back to /etc/sb_config file and ultimately saves to flash/sb_config so the user-modified environment configuration information is stored even if Eddy is reset.

The following example shows processing part of getagent.c to display configuration value HTML page of example above.

[Source abstract]

```
  if (cgiFormStringNoNewlines("N_IP", buff, 16) == cgiFormNotFound)
  {
              sprintf(buff, "%d.%d.%d.%d",cfg.system.ip[0], cfg.system.ip[1],cfg.system.ip[2],cfg.system.ip[3]);
              listPutf(list, "n_ip", buff);
  }
  else
              listPutf(list, "n_ip", buff);

  if (cgiFormStringNoNewlines("N_MASK", buff, 16) == cgiFormNotFound)
  {
              sprintf(buff, "%d.%d.%d.%d",cfg.system.mask[0], cfg.system.mask[1],
                          cfg.system.mask[2],cfg.system.mask[3]);
              listPutf(list, "n_mask", buff);
  }
  else
            listPutf(list, "n_mask", buff);

  if (cgiFormStringNoNewlines("N_GW", buff, 16) == cgiFormNotFound)
  {
            sprintf(buff, "%d.%d.%d.%d", cfg.system.gateway[0], cfg.system.gateway[1],
                      cfg.system.gateway[2],cfg.system.gateway[3]);
            listPutf(list, "n_gw", buff);
  }
  else
            listPutf(list, "n_gw", buff);

if (cgiFormStringNoNewlines("N_DNS", buff, 16) == cgiFormNotFound)
{
            sprintf(buff, "%d.%d.%d.%d",cfg.system.dns[0], cfg.system.dns[1],
                      cfg.system.dns[2],cfg.system.dns[3]);
          listPutf(list, "n_dns", buff);
}
else
            listPutf(list, "n_dns", buff);

cgiFormInteger("N_TELNET", &value, cfg.system.telnet_server);
if (value == 1)
{
            listPutf(list, "n_telnet_di", "");
            listPutf(list, "n_telnet_en", "selected");
}
else
{
            listPutf(list, "n_telnet_di", "selected");
          listPutf(list, "n_telnet_en", "");
}
cgiFormInteger("N_WEB", &value, cfg.system.web_server);
if (value == 1)
{
            listPutf(list, "n_web_di", "");
          listPutf(list, "n_web_en", "selected");
  }
```

```
 else
  {
                 listPutf(list, "n_web_di", "selected");
                 listPutf(list, "n_web_en", "");
  }
```

The following shows processing part of setagent.c to save user-modified configuration value when the user clicks on “submit” button on HTML page.

[Source abstract]

```
value2 = cgiFormStringNoNewlines("N_IP", buff, 16);
if (value2 != cgiFormEmpty)    convert_address (buff, cfg.system.ip);

value2 = cgiFormStringNoNewlines("N_MASK", buff, 16);
if (value2 != cgiFormEmpty)    convert_address (buff, cfg.system.mask);

value2 = cgiFormStringNoNewlines("N_GW", buff, 16);
if (value2 != cgiFormEmpty)    convert_address (buff, cfg.system.gateway);

value2 = cgiFormStringNoNewlines("N_DNS", buff, 16);
if (value2 != cgiFormEmpty)    convert_address (buff, cfg.system.dns);

cgiFormInteger("N_TELNET", &value, cfg.system.telnet_server);
cfg.system.telnet_server = value;

cgiFormInteger("N_WEB", &value, cfg.system.web_server);
cfg.system.web_server = value;
```

Chpater9. Appendix

This chapter explains how to recover Eddy when flash of Eddy is damaged and it cannot be booted.

9.1 System recovery

Even if the flash in the user area has been damaged, it does not affect system booting. But if the system continuously reboots due to user program failure, or if the system is inaccessible as a result of wrong IP setting, you have to change the system to factory default status.

You can reload firmware from bootloader to change the system to default status. In order to do this, TFTP server has to be installed at the computer with Linux environment.

- Warning

Once the bootloader is damaged, it cannot be recovered. Therefore user should not use command other than ones provided from manual.

9.1.1 Installing TFTP in Linux environment

The following explains how to recover system with bootloader in Fedora core 5 operating system.

If you are using other operating system, you will need tftp-server and xinetd daemon compatible with that operating system.

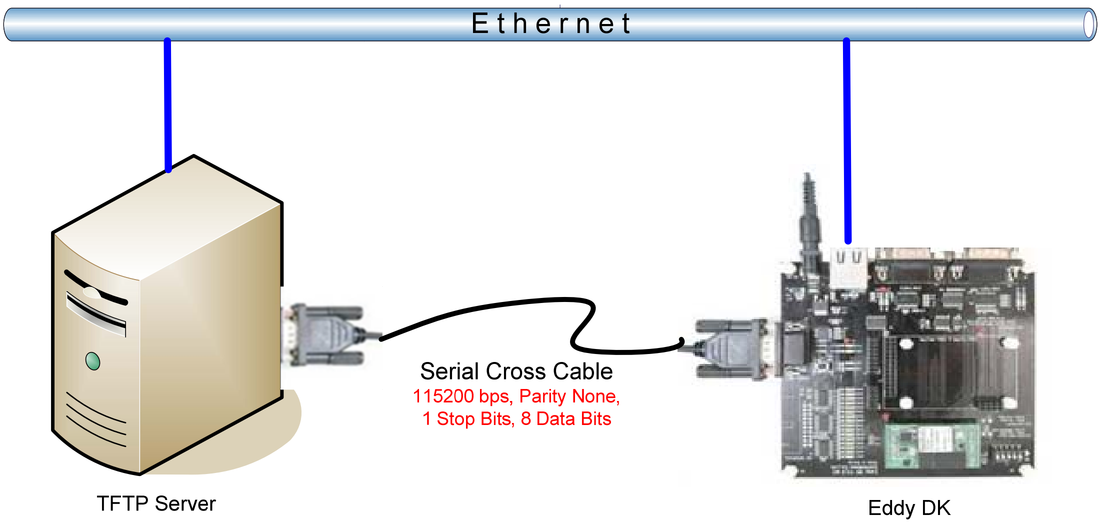
First check to make sure tftp-server is installed.

If you don't install tftp-server, you should install.

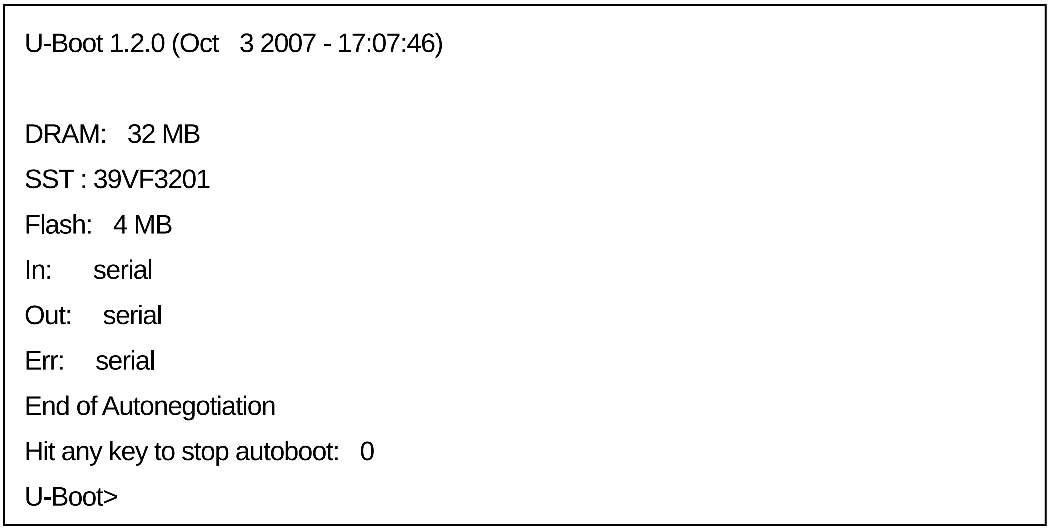
After install tftp-server, move provided firmware (firmware folder in SDK folder) to tftpboot folder(usually /tftpboot folder in Fedora core 5).

9.1.2 Hardware Install and Recovery

Connect LAN port of computer and that of DK board using LAN cable.
Connect debug port and computer's serial cable using serial cross cable and use minicom to connect to computer's serial port. Configure computer's serial port setting to 115200 bps, 8 data bit, No parity, 1 stop bit and power on Eddy DK.



After power on the following messages will be printed to minicom.
When these are printed, press enter to enter into bootloader. The below image shows status after entering bootloader.



```
U-Boot 1.2.0 (Oct   3 2007 - 17:07:46)


DRAM:   32 MB
SST : 39VF3201
Flash:   4 MB
In:      serial
Out:     serial
Err:     serial
End of Autonegotiation
Hit any key to stop autoboot:   0
U-Boot>
```

You can recover by copying OS, firmware, and config image to flash memory in bootloader.

To upgrade OS, firmware, and config image file, you have to configure Eddy's virtual IP address and TFTP server's IP address in bootloader.

You can use "printenv" command to check the current configuration of Eddy and TFTP server's IP address configured in bootloader.

```
U-Boot> printenv
Bootstrap_FLASH=0x10000000
bootloader_FLASH=0x10002000
BootEnv_FLASH=0x10001000
OS_FLASH=0x1001E000
FileSystem_FLASH=0x1012E000
Config_FLASH=0x103AE000
Bootstrap_END=0x10000FFF
bootloader_END=0x1001DFFF
BootEnv_END=0x10001FFF
OS_END=0x1012DFFF
FileSystem_END=0x103ADFFF
Config_END=0x103FFFFF
Download_SDRAM=0x20000000
OS_SDRAM=0x20000000
FileSystem_SDRAM=0x20500000
Bootstrap_Version=20a
bootloader_Version=20a
OS_Version=20a
FileSystem_Version=20a
Config_Version=20a
bootargs=root=/dev/ram rw console=ttyS0,115200,mem=32M
bootcmd=cp.b ${OS_FLASH} ${OS_SDRAM} 0x110000; cp.b ${FileSystem_FLASH}
${FileSystem_SDRAM} 0x280000; bootm ${OS_SDRAM} ${FileSystem_SDRAM}
bootdelay=1
baudrate=115200
ethaddr=00:05:F4:11:22:33
Config_Size=10000
stdin=serial
stdout=serial
stderr=serial
OS_Size==20000000
filesize=1f0f07
fileaddr=20000000
netmask=255.255.255.0
ipaddr=192.168.0.223
serverip=192.168.0.220
FileSystem_Size=0
```

```
U-Boot> setenv serverip   <TFTP server IP address>
U-Boot> setenv ipaddr     <Eddy IP address>
U-Boot>
```

Once the IP information is confirmed start recovery.

```
install   bootloader   <name of bootloader firmware>        ; When recovering bootloader area
install   os           <name of OS firmware>                ; When recovering OS area
install   fs           <name of File System firmware>       ; When recovering File System area
install   config       <name of Congif firmware>            ; When recovering Config area
```

When recovering Config area, MAC address assigned to Eddy is lost. Therefore you must connect via telnet and use def command to change MAC address to one assigned to Eddy(See the label attached to the product) after recovering config area.

Proceed as follows and it will recover by downloading image file from TFTP server configured.

The next shows OS recovery procedure.

```
U-Boot> install   os   eddy-os-20a.bin
TFTP from server 192.168.0.220; our IP address is 192.168.0.223
Filename 'eddy-os-20a.bin'.
Load address: 0x20000000
Loading:#####################################################################################
#######################################################################
done
Bytes transferred = 1112284 (10f8dc hex)
Erasing
sector .......................................................................................................................................
.......done
Erased 272 sectors
Copy to Flash... .done
Un-Protected 1 sectors
Erasing Flash...Erasing sector .done
Erased 1 sectors
Writing to Flash... .done
Protected 1 sectors
```

The next shows file system recovery procedure.

```
U-Boot> install   fs   eddy-fs-20a.bin
TFTP from server 192.168.0.220; our IP address is 192.168.0.223
Filename 'eddy-fs-20a.bin'.
Load address: 0x20000000
Loading:####################################################################################
############################################################################################
############################################################################################
#######done
Bytes transferred = 2035463 (1f0f07 hex)
Erasing
sector .....................................................................................................................................................
.................................................................................................................... done
Erased 640 sectors
Copy to Flash...
Un-Protected 1 sectors
Erasing Flash...Erasing sector done
Erased 1 sectors
Writing to Flash... Flash not Erased
Protected 1 sectors
```

Configuration recovery

```
U-Boot> install config eddy-cf-20a.bin
TFTP from server 192.168.0.220; our IP address is 192.168.0.223
Filename 'eddy-cf-20a.bin'.
Load address: 0x20000000
Loading: #############
done
Bytes transferred = 65536 (10000 hex)
Erasing sector ................................................................................done
Erased 82 sectors
Copy to Flash... .done
Un-Protected 1 sectors
Erasing Flash...Erasing sector .done
Erased 1 sectors
Writing to Flash... .done
Protected 1 sectors
U-Boot>
```

Once the recovery is done, use “boot” command start booting.

```
U-Boot> boot
## Booting image at 20000000 ...
    Image Name:    eddy-os-20a.img
    Image Type:    ARM Linux Kernel Image (uncompressed)
    Data Size:     1112220 Bytes =   1.1 MB
    Load Address: 20008000
    Entry Point:   20008000
    Verifying Checksum ... OK
OK
## Loading Ramdisk Image at 20500000 ...
```

Registering Mac address

Once it has been recovered, login screen is displayed. Now type in ID and password as you would access to telnet.

Then register deleted Mac address. Input command for Mac address is “def mac xx:xx:xx:xx:xx:xx”

It can be saved by “def save” command. Reboot after saving

Mac address is printed at the label attached on top of the product.

The following shows example of Mac address “00:01:02:03:04:05”.

```
Welcome to the Eddy development environment.

Eddy login: eddy
Password:
# def mac 00:01:02:03:04:05
# def save
# def view
Flash Write Successfully
# def view
===========< Welcome to Eddy Configuration Manager >=============
BootLoader Version : 2.0a
Kernel      Version : 2.0a
Fimeware    Version : 2.0a
---------------------------------------------------------------
Device Type          : Eddy-CPU
Device Name           : Eddy
Username              : eddy
Password             : 99999999
MAC Address           : 00:05:f4:7a:11:04
Network Line         : Static IP
       :
       :
================================================================
# reboot
```

Recovery will be done by following above steps. Should there have been any problem during recovery, see the next page.

9.1.3 Solving problems during recovery

```
U-Boot> install os   eddy-os-20a.bin
TFTP from server 192.168.0.220; our IP address is 192.168.0.223
Filename 'eddy-os-20a.bin'.
Load address: 0x20000000
Loading: *
```

When recovery is not proceeded with message shown above, check LAN connection and confirm the IP address of tftp-server PC is configured as 192.168.0.220. (This server IP address is just example, so it can be differ with user tftp-server PC IP address)

```
U-Boot> install fs   eddy-fs-123.bin
TFTP from server 192.168.0.220; our IP address is 192.168.0.223
Filename 'eddy-fs-123.bin'.
Load address: 0x20000000
Loading: *
TFTP error: 'File not found' (1)
Starting again
```

When recovery is not proceeded with message shown above, check firmware version information or name is correct. Shown in the red box above has to be same with firmware name of PC with tftp-server installed.

```
U-Boot> install os eddy-os-20a.bin
TFTP from server 192.168.0.220; our IP address is 192.168.0.223
Filename 'eddy-os-20a.bin'.
Load address: 0x20000000
Loading: TTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTT#TTT#
```

When recovery is not proceeded with message shown above, it means there is product with same MAC address or IP in the network. Check whether there are other Eddy products in the same network.

9.2 Product Specifications

Item	Classification	Specification
Network	LAN port	10/100Mbps RJ-45 Port * 1
Hardware	LED	GPIO LED (Active High : 3.3V DC, Active Low : 0 V) 4 (Eddy-S1/Pin) 16(Eddy-CPU) Status LED
	Power input	5V DC (400mA or higher)
	Power consumption	400mA / 2 W
	Size	115 * 125 mm
	Weight	100g (without Eddy module mounted)
Serial	Port	1 (Eddy-S1/Pin) 2 (Eddy-CPU)
	Interface	Selectable RS232/RS422/RS485
	Speed	Max 921.6 Kbps
	Signal lines	TX, RX, DTR, DSR, CTS, RTS, DCD
Serial	Overvoltage protection	15KV Surge Protection for all signals
	UART	Uses internal UART of CPU
Environment	Operating temperature	0 ~ 50˚C
	Storage Temperature	-20 ~ 80˚C
	Humidity	5 ~ 95% Non-Condensing
Certification	CE Class A, FCC Class A, RoHS compliant	CE FC RoHS RoHS Compliant

9.3 Ordering information

The purchase order information for Eddy-Serial products is as follows.

Product Name	Description
Eddy-CPU-4M	Programmable embedded CPU module 4MB Flash Memory
Eddy-CPU-8M	Programmable embedded CPU module 8MB Flash Memory
Eddy-S1/PIN	RS232 pin header interface 3.3 ~ 5V input voltage
Eddy-S1/PIN-C	RS422/485 pin header interface 3.3 ~ 5V input voltage
Eddy-S1/DB9	RS232 DB9 interface 5V input voltage
Eddy-S1/DB9-C	RS422/485 DB9 interface 5V input voltage
Eddy-S1/DB9-PoE	RS232 DB9 interface 5V(power jack) input voltage or PoE
Eddy-S1/DB9-PoE-C	RS422/485 DB9 interface 5V(power jack) input voltage or PoE
Eddy-DK	Development Kit for Eddy-Serial module CPU,S1/Pin

The purchase order information for Eddy-Memory products is as follows.

Product Name	Description
Eddy-S2M/PIN	2 x RS232 pin header interface, USB Host, MMC 3.3 ~ 5V input voltage
Eddy-S2M/PIN-C	2 x RS422/485 pin header interface, USB Host, MMC 3.3 ~ 5V input voltage