Eddy™ means real-time

Eddy DK

Programmer Guide

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Revision History

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Sep-10-2009	2.1.0.2	All	Added WiFi
Oct-14-2009	2.1.0.3	11	J2 pin33 PC12 → PC13 J2 pin35 PC13 → PC12
Oct-22-2009	2.1.0.3	17,18,19	J2 pin33 PC12 → PC13 J2 pin35 PC13 → PC12
		18,19	J2 pin33 J9_26 → J9_33 J2 pin34 J9_25 → J9_34 J2 pin33 J9_24 → J9_35
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Chapter 1. Introduction

This chapter 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.

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
LemonIDE Manual	Guide for primary function of each tool contained in LemonIDE on Windows and Linux.
Portview User Manual	Guide for SystemBase device server management application Portview
COM Port Redirector User Manual	Guide for SystemBase COM Port Redirector
TestView User Manual	Guide for TestView application for testing Eddy serial port and lan port.

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-CPU Spec Sheet	Specifications for Eddy CPU and DK board.
Eddy-S4M Spec Sheet	Eddy-S4M spec description
Eddy-WiFi Spec Sheet	Eddy-WiFi module spec description
Eddy-BT Spec Sheet	Eddy-BT module spec description
LemonIDE Spec Sheet	integrated development environment description
Eddy White Paper	An introductory reading for anyone new to embedded device server. Deals with background, history, market environment, and technology

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

Chapter 2. 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.

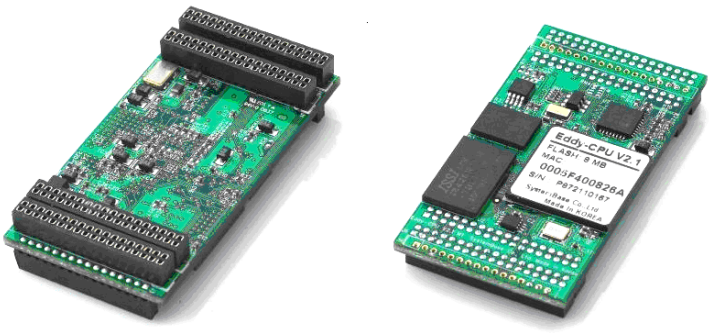
Eddy DK is different with other device servers in which it can run customized applications. Users can upload most existing socket/serial communication applications that are running on the Linux environment. This openness allows users to apply wide variety of functions into the module with relatively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

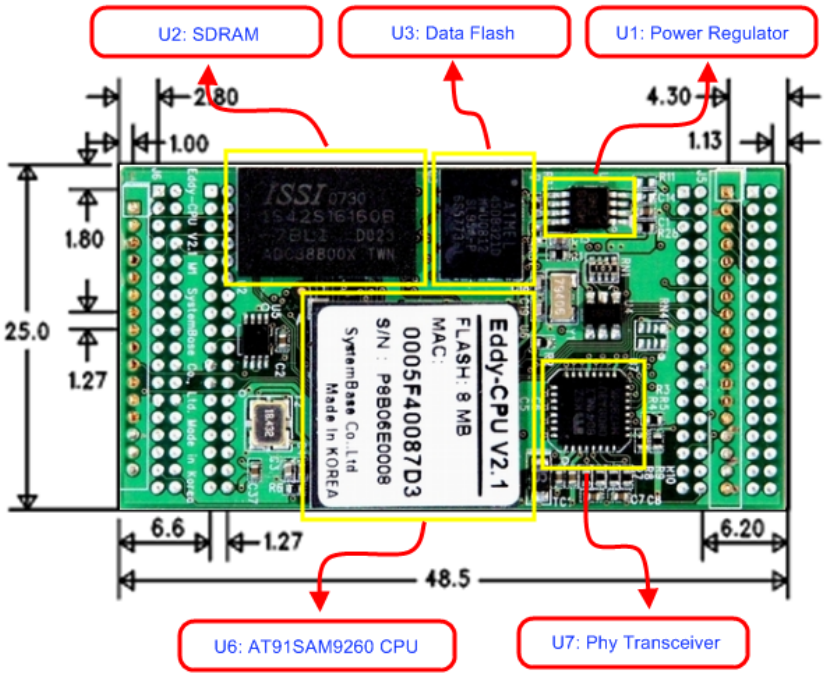
Eddy DK supports IDE (LemonIDE) and SDK environment to help programmers to execute their own applications on the module. Programmers can easily write applications using the Linux environment, with the help of SDK and example source codes. Cross-compiler running on the standard Linux environment helps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

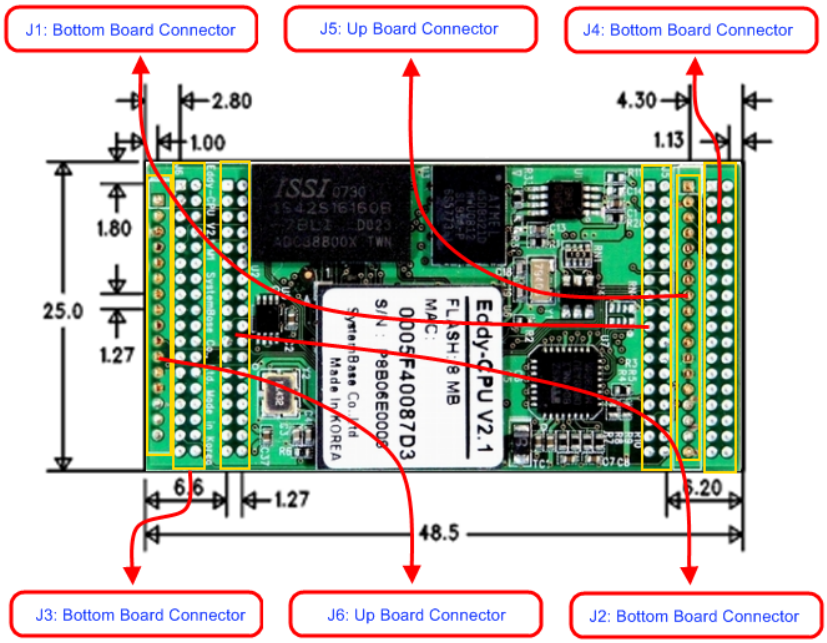
2.2 Eddy-DK Package Contents

Eddy-DK includes Eddy module.
Eddy-DK package contains as follows. Make sure following contents are included in the Eddy Serial DK Package.
- Case of Eddy-DK (Eddy-CPU v2.1/v2.5 1ea, Eddy-DK v2.1board 1ea)
- Case of Eddy-S4M-DK (Eddy-S4M v2.1 1ea, Eddy-S4M-DK board 1ea, (Option : Eddy-S4M-JIG))
- 1EA , Serial cable
- 1EA , LAN cable
- 1EA, USB A to B Cable
- 1EA , Power adaptor
- 1EA , CD (SystemBase SDK, LemonIDE, compile environment, utilities, manuals)

2.3 Eddy-CPU v2.1 / v2.5







Eddy-CPU v2.1/v2.5 Pin Assignment

J1			
Pin	Signal Name	Pin	Signal Name
1	PA5	2	PA4
3	PC5	4	PC19
5	PC21	5	PC23
7	HDMA	8	NC
9	HDPA	10	DDM
11	PC26	12	DDP
13	PC4 (RDY#)	14	PC16
15	ICE_NTRST	16	RTCK
17	TDO	18	TMS
19	TDI	20	TCK
21	3.3V	22	GND
23	3.3V	24	GND
25	PB29 (CTS1)	26	PB28 (RTS1)
27	PB6 (TXD1)	28	PB7 (RXD1)
29	A20	30	A19
31	LAN_Speed	32	LAN_lLink
33	LAN_RX-	34	LAN_RX+
35	LAN_TX-	36	LAN_TX+

J2			
Pin	Signal Name	Pin	Signal Name
1	A15	2	A14
3	A13	4	A12
5	A11	5	A10
7	A9	8	A8
9	A7	10	A6
11	A5	12	A4
13	A3	14	A2
15	A1	16	A0
17	PC9	18	NWE
19	FPG	20	NRD
21	GND	22	3.3V
23	GND	24	3.3V
25	D7	26	D6
27	D5	28	D4
29	D3	30	D2
31	D1	32	D0
33	PC13	34	JTAGSEL
35	PC12	36	NC

J3			
Pin	Signal Name	Pin	Signal Name
1	PID0	2	PID1
3	PID2	4	PID3
5	PID4	5	GND
7	PC14	8	PC17
9	PC18	10	PC8 (RTS3)
11	PC20	12	PC10 (CTS3)
13	PA22	14	PC15 (IRQ1)
15	PB8	16	PB9 (RXD2)
17	PB10	18	PB11(RXD3)
19	PC0	20	PC1 (AD1)
21	PC2	22	PC3 (AD3)
23	PB14 (DRXD)	24	PB15 (DTXD)
25	GND	26	GND
27	BMS	28	NRST
29	PB23 / DCD0	30	PB5 / RXD0
31	PB4 / TXD0	32	PB24 / DTR0
33	PB22 / DSR0	34	PB26 / RTS0
35	PB27 / CTS0	36	PB25 / RI0

J4			
Pin	Signal Name	Pin	Signal Name
1	PB12	2	PB13
3	PB30	4	PB31
5	PB0	5	PC22
7	PB1	8	PB16
9	PB2	10	PB17
11	PB3	12	PB18
13	BHDM	14	PB19
15	BHDP	16	PB20
17	A16	18	PB21
19	A17	20	A18
21	D8	22	D9
23	D10	24	D11
25	D12	26	D13
27	D14	28	D15
29	TWD	30	TCK
31	NANDOE	32	NAND_CLE / A22
33	NANDWE	34	NAND_ALE / A21
35	NC	36	NC

J5	
Pin	Signal Name
1	PB0
2	PB1
3	PB2
4	PB3
5	3.3V
6	3.3V
7	BHDM, USB Host Data(-)
8	BHDP, USB Host Data(+)
9	PA31 / TXD4
10	PA30 / RXD4
11	NRST
12	GND
13	GND
14	PA9 / WPID0
15	PC6 / WPID1
16	PC7 / WPID2
17	NC
18	NC

J6	
Pin	Signal Name
1	NC
2	NC
3	3.3V
4	3.3V
5	PC25 / BT_Factory
6	PB10 / TXD3
7	PB11 / RXD3
8	PC8 / RTS3
9	PC10 / CTS3
10	PC24 / BT_MODE
11	NRST
12	GND
13	GND
14	NC
15	NC
16	NC

J1 Specifications

J1			
Pin	Signal Name	Pin	Signal Name
1	PA5	2	PA4
3	PC5	4	PC19
5	PC21	5	PC23
7	HDMA	8	NC
9	HDPA	10	DDM
11	PC26	12	DDP
13	PC4 (RDY#)	14	PC16 (nRESET)
15	ICE_NTRST	16	RTCK
17	TDO	18	TMS
19	TDI	20	TCK
21	3,3V	22	GND
23	3,3V	24	GND
25	PB29 (CTS1)	26	PB28 (RTS1)
27	PB6 (TXD1)	28	PB7 (RXD1)
29	A20	30	A19
31	LAN_Speed	32	LAN_lLink
33	LAN_RX-	34	LAN_RX+
35	LAN_TX-	36	LAN_TX+

J1 Pin Description

Pin No	Name	DK v2.1 Pin No	Expansion Header Pin No	Description	
1	PA5	J10_1	J4_2	Peripheral A : CTS2	UART #2 Clear to Send Signal
				Peripheral B : MCBD1	Disabled. Data Flash connected with SPI0 is used for Eddy-CPU v2.1/v2.5. For this reason SPI0 and MCDB0, MCDB3, and MCCDB signals, multiplexing, cannot be used, thus Multimedia Card Slot B is disabled.
2	PA4	J10_2	J4_1	Peripheral A : RTS2	UART #2 Request to Send Signal
				Peripheral B : MCDB2	Disabled.
3	PC5	J10_3	J4_12	Peripheral A : A24	External Address Bus
				Peripheral B : SPI1_NPCS1	SPI1(Serial Peripheral Interface) Peripheral Chip Select 1
4	PC19	J10_4	J4_24	Peripheral A : A24	Multimedia Card Slot B Data
				Peripheral B : SPI1_NPCS2	SPI1(Serial Peripheral Interface) Peripheral Chip Select 2
5	PC21	J10_5	J4_26	Peripheral A : D21	External Data bus
				Peripheral B : EF100	Ethernet(WAN) Force 100Mbit/sec.
6	PC23	J10_6	J4_28	Peripheral A : D23	External Data Bus
7	HDMA	J10_7	J1_27	USB Host Port A Data -	
8	NC	J10_8	--	Not Connect	
9	HDPA	J10_9	J1_29	USB Host Port A Data +	
10	DDM	J10_10	-	USB Device Port Data -	
11	PC26	J10_11	-	D26	External Data Bus
12	DDP	J10_12	-	USB Device Port Data +	
13	PC4 (RDY#)	J10_13	J4_11	Eddy-DK v2,1 : RDY#(OUT)	Ready signal. Output signal for CPU operation status
				Peripheral A : A23	External Address Bus
				Peripheral B : SPI1_NPCS2	SPI1(Serial Peripheral Interface) Peripheral Chip Select 2
14	PC16 (nRESET)	J10_14	J4_21	Eddy-DK v2,1 : nRESET#(IN)	Polling Input signal continually from External Reset key, implement as ~~below with checking the constant time of "Low."~~ Less than 5 seconds: General reset function.

					More than 5 seconds: Factory Default function.
				Peripheral A : D16	External Data Bus
				Peripheral B : SPI0_NPCS2	Disabled SPI0_SPCK, SPI0_MISO, and SPI0_MOSI signals for SPI0 are disabled as they are not connected externally.
15	ICE_NTRST	J10_15	J7_3	ICE Test Reset Signal	
16	RTCK	J10_16	J7_11	Return Test Clock	
17	TDO	J10_17	J7_13	Test Data Out	
18	TMS	J10_18	J7_7	Test Mode Select	
19	TDI	J10_19	J7_5	Test Data In	
20	TCK	J10_20	J7_9	Test Clock	
21	3.3V	3.0V to 3.6V power input			
22	GND	Ground			
23	3.3V	3.0V to 3.6V power input			
24	GND	Ground			
25	PB29	J10_25	J2_30	Peripheral A : CTS1	USART1 Clear To Send
				Peripheral B : ISI_VSYNC	Image Sensor Vertical Synchronization
26	PB28	J10_26	J2_29	Peripheral A : RTS1	USART1 Request To Send
				Peripheral B : ISI_PCK (IN)	Image Sensor Pixel Clock Provided by the Image Sensor
27	PB6	J10_27	J2_7	Peripheral A : TXD1	USART1 Transmit Data
				Peripheral B : TCLK1	Timer Counter ch1 External CLK IN
28	PB7	J10_28	J2_8	Peripheral A : RXD11	USART1 Receive Data
				Peripheral B : TCLK2	Timer Counter ch2 External CLK IN
Address Bus					
29	A20	J10-29	J1_31	Address Bus	
30	A19	J10_30	J1_32	Address Bus	
Ethernet 10/100 (Auto MDI/MDIX)					

<table>
<tr><td>31</td><td>LED_Speed</td><td>J10_31</td><td>-</td><td>LAN connection speed<table><tr><td>Speed</td><td>Pin State</td><td>LED Definition</td></tr><tr><td>10Base-T</td><td>H</td><td>OFF</td></tr><tr><td>100Base-TX</td><td>L</td><td>ON</td></tr></table></td></tr>
<tr><td>32</td><td>LED_Link</td><td>J10_32</td><td>-</td><td>LAN connection status<table><tr><td>Link/Activity</td><td>Pin State</td><td>LED Definition</td></tr><tr><td>No Link</td><td>H</td><td>OFF</td></tr><tr><td>Link</td><td>L</td><td>ON</td></tr><tr><td>Activity</td><td>Toggle</td><td>Blinking</td></tr></table></td></tr>
<tr><td>33</td><td>LAN_RX-</td><td>J10_33</td><td>-</td><td>CPU 내부 Ethernet PHY(WAN)의 Physical receive or transmit signal (- differential)</td></tr>
<tr><td>34</td><td>LAN_RX+</td><td>J10_34</td><td>-</td><td>CPU 내부 Ethernet PHY(WAN)의 Physical receive or transmit signal (+ differential)</td></tr>
<tr><td>35</td><td>LAN_TX-</td><td>J10_35</td><td>-</td><td>Physical transmit of CPU Internal Ethernet PHY(WAN) or receive signal (- differential)</td></tr>
<tr><td>36</td><td>LAN_TX+</td><td>J10_36</td><td>-</td><td>Physical transmit of CPU Internal Ethernet PHY(WAN) or receive signal (+ differential)</td></tr>
</table>

J2 Specifications

Connect USB cable to J1 while the jumper is connected to J2, so that applications can be compiled, linked, created, and uploaded to the Eddy-CPU module. (Please refer to Programmer Guide for more information.)

J2			
Pin	Signal Name	Pin	Signal Name
1	A15	2	A14
3	A13	4	A12
5	A11	5	A10
7	A9	8	A8
9	A7	10	A6
11	A5	12	A4
13	A3	14	A2

15	A1	16	A0
17	PC9	18	NWE
19	FPG	20	NRD
21	GND	22	3.3V
23	GND	24	3.3V
25	D7	26	D6
27	D5	28	D4
29	D3	30	D2
31	D1	32	D0
33	PC13	34	JTAGSEL
35	PC12	36	NC

J2 Pin Description

Pin No	Name	DK v2.1 Pin No	Expansion Header Pin No	Description	
1~16	A[15:0]	J9_1 -J9_16	J3_4-J3_20	External Address Bus 0-15 (0 at reset) DK is directly connected with CPU and external connecter (J3) is connected by buffer.	
17	PC9	J9_17	J4_14	Peripheral A : NCS5	External device Chip Select 5. 256MB memory area addressable, active low
				Peripheral B : TIOB0	Timer Counter ch0 I/O Line B
18	NEW	J9_18	J1_21	External device Write Enable signal, active low	
19	FPG	J9_19	-	For Flash Programming You can program Data Flash in Eddy CPU v2.1/v2.5 via USB. Refer to 2.4.2.3 S6:NAND Flash & Data Flash Chip Select for further information.	
20	NRD	J9_20	J1_23	External device Read Enable signal, active low	
21, 23	GND	Ground			
22, 24	3.3V	3.0V to 3.6V power input			
25~32	D[7:0]	J9_25	J3_29 - J3_36	External Data Bus 0-7	

		- J3_32		DK is directly connected with CPU and external connecter (J3) is connected by buffer. You should enable PC13(NCS6 : Chip Select 6) for working buffer, if you reset, it becomes Pulled-up input.	
33	PC13	J9_33	J4_18	Edd-DK v2.1 : NCS6	Data Bus connected with external header can be used when NCS6 is enabled.
				Peripheral A : FIQ	Fast Interrupt Input
				Peripheral B : NCS6	External device Chip Select 6 256MB memory area addressable, active low
34	JTAGSEL	J9_34	-	JTAG boundary scan can be used by connecting pin34 and 36(J14 connection). This pin should not be connected when using ICE (In-Circuit Emulator) or in normal operation status.	
35	PC12	J9_35	J4_17	Peripheral A : IRQ0	External Interrupt Input 0
				Peripheral B : NCS7	External device Chip Select 7. 256MB memory area addressable, active low
36	NC	Not Connect			

J3 Specifications

J3			
Pin	Signal Name	Pin	Signal Name
1	PID0	2	PID1
3	PID2	4	PID3
5	PID4	5	GND
7	PC14	8	PC17
9	PC18	10	PC8 (RTS3)
11	PC20	12	PC10 (CTS3)
13	PA22	14	PC15 (IRQ1)

15	PB8	16	PB9 (RXD2)
17	PB10	18	PB11(RXD3)
19	PC0	20	PC1 (AD1)
21	PC2	22	PC3 (AD3)
23	PB14 (DRXD)	24	PB15 (DTXD)
25	GND	26	GND
27	BMS	28	NRST
29	PB23 / DCD0	30	PB5 / RXD0
31	PB4 / TXD0	32	PB24 / DTR0
33	PB22 / DSR0	34	PB26 / RTS0
35	PB27 / CTS0	36	PB25 / RI0

J3 Pin Description

Pin No	Name	DK v2.1 Pin No	Expansion Header Pin No	Description	
1-5	PID[4:0]	J8_1 ~J8_5	-	Product ID only used by the manufacturer. Please do not work on these pins.	
6,25,26	GND	Ground			
7	PC14	J8_7	J4_19	Peripheral A : NCS3	External Device Chip Select 3
				Peripheral B : IRQ2	External Interrupt Input 2
8	PC17	J8_8	J4_22	Peripheral A : D17	External Data Bus
				Peripheral B : SPI0_NPCS3	Disabled
9	PC18	J8_9	J4_23	Peripheral A : D18	External Data Bus
				Peripheral B : SPI1_NPCS1	SPI1(Serial Peripheral Interface) Peripheral Chip Select 1
10	PC8	J8_10	J4_13	Peripheral A : NCS4	External Device Chip Select 4

				Peripheral B : RTS3	USART3 Request to Send
11	PC20	J8_11	J4_25	Peripheral A : D20	External Data Bus
				Peripheral B : SPI1_NPCS3	SPI1(Serial Peripheral Interface) Peripheral Chip Select 3
12	PC10	J8_12	J4_15	Peripheral A : A25	External Address Bus
				Peripheral B : CTS3	USART3 Clear to Send
13	PA22	J8_13	-	Digital I/O Input 4	
14	PC15	J8_14	J4_20	Peripheral A : NWAIT	External Wait Signal Input
				Peripheral B : IRQ1	External Interrupt Input 2
15	PB8	J8_15	J2_9	Peripheral A : TXD2	UART2 Transmit Data
16	PB9	J8_16	J2_10	Peripheral A : RXD2	UART2 Receive Data
17	PB10	J8_17	J2_11	Peripheral A : TXD3	UART3 Transmit Data
				Peripheral B : ISI_D8	Image Sensor Data 8
18	PB11	J8_18	J2_12	Peripheral A : RXD3	UART3 Receive Data
				Peripheral B : ISI_D9	Image Sensor Data 9
19	PC0	J8_19	J4_7	Peripheral A : AD0	Analog to Digital Converter Input Ch0
				Peripheral B : SCK3	USART3 Serial Clock
20	PC1	J8_20	J4_8	Peripheral A : AD1	Analog to Digital Converter Input Ch1
				Peripheral B : PCK0	Programmable Clock Output 0
21	PC2	J8_21	J4_9	Peripheral A : AD2	Analog to Digital Converter Input Ch2
				Peripheral B : PCK1	Programmable Clock Output 1
22	PC3	J8_22	J4_10	Peripheral A : AD3	Analog to Digital Converter Input Ch3
				Peripheral B : SPI1_NPCS3	SPI1(Serial Peripheral Interface) Peripheral Chip Select 3
23	PB14	J8_23	J2_15	Peripheral A : DRXD	Debug Receive Data
24	PB15	J8_24	J2_16	Peripheral A : DTXD	Debug Transmit Data
27	BMS	J8_27	-	Boot Mode Select signal BMS = 1, Boot on Embedded ROM BMS = 0, Boot on External Memory	

28	NRST	J8_28	J1_20	External device Reset signal, active low signal	
29	PB23	J8_29	J4_28	Peripheral A : DCD0	USART0 Data Carrier Detection
				Peripheral B : ISI_D3	Image Sensor Data 3
30	PB5	J8_30	J2_6	Peripheral A : RXD0	USART0 Receive Data
31	PB4	J8_31	J2_5	Peripheral A : TXD0	USART0 Transmit Data
32	PB24	J8_32	J2_25	Peripheral A : DTR0	USART0 Data Terminal Ready
				Peripheral B : ISI_D4	Image Sensor Data 4
33	PB22	J8_33	J2_23	Peripheral A : DSR0	USART0 Data Set Ready
				Peripheral B : ISI_D2	Image Sensor Data 2
34	PB26	J8_34	J2_27	Peripheral A : RTS0	USART0 Request To Send
				Peripheral B : ISI_D6	Image Sensor Data 6
35	PB27	J8_35	J2_28	Peripheral A : CTS0	USART0 Clear To Send
				Peripheral B : ISI_D7	Image Sensor Data 7
36	PB25	J8_36	J2_26	Peripheral A : RI0	USART0 Ring Indicator
				Peripheral B : ISI_D5	Image Sensor Data 5

J4 Specifications

J4			
Pin	Signal Name	Pin	Signal Name
1	PB12	2	PB13
3	PB30	4	PB31
5	PB0	5	PC22
7	PB1	8	PB16
9	PB2	10	PB17
11	PB3	12	PB18
13	BHDM	14	PB19
15	BHDP	16	PB20
17	A16	18	PB21
19	A17	20	A18
21	D8	22	D9
23	D10	24	D11
25	D12	26	D13
27	D14	28	D15
29	TWD	30	TCK
31	NANDOE	32	NAND_CLE / A22
33	NANDWE	34	NAND_ALE / A21
35	NC	36	NC

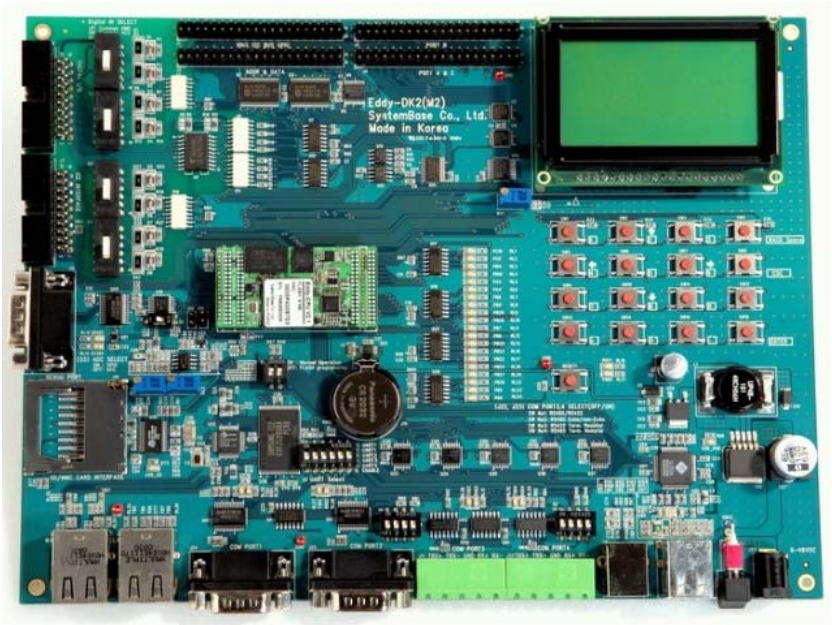
J4 Pin Description

Pin No	Name	DK v2.1 Pin No	Expansion Header Pin No	Description	
1	PB12	J11_1	J2_17	Peripheral A : TXD5	USART5 Transmit Data
				Peripheral B : ISI_D10	Image Sensor Data 10
2	PB13	J11_2	J2_18	Peripheral A : RXD5	USART5 Receive Data
				Peripheral B : ISI_D11	Image Sensor Data 11
3	PB30	J11_3	J2_31	Peripheral A : PCK0	Programmable Clock Output 0
				Peripheral B : ISI_HSYNC	Image Sensor Horizontal Synchronization
4	PB31	J11_4	J2_32	Peripheral A : PCK1	Programmable Clock Output 1
5	PB0	J11_5	J2_2	Peripheral A : SPI1_MISO	SPI1(Serial Peripheral Interface) Master In Slave Out
				Peripheral B : TIOA3	Timer Counter ch3 I/O Line A
6	PC22	J11_6	J4_27	Peripheral A : D22	
				Peripheral B : TCLK5	Timer Counter ch5 External CLK IN
7	PB1	J11_7	J2_3	Peripheral A : SPI1_MOSI	
				Peripheral B : TIOB3	Timer Counter ch3 I/O Line B
8	PB16	J11_8	J2_17	Peripheral A : TK0	SSC Transmit Clock
				Peripheral B : TCLK3	Timer Counter ch3 External CLK IN
9	PB2	J11_9	J2_4	Peripheral A : SPI1_SPCK	SPI1(Serial Peripheral Interface) Serial Clock
				Peripheral B : ISI_D3	Image Sensor Data 3
10	PB17	J11_10	J2_18	Peripheral A : TF0	SSC Transmit Frame Sync
				Peripheral B : TCLK4	Timer Counter ch4 External CLK IN
11	PB3	J11_11	J2_5	Peripheral A : SPI1_NPCS0	SPI1(Serial Peripheral Interface) Peripheral Chip Select 0

				Peripheral B : TIOA5	Timer Counter ch5 I/O Line A
12	PB18	J11_12	J2_19	Peripheral A : TD0	SSC Transmit Data
				Peripheral B : TIOB4	Timer Counter ch4 I/O Line B
13	HDMB	J11_13	J1_28	USB Device Port Data -	
14	PB19	J11_14	J2_20	Peripheral A : RD0	SSC Receive Data
				Peripheral B : TIOB5	Timer Counter ch5 I/O Line B
15	HDPB	J11_15	J1_30	USB Device Port Data +	
16	PB20	J11_16	J2_21	Peripheral A : RK0	SSC Receive Clock
				Peripheral B : ISI_D0	Image Sensor Data 0
17	A16	J11_17	J3_3	External Address Bus	
18	PB21	J11_18	J2_22	Peripheral A : RF0	SSC Receive Frame Sync
				Peripheral B : ISI_D1	Image Sensor Data 1
19	A17	J11_19	J3_2	External Address Bus	
20	A18	J11_20	J3_1		
21-28	D[8:15]	J11_21 ~J11_28	J3_28 ~J3_21	External Data Bus 8-15 DK is directly connected with CPU and external connecter (J3) is connected by buffer. PC13(NCS6 : Chip Select 6) should be enabled for working buffer, if it is reset, it work as Pulled-up input.	
29	TWD	J11_29	J4_3	Two-wire Serial Data. This pin cannot be used for GPIO.	
30	TWCK	J11_30	J4_4	Two-wire Serial Data. This pin cannot be used for GPIO.	
31	NANDOE	J11_31	-	NAND Flash Output Enable	
32	A22	J11_32	J1_29	Address Bus DK is directly connected with CPU and external connecter (J3) is connected by buffer.	
33	NANDWE	J11_33	-	NAND Flash Write Enable	
34	A21	J11_34	J1_30	Address Bus	
35,36	NC	Not Connect			

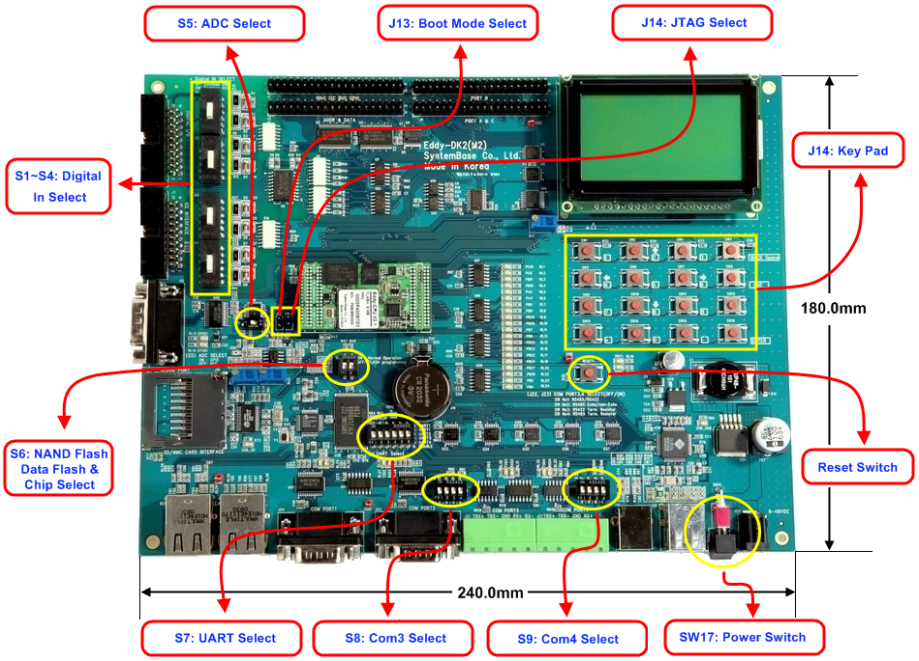
2.4 Eddy-DK v2.1

2.4.1 Modules' Locations



NOTE:
Ensure that the input power supply for Eddy Serial DK is from 9V to 48V with 500 mA (or higher).

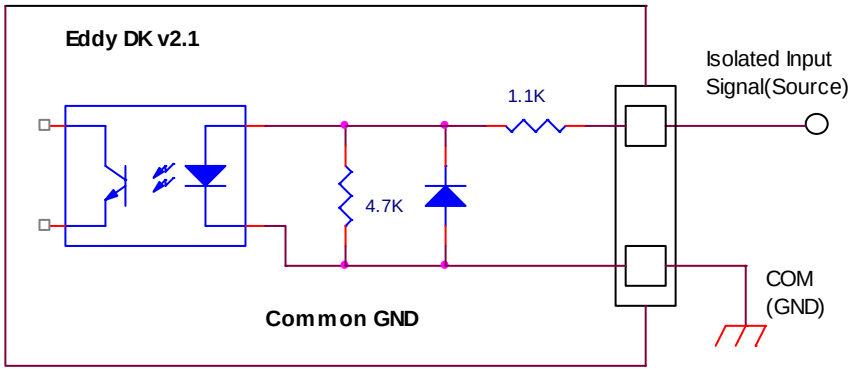
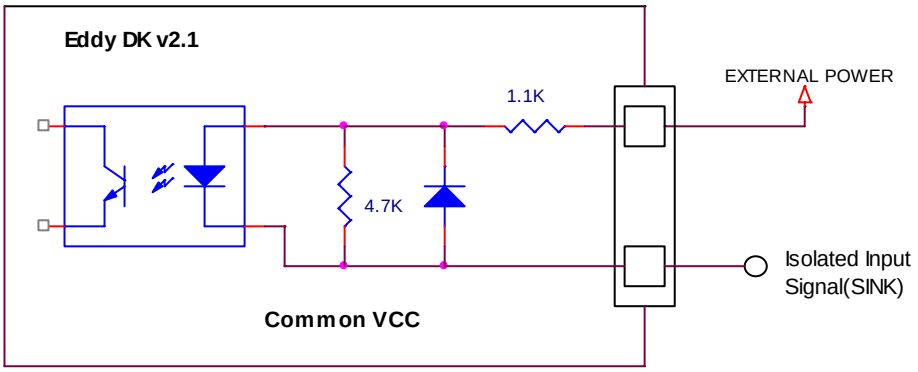
2.4.2 Switch Description



2.4.2.1. S1~S4: Digital In Select

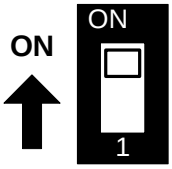
It is possible to select the Distal Input mode with this switch (S1 ~ S4). In order to use VCC Common Mode, switch down, and to use GNC Common Mode switch up refer to below feature.
This below schematic is just for reference, So you should make you own schematic with the current and voltage that you want.

Common Input Setting (Switch S1~S4)

MODE	Switch	설명
GND Common	UP 	
VCC Common	Down 	

2.4.2.2. S5: ADC Select

You can choice the GPIO and ADC function with this switch. In order to use the ADC device, you should switch off. And In order to use the GPIO function, you should switch on.



SW Off : ADC mode
SW ON : GPIO mode

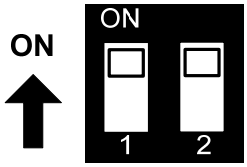
PIN name	Fuction	Discription	I/O
PC0	ADC0	Temp. Sensor Input(LM50), RN: U22	IN

PC1	ADC1	Lux. Sensor Input(BH1600), RN: U26	IN
PC2	ADC2	Temp. Sensor Input(TMP300), RN: U24	IN
PC3	ADC3	N/A	IN

* RN = Reference Number

2.4.2.3. S6: NAND Flash & Data Flash Chip Select

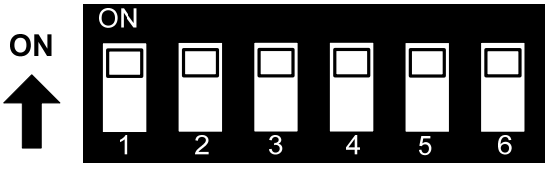
This switch is Nand Flash & Data Flash Chip select switch. This switch is needed in firmware Programming.



Flash Programming & Booting device Selection		
Switch No 1	**Switch No 2**	**Operation descriotion**
OFF	OFF	For Flash Programming This setting is needed in firmware Programming. refer to 9.2 System recovery via USB
OFF	ON	Boot from Data Flash.
ON	OFF	Boot from Nand Flash
ON	ON	Boot from Data Flash or Nand Flash which have bootloader. if Both devices have the bootloader, algorithm in CPU select the bootloader of Data Flash. (Reference : CPU Datasheet 13 장 AT91SAM9260 Boot Program)

2.4.2.4. S7:UART Select

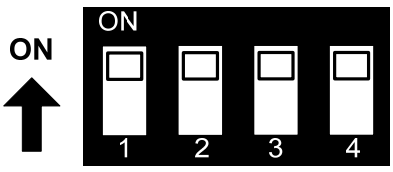
In order to test Serial Port, UART Select Switches are pulled down. It means that UARTs in CPU are connected to Serial Port. If switches are pulled up, GPIO Ports are enabled and LEDs are controlled by GPIO Ports. And if Switch No.6 is pulled up, GPIO ports are connected with the Expansion Headers.



Serial Port & LED			
Switch Bank	**Switch No**	**Down Position(OFF) Serial Port Test**	**UP Position(ON) GPIO TEST (High : LED On)**
S7	1	UART#0 TEST UART#0 의 TXD, RXD, RTS, CTS signals are connected with UART#0 RS232 driver IC.	GPIO (PB4, PB5, PB26, PB27) ports are connected with the GPIO LED of DK board and disconnected with the UART#0 RS232 driver IC.
	2	UART#0 TEST UART#0 의 DTR, DSR, DCD, RI signals are connected with UART#0 RS232 driver IC.	GPIO (PB24, PB22, PB23, PB25) ports are connected with the GPIO LED of DK board and disconnected with the UART#0 RS232 driver IC.
	3	UART#1 TEST UART#1 의 TXD, RXD, RTS, CTS signals are connected with UART#1 RS232 driver IC.	GPIO (PB6, PB7, PB28, PB29) ports are connected with the GPIO LED of DK board and disconnected with the UART#1 RS232 driver IC.
	4	UART#2 TEST UART#2 의 TXD, RXD, RTS, CTS signals are connected with UART#2 RS422/485 driver IC.	GPIO (PB8, PB9, PA4, PA5) ports are connected with the GPIO LED of DK board and disconnected with the UART#2 RS422/485 driver IC.
	5	UART#3 TEST UART#3 의 TXD, RXD, RTS, CTS signals are connected with UART#3 RS422/485 driver IC.	GPIO (PB10, PB11, PC8, PC10) ports are connected with the GPIO LED of DK board and disconnected with the UART#3 RS422/485 driver IC.
	6	For Serial Port & GPIO Test Serial Port and GPIO LED of DK board are enabled.	Connect to Expansion Header UART#0~#3 and GPIO LEDs are disconnected with the Eddy-CPU board and directly connected with the Expansion Header(J2, J4)

2.4.2.5. S8:COM3 & S9: COM4 Select

COM Port #3 and COM Port #4 set the RS422/RS485 mode.



COM PORT#3, #4 settings			
Switch Bank	**Switch No**	**Down Position(OFF)**	**UP Position(ON)**
S8 Port#3	1	RS485 Half-Duplex mode	RS422 Full-Duplex mode
	2	RS422(RX enabled) RS485 echo-mode	RS485 non echo-mode

	3	RS422 Termination Resistor not connected	RS422 Termination Resistor Connected
	4	RS485 Termination Resistor not connected	RS422 Termination Resistor Connected
S9 Port#4	1	RS485 Half-Duplex mode	RS422 Full-Duplex mode
	2	RS422(RX enabled) RS485 echo-mode	RS485 non echo-mode
	3	RS422 Termination Resistor not connected	RS422 Termination Resistor Connected
	4	RS485 Termination Resistor not connected	RS422 Termination Resistor Connected

2.4.2.6. SW1~SW16: Key Pad

Key Pad of DK board are consisted with the 4x4 matrix. GPIOs are set to Input mode to read the Key value. and Key 2, 4, 6, 8 also have the ▲(UP), ▼(DN), ◀(LEFT), ▶(RIGHT) direction function for LCD menu.

P10-P17	4x4 Key matrix	I/O
PB20	First Row line	IN
PB21	Second Row line	IN
PB30	Third Row line	IN
PB31	Forth Row line	IN
PC20	First Column line from left	IN
PC21	Second Column line from left	IN
PC22	Third Column line from left	IN
PC23	Fourth Column line from left	IN

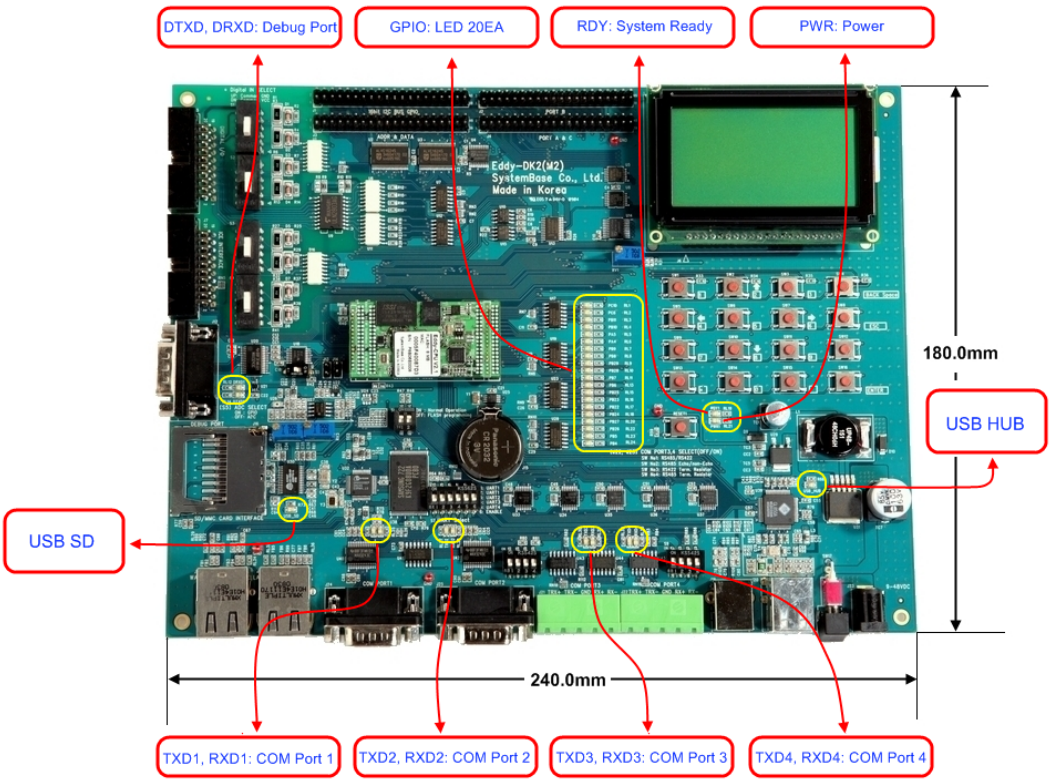
2.4.2.7. SW17: Power

In order to power up, pull up this switch.

2.4.2.8. Reset1: Reset

Pin name	Function	Discription	I/O
PC16	nRESET	Polling Input signal continually from External Reset key, implement as below with checking the constant time of "Low." Less than 5 seconds: General reset function. More than 5 seconds: Factory Default function.	IN

2.4.3 LED Description



2.4.3.1. GPIO LED

Eddy-CPU v2.1/v2.5 supports Max 56 GPIO ports. DK board has 20 GPIO LEDs of all GPIO to test. This GPIO LEDs are controlled by UART select switches.(refer to 2.4.2.4 UART Select)

PIN name	Function	Discription	I/O
PC10	CTS3	UART #3 Clear to Send	I
PC8	RTS3	UART #3 Request to Send	O
PB11	RXD3	UART #3 Receive Data	I
PB10	TXD3	UART #3 Transmit Data	O

PA5	CTS2	UART #2 Cleat to Send	I
PA4	RTS2	UART #2 Request to Send	O
PB9	RXD2	UART #2 Receive Data	I
PB8	TXD2	UART #2 Transmit Data	O
PB29	CTS1	UART #1 Cleat to Send	I
PB28	RTS1	UART #1 Request to Send	O
PB7	RXD1	UART #1 Receive Data	I
PB6	TXD1	UART #1 Transmit Data	O
PB25	RI0	UART #0 Ring Indicator	I
PB23	DCD0	UART #0 Data Carrier Detection	I
PB22	DSR	UART #0 Data Set Ready	O
PB24	DTR0	UART #0 Data Terminal Ready	I
PB27	CTS0	UART #0 Clear to Send	I
PB26	RTS0	UART #0 Request to Send	O
PB5	RXD0	UART #0 Receive Data	I
PB4	TXD0	UART #0 Transmit Data	O

41.2 DC Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Units
Io	Output Current	PA0-PA31 PB0-PB31 PC0-PC3			16	
		PC4 - PC31 in 3.3V range			2*	mA
		PC4 - PC31 in 1.8V range			4	

* Eddy DK v2.1 has 3.3V range, so PC4-PC31 PIO is set to 2mA.
(Refer to CPU Datasheet의 41.2 DC characteristics)

2.4.3.2. Power, Ready LED

System Ready (RDY): Indicates that the system is operating normally. (Normal: LED blinks)
Power (PWR): Indicates that the 5 V power is being supplied. (Supplying power: Red LED ON)

2.4.3.3. Debug Port LED

DTXD (Debug Port Transmit Dta LED) : Shows transmission status of the Debug Port.
DRXD (Debug Port Receive Data LED) : Shows reception status of the Debug Port.

2.4.3.4. COM Port 1 LED

COM Port 1 Transmit LED : Shows transmission status of COM1 Port.
COM Port 1 Receive LED : Shows reception status of COM1 Port.

2.4.3.5. COM Port 2 LED

COM Port 2 Transmit LED : Shows transmission status of COM2 Port.
COM Port 2 Receive LED : Shows reception status of COM2 Port.

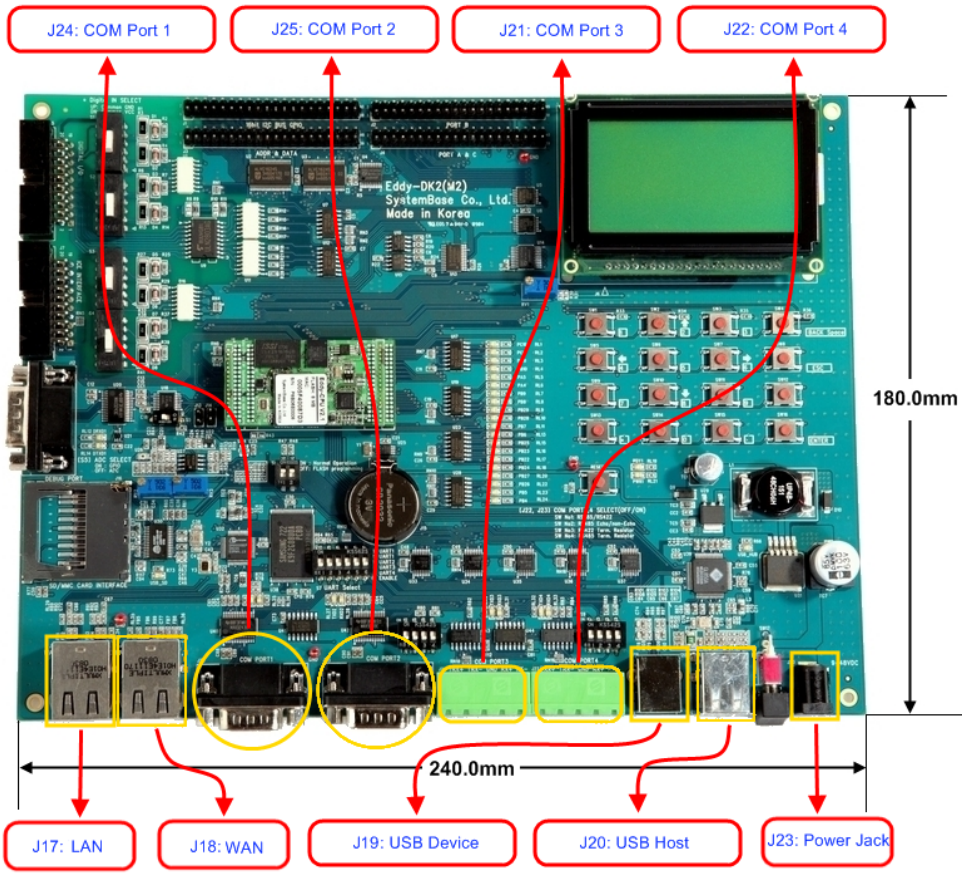
2.4.3.6. COM Port 3 LED

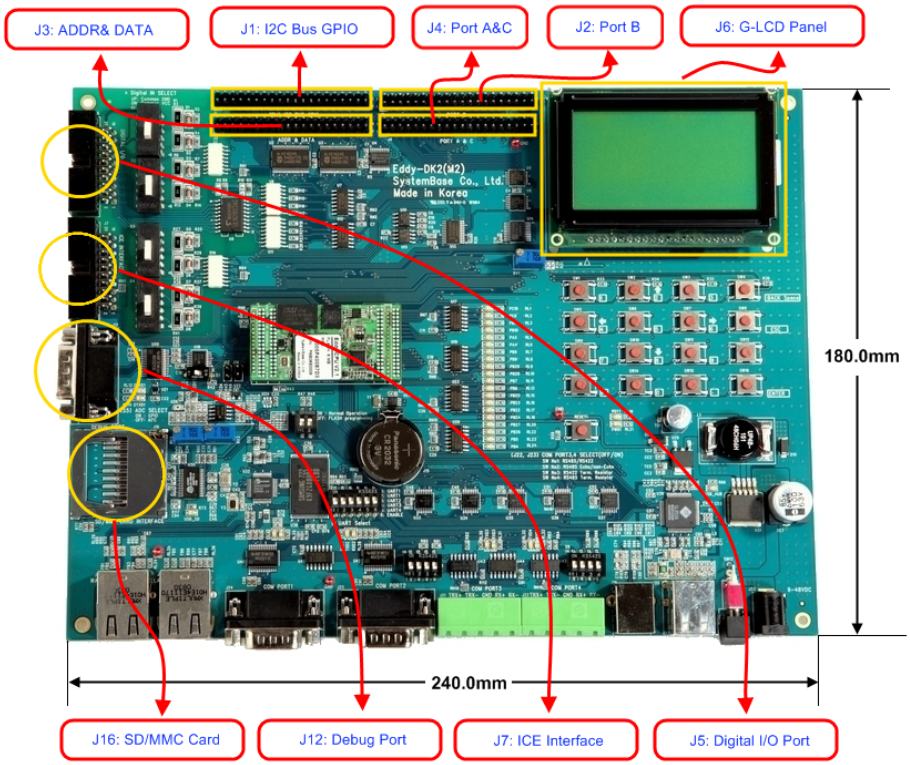
COM Port 3 Transmit LED : Shows transmission status of COM3 Port.
COM Port 3 Receive LED : Shows reception status of COM3 Port.

2.4.3.7. COM Port 4 LED

COM Port 4 Transmit LED : Shows transmission status of COM4 Port.
COM Port 4 Receive LED : Shows reception status of COM4 Port.

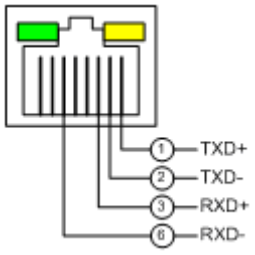
2.4.4 External Device Interface Description





2.4.4.1. WAN & LAN Interface

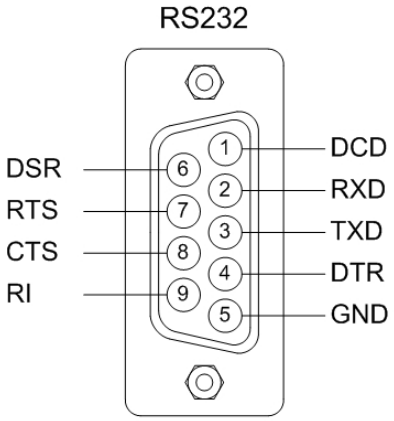
WAN & LAN Port automatically recognizes Cross/ Direct.(auto MDIX)



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

LED	Description
Left Green	Upon 100BaseT link, it lights Upon 10BaseT link, it off
Right Yellow	Default Lights, When the data is sent or received, it blinks.

2.4.4.2. COM Port 1 & COM Port 2

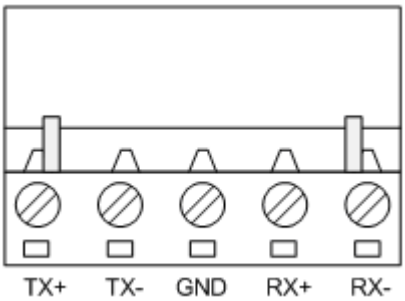


DB9 Male (COM Port 1, 2 공통)

RS232

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

2.4.4.3. COM Port 3 & COM Port 4



RS422 Full Duplex

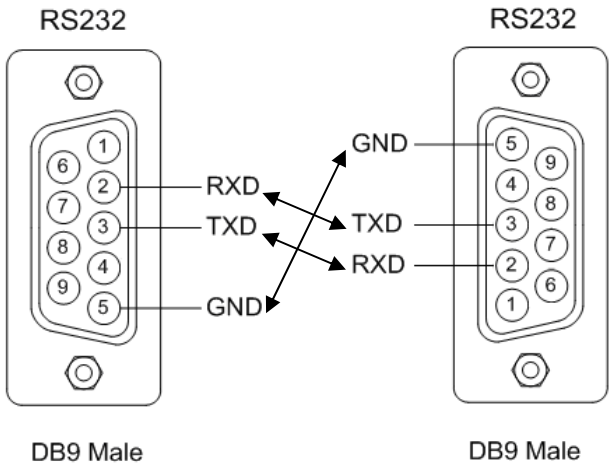
Pin	Signal	Description
1	TXD+	Transmit differential data positive (Output)
2	TXD-	Transmit differential data negative (Output)
3	GND	Ground
4	RXD+	Receive differential data positive (Input)
5	RXD-	Receive differential data negative (input)

RS485 Half Duplex

Pin	Signal	Description
1	TRX+	Transmit/Receive differential data positive
2	TRX-	Transmit/Receive differential data negative

2.4.4.4. Debug Port

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



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

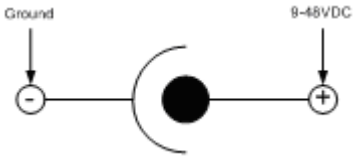
Data bit: 8 bit

Parity bit: Non Parity

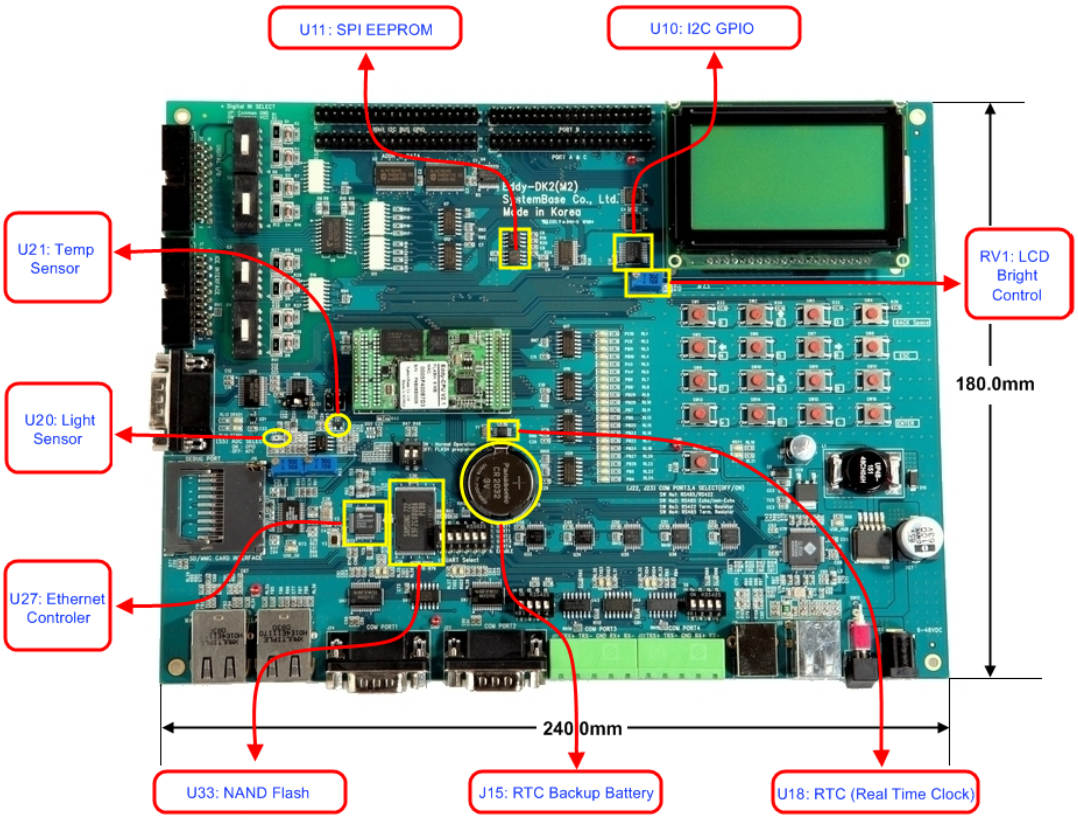
Stop bit: 1 bit

2.4.4.5. Power Jack

Contact	Polarity
Center (D : 2mm)	9-48VDC
Outer (D: 6.5mm)	Ground



2.4.5 Internal Device Description



2.4.5.1. EEPROM

Eddy-DK v2.1 has the AT25160, 2Kx8bit SPI EEPROM.

2.4.5.2. LCD Module

Graphic LCD Module (PowerTIP PG12864LRU-JCNH11Q and I2C-Bus I/O Expander IC PCA9539)

Signal Name	Function	Description	I/O
P[00:07]	Data bits	Used for data transfer between the CPU and the LCD module.	I/O
P10	/CS1	Chip enable for D2 (Segment 1 to 64)	IN
P11	/CS2	Chip enable for D3 (Segment 65 to 128)	IN
P12	R/W	R/W signal input is used to select the read /write mode High = Read mode, Low = Write mode	IN
P13	D/$\overline{I}$	Register selection input High = Data register Low = Instruction register (for write) Busy flag address counter (for read)	IN
P14	E	Start enable signal to read or write the data.	IN

2.4.5.3. 16bit I2C Bus GPIO

This 16-bit I2C Bus GPIO (PCA9539) provides general-purpose remote I/O expansion.
Slave address of this chip is set to 0x74 in DK board. and Address can be changed with A1,A0 address input from 0x74 to 0x77.
16-bit I/O is used to Digital Input/Output as below, and this is connected with the Expansion Header also. If you use for GPIO, it is possible to configure individually.

Function	Description	I/O
P00-P07	DIO Output, Connected with DO[0:7]	OUT
P00	DIO output, DO0	
P01	DIO output, DO1	
P02	DIO output, DO2	
P03	DIO output, DO3	
P04	DIO output, DO4	
P05	DIO output, DO5	
P06	DIO output, DO6	
P07	DIO output, DO7	
P10-P17	DIO Intput, Connected with DI[0:7]	IN
P10	DIO Input, DI0	
P11	DIO Input, DI1	
P12	DIO Input, DI2	
P13	DIO Input, DI3	
P14	DIO Input, DI4	
P15	DIO Input, DI5	
P16	DIO Input, DI6	
P17	DIO Input, DI7	
/INT	Connected with PB16 of Eddy-CPU	OUT

2.4.5.4. RTC

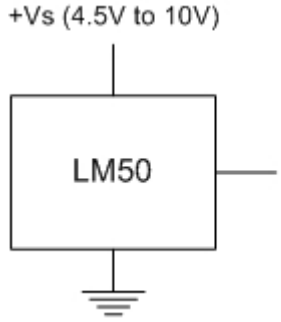
- DS1340 (Dallas, I2C interface)
- 12.5pF load capacitance crystal must be used. (Refer to Crystal Spec below)
- Do not use another RTC Chip.
- Backup Battery: CR2032 (235mAh) Lithium Battery.

DS1340 Crystal Specifications

Parameter	Symbol	MIN	TYP	MAX	Units
Normal Frequency	fo		32.768		KHz
Series Resistance	ESR			45,60	KΩ
Load Capacitance	CL		12.5		pF

2.4.5.5. Temp Sensor

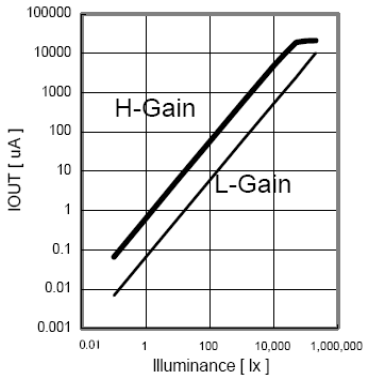
AD0(PC0)에 National LM50



Output
Vout = (10mV/℃ Temp x ℃) + 500mV
Vout = +1.750V at +125 ℃
Vout = +750mV at +25 ℃
Vout = +100mV at -40 ℃

2.4.5.6. Light Sensor

BH1600FVC (Rohm)



The Output voltage is caculated as below

Viout = 0.6 x10-6 x Ev x R1

Where, Viout = IOUT output voltage [V]

Ev = lilluminance of the ALS(Ambient Light Sensor) surface [lx]

R1 = IOUT output resistor [Ω]

2.4.5.7. NAND Flash

- 256MB, 8bit Flash (Samsung K9F2G08U0A-PCB0)
- Chip Select #3 used, Address range : 0x4000_0000~0x4FFF_FFFF.

Eddy-CPU v2.1 /v2.5 Signal Name	Function	Discription	I/O
A22	CLE	COMMAND LATCH ENABLE The CLE input controls the activating path for commands sent to the command register.	OUT
A21	ALE	ADDRESS LATCH ENABLE The ALE input controls the activating path for	OUT

		address to the internal address registers.	
NANDOE	NANDOE	data-out control	OUT
NANDWE	NANDWE	controls writes to the I/O port	OUT
PC14(NCS3)	NANDCS	device selection control	OUT
PC17	RDYBSY (R/B)	READY/BUSY OUTPUT The R/B output indicates the status of the device operation. When low, it indicates that a program, erase or random read operation is in process and returns to high state upon completion. It is an open drain output and does not float to high-z condition when the chip is deselected or when outputs are disabled.	IN
D[0:7]	DATA bits	DATA INPUTS/OUTPUTS The I/O pins are used to input command, address and data, and to output data during read operations. The I/O pins float to high-z when the chip is deselected or when the outputs are disabled.	I/O

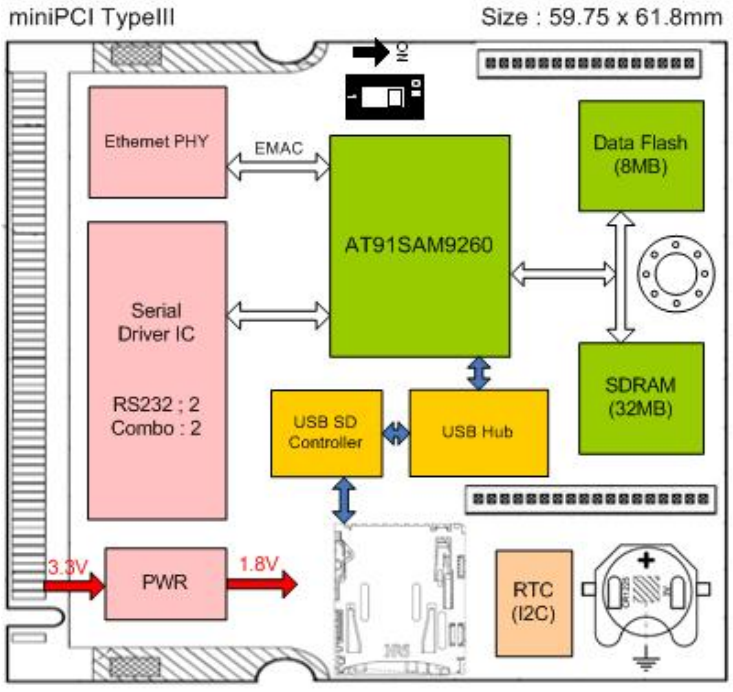
2.4.5.8. Ethernet Controller (WAN Port)

- Davicom DM9000B Ethernet Controller
- 16 bit mode set.
- EECS pin should be connected with pull-up resistor to use link/speed LED.
- RJ45 Transformer Center Tap is powered by DM9000B AVDD18.

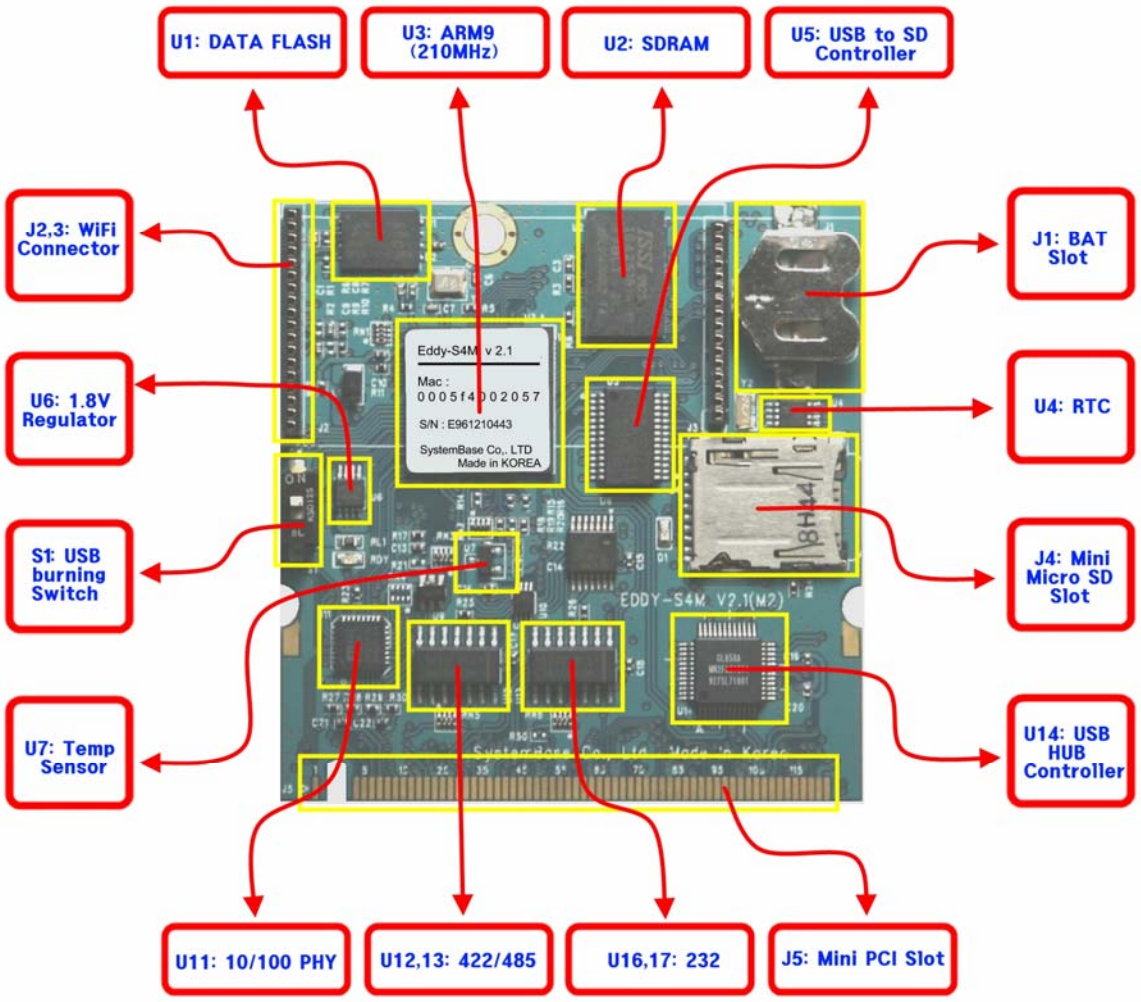
Eddy-CPU v2.1 /v2.5 Signal Name	DM9000B Signal Name	Description	I/O
PC12/NCS7	CSN	Chip Select #7 Address : 0x8000 0000-0x8FFF FFFF	OUT
PC15/IRQ1	INTRN	Interrupt depend on EECK(pin20) setting. 1 : INT pin low active 0 : INT pin high active EECK is not connected in DK board, so Interrupt is acted with active high.	IN
A2	CMD	Command Type When high, Data port When low, INDEX port	OUT
D[0:15]	Data Bus	16-bit mode	I/O

2.5 Eddy-S4M v2.1

Eddy-S4M is a high-performance mini PCI type embedded module which include ATMEL AT91SAM9260-CJ porcessor 32MB SDRAM, 8MB DataFlash, 10/100Base-T Ethernet port, Serial 4 Channel, RTC with Battery, minroSD, 4ch ADC, temperature sensor, max 34 programmable GPIO pins. Eddy-S4M is 59.75 x 61.8mm size. If using Eddy-S4M-JIG board, user could develop their customized device without other H/W development, which minimizing time and cost to develop.
Referring Example code and Evaluation Kit circuit allow developer to design device they want.



[Eddy-S4M v2.1 Block Diagram]



2.5.1 5.1 miniPCI Card Type III Connector Pinout (J5)

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	JTAG_TDI	2	JTAG_TDO	63	3.3V	64	PB13
	Key		Key	65	PB16	66	PB17
2	JTAG_TMS	4	JTAG_RTCK	67	PB18	68	PB19
3	JTAG_TCK	6	ICE_NTRST	69	GND	70	3.3V
7	LAN_RX+	8	LAN_TX+	71	PB20	72	PB21
9	LAN_RX-	10	LAN_TX-	73	PB30	74	GND
11	LAN_Speed	12	LAN_LINK	75	PC0	76	PB31
13	P3_RX-	14	RDY#	77	GND	78	PC1
15	GND	16	NC	79	PC2	80	PC3
17	P3_RX+	18	NC	81	PC5	82	GND
19	3.3V	20	DCD0	83	GND	84	PC9
21	P3_TX+	22	DTR0	85	PC10	86	PC12
23	GND	24	3.3V	87	PC13	88	3.3V

25	P3_TX-	26	nRESET	89	3.3V	90	PC14
27	GND	28	3.3V	91	PC15	92	PC17
29	P4_RX+	30	RxD0#	93	PC18	94	PC19
31	3.3V	32	GND	95	PC24	96	PC20
33	P4_RX-	34	RTS0	97	NC	98	PC25
35	P4_TX+	36	TxD0#	99	I2C_TWCK	100	I2C_TWD
37	GND	38	CTS0	101	GND	102	GND
39	P4_TX-	40	3.3V	103	DDM	104	DDP
41	DEBUG_TxD	42	DSR0	105	DM2	106	DP2
43	DEBUG_RxD	44	RI0	107	DM3	108	DP3
45	PA5	46	RxD1#	109	DM4	110	DP4
47	PA22	48	RTS1	111	SDDATA0	112	SDDATA1
49	GND	50	GND	113	SDDATA2	114	GND
51	PA30	52	TxD1#	115	SDCMD	116	SDDATA3
53	NC	54	CTS1	117	SDCDN	118	SDCLK
55	GND	56	NRST	119	JTAG_SEL	120	SDWP
57	PB0	58	PB1	121	NC	122	BMS
59	PB2	60	PB3	123	NC	124	3.3V
61	PB12	62	GND				

2.5.2 Connector Pinout of Boards

2.5.2.1. ICE and JTAG

S4M Pin No (124)	Name	S4M-JIG Pin HDR (46*2)	S4M-DK Pin HDR (46*2)	Description
1	TDI	-	-	Test Data IN
2	TDO	-	-	Test Data Out
3	TMS	-	-	Test Mode Select
4	RTCK	-	-	Return Test Clock
5	TCK	-	-	Test Clock
6	NTRST	-	-	Test Reset
119	JTAGSEL	-	-	JTAG boundary scan can be used by connecting J3. This pin should not be connected when using ICE (In-Circuit Emulator) or in normal operation status.

2.5.2.2. Ethernet signal from or to PHYceiver

S4M Pin No (124)	Name	S4M-JIG Pin HDR (46*2)	S4M-DK Pin HDR (46*2)	Description
7	LAN_RX+	J5 pin2	J7 Pn2	Ethernet PHY Physical receive or transmit signal (+ differential) in CPU
8	LAN_TX+	J5 pin1	J7 Pin1	Ethernet PHY Physical receive or transmit signal (- differential) in CPU
9	LAN_RX-	J5 pin3	J7 pin3	Ethernet PHY Physical receive or transmit signal (+ differential) in CPU
10	LAN_TX-	J5 pin4	J7 pin4	Ethernet PHY Physical receive or transmit signal (- differential) in CPU

<table>
<tr><td>11</td><td>LAN_Speed</td><td>J5 pin6</td><td>J7 pin6</td><td>LAN connection status LED
<table><tr><th>Link/Activity</th><th>Pin State</th><th>LED Definition</th></tr><tr><td>No Link</td><td>H</td><td>OFF</td></tr><tr><td>Link</td><td>L</td><td>ON</td></tr><tr><td>Activity</td><td>Toggle</td><td>Blinking</td></tr></table></td></tr>
<tr><td>12</td><td>LAN_Link</td><td>J5 pin5</td><td>J7 pin5</td><td><table><tr><th>Link/Activity</th><th>Pin State</th><th>LED Definition</th></tr><tr><td>No Link</td><td>H</td><td>OFF</td></tr><tr><td>Link</td><td>L</td><td>ON</td></tr><tr><td>Activity</td><td>Toggle</td><td>Blinking</td></tr></table></td></tr>
</table>

2.5.2.3. Serial (RS232 & COMBO) and PIOA (Peripheral I/O Controller A)

S4M Pin No (124)	Name	S4M-JIG Pin HDR (46*2)	S4M-DK Pin HDR (46*2)	Description
13	P2_RX-	J4 pin20	J6 pin20	COM port #3 Receive differential data negative (Input) RS422/485 inverting receiver input of Eddy-S4M module
14	RDY#	J4 pin45	J6 pin45	Indicate state of CPU (normal : blinking)
17	P2_RX+	J4 pin19	J6 pin19	COM port #3 Receive differential data positive (Input) RS422/485 Noninverting receiver input of Eddy-S4M module
20	DCD0	J4 pin9	J6 pin9	COM port #1 Data Carrier Detection signal RS232 receiver input of Eddy-S4M module
21	P2_TX+	J4 pin17	J6 pin17	COM port #3 Transmit differential data positive (Output) RS422/485 Noninverting driver ouput of Eddy-S4M module
22	DTR0	J4 pin7	J6 pin7	COM port #1 Data Terminal Ready signal RS232 driver output of Eddy-S4M module
25	P2_TX-	J4 pin18	J6 pin18	COM port #3 Transmit differential data negative (Output) RS422/485 inverting driver ouput of Eddy-S4M module
26	nRESET	J4 pin46	J6 pin46	Reset Input. In S/W, continuously check the interval of "LOW" when polling input signal from external Reset Key. Under 5sec : Normal reset function Over 5sec : Factory Default function
29	P3_RX+	J4 pin23	J6 pin23	COM port #4 Receive differential data negative (Input) RS422/485 Noninverting receiver input in Eddy-S4M module
30	RxD0#	J4 pin4	J6 pin4	COM port #1 Receive Data signal RS232 receiver input in Eddy-S4M module
33	P3_RX-	J4 pin24	J6 pin24	COM port #4 Receive differential data negative (Input) RS422/485 inverting receiver input in Eddy-S4M module
34	RTS0	J4 pin5	J6 pin5	COM port #1 Request To Send signal

				RS232 driver output in Eddy-S4M module
35	P3_TX+	J4 pin21	J6 pin21	COM port #4 Transmit differential data positive (Output) RS422/485 Noninverting driver ouput in Eddy-S4M module
36	TxD0#	J4 pin3	J6 pin3	COM port #1 Transmit Data signal RS232 driver output in Eddy-S4M module
38	CTS0	J4 pin6	J6 pin6	COM port #1 Request to Send signal RS232 receiver input in Eddy-S4M module
39	P3_TX-	J4 pin22	J6 pin22	COM port #4 Transmit differential data negative(Output) RS422/485 inverting driver ouput in Eddy-S4M module
41	DTxD#	J4 pin1	J6 pin1	Transmit Data signal of Debug Port RS232 driver output in Eddy-S4M module
42	DSR0	J4 pin8	J6 pin8	COM port #1 Data Set Ready signal RS232 receiver input in Eddy-S4M module
43	DRxD	J4 pin2	J6 pin2	Receive Data signal of Debug Port RS232 receiver input in Eddy-S4M module
44	RI0	J4 pin8	J6 pin8	COM port #1 Ring Indicator signal RS232 receiver input in Eddy-S4M module
45	PA5	J5 pin7	J7 pin7	Only used for GPIO
46	RxD1#	J4 pin12	J6 pin12	COM port #1 Receive Data signal RS232 receiver input in Eddy-S4M module
47	PA22	J5 pin8	J7 pin8	Only used for GPIO
48	RTS1	J4 pin13	J6 pin13	COM port #1 Request to Send signal RS232 driver output in Eddy-S4M module
51	PA30	J5 pin9	J7 pin9	Only used for GPIO
52	TxD1#	J4 pin11	J6 pin11	COM port #1 Request to Send signal RS232 driver output in Eddy-S4M module
54	CTS1	J4 pin14	J6 pin14	COM port #1 Request to Send signal RS232 receiver input in Eddy-S4M module
56	NRST	J5 pin46	J7 pin46	External device Reset output signal (active low)

2.5.2.4. PIOB and PIOC (Peripheral I/O Controller B/C)

S4M Pin No (124)	Name	S4M-JIG Pin HDR (46*2)	S4M-DK Pin HDR (46*2)	Description	
57	PB0	J5 pin11	J7 pin11	Peripheral A : SPI1_MISO	SPI1(Serial Peripheral Interface) Master In Slave Out
				Peripheral B : TIOA3	Timer Counter ch3 I/O Line A

58	PB1	J5 pin12	J7 pin12	Peripheral A : SPI1_MOSI	SPI1(Serial Peripheral Interface) Master Out Slave In
				Peripheral B : TIOB3	Timer Counter ch3 I/O Line B
59	PB2	J5 pin13	J7 pin13	Peripheral A : SPI1_SPCK	SPI1(Serial Peripheral Interface) Serial Clock
60	PB3	J5 pin14	J7 pin14	Peripheral A : SPI1_NPCS0	SPI1(Serial Peripheral Interface) Peripheral Chip Select 0
				Peripheral B : TIOA5	Timer Counter ch5 I/O Line A
61	PB12	J5 pin17	J7 pin17	Peripheral A : TXD5	USART5 Transmit Data
64	PB13	J5 pin18	J7 pin18	Peripheral A : RXD5	USART5 Receive Data
65	PB16	J5 pin119	J7 pin119	Peripheral A : TK0	SSC Transmit Clock
				Peripheral B : TCLK3	Timer Counter ch3 External CLK IN
66	PB17	J5 pin20	J7 pin20	Peripheral A : TF0	SSC Transmit Frame Sync
				Peripheral B : TCLK4	Timer Counter ch4 External CLK IN
67	PB18	J5 pin21	J7 pin21	Peripheral A : TD0	SSC Transmit Data
				Peripheral B : TIOB4	Timer Counter ch4 I/O Line B
68	PB19	J5 pin22	J7 pin22	Peripheral A : RD0	SSC Receive Data
				Peripheral B : TIOB5	Timer Counter ch5 I/O Line B
71	PB20	J5 pin23	J7 pin23	Peripheral A : RK0	SSC Receive Clock
72	PB21	J5 pin24	J7 pin24	Peripheral A : RF0	SSC Receive Frame Sync
73	PB30	J5 pin25	J7 pin25	Peripheral A : PCK0	Programmable Clock Output 0
75	PC0	J5 pin27	J7 pin27	Peripheral A : AD0	Analog to Digital Converter Input Ch0
76	PB31	J5 pin26	J7 pin26	Peripheral A : PCK1	Programmable Clock Output 1
78	PC1	J5 pin28	J7 pin28	Peripheral A : AD1	Analog to Digital Converter Input Ch1
				Peripheral B : PCK0	Programmable Clock Output 0
79	PC2	J5 pin29	J7 pin29	Peripheral A : AD2	Analog to Digital Converter Input Ch2
				Peripheral B : PCK1	Programmable Clock Output 1
80	PC3	J5 pin30	J7 pin30	Peripheral A : AD3	Analog to Digital Converter Input Ch3
				Peripheral B : SPI1_NPCS3	SPI1(Serial Peripheral Interface) Peripheral Chip Select 3
81	PC5	J5 pin33	J7 pin33	Peripheral B : SPI1_NPCS1	SPI1(Serial Peripheral Interface) Peripheral Chip Select 1

84	PC9	J5 pin34	J7 pin34	Only GPIO	
85	PC10	J5 pin35	J7 pin35	Only GPIO	
86	PC12	J5 pin36	J7 pin36	Only GPIO	
87	PC13	J5 pin37	J7 pin37	Only GPIO	
90	PC14	J5 pin38	J7 pin38	Only GPIO	
91	PC15	J5 pin39	J7 pin39	Only GPIO	
92	PC17	J5 pin40	J7 pin40	Only GPIO	
93	PC18	J5 pin41	J7 pin41	Peripheral B : SPI1_NPCS1	SPI1(Serial Peripheral Interface) Peripheral Chip Select 1
94	PC19	J5 pin42	J7 pin42	Peripheral B : SPI1_NPCS2	SPI1(Serial Peripheral Interface) Peripheral Chip Select 2
95	PC24	J5 pin44	J7 pin44	Only GPIO	
96	PC20	J5 pin43	J7 pin43	Peripheral B : SPI1_NPCS3	SPI1(Serial Peripheral Interface) Peripheral Chip Select 3
98	PC25	J5 pin45	J7 pin45	Only GPIO	

2.5.2.5. Two Wire Interface

S4M Pin No (124)	Name	S4M-JIG Pin HDR (46*2)	S4M-DK Pin HDR (46*2)	Description
99	I2C_TWCK	J4 pin43	J6 pin43	Two-wire Serial Clock. This can be used GPIO pin unless RTC function is used.
100	I2C_TWD	J4 pin44	J6 pin44	Two-wire Serial Data. This can be used GPIO pin unless RTC function is used.

2.5.2.6. Universal Serial Bus

S4M Pin No (124)	Name	S4M-JIG Pin HDR (46*2)	S4M-DK Pin HDR (46*2)	Description
103	DDM	J4 pin25	J6 pin25	USB Device Port Data −
104	DDP	J4 pin26	J6 pin26	USB Device Port Data +
105	DM2	J4 pin27	J6 pin27	USB Port2 Data −. Connected to DSPORT2 of GL850A USB 2.0 Hub Controller.
106	DP2	J4 pin27	J6 pin27	USB Port2 Data +. Connected to DSPORT2 of GL850A USB 2.0 Hub Controller.

107	DM3	J4 pin29	J6 pin29	USB Port3 Data −. Connected to DSPORT2 of GL850A USB 2.0 Hub Controller.
108	DP3	J4 pin30	J6 pin30	USB Port3 Data +. Connected to DSPORT2 of GL850A USB 2.0 Hub Controller.
109	DM4	J4 pin33	J6 pin33	USB Port4 Data -. Connected to DSPORT2 of GL850A USB 2.0 Hub Controller.
110	DP4	J4 pin34	J6 pin34	USB Port4 Data +. Connected to DSPORT2 of GL850A USB 2.0 Hub Controller.

2.5.2.7. Multimedia Card Interface

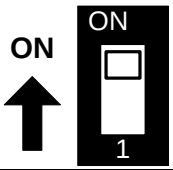
S4M Pin No (124)	Name	S4M-JIG Pin HDR (46*2)	S4M-DK Pin HDR (46*2)	Description
111	SDDATA0	J4 pin35	J6 pin35	SD Data0
112	SDDATA1	J4 pin36	J6 pin36	SD Data1
113	SDDATA2	J4 pin37	J6 pin37	SD Data2
115	SDCMD	J4 pin38	J6 pin38	SD command
116	SDDATA3	J4 pin39	J6 pin39	SD Data3
117	SDCDN	J4 pin40	J6 pin40	SD card detect
118	SDCLK	J4 pin41	J6 pin41	SD Clock
120	SDWP	J4 pin42	J6 pin42	SD Write Protect
122	BMS	-	-	Boot Mode Select signal BMS = 1, Boot on Embedded ROM BMS = 0, Boot on External Memory

2.5.2.8. etc

S4M Pin No (124)	Name	S4M-JIG Pin HDR (46*2)	S4M-DK Pin HDR (46*2)	Description
16, 18, 53, 97, 121, 123	NC	J5 pin10	J5 pin10	No Connection
15, 23, 27, 32, 37, 49, 50, 55, 62,	GND	J4: 31,32 J5: 31,32	J6: 31,32 J7: 31,32	Ground

69, 74, 77, 82, 83, 101, 102, 114				
19, 24, 28, 31, 40, 63, 70, 88, 89, 124	3.3V	J4: 15,16	J6: 15,16	3.0 to 3.6V power input

2.5.3 Switch Operation



Switch No 1	Operation descriotion
OFF	**For Flash Programming** Store firmware image to Flash memory through USB Device. (Only via Window Host). For more information, please refer to chapter 9, system recovery.
ON	Normal booting via Eddy-S4M v2.1 Data Flash

2.5.4 LED Operation

System Ready (RDY): Indicate normal state of system (Normal: blinking)

2.5.5 Ethernet

Since there is KSZ8041NL PHY in Eddy-S4M module, when integrating Ethernet, just connect RJ45 in which transformer located

WARNING : When you use RJ45 which has transformer in its internal circuit, it is possible to each product doesn' t have equal PIN spec. Therefore, you must confirm PIN number

Bellow is KSZ8041NL functions

- Fully compliant to IEEE 802.3u Standard
- Supports MDI/MDI-X auto crossover (Auto-MDI)
- MII interface support
- RMII interface support with external 50MHz system clock
- ESD rating (6kV)
- Built-in 1.8V regulator for core
- Available in 32-pin (5mm x 5mm) MLF® package

2.5.6 RTC

- We used D1340 which is connected I2C interface.
- In DS1340, you must use crystal of load capacitance = 12.5pF (Refer to bellow Crystal spec)

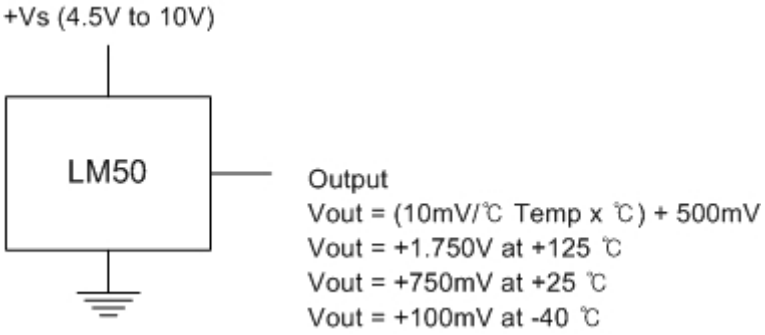
- You have to confirm Crystal spec because some RTC Chips have different spec
- We used CR2032 (235mAh) Lithium with Backup Battery

DS1340 Crystal Specifications

Parameter	Symbol	MIN	TYP	MAX	Units
Normal Frequency	fo		32.768		KHz
Series Resistance	ESR			45,60	KΩ
Load Capacitance	CL		12.5		pF

2.5.7 Temp Sensor

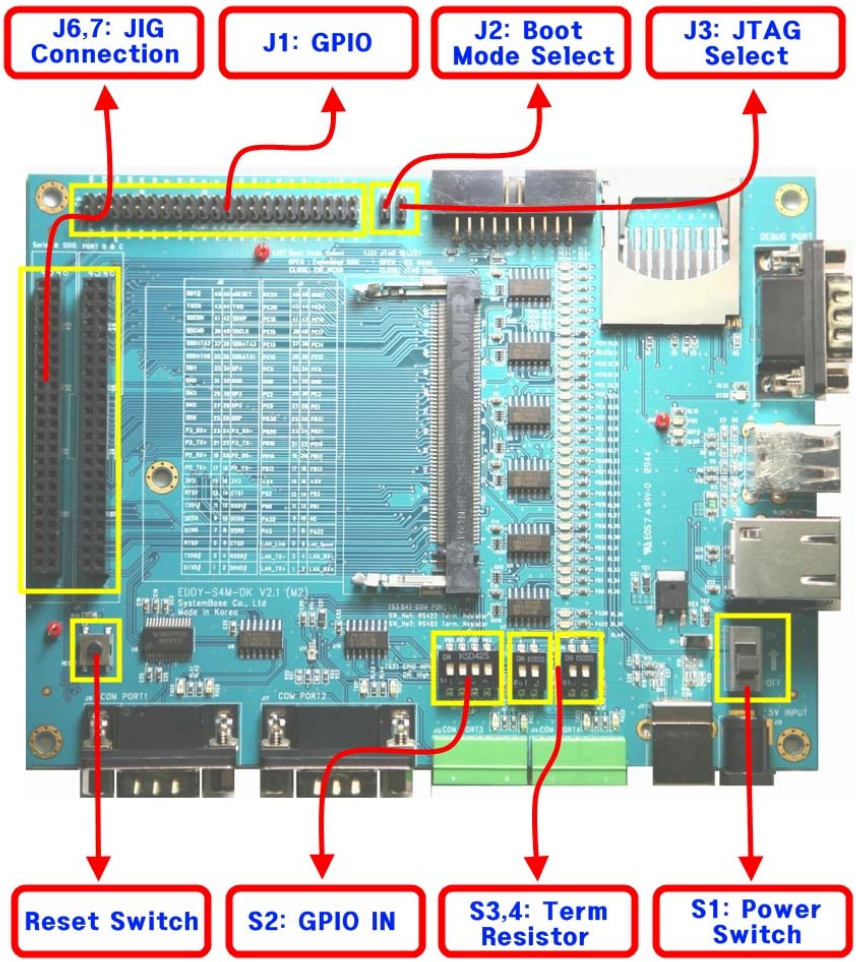
we used LM50(National) to AD0(PC0)



2.6 Eddy-S4M-DK v2.1

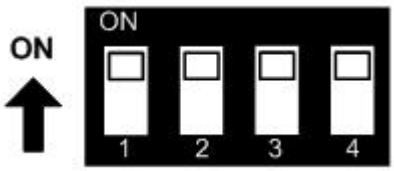
Eddy-S4M DK is Development Kit supporting programmer can easily materialize and test their application.

2.6.1 Switch and Connector explanation



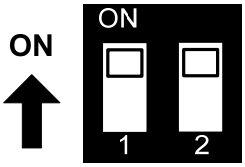
2.6.1.1. S2 : GPIO Input Configuration

After configure PB0-PB4 to input, you can confirm whether the input value is changing with dip switch control.



Switch No		Down Position(OFF)	UP Position(ON)
1	PB0 Value	Low	High
2	PB0 input value	Low	High
3	PB0 input value	Low	High
4	PB0 input value	Low	High

2.6.1.2. S3,4 : Terminal Resistor selection



COM Port #3 and COM Port #4 is Combo port which support RS422/RS485 interface. Terminal resistors in each port are configured by switch upon each Terminal Block.

Switch No	Down Position(OFF)	UP Position(ON)
1	RS422 Termination Resistor not connected	RS422 Termination Resistor Connected
2	RS485 Termination Resistor not connected	RS422 Termination Resistor Connected
1	RS422 Termination Resistor not connected	RS422 Termination Resistor Connected
2	RS485 Termination Resistor not connected	RS422 Termination Resistor Connected

2.6.1.3. J6,J7 : JIG Board connector(Socket)

J6

Pin	Signal	Pin	Signal
1	DTxD	2	DRxD
3	TxD0#	4	RxD0#
5	RTS0	6	CTS0
7	DTR0	8	DSR0
9	DCD0	10	RI0
11	TxD1#	12	RxD1#
13	RTS1	14	CTS1
15	3.3V	16	3.3V
17	P3_TX+	18	P3_TX-
19	P3_RX+	20	P3_RX-
21	P4_TX+	22	P4_TX-
23	P4_RX+	24	P4_RX-
25	DDM	26	DDP
27	DM2	28	DP2
29	DM3	30	DP3

J7

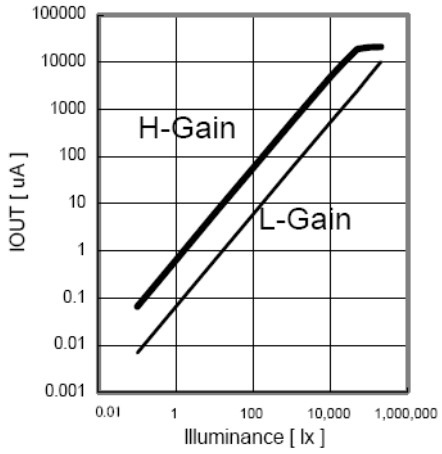
Pin	Signal	Pin	Signal
1	LAN_RX+	2	LAN_TX+
3	LAN_RX-	4	LAN_TX-
5	LAN_Speed	6	LAN_LINK
7	PA5	8	PA22
9	PA30	10	NC
11	PB0	12	PB1
13	PB2	14	PB3
15	5V	16	5V
17	PB12	18	PB13
19	PB16	20	PB17
21	PB18	22	PB19
23	PB20	24	PB21
25	PB30	26	PB31
27	PC0	28	PC1
29	PC2	30	PC3

31	GND	32	GND
33	DM4	34	DP4
35	SDDATA0	36	SDDATA1
37	SDDATA2	38	SDDATA3
39	SDCMD	40	SDCLK
41	SDCDN	42	SDWP
43	TWCK	44	TWD
45	RDY#	46	nRESET(IN)

31	GND	32	GND
33	PC5	34	PC9
35	PC10	36	PC12
37	PC13	38	PC14
39	PC15	40	PC17
41	PC18	42	PC19
43	PC20	44	PC24
45	PC25	46	NRST(OUT)

2.6.1.4. U7 : Light Sensor

Bellow is comparison between luminance and out current. We used BH1600FVC (Rohm)



The Output voltage is caculated as below

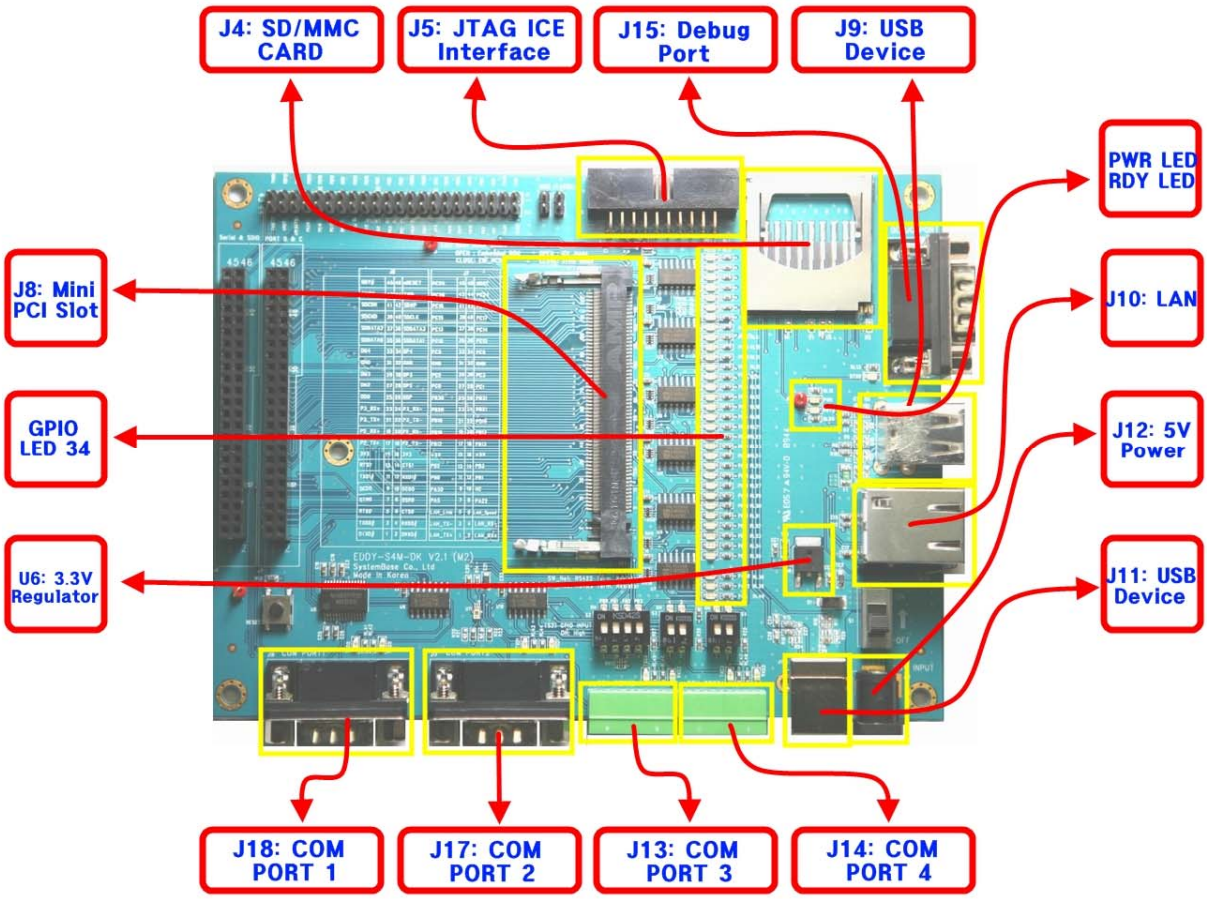
Viout = 0.6 x10-6 x Ev x R1

Where, Viout = IOUT output voltage [V]

Ev = lilluminance of the ALS(Ambient Light Sensor) surface [lx]

R1 = IOUT output resistor [Ω]

2.6.2 Interface Explanation



2.6.2.1. Power, Ready LED

System Ready (RDY): Indicate normal state of system (Normal: blinking)
Power (PWR): indicate Power is inserted (RED LED ON state)

2.6.2.2. Serial Port LED

Operation description

Pin Name	Signal Name	Descriotion
Debug Port	TxD	Debug Port Tx LED
	RxD	Debug Port Rx LED
COM Port 1 (RS232)	TxD	COM Port1 Tx LED
	RxD	COM Port1 Rx LED
COM Port 2 (RS232)	TxD	COM Port2 Tx LED
	RxD	COM Port2 Rx LED
COM Port 3 (RS422/RS485)	TxD	If RS422 is COM Port3 Tx LED If RS485 is Tx/Rx Common LED
	RxD	If RS422 is COM Port3 Rx LED

		If RS485 is LED Off (Not Used)
COM Port 4 (RS422/RS485)	TxD	If RS422 is COM Port4 Tx LED If RS485 is Tx/Rx Common LED
	RxD	If RS422 is COM Port4 Rx LED If RS485 is LED Off (Not Used)

2.6.2.3. GPIO LED

Eddy-S4M Provide max 34ea GPIO port.

No	Pin Name	Descriotion	I/O
1	PC25	GPIO Only	I/O
2	PC24	GPIO Only	I/O
3	PC20	GPIO or SPI1_NPCS3	I/O
4	PC19	GPIO or SPI1_NPCS2	I/O
5	PC18	GPIO or SPI1_NPCS1	I/O
6	PC17	GPIO Only	I/O
7	PC15	GPIO Only	I/O
8	PC14	GPIO Only	I/O
9	PC13	GPIO Only	I/O
10	PC12	GPIO Only	I/O
11	PC10	GPIO Only	I/O
12	PC9	GPIO Only	I/O
13	PC5	GPIO or SPI1_NPCS1	I/O
14	PC3	GPIO or AD3 or SPI1_NPCS3	I/O
15	PC2	GPIO or AD2 or PCK0	I/O
16	PC1	GPIO or AD1 or PCK0	I/O
17	PC0	GPIO or AD0	I/O
18	PB31	GPIO or PCK1	I/O
19	PB30	GPIO or PCK0	I/O
20	PB21	GPIO or RF0	I/O
21	PB20	GPIO or RK0	I/O
22	PB19	GPIO or RTD0 or TIOB5	I/O
23	PB18	GPIO or TD0 or TIOB4	I/O
24	PB17	GPIO or TF0 or TCLK4	I/O
25	PB16	GPIO or RxD5 or TCLK3	I/O
26	PB13	GPIO or RxD5	I/O
27	PB12	GPIO or TxD5	I/O
28	PB3	GPIO or SPI1_NPCS0 or TIOA5	I/O
29	PB2	GPIO or SPI1_SPCK	I/O
30	PB1	GPIO or SPI1_MOSI or TIOB3	I/O
31	PB0	GPIO or SPI1_MISO or TIOA3	I/O
32	PA30	GPIO Only	I/O
33	PA22	GPIO Only	I/O
34	PA5	GPIO Only	I/O

PIO line has high-drive current capable so that can drive about 16mA except PC4-PC31(2mA).
(41.2 DC characteristics of CPU Datasheet, Refer to bellow)

AT91SAM9260 DC Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Units
I_o	Output Current	PA0-PA31 PB0-PB31 PC0-PC3			16	
		PC4 - PC31 in 3.3V range			2*	mA
		PC4 - PC31 in 1.8V range			4	

* Since Eddy-S4M v2.1 is 3.3V range, PC4-PC31 PIO can drive 2mA.

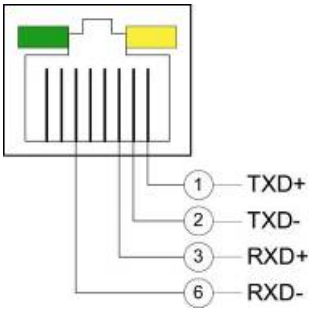
2.6.2.4. J10 : Ethernet

Since there is KSZ8041NL PHY in Eddy-S4M module, when integrating Ethernet, just connect RJ45 in which transformer located

WARNING : When you use RJ45 which has transformer in its internal circuit, it is possible to each product doesn't have equal PIN spec. Therefore, you must confirm PIN number

Bellow is KSZ8041NL functions

- Fully compliant to IEEE 802.3u Standard
- Supports MDI/MDI-X auto crossover (Auto-MDI)
- MII interface support
- RMII interface support with external 50MHz system clock
- ESD rating (6kV)
- Built-in 1.8V regulator for core
- Available in 32-pin (5mm x 5mm) MLF® package



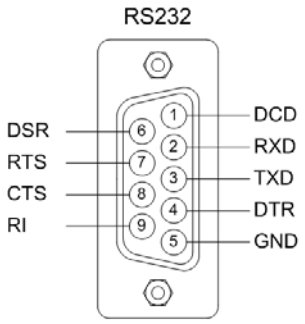
Pin	Signal	Description
1	TXD+	Physical transmit or receive signal (+ differential)
2	TXD-	Physical transmit or receive signal (- differential)
3	RXD+	Physical transmit or receive signal (+ differential)
6	RXD-	Physical transmit or receive signal (- differential)

LED	Description
Left Green	LAN Connection Speed

Speed	Pin State	LED Definition
10Base-T	H	OFF
100Base-TX	L	ON

Right Yellow	LAN Connection Status		
	Speed	Pin State	LED Definition
	No Link	H	OFF
	Link	L	ON
	Activity	Toggle	Blinking

2.6.2.5. J17, 18 : COM Port 1 & Port 2



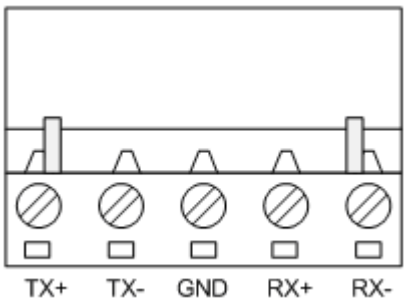
DB9 Male (COM Port 1, 2 공통)

RS232

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

* COM Port 2 provide only TxD, RxD, RTS, CTS signal.

2.6.2.6. J13, 14 : COM Port 3 & Port 4



RS422 Full Duplex

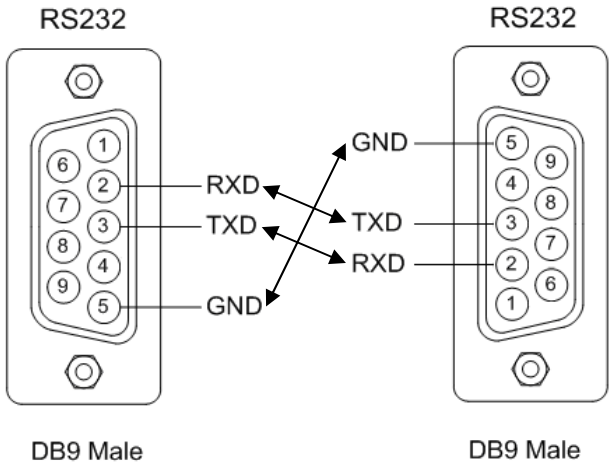
Pin	Signal	Description
1	TXD+	Transmit differential data positive (Output)
2	TXD-	Transmit differential data negative (Output)
3	GND	Ground
4	RXD+	Receive differential data positive (Input)
5	RXD-	Receive differential data negative (input)

RS485 Half Duplex

Pin	Signal	Description
1	TRX+	Transmit/Receive differential data positive
2	TRX-	Transmit/Receive differential data negative

J15 : Debug Port

You can confirm debug massage and information of state through debug port.



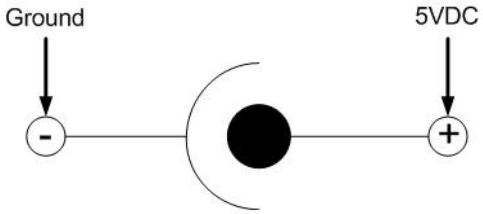
Environment Configuration

Debug port is configured like below so that you must change serial port (connected with debug port) configuration like bellow.

- Speed : 115200 bps
- Data bit : 8 bit
- Parity bit : Non Parity
- Stop bit : 1 bit
- Flow control : none

2.6.2.7. S1 : Power Jack

Contact	Polarity
Center (D : 2mm)	5VDC
Outer (D: 6.5mm)	Ground

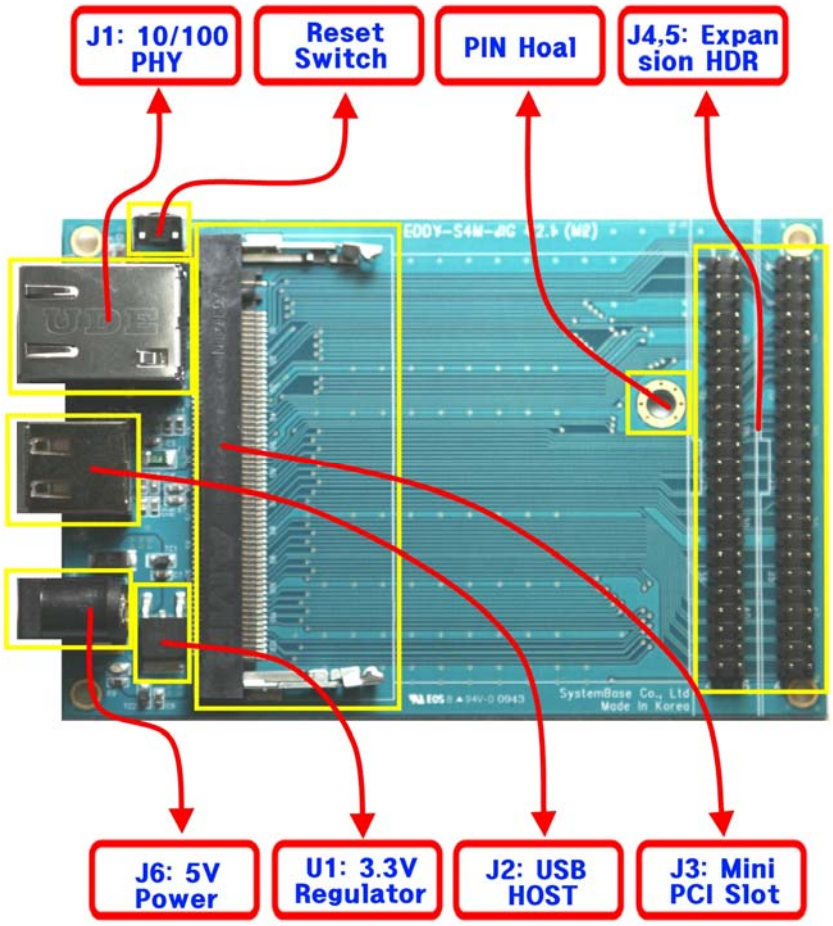


GPIO Connector pinout

Pin	Signal	Pin	Signal
1	PA5	2	PA22
3	PA30	4	NC
5	PB0	6	PB1
7	PB2	8	PB3
9	PB12	10	PB13
11	PB16	12	PB17
13	PB18	14	PB19
15	3.3V	16	3.3V
17	PB20	18	PB21
19	PB30	20	PB31
21	PC0	22	PC1
23	PC2	24	PC3
25	PC5	26	PC9
27	PC10	28	PC12
29	PC13	30	PC14
31	GND	32	GND
33	PC15	34	PC17
35	PC18	36	PC19
37	PC20	38	PC24
39	PC25	40	nRESET(IN)
41	RDY#	42	NRST(OUT)
43	TWCK	44	TWD

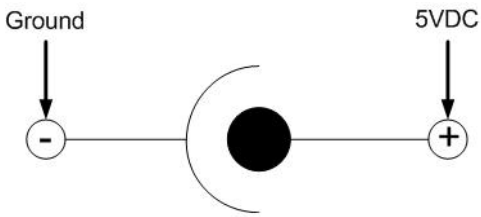
2.7 Eddy-S4M-JiG v2.1

Eddy-S4M JIG board is test board which enable of user to integrate and test their application with Eddy-S4M. JIG board include mini connector for joining Eddy-S4M, Ethernet RJ45, USB Host, Power, Reset Switch, and providing connectors to all Eddy-S4M functions.



2.7.1 J6 : Power Jack

Contact	Polarity
Center (D : 2mm)	5VDC
Outer (D: 6.5mm)	Ground



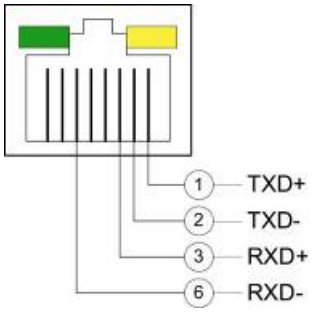
2.7.2 J1 : Ethernet

Since there is KSZ8041NL PHY in Eddy-S4M module, when integrating Ethernet, just connect RJ45 in which transformer located

WARNING : When you use RJ45 which has transformer in its internal circuit, it is possible to each product doesn't have equal PIN spec. Therefore, you must confirm PIN number

Bellow is KSZ8041NL functions

- Fully compliant to IEEE 802.3u Standard
- Supports MDI/MDI-X auto crossover (Auto-MDI)
- MII interface support
- RMII interface support with external 50MHz system clock
- ESD rating (6kV)
- Built-in 1.8V regulator for core
- Available in 32-pin (5mm x 5mm) MLF® package



Pin	Signal	Description
1	TXD+	Physical transmit or receive signal (+ differential)
2	TXD-	Physical transmit or receive signal (- differential)
3	RXD+	Physical transmit or receive signal (+ differential)
6	RXD-	Physical transmit or receive signal (- differential)

LED	Description
Left Green	LAN Connection Speed

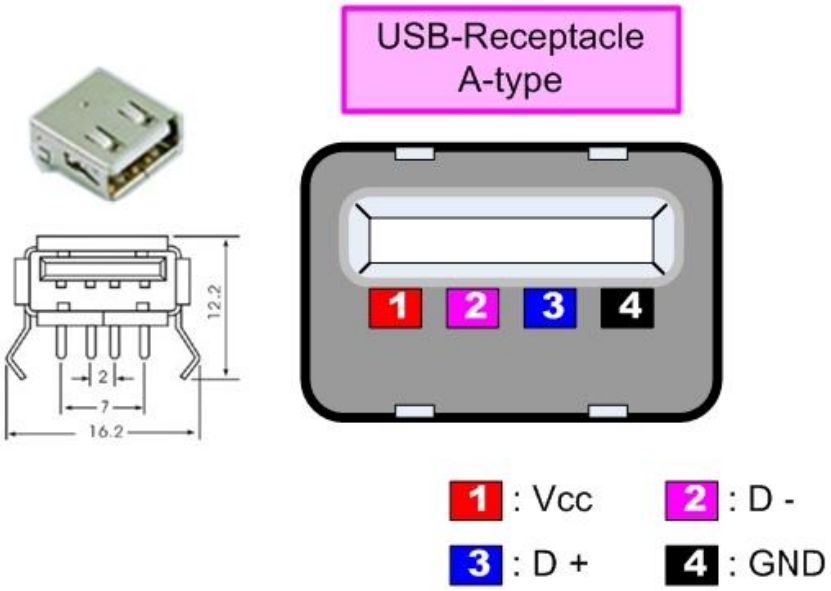
Speed	Pin State	LED Definition
10Base-T	H	OFF
100Base-TX	L	ON

LED	Description
Right Yellow	LAN Connection Status

Speed	Pin State	LED Definition
No Link	H	OFF
Link	L	ON
Activity	Toggle	Blinking

2.7.3 J2 : USB Host

J2 is connected to USB HUB ControllerEddy-S4M in Eddy-S4M. Bellow is its PIN spec



2.7.4 RESET switch

Pin	Definition	Description	I/O
PC16	nRESET	Polling Input signal continually from External Reset key, implement as below with checking the constant time of "Low." Less than 5 seconds: General reset function. More than 5 second: Factory Default function.	IN

2.7.5 J4, 5 : Expansion Header

Provide most function of eddy-S4M with pin connector.
You can confirm the function with direct conjunction to Eddy-S4M-DK.

J4

Pin	Signal	Pin	Signal
1	DTxD	2	DRxD
3	TxD0#	4	RxD0#
5	RTS0	6	CTS0
7	DTR0	8	DSR0
9	DCD0	10	RI0
11	TxD1#	12	RxD1#
13	RTS1	14	CTS1
15	3.3V	16	3.3V
17	P3_TX+	18	P3_TX-
19	P3_RX+	20	P3_RX-
21	P4_TX+	22	P4_TX-
23	P4_RX+	24	P4_RX-
25	DDM	26	DDP

J5

Pin	Signal	Pin	Signal
1	LAN_RX+	2	LAN_TX+
3	LAN_RX-	4	LAN_TX-
5	LAN_Speed	6	LAN_LINK
7	PA5	8	PA22
9	PA30	10	NC
11	PB0	12	PB1
13	PB2	14	PB3
15	5V	16	5V
17	PB12	18	PB13
19	PB16	20	PB17
21	PB18	22	PB19
23	PB20	24	PB21
25	PB30	26	PB31

27	DM2	28	DP2
29	DM3	30	DP3
31	GND	32	GND
33	DM4	34	DP4
35	SDDATA0	36	SDDATA1
37	SDDATA2	38	SDDATA3
39	SDCMD	40	SDCLK
41	SDCDN	42	SDWP
43	TWCK	44	TWD
45	RDY#	46	nRESET(IN)

27	PC0	28	PC1
29	PC2	30	PC3
31	GND	32	GND
33	PC5	34	PC9
35	PC10	36	PC12
37	PC13	38	PC14
39	PC15	40	PC17
41	PC18	42	PC19
43	PC20	44	PC24
45	PC25	46	NRST(OUT)

2.8 Eddy-WiFi v2.1

Linking to Eddy-CPU and Eddy-S4M, Eddy-WiFi module enables to use various types of serial device (Security equipment, telecommunications device, modem, data output devices, industrial instruments etc.) through wireless LAN. Eddy-WiFi module supports IEEE 802.11b/g.
For application development, please refer to WiFi.c, the source code for Eddy-WiFi module.

LEFT	Description
1	NA
2	NA
3	NA
4	NA

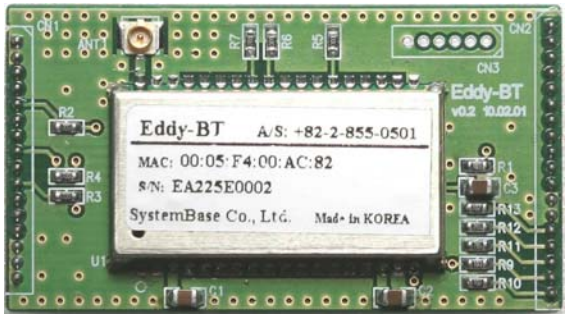
RIGHT	Description
1	NA
2	NA
3	NA
4	NA
5	VCC(3.3V)
6	VCC(3.3V)
7	USB Host Data(-)
8	USB Host Data(+)
9	NA
10	NA
11	H/W Reset
12	Ground
13	Ground
14	NA
15	NA
16	NA
17	NA
18	NA

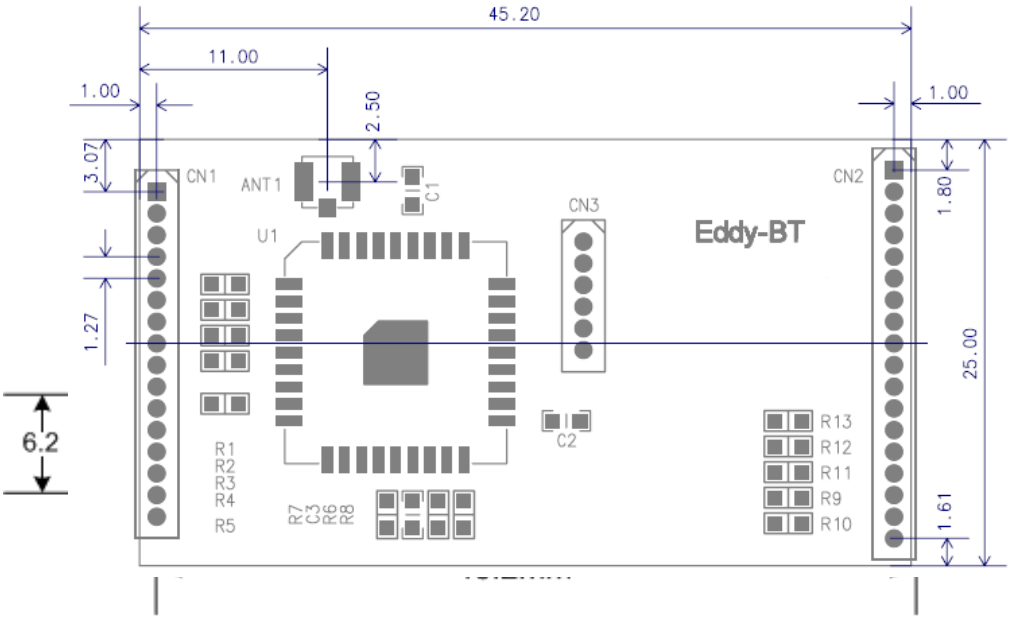
2.9 Eddy-BT v2.1

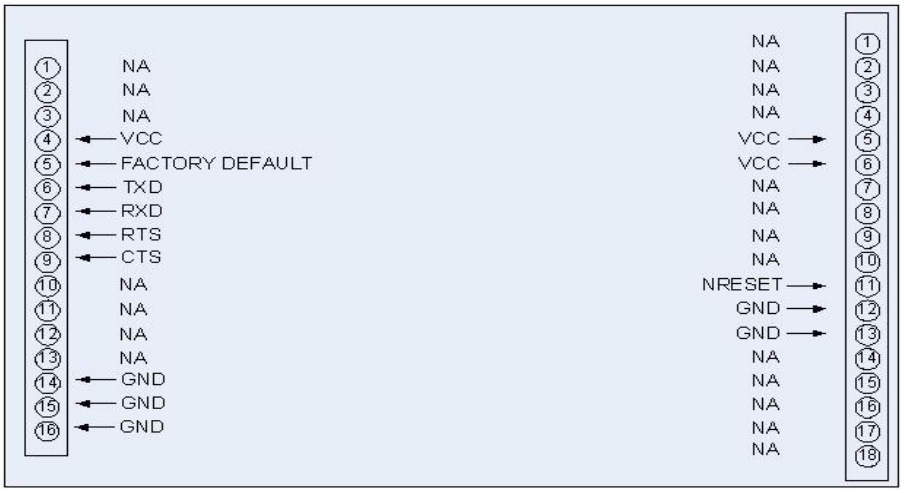
Eddy-BT module is based on Bluetooth 2.0 and supports communication distance of up to 1,000m. Linking to Eddy-CPU and Eddy-S4M, Eddy-BT module enables communication with various types of Bluetooth device in Bluetooth method. Eddy-BT module' s communication interface supports serial method. To connect to Eddy-CPU, Eddy-S4M, it uses 4th serial port.

Since it is not considered to use Eddy-BT in Eddy' s operating environment, it can lose data in case of using HW Flow Control. (4th port is composed to support RS422 or RS 485. Since it uses RTS/CTS signal line in Auto Toggle method, it can not be used for HW flow control of RS232.)

To use Eddy-BT right, please refer to test_bluetooth.c, the sample source code.







LEFT	Description
1	NA
2	NA
3	NA
4	VCC(3.3V)
5	Factory Reset
6	UART TXD
7	UART RXD
8	UART RTS
9	UART CTS
10	Pairing Signal
11	H/W Reset
12	NA
13	NA
14	Ground
15	Ground
16	Ground

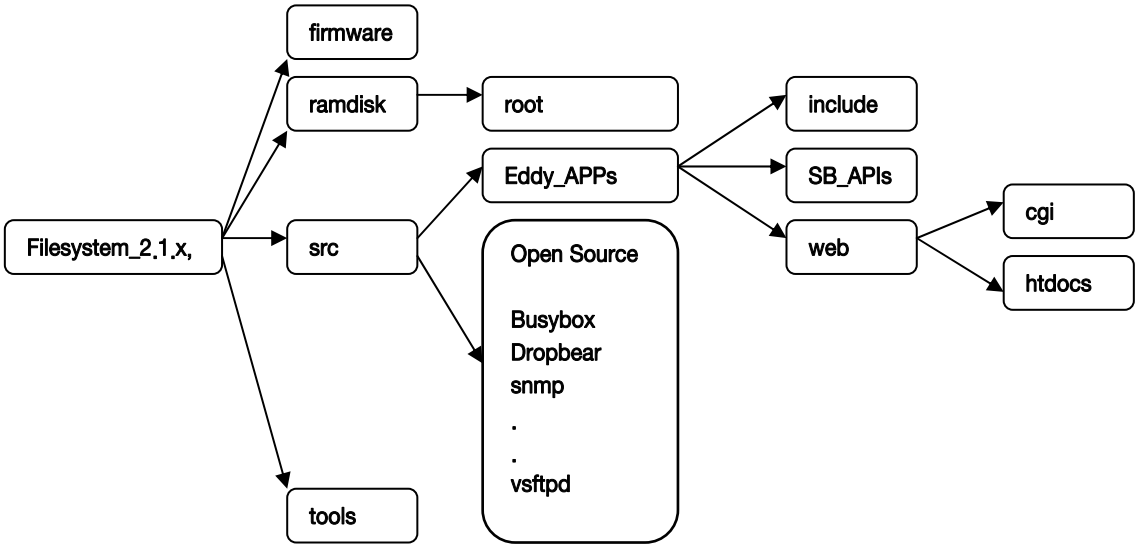
RIGHT	Description
1	NA
2	NA
3	NA
4	NA
5	VCC(3.3V)
6	VCC(3.3V)
7	NA
8	NA
9	NA
10	NA
11	H/W Reset
12	Ground
13	Ground
14	NA
15	NA
16	NA
17	NA
18	NA

Chapter 3. Development Environment

This chapter explains the process of application programming and other important notes.
SDK' s directory structures are as follows.

> Note
> All material related to Eddy including documentation, reference sources and utilities are periodically updated to www.embeddedmodule.com without prior notice. Please visit and download latest updates from the site.

3.1 Source code directory structure



Firmware Directory
Boot Loader, kernel, filesystem, image are stored.

Ramdisk Directory
Filesystem images are created here
root: Linux Filesystem for Eddy is stored.

Tools Directory
Tools used for creating image files is stored.

Src Directory
Source codes of applicatons in Eddy are stored.
Please refer Chapter4. Compiling Application for the detail description of src directory.
Eddy-APPs folder contains the source code of the basic application.

Other folders contain open sources for Eddy applications.

3.2 Language

Eddy-DK application should be composed with C language. All example source codes provided are composed in C language. You can use more than one source file if you are using C programming Language. If you are familiar with programming with ANSI C, there will be no difficulties creating applications for Eddy.

3.3 Development Environment

Eddy DK requires Windows or Linux host system.
Officially supported OSs are as follows.

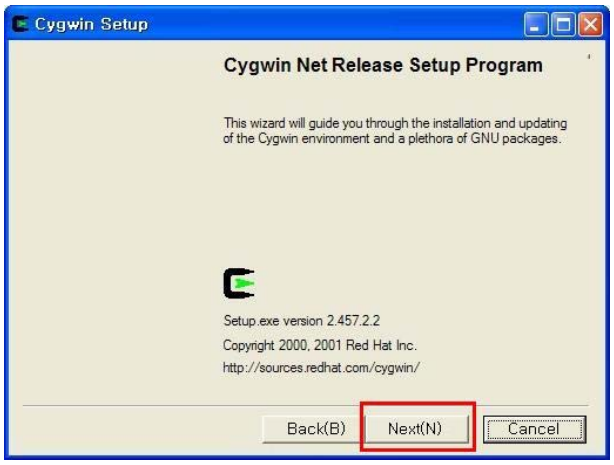
Windows	Linux
Windows XP SP2 Windows 2000 Windows 2003	Red Hat 9.0 Fedora Core 4, 5, 6 SUSE Linux Enterprise Server 10.2 Ubuntu Linux 6.x, 7.x Debian Linuv 4.0 CentOS 4.5 Asianux edition 3

3.4 Installing on Windows OS

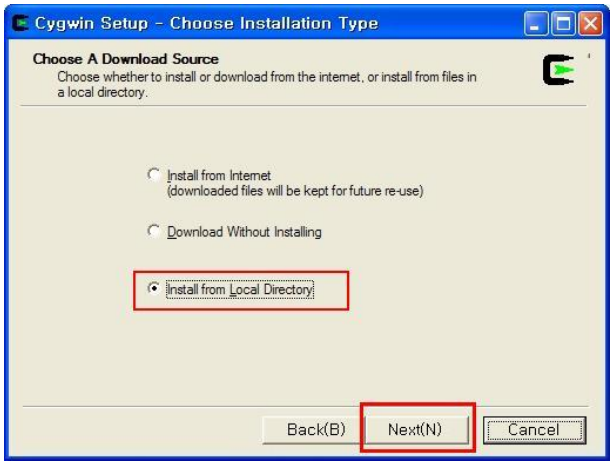
This chapter will describe how to install Eddy Development Environment on Windows host.
The explanation of this manual based on Windows XP.
To establish Eddy's integrated development environment, LemonIDE, please refer to "LemonIDE_User_Guide" for further instructions.

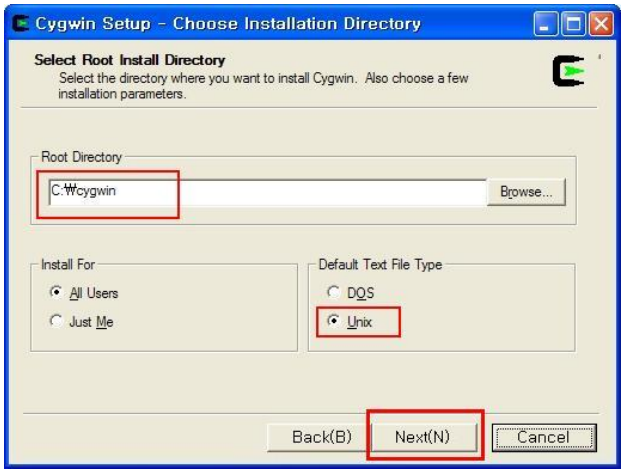
3.5 Installation of Cygwin

To execute LemonIDE on Windows hosts, some of libraries from Linux system are required.
Cygwin is a virtual Linux program for Windows. To install Cygwin, please refer to Cygwin-Setup.zip in SDK/Windows folder of Eddy DK CD. After unzipping this file in Windows PC, run Setup.exe file.

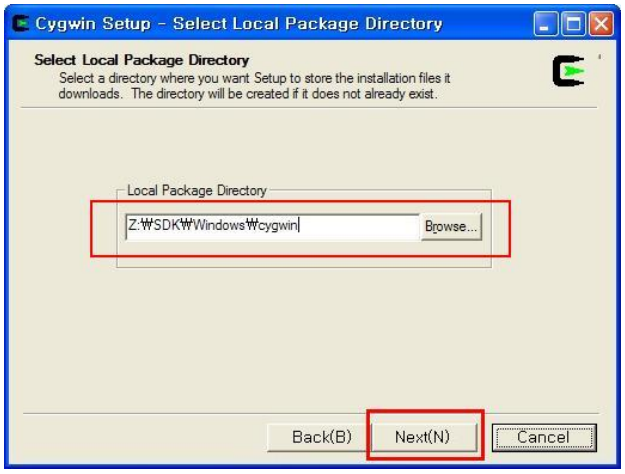


Select "Install from Local Directory" and click "Next".

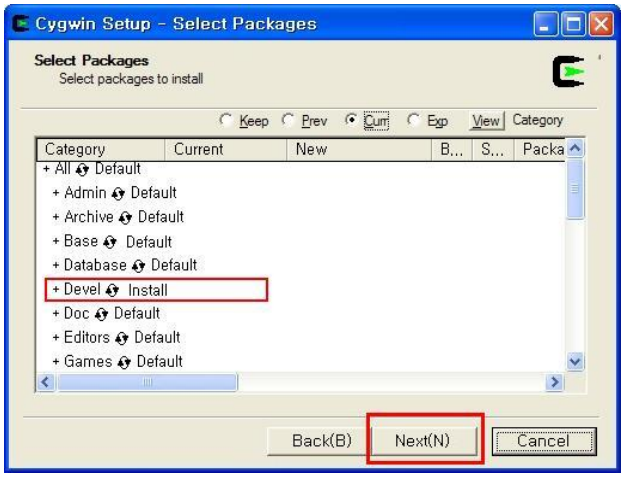




Select installation directory as “c:\cygwin” .



Select a folder which Cygwin-Setup.zip is unzipped. .
If it is unzipped in C:\cygwin-Setup folder, select “c:\cygwin-setup” folder..



Select the package to install.
Only select “Devel” as left picture.
Make sure the option changed to “Install” from “Default:.

3.6 Configuration of Windows Environment Variables

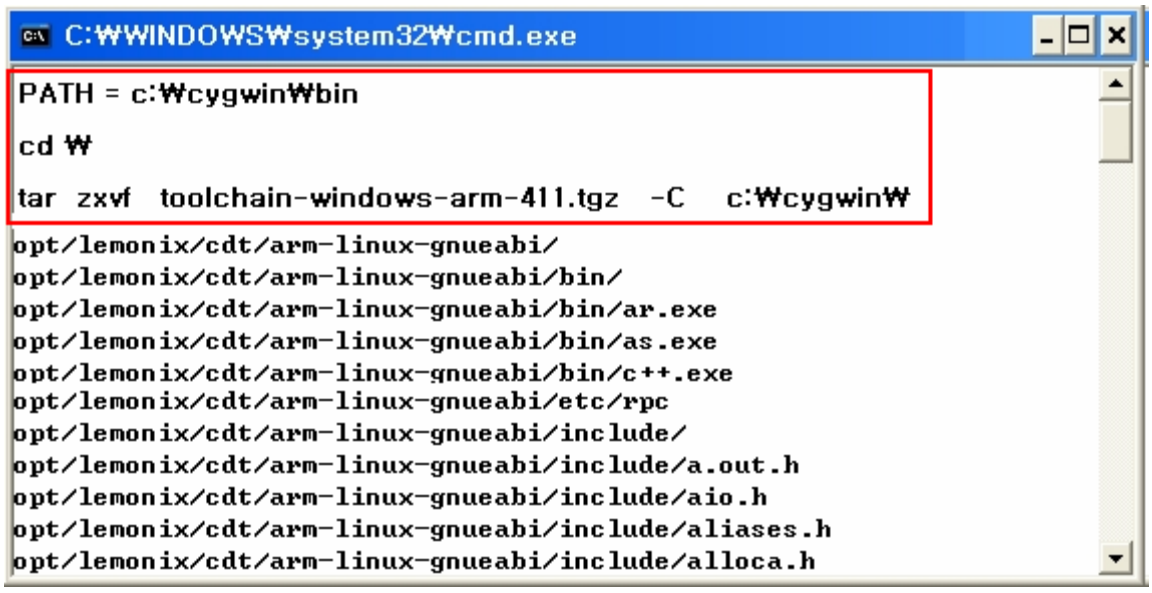
Path should be added in order to refer required Eddy libraries in Windows environment.
Select "Desktop" → "My Computer" → Right click → "Properties" → select "Advanced" tab → click "Environment Variables".
Select Path from System Variable and add the following line on the very beginning.

c:\cygwin\bin;

3.7 Installation of Toolchain

Toolchain compiles source codes composed on Windows environment and make it executable on the target, Eddy. Eddy. Toolchain installation file, "toolchain-windows-arm-411.tgz", can be found under SDK/Windows folder in Eddy DK's CD. Copy the file to the root directory of "C:", and unzip the file from Windows command line as below.
Toolchain should be installed to "c:\cygwin\opt\lemonix\cdt".

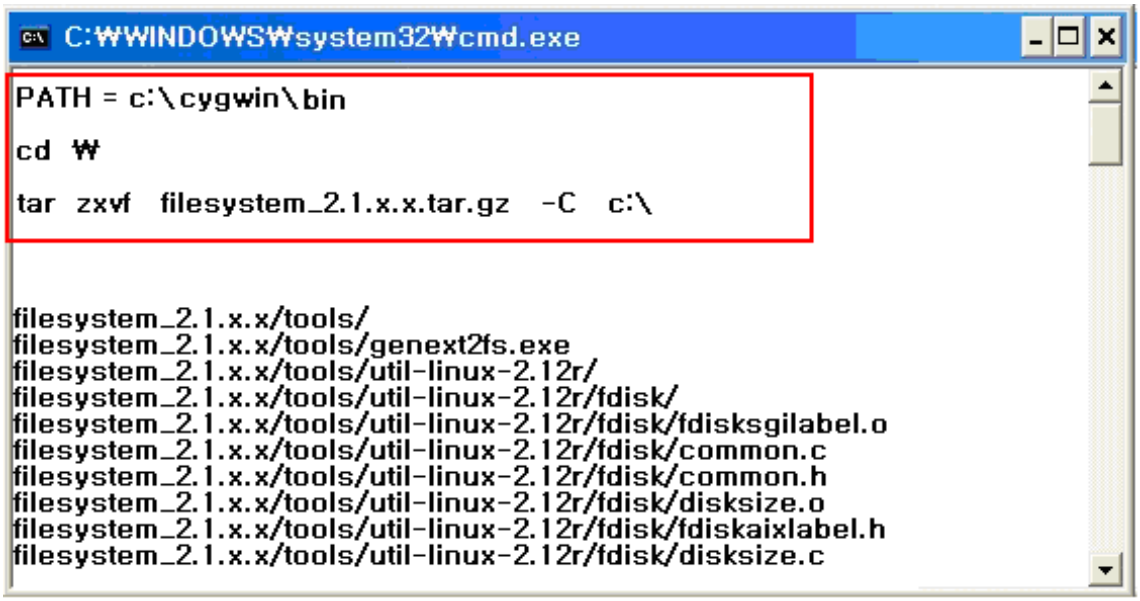
Note that the command is case-sensitive.



3.8 Installation of Eddy DK Source

Install Eddy DK Source. DK Source file, "filesystem_2.x.x.x.tar.gz", can be found under SDK folder of Eddy DK's CD. Copy the file to the root directory of "C:", and unzip the file from Windows command line as below.
DK Source should be installed to **c:\eddy_DK_2xx**".

Note that the command is case sensitive.



3.9 Installing on Linux

This chapter will describe how to install Eddy Development Environment on Linux host.
The explanation of this manual based on Fedora Core 5.
To establish Eddy's integrated development environment, LemonIDE, please refer to "LemonIDE_User_Guide" for further instructions.

3.10 Installation of Toolchain

Toolchain compiles source codes composed on Linux environment and make it executable on the target, Eddy. Toolchain install file, "lemonide_linux_10x.tar.gz", can be found under SDK/linux folder in Eddy DK's CD. Toolchain should be installed to **/opt/lemonix**.

Note that the command is case sensitive.

> Note
> Carry out all install procedures under the 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 /
```

3.11 Installation of Eddy DK Source

Install the entire source of Eddy DK. Eddy DK Source file, "Filesystem_2.x.x.x.tar.gz", can be found under SDK

folder on Eddy DK' s CD.
Install Eddy DK Source as shown below. The eddy_DK_2xx folder will be created after the installation.

```
# pwd
/home/shlee
# tar -zxvf   filesystem_2.1.x.x.tar.gz
```

Unzip the file. If Eddy_DK_2xx folder is created, the installation is completed. The below shows the 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
```

3.12 Removing Development Environment

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

3.13 Removing Windows Development Environment

Delete the folders where DK Source and Cywin are installed.

3.14 Removing Linux Development Environment

```
# rm –rf filesystem_2.1.x.x          ; Removal of Eddy DK Source
# rm   -rf /opt/Lemonix              ; Removal of Eddy ToolChain
```

Chapter 4. Compiling of Application Program

4.1 Program Type

This chapter explains how to compose application program, load to Eddy to execute and store it to flash memory of Eddy as a firmware.

Application programs running in Eddy are made of Device Server functions. SystemBase does not provide part of application source running in Device server. Developers can refer to open source, socket and serial provided as sample source. Since these are optimized to enable application, developers can use its advantage. The followings are open sources in src directory.

Folder Name	Description
busybox-1.5.0	Linux Utility containing basic commands for the shell
dropbear-0.50	SSH (Secure Shell) Server
gdbserver	Remote debugging program for LemonIDE (Only executable file provided.)
mtd-util	Management program for Mtd
openssl-0.9.7c	OpenSSL Library (SSL type)
matrixssl-1-8-3	Matrixssl program (SSL type)
thttpd-2.25b	HTTP Server
vsftpd-2.0.5/	FTP Server
ddns-1.8	DDNS Server
ethtool-6	Ethernet based network testing program
netkit-ftp-0.18	ftp client
target-agent	Program helps to upload, download and execute user' s programs, linked with LemonIDE. The source code not provided.
net-snmp-5.4.1	SNMP V1/V2/V3 program
Iptables-1.3.7	Bridge program for NAT function of LAN port
RT73	WiFi Device Driver
Wireless_tools.29	Wireless support Tool Applications

In case you make new application program, refer to sample source in Eddy_APPs folder. Among the programs in Eddy_APPs directory, source for device server application is not provided. So, refer to source code for various purposes provided as sample.

File Name	Description	Source Availability
eddy.c	Program which runs first when boots up Eddy. It also operates Eddy as configuration.	O
pinetd.c	Eddy' s most significant program which runs and monitors subordinate programs.	O

	In case of building new application, if it is registered in this file, the registered application is running when booted.	
com_redirect.c	Program which enables to recognize Eddy's serial port as its Com port on Windows PC in network.	X
tcp_client.c	Program which connects to server and exchanges data between serial port and socket.	X
tcp_server.c	Program which waits for socket connection and exchanges data between serial port and socket.	X
detect.c	Program that interworks with Portview's detector.	X
Portview.c	Agent of NMS program for Windows, Portview, provided by SystemBase	X
tcp_broadcast.c	As a multi TCP server function, it supports client connection up to 5 and broadcasts serial data to the whole client.	X
tcp_multiplex.c	As a multi TCP server function, it supports client connection up to 5 and transmits serial data to each client.	X
udp.c	UDP server and client program which exchanges data between UDP socket and serial port.	X
wifi.c	WiFI Operating Source This sample source reads Config file of Flash and runs WiFi as the registered setting.	O
test_bluetooth.c	Bluetooth Application Sample Source Sample source of Eddy-BT module connected to Eddy-CPU, Eddy-S4M.	O
test_read_config.c	Flash Configuration Read/Write sample source	O
test_serial.c	Serial port application sample source This sample source opens port number appointed to Argment and retransmits the received data to the other socket.	O
test_serial_to_lan-1.c	serial to lan communication application sample source This sample source reads Config file information of Flash and waits for TCP socket connection. After connection, it exchanges data between serial and socket port.	O
test_serial_to_lan-2.c	serial to lan communication application sample source This sample source reads Config file information of Flash and tries TCP connection.to the registered server. After connection, it exchanges data between serial and socket port.	O
test_tcp_server.c	TCP socket communication application sample source This sample source waits for TCP connection to socket number appointed to argment and retransmits the received data to the other socket.	O
test_tcp_client.c	TCP socket communication application sample source This sample source tries connection to IP address and socket number of the server appointed to argment. After connection, it retransmits the received data to the other socket.	O
test_udp_server.c	UDP socket communication application sample source This sample source waits for UDP connection to socket number appointed to argment and retransmits the received data to the	O

	other socket.	
test_udp_client.c	UDP socket communication application sample source This sample source tries UDP connection to IP address and socket number of the server appointed to argment. After connection, it retransmits the received data to the other socket.	O
def.c	Eddy Configuration program Program which links to telnet and enables configuration of Eddy	O
upgrade.c	Firmware update program	O
testdk.c	Eddy-DK, Eddy-S4M-DK Test Program	O
ddns_agent.c	Program that delivers Eddy IP information to DDNS server	O
test_gpio_led.c	GPIO LED Test Program (Only Eddy-DK)	O
test_gpio_pin.c	GPIO Pin Test Program (Only Eddy-DK)	O
test_adc.c	ADC (Analog Disgital Converter) Test Program	O
test_sio.c	Serial Port Test Program	O
test_rtc.c	RTC (Real Time Clock) Test Program	O
test_dio.c	DIO (Digital Input Output) Test Program (Only Eddy-DK)	O
test_keypad.c	Key Pad Test Program (Only Eddy-DK)	O
test_mmc.c	SD Memory Test Program	O
test_lcd.c	LCD Test Program (Only Eddy-DK)	O
test_nand.c	NAND Flash Test Program (Only Eddy-DK)	O
test_spi_eeprom.c	EEPROM Test Program linked to SPI interface(Only Eddy-DK)	O
/include	Directory where there is a header file for application	O
/SB_APIs	Library directory in Eddy	X
/web	Html code of web and CGI source directory running in Eddy	O

4.2 Writing Application Program

This chapter shows how to write an application program for Eddy.
First, create a "hello_world.c" file under the "scr/Eddy_APPs" directody.

```
#include <stdio.h>

int main()
{
    While (1)
        {
        printf("hello world !!!\n");
        sleep (1);
        }
}
```

4.3 Writing Makefile

To compile an application program, compile information of the application program has to be registered on the Eddyy_APPs/Makefile directory. The below is description of "Makefile" under directory of src/Eddy_APPs/.

The picture blow shows the environment setting area for an application program compile.
Add a name under the "TARGET" highlighted as red, and register to the compile environment.

```
TARGET    = eddy          pinetd       def              ddns_agent                \
upgrade     portview     upgradetftp     detect                          \
tcp_server   tcp_client   tcp_multiplex   tcp_broadcast                \
udp           rt_test       hello_world
udp : udp.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) $@
```

4.4 Application Program Compile

Compile the application program to execute on Eddy after registering the compile environment to the "Makefile".

4.5 Compiling on Windows

Enter "make" command through cmd(command prompt) on the directory where "Makefile" is located. As shown below, if a compile is successfully completed, execution file named "Hello_World" would be created. Of course, as this file was cross-compiled, it can not run on Windows environment. Upload this file to Eddy using a FTP to execute the file on Eddy, (Files uploaded with FTPs will not permanently saved on Eddy.).
This will be further explained on the 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  .  .  .
```

4.6 Compiling on Linux

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

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

4.7 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 be all carried out with LemonIDE.
Refer to "LemonIDE_User_Guide" for detailed information.

4.8 Running Application on Eddy

To run an application on Eddy, there are several methods. First method is to convert an application as a firmware and loads it into the flash memory area and execute. However, this method is not recommended for developing phase of application, since it is time consuming task. Second method is to load and execution file of an application to RAM type file system by using the FTP Server on Eddy DK, and execute it from there. This method is suitable for developing phase of application; however the application loaded to Eddy will be deleted when the power is disconnected.
The LemonIDE integrated developing environment provides advanced solution. LemonIDE debugging tool supports the direct transmission of compiled applications to Eddy. By using this tool, the user can execute and check the result instantly on site.
If you wish to use LemonIDE, please refer to "LemonIDE_User_Guide".

4.9 Uploading and Executing on Eddy

Connect to Eddy by using FTP.
ID and password for FTP server are same as the one using with telnet connection.
The example below shows how to upload an example file, "hello_world", to /tmp folder of Eddy on Linux using FTP.
When uploading a file, "bin" command must be entered first for binary mode.
For uploading enter "put 〈file name〉 on the command line.

```
[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]$
```

On Windows environment, use FTP program of Windows on the Command Prompt.
When the transmission is completed, a user can check the file using Telnet terminal connected Eddy.
The file is executable using "chmod" command; however the mode has to be switched to executable.
After switching to Executable Mode, execute the file by entering "/hello_world".
To terminate a program, press "Ctr" and "C" key simultaneously.

```
# ls
hello_world          login.id              thttpd.log                  login.pw
thttpd.pid           utmp      .   .   .
#
# chmod 777 hello_world
#
# ./hello_world
Welcome to Eddy !
Welcome to Eddy !
Welcome to Eddy !
Welcome to Eddy !
```

4.10 Execute a file on Booting of Eddy

If auto running is not necessary, you can skip this section.

If the application is successfully executed on Eddy, make a firmware image and load to Flash memory of Eddy to execute on booting.

Register the application to "pinetd.c" on the directory of Eddy_APPS.

```
//〈=====================================================================
//   Here User Application Launching !!
// ---------------------------------------------------------------------------
//
//   ex) Task_Launch ("/sbin/hello", argument);
//                                |             |
//                                |             +---- Integer argument
//                                +---------------- Application name with path
//
//=====================================================================〉
Task_Launch ("/sbin/hello_world", 0);

signal(SIGCHLD, sig_chld);
```

If "printed.c" is modified, a user must re-compile it by executing "make pinetd" as above example of section 4.4.

Chapter 5. Creating Firmware

On the previous chapter, we explained how to make and compile application program with sample program. This chapter introduces methods to create a firmware which permanently saves the application into the Eddy module and apply it to hardware of Eddy.

5.1 How to Create a Firmware

Firmware image can be created on filesystem_2.x.x.x/ramdisk folder.
Modify "Makefile" on filesystem_2.x.x.x/ramdisk directory to create a firmware image.
Version info, required Ramdisk amount and desired application to copy can be set up on the "Makefile".

(NOTE)
Provided DK Sources are Linux based. Some commands are not executable on Windows environment. To prevent this problem, a suffix, "exe", has to be added for some utilities after file name as shown below.
../tool/genext2fs → ../tool/genext2fs.exe
../tool/mkimage → ../tool/mkimage.exe

```
IMAGE=ramdisk
FW_NAME        =     eddy-fs-2.x.x.x.bin        → Name and Version Info of Firmware Image

FIRMWARE_DIR =     ../firmware                → Directory to store created firmware

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 -N 1024 -d root -D device_table.txt ramdisk   → Make size of
Ramdisk to 10,240 K and register the device of Eddy/dev as indicated on Devide_table.txt.
gzip -vf9 ramdisk
est -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)/

release:                    → Register the desired application to the directory for copying to Eddy
cp -f ../src/Eddy_APPs/hello_world                root/sbin
cp -f ../src/Eddy_APPs/eddy                       root/sbin
```

```
cp -f ../src/Eddy_APPs/com_redirect                root/sbin
cp -f ../src/Eddy_APPs/tcp_server                  root/sbin
cp -f ../src/Eddy_APPs/tcp_client                  root/sbin
cp -f ../src/Eddy_APPs/tcp_broadcast               root/sbin
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/net-snmp-5.4.1/agent/snmpd                root/usr/local/sbin
```

List of task on the "Makefile" options are as follows;
Make release ; Copy modules registered on the release to Ramdisk area.
Make install ; Create a Filesystem to a firmware image for using on Eddy.

If the modification of "Makefile" is completed, execute "make release and "make install" in turns and create a Firmware image.
Created firmware is stored on the "FIRMWARE_DIR" directory stated on the "Makefile" .
On Windows, use cmd(command prompt) to carry out procedures explained on Linux.

```
[shlee@localhost ramdisk]$ make release
.
.
[shlee@localhost ramdisk]$ make install
.
.
[shlee@localhost ramdisk]$ ls ../firmware
-rwxr-xr-x ----------------------------------------eddy-bl-2.x.x.x.bin
-rwxr-xr-x ----------------------------------------eddy-bs-2.x.x.x.bin
-rwxr-xr-x ----------------------------------------eddy-os-2.x.x.x.bin
-rwxr-xr-x ----------------------------------------eddy-fs-2.x.x.x.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 release
.
.
[shlee@localhost ramdisk]$ make install
.
.
```

```
[shlee@localhost ramdisk]$ ls ../firmware
-rwxr-xr-x ----------------------------------------eddy-bl-2.x.x.x.bin
-rwxr-xr-x ----------------------------------------eddy-bs-2.x.x.x.bin
-rwxr-xr-x ----------------------------------------eddy-os-2.x.x.x.bin
-rwxr-xr-x ----------------------------------------eddy-fs-2.x.x.x.bin
.
```

As shown in the picture above, a new firmware file "eddy-fs-2.x.x.x.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 as the loaded firmware settings.

5.2 Firmware Upgrade

Upload created firmware file to Eddy and save on the Flash Memory.
Eddy provides four ways of upgrading method.

FTP	Upload a firmware image using FTP program, and execute the upgrade command to save it to the Flash memory using Telnet.
Web Browser	Connect to Web server of Eddy and save a firmware to the Flash memory. Please refer Eddy_User_Guide for detail information.
Boot Loader	Use the boot loader which operates on booting to save a firmware through the debugging port of Eddy DK board. Please refer "the chapter 9: System Recovery" for detail.
USB	Use USB client port of Eddy DK board to upload a firmware. Please refer "the chapter 9: System Recovery" for detail.

This section explains how to upload a firmware using a FTP.
On Windows, FTP can be used in cmd(command prompt) to carry out upload process.
Upload the created firmware, "eddy-fs-2.x.x.x.bin", to the /tmp directory of Eddy, using an FTP.

```
[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-2.1.x.x.bin
local: eddy-fs-2.x.x.x.bin remote: eddy-fs-2.x.x.x.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> bye
```

```
221 Goodbye.
[shlee@localhost firmware]$
```

Use Telnet to check "eddy-fs-2.x.x.x.bin" file is in the /tmp directory.
Use "upgrade eddy-fs-2.x.x.x.bin" command to update the firmware.

```
# pwd
/tmp
# ls  eddy-fs-2.x.x.x.bin
eddy-fs-2.x.x.x.bin
#
# upgrade  eddy-fs-2.x.x.x.bin
 FileSystem Erase ... 2388341 Bytes
FileSystem Write ... eddy-fs-2.x.x.x.bin, 2388341 Bytes
2388341   (2388341 bytes)
Flash Write OK
Flash Verify OK
…
```

In order for the updated firmware to take effect, you need to reboot the module.
After rebooting you can see the sample program running using Telnet program as shown below.

```
Eddy login: eddy
Password:
# cd /sbin
# ls
hello_world          ifconfig          nameif          switch_root
com_redirect         ifdown            pinetd          sysctl
…
# ps -ef
PID   USER     COMMAND
1     root     init
2     root     [posix_cpu_timer]
3     root     [softirq-high/0]
.
.
xx    root     /sbin/hello_world  1
```

Execution result of application program only output to the console port of Eddy. The console is a debug port of Eddy DK board and only execution result of application program is generated.
The result can be seen on a computer screen using a serial emulator program such as hyper-terminal on Windows by connecting the debug port to PC and setting communication speed to 115K, None, 8, 1.

```
Welcome to Eddy !
Welcome to Eddy !
Welcome to Eddy !
Welcome to Eddy !
Welcome to Eddy !
Welcome to Eddy !
Welcome to Eddy !
```

Chapter 6. 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_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	Delays in exact 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_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 the version function reads. '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, char *Dest, int Size);	
Parameter	FileName	File name that includes the path of the file to be read.
	*Dest	Pointer to the buffer in which the configuration file will be stored.
	Size	The size of the file to be read.
Returns	Error Code	Returns 1 if succeeded, -1 if failed.
Notice	Configuration file in Eddy is stored in /etc, /flash. Configuration changes made through web or telent is stored here and all Eddy applications operates with respect to configuration files here.	

SB_WriteConfig

Function	Saves Eddy's operating environment configuration information into file.	
Format	void SB_WriteConfig (char *FileName, char *Source, int Size);	
Parameter	FileName	File name that includes path of the file to be written.
	Source	Pointer to the struct buffer in which the configuration information is saved.
	Size	Size of the struct to be written.
Returns	Error Code	Return 1 if succeeded, -1 if failed.
Notice		

SB_GetSharedMemory

Function	Reads pointer to 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
	*buffer_address	Memory address of shared memory
Returns		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 reads 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.	

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 rate

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 bit 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_SendSerial

Function	Send data to the serial port.	
Format	Void SB_SendSerial (int handle, char *data, int length);	
Parameter	handle	Handle to serial port or socket
	data	Pointer to 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 to serial port.
	data	Buffer pointer where the read data will be saved.
	length	Size(length) of the buffer memory
	wait_msec	Time the function will wait for next received data after reading from read 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 to 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 to 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 to serial port.
	Value	0: off Set DTR signal to low. 1: on Set DTR signal to high.
Returns	None	
Notice		

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 WAN port. “eth1” for LAN port.
Returns	Unsigned int	returns IP address in unsigned int type.

Notice	Note that the function 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 WAN port. “eth1” for LAN port.
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 seconds)
	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 to the connected socket
Notice	If the connection is not made, the function t 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

GPIO functions control up to 56 GPIO ports provided by Eddy-CPU, 34 GPIO ports provided by Eddy-S4M
They can spot 3.3V power or control writes with individual GPIO port.
Pins provided by Eddy CPU/S4M are public pins that can be used to control other devices and are not used solely for GPIO.
Eddy CPU/S4M provides 32 signal lines as 3 port groups; Port A, B, C.
Each port in Port A, B, C can be configured to be used as device or GPIO. They can be configured in Web.
Please refer to sample source 'testdk.c' in Eddy_Apps directory for precise usage.

Eddy-CPU GPIO Table

bytes	3								2								1								0							
bits	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Port A										*																	S2	S2				
Port B	KEY	KEY	S1	S1	S0	S0	S0	S0	S0	S0	KEY	KEY	*	*	*	*	DEBUG	DEBUG	*	*	S3	S3	S2	S2	S1	S1	S0	S0	EEPROM	EEPROM	EEPROM	EEPROM
Port C						*			KEY	KEY	KEY	KEY	*	*	NAND	RESET	LAN	NAND		LAN		S3	*	S3			*	RDY	ADC	ADC	ADC	ADC

The Yellow parts can all be used as GPIO ports if they are not used as devices.

Section	Description	Number of Ports
S0 ~ S3	Serial Port 1 ~ 4	20
Debug	Debug Port	2
Reset	Reset	1
Rdy	Ready LED	1
ADC	Analog Digital Converter	4
LAN	LAN Port	2
EEPROM	SPI (EEPROM)	4
NAND	NAND Flash	2
KEY	Key Pad	8
*	GPIO & User Peripheral	12

Eddy-S4M GPIO Table

bytes	3								2								1								0							
bits	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
bit	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
Port A		*								*																	*					
Port B	*	*									*	*	*	*	*	*													*	*	*	*
Port C							*	*				*	*	*	*		*	*	*	*		*	*				*		*	*	ADC	ADC

Section	Description	Number of GPIO
ADC	Analog Digital Converter	2
*	GPIO & User Peripheral	32

Each port in Port A, B, C can be shown as 32 GPIO ports. So GPIO ports are shown as each bit in 4 byte int variable in program.

```
struct   eddy_gpio   {
            Unsigned   int   value    [3];          // Read/write value for each GPIO channel in Port A, B, C
            Unsigned   int   mode     [3];          // Configure read/write for each GPIO channel in Port A, B, C
            Unsigned   int   pullup   [3];          // Pullup/Pulldown when configuring write
                                                    // for each GPIO channel in Port A, B, C
            Unsigned   int   enable   [3];          // Whether to use GPIO for each GPIO channel in Port A, B, C
            };
```

enable: 0 → disable (Do not use as GPIO), 1 → Enable (use as GPIO)
mode: 0 → Set as input mode,, 1 → Set as output mode
value: 0 → Read/Write status is set to Low, 1 → Read/Write status is set to High
pullup: 0 → pulldown, 1 → pullup

SETGPIOINIT

Function Initializes ports that will be used as GPIO after boot.

Format void ioctl(int fd, SETGPIOINIT, struct *gpio_struct);

Parameter	fd	Handle to GPIO device("/dev/eddy_gpio")
	gpio_struct	Pointer to the struct which stores GPIO table value in /etc/eddy_gpio.cfg with GPIO configuration file registered in Web configuration. struct gpio_struct { unsigned int value[3]; unsigned int mode[3]; unsigned int pullup[3]; unsigned int enable[3]; };
Returns	None	
Notice	Eddy-CPU provides maximum GPIO ports of 56. Eddy-S4M provides maximum GPIO ports of 34. That is when using only WAN and when devices such as serial ports, ADC, Rese, RDY LED… are used, number of available GPIO ports decreases. This command initializes available GPIO ports leaving the devices that are registered in configuration in Pinetd.c after boot so users don't have use this command. When used, users need to be careful. For instance, if a serial port is enabled through web configuration and Eddy is rebooted, the port acts as a serial port, not a GPIO port. But when this port is forced to be used as GPIO port with this command, the application that uses this serial port will not operate properly.	

SETGPIOMOD_LM

Function	Sets Read/Write direction for all Port A, B, C	
Format	void ioctl(int fd, SETGPIOMOD_LM, int *mode[3]);	
Parameter	fd	Handle to GPIO device("/dev/eddy_gpio")
	mode	Pointer to the buffer that stores "mode" value for Port A, B, C. Bit value 0 means input, 1 means output.
Returns	None	
Notice	Any value is ok for bits that are not set to be used GPIO	

GETGPIOMOD_LM

Function	Reads Read/Write direction for all Port A, B, C	
Format	void ioctl(int fd, GETGPIOMOD_LM, int *mode[3]);	
Parameter	fd	Handle to GPIO device("/dev/eddy_gpio")
	mode	Pointer to the buffer that will store the "mode" value of Port A, B, C
Returns	None	
Notice		

SETGPIOVAL_LM

Function	Sets output value when Port A, B, C are all in output mode.	
Format	void ioctl(int fd, SETGPIOVAL_LM, int *value[3]);	
Parameter	fd	Handle to GPIO device("/dev/eddy_gpio")
	mode	Pointer to the buffer that stores the "value" value of Port A, B, C. Bit value 0 means Low, 1 means High.
Returns	None	
Notice	Any value is ok for bits that are not set to be used GPIO	

GETGPIOVAL_LM

Function	Reads Read/Write status value for Port A, B, C	
Format	void ioctl(int fd, GETGPIOVAL_LM, int *mode[3]);	
Parameter	fd	Handle to GPIO device("/dev/eddy_gpio")
	mode	Pointer to the buffer that will store the "value" value of Port A, B, C
Returns	None	
Notice		

SETGPIOPUL_LM

Function	Sets pullup value when Port A, B, C are all in input mode.	
Format	void ioctl(int fd, SETGPIOVAL_LM, int *value[3]);	
Parameter	fd	Handle to GPIO device("/dev/eddy_gpio")
	mode	Pointer to the buffer that stores the "pullup" value of Port A, B, C. Bit value 0 means Pulldown, 1 means Pullup.
Returns	None	
Notice	Any value is ok for bits that are not set to be used GPIO	

GETGPIOPUL_LM

Function	Reads Read/Write status value for Port A, B, C	
Format	void ioctl(int fd, GETGPIOVAL_LM, int *mode[3]);	
Parameter	fd	Handle to GPIO device("/dev/eddy_gpio")
	mode	Pointer to the buffer that will store the "pullup" value of Port A, B, C
Returns	None	
Notice		

SETGPIOMOD_LA
SETGPIOMOD_LB
SETGPIOMOD_LC

Function	Sets Read/Write direction for one of Port A, B, C	
Format	void ioctl(int fd, SETGPIOMOD_L?, int *mode[3]);	
Parameter	fd	Handle to GPIO device("/dev/eddy_gpio")
	mode	Pointer to the buffer that stores "mode" value. Bit value 0 means input, 1 means output.
Returns	None	
Notice	Any value is ok for bits that are not set to be used GPIO	

GETGPIOMOD_LA
GETGPIOMOD_LB
GETGPIOMOD_LC

Function	Reads Read/Write direction for one of Port A, B, C	
Format	void ioctl(int fd, GETGPIOMOD_L?, int *mode[3]);	
Parameter	fd	Handle to GPIO device("/dev/eddy_gpio")
	mode	Pointer to the buffer that will store the "mode" value.
Returns	None	
Notice		

SETGPIOVAL_LA
SETGPIOVAL_LB
SETGPIOVAL_LC

Function	Sets output value when Port is in output mode.	
Format	void ioctl(int fd, SETGPIOVAL_L?, int *value[3]);	
Parameter	fd	Handle to GPIO device("/dev/eddy_gpio")
	mode	Pointer to the buffer that stores the "value" value. Bit value 0 means Low, 1 means High.
Returns	None	
Notice	Any value is ok for bits that are not set to be used GPIO	

GETGPIOVAL_LA
GETGPIOVAL_LB
GETGPIOVAL_LC

Function	Reads Read/Write status value for one of Port A, B, C	
Format	void ioctl(int fd, GETGPIOVAL_L?, int *mode[3]);	
Parameter	fd	Handle to GPIO device("/dev/eddy_gpio")
	mode	Pointer to the buffer that will store the "value" value.
Returns	None	
Notice		

SETGPIOPUL_LA SETGPIOPUL_LB SETGPIOPUL_LC

Function	Sets pullup value when Port is in input mode.	
Format	void ioctl(int fd, SETGPIOVAL_L?, int *value[3]);	
Parameter	fd	Handle to GPIO device("/dev/eddy_gpio")
	mode	Pointer to the buffer that stores the "pullup" value. Bit value 0 means Pulldown, 1 means Pullup.
Returns	None	
Notice	Any value is ok for bits that are not set to be used GPIO	

GETGPIOPUL_LA GETGPIOPUL_LB GETGPIOPUL_LC

Function	Reads Read/Write status value for one of Port A, B, C	
Format	void ioctl(int fd, GETGPIOVAL_L?, int *mode[3]);	
Parameter	fd	Handle to GPIO device("/dev/eddy_gpio")
	mode	Pointer to the buffer that will store the "pullup" value.
Returns	None	
Notice		

6.8 ADC Function

Eddy CPU provides 4 channels of ADC(Analog Digital Converter).
Eddy DK board has temperature and illumination sensor for testing and the status of the sensors can be checked in real time with ADC.
Sample program "Eddy_Apps/test_adc.c" uses ADC interface so users can refer to this source for developing programs.

ADCSETCHANNEL

Function	Configures whether to use 4 channels of ADC device or not.
Format	void ioctl(int fd, ADCSETCHANNEL, int *channel);
Parameter	fd Handle to ADC device("/dev/adc") mode Pointer to the buffer that stores channel configuration
Returns	None
Notice	X X X X X X X X (bits) | | | |----- channel 1 (temperature sensor) | | |--------- channel 2 (illumination sensor) | |------------- channel 3 (future use) |----------------- channel 4 (future use)

ADCGETVALUE

Function	Reads operation status of 4channels of ADC device
Format	void ioctl(int fd, ADCGETVALUE, struct adc_struct *channels);
Parameter	fd Handle to ADC device("/dev/adc") mode Pointer to the buffer that will store channel operation status
Returns	None

Notice	Struct adc_value {
	int ch1_value;
	int ch2_value;
	int ch3_value;
	int ch4_value;
	};

6.9 RTC Function

Eddy CPU provides separate RTC(Real Time Clock) in DK.
Date and time can be configured through program or with Date and rdate provided by Busybox.
Sample program "Eddy_Apps/test_rtc.c" uses RTC device so users can refer to this source for developing programs.

RTC_SET_TIME

Function	Configures date and time in RTC device
Format	void ioctl(int fd, RTC_SET_TIME, struct tm *tm);
Parameter	fd Handle to RTC device("/dev/rtc0") tm Pointer to struct that stores date and time to be configured. Compatible with struct tm for Linux

standard time interface.

Returns None
Notice

RTC_RD_TIME

Function Reads date and time from RTC device

Format void ioctl(int fd, RTC_RD_TIME, struct tm *tm);

Parameter
- fd — Handle to RTC device("/dev/rtc0")
- tm — Pointer to struct that will store date and time read. Compatible with struct tm for Linux standard time interface.

Returns None
Notice

6.10 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

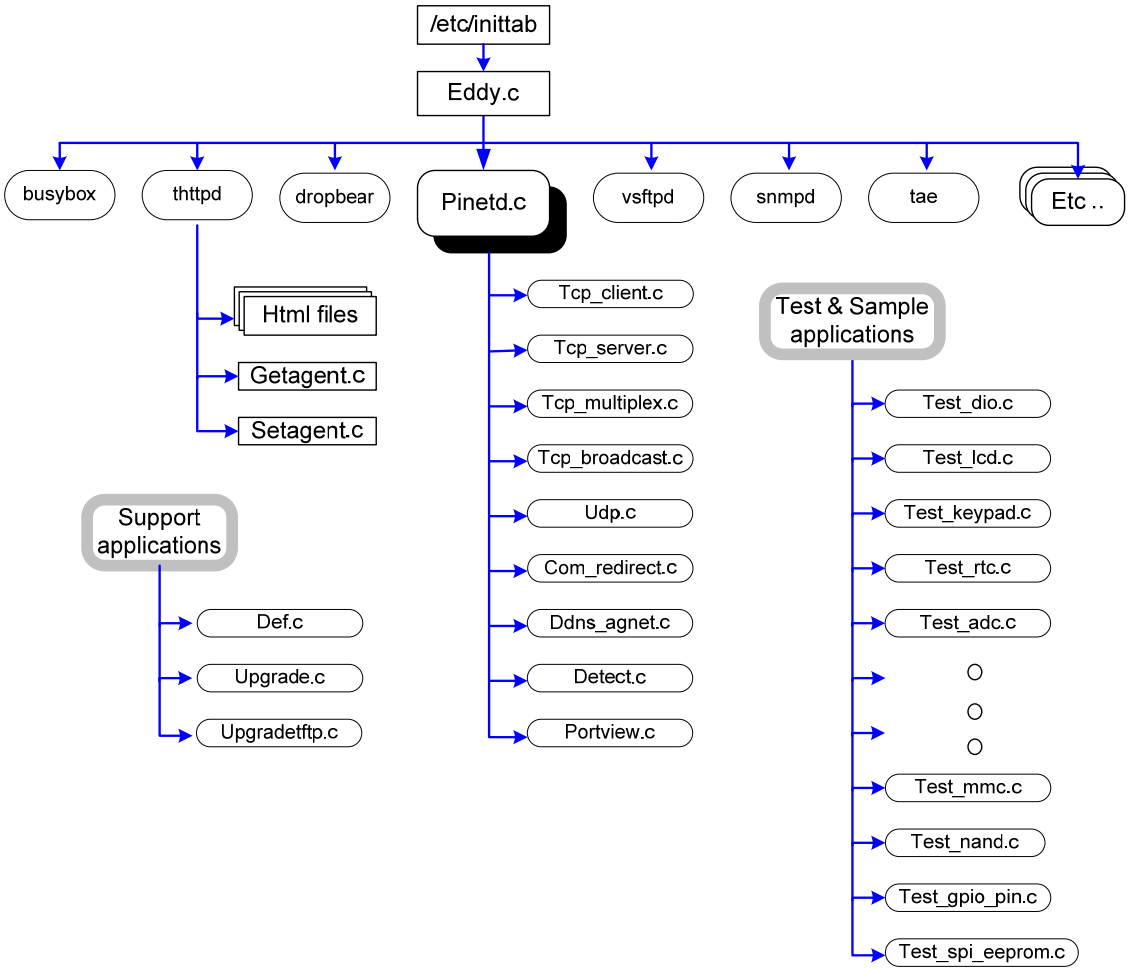
Function	Prints in the same format as Printf.
Format	void SB_LogMsgPrint (const char *Format, . . .);
Parameter	*Format Format of Printf
Returns	None
Notice	Prints messages to telnet which logged in first. The message include Eddy' s tick counter of 1msec unit and printed in following form. SB_LogMsgPrint ("%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〉

Chapter 7. 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. All disclosed source codes may be used as development guide when programming a firmware.

7.1 Software Structure Diagram

Eddy.c is the first program to be executed upon the booting. Environment Configure Information configured either by web or def.c is loaded next.
All provided Eddy applications developed by using libraries explained on Chapter 6.



7.2 Main Applications

This section explains the most important aspects of Eddy, eddy.c and pinetd.c.
Applications other than these two can be divided into monitoring applications executed by pinetd.c and user applications manually executed by users. Please refer "4.1 Source Code" for brief explanation of functions of

each application.

7.3 eddy.c Application

Program runs the first after Eddy is booted, it reads the environment configuration saved under /flash folder.
This initializes network with configuration information , and runs various daemon program.
If environment file is not present on /flash, it will reset the environment configuration to factory setting.

7.4 Pinetd.c Application

It is a daemon program with the highest hierarchy of Eddy run by Eddy.c, which monitors lower processor.
It periodically monitors the Reset Switch to detect a factory reset request.

7.5 Other Applications

The list of applications runs according to the defined protocol of each serial port:
tcp_server, tcp_client, com_redirect, tcp_broadcast, tcp_multiplex, udp (udp_server/client)
The list of applications runs to handle external network service independently to serial ports:
portview, detect, ddns_agent
The list of applications can be manually run using telnet.
Def, upgrade, loopback,
The list of applications to test Eddy DK v2.1 board and a device:
test_sio, test_dio, test_lcd, test_keypad, test_spi_eeprom, test_nand, test_sd,
test_adc, test_gpio_pin, test_gpio_led
Sample source to build socket, serial port application program is the following.
Test_serial, test_serial_to_lan-1, test_serial_lan-2, test_tcp_server, test_tcp_client,
test_udp_server, test_udp_clinet, test_read_config, test_bluetooth

Chapter 8. Handling HTML & CGI

This chapter describes the CGI module for the environment configuration used by HTML files and HTML codes. Provided CGI source and HTML documents are used as Eddy's default firmware, and it is modifiable as needed.

8.1 WEB Configuration

HTML sources for Eddy are located on src/Eddy_APPs/web/htdocs.
CGI sources containing information for HTML is located on src/Eddy_APPs/web/cgi.

getagent.c
It reads environment configuration file of /etc folder and transfers configuration value to the HTML page to show the information on the web browser.

setagent.c
It reads configuration value modified by a user on the HTML page and saves the value to a temporary environment configuration file on /etc.

8.2 Example of HTML Code

The following example shows a part of main.html source.
Coding is executed with values handed over from the CGI and linked symbols, due to the coding cannot be done on a HTML using variables like on the C language.
Shown in red below are symbol link which transfers value from getagent.c.

(network.html 소스 요약)

```
〈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 parts for each record to link with CGI.
Name stores information modified by user in HTML, so that it can save modified value when a user click on the submit button on the lower part of HTML page. Value reads value to getagent.c to display on HTML page and let user to modify the value as needed.

8.3 Example CGI Code

Eddy-Serial DK has two CGI programs: getagent.cgi and setagent.cgi.
"getagent.c" reads an environment configuration file on /etc/ folder to HTML document , and "setagent.c" saves user-modified information on the HTML document back the environment file on /etc/folder and saves it to flash/, so the user-modified environment configuration is stored.

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

[Source Summary]

```
 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.

[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;
```

Chapter 9. Appendix

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

9.1 System recovery via Bootloader

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.

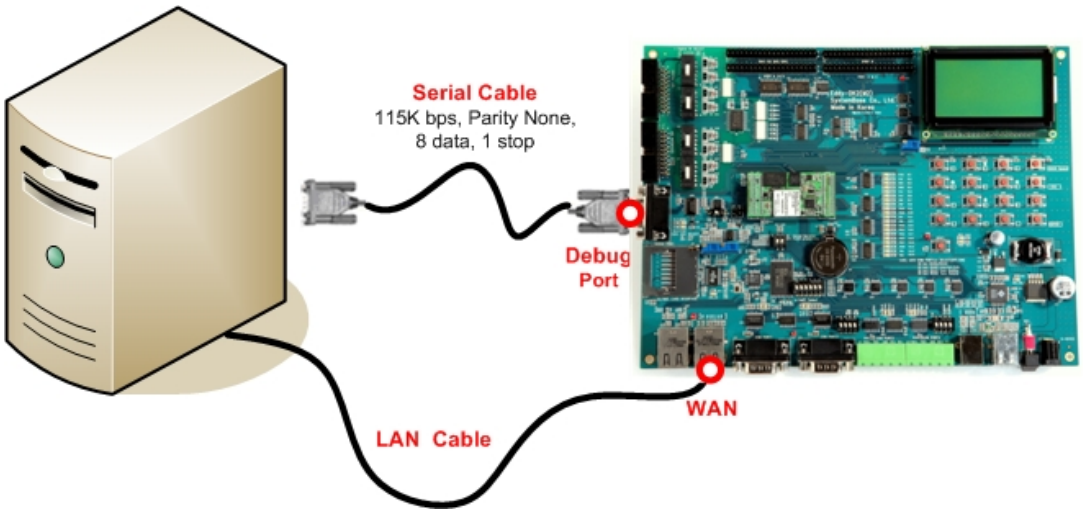
> Note:
> Once the bootloader is damaged, it cannot be recovered. Therefore user should not use command other than ones provided from manual.

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.

```
NAND:   256 MB
Macb0: Autonegotiation complete
Macb0: link up, 100 Mbps full-duplex (lpa: 0x45e1)
Hit any key to stop autoboot:  0
U-Boot〉
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
.
.
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          ← IP Address of Eddy
serverip=192.168.0.220        ← IP Address of TFTP server
FileSystem_Size=0
.
.
U-Boot〉
```

To change Eddy's temporary IP address and TFTP server's IP address proceed as follows.

```
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
(Note: If the bootloader was damaged, it could not be recovered.)
install os 〈name of OS firmware〉 ; When recovering OS area
install fs 〈name of File System firmware〉 ; When recovering File System 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-2.1.x.x.bin
TFTP from server 192.168.0.220; our IP address is 192.168.0.223
Filename 'eddy-os-2.1.x.x.bin'.
Load address: 0x20000000
Loading:#################################################################################
#########################################################
done
Bytes transferred = 1112284 (10f8dc hex)
            .
            .
            .
U-Boot〉
```

The next shows file system recovery procedure.

```
U-Boot〉install  fs  eddy-fs-2.1.x.x.bin
TFTP from server 192.168.0.220; our IP address is 192.168.0.223
Filename 'eddy-fs-2.1.x.x.bin'.
Load address: 0x20000000
Loading:#################################################################################
#################################################################################
#################################################################################done
e
Bytes transferred = 2035463 (1f0f07 hex)
            .
            .
            .
U-Boot〉
```

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

```
U-Boot〉boot
```

9.1.3 Solving problems during recovery

```
U-Boot〉install os  eddy-os-21.1.x.x.bin
TFTP from server 192.168.0.220; our IP address is 192.168.0.223
Filename 'eddy-os-21.1.x.x.bin'.
Load address: 0x20000000
Loading: ·····
```

When recovery is not proceeded with message shown above, check WAN 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-2.1.x.x.bin
TFTP from server 192.168.0.220; our IP address is 192.168.0.223
Filename 'eddy-fs-2.1.x.x.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. The red name above has to be same with firmware name of PC with tftp-server installed.

```
U-Boot> install os eddy-os-21.x.x.bin
TFTP from server 192.168.0.220; our IP address is 192.168.0.223
Filename 'eddy-os-2.1.x.x.bin'.
Load address: 0x20000000
Loading: TTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTTT#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 System recovery via USB

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 via USB to change the system to default status.

9.2.1 System recovery preparation via USB

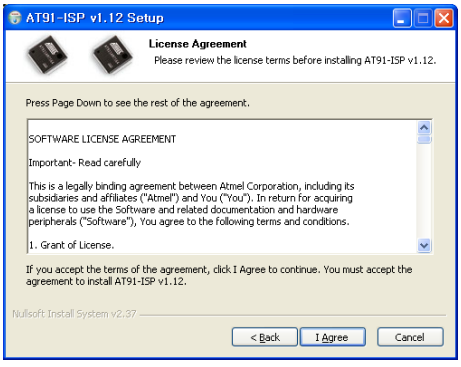
Please refer to the follows because the installation procedures of Eddy-CPU v2.1 and Eddy-CPU v2.5 differ.

Eddy-CPU v2.1

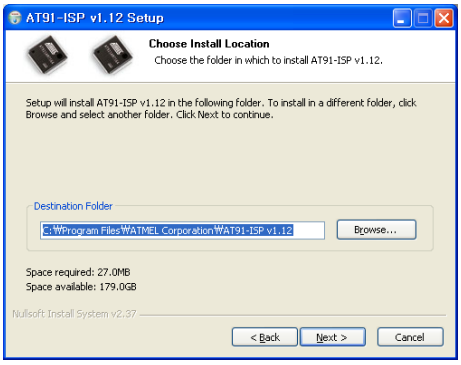
Copy Eddy-CPU_v21_USB_Recovery.zip file to any directory (e.g. C:\SystemBase\USB_recovery) from SDK\Windows\USB_recovery directory in Eddy DK CD.

Double-click "AT91-ISP.exe" file and begin the installation process of USB Tool program, then click Next.

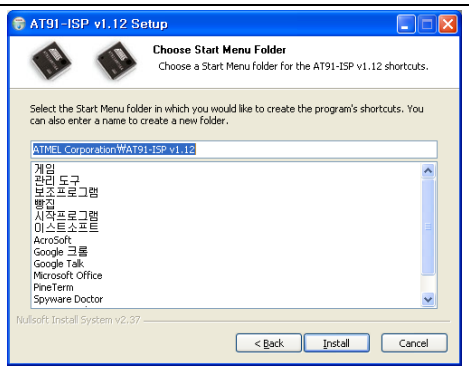
On the splash screen, click I Agree.



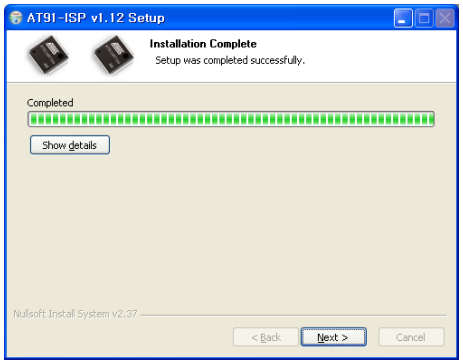
Browse to the following directory, then click Next.
C:\ProgramFiles\ATMELCorporation\
AT91-ISP v1.12



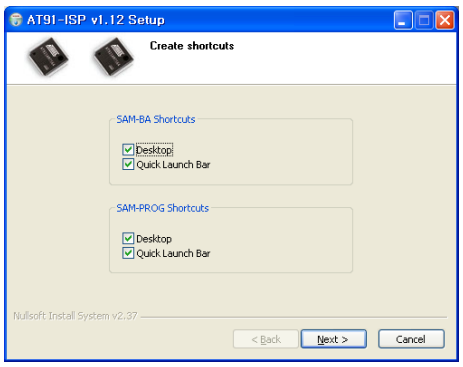
Click Install.



Click Next.



If you want to create Shortcuts, check Desktop or Quick Launch Bar, then click Next.



- Check Reboot now then click Finish. After system reboot, copy the "isp-extram-at91sam9260.bin" file from CD to the following directory: C:\Program Files\ATMEL Corporation\ AT91-ISP v1.12\SAM-BA v2.8\lib \ AT91SAM9260-EK After installing the "AT91-ISP.exe" file, prepare to install the Eddy -DK v2.1 board driver.

Prepare firmware files and flash writing utility programs as follows.

1) Copy usb_recovery_xxx.zip file to any directory (e.g. C:\SystemBase\USB_recovery) from SDK\Windows\USB_recovery directory in Eddy DK CD. (Refer to the Eddy official community site http://www.embeddedmodule.com)

2) Among files extracted **copy isp-extram-at91sam9260.bin** file to the below directory. **C:/Program Files/ATMEL Corporation/AT91-ISP v1.12/SAM-BA v2.8/lib/AT91SAM9260-EK**

3) Among files extracted copy below listed files to the firmware directory in DK source code directory.
eddy-bl-2.1.x.x.bin (Boot Loader)
eddy-bs-2.1.x.x.bin (Boot Strap File Name)
eddy-os-2.1.x.x.bin (Kernel File Name)
eddy-fs-2.1.x.x.bin (File System File Name)

4) Among files extracted Eddy_burning_DataFlash.bat file performs transferring firmware to Eddy-DK board by executing a TCL file then creates a log file. In this file eddy-bl-2.1.x.x.bin file name should be same with the name of the file copied.

```
sam-ba.exe \usb\ARM0 AT91SAM9260-EK Eddy_burning_DataFlash.tcl ./ eddy-bl-2.1.x.x.bin 〉logfile.log
notepad logfile.log
```

5) Among files extracted Eddy_burning_DataFlash.tcl file performs transferring firmware to Eddy DK v2.1 board. In this file eddy-bs-2.1.x.x.bin, eddy-os-2.1.x.x.bin, and eddy-fs-2.1.x.x.bin file names should be same with the names of the files copied.

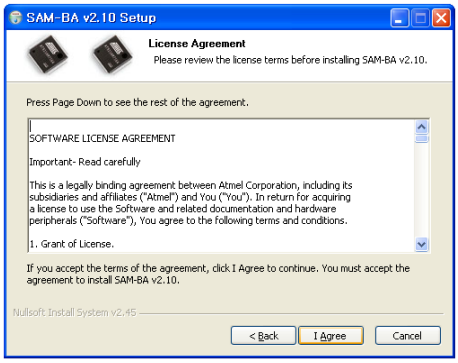
```
…
#########################################################################
#   Main script: Load the linux demo in DataFlash,
#                Update the environment variables
#########################################################################
array set df_mapping {
    bootstrapFileName    "eddy-bs-2.1.X.X.bin"
    kernelFileName       "eddy-os-2.1.X.X.bin"
    filesystemFileName   "eddy-fs-2.1.X.X.bin"
```

Eddy-CPU v2.5

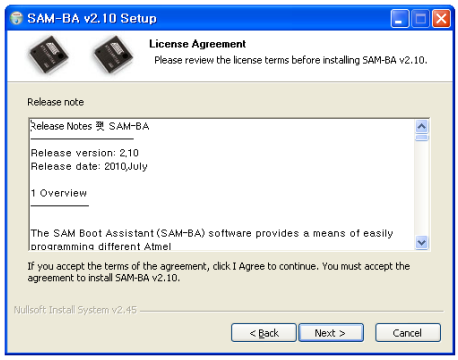
Copy Eddy-CPU_v25_USB_Recovery.zip file to any directory (e.g. C:\SystemBase\USB_recovery) from SDK\Windows\USB_recovery directory in Eddy DK CD.

Double-click "Sam-ba_2.10.exe" file and begin the installation process of USB Tool program, then click Next.

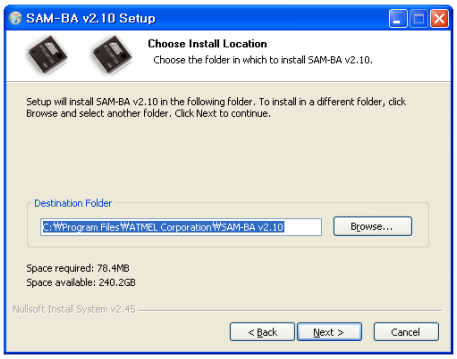
- On the splash screen, click I Agree.



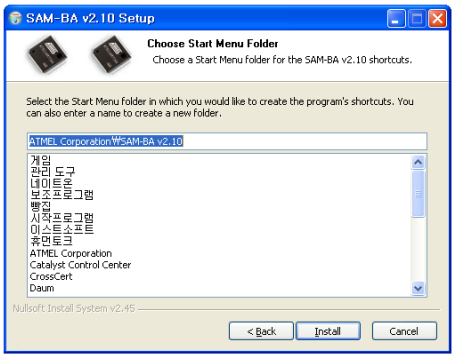
- Click Next.



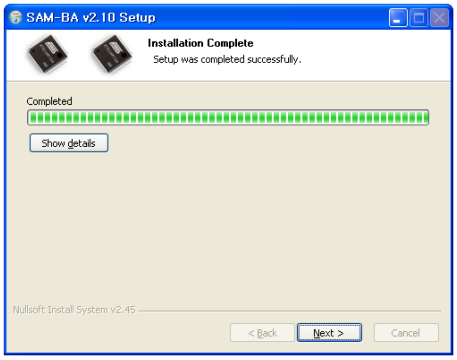
- Browse to the following directory, then click Next.
  C:\ProgramFiles\ATMELCorporation\
  SAM-BA v2.10



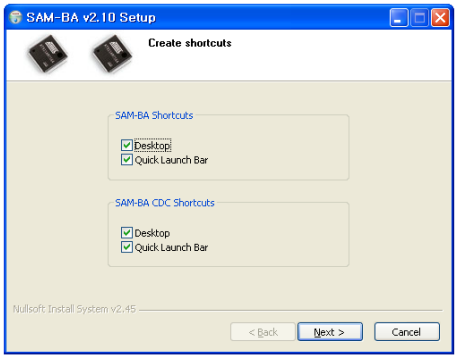
- Click Install.



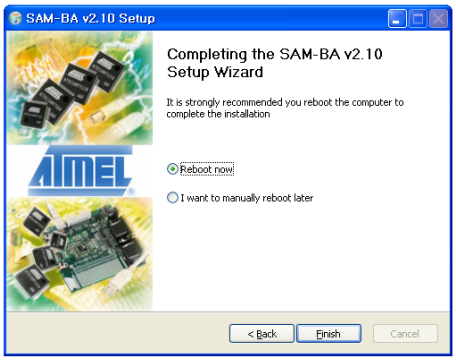
- Click Next.



- If you want to create Shortcuts, check Desktop or Quick Launch Bar, then click Next..



- Check Reboot now then click Finish.



Prepare firmware files and flash writing utility programs as follows.

1) Copy usb_recovery_xxx.zip file to any directory (e.g. C:\SystemBase\USB_recovery) from SDK\Windows\USB_recovery directory in Eddy DK CD. (Refer to the Eddy official community site http://www.embeddedmodule.com)

2) Among files extracted copy **at91sam9g20-ek.tcl & isp-serialflash-at91sam9g20.bin** file to the below directory. **C:\Program Files\ATMEL Corporation\SAM-BA v2.10\tcl_lib\at91sam9g20-ek.**

3) Among files extracted copy below listed files to the firmware directory in DK source code directory.

eddy-bl-2.5.x.x.bin (Boot Loader)

eddy-bs-2.5.x.x.bin (Boot Strap File Name)

eddy-os-2.5.x.x.bin (Kernel File Name)

eddy-fs-2.5.x.x.bin (File System File Name)

4) Among files extracted Eddy_burning_SerialFlash.bat file performs transferring firmware to Eddy-DK board by executing a TCL file then creates a log file. In this file eddy-bl-2.5.x.x.bin file name & Eddy_burning_SerialFlash.tcl file name should be same with the name of the file copied.

```
sam-ba.exe  \usb\ARM0  AT91SAM9G20-EK  Eddy_burning_SerialFlash.tcl  ./  eddy-bl-2.5.x.x.bin  〉
logfile.log
notepad logfile.log
```

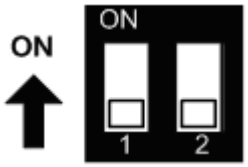
5) Among files extracted Eddy_burning_SerialFlash.tcl file performs transferring firmware to Eddy DK v2.1 board. In this file eddy-bs-2.5.x.x.bin, eddy-os-2.5.x.x.bin, and eddy-fs-2.5.x.x.bin file names should be same with the names of the files copied.

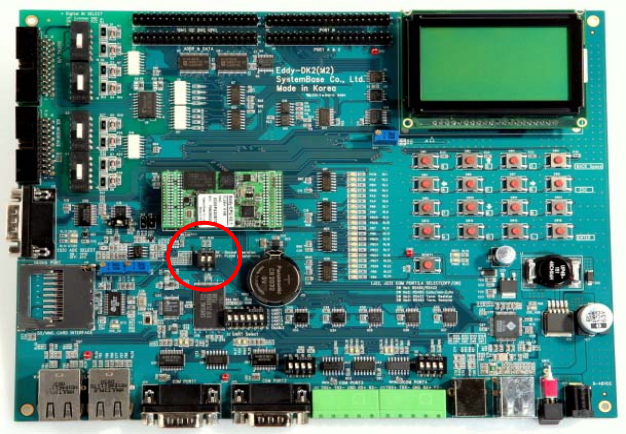
```
…
#########################################################################
#   Main script: Load the linux demo in SerialFlash,
#                Update the environment variables
#########################################################################
array set df_mapping {
    bootstrapFileName    "eddy-bs-2.5.X.X.bin"
    kernelFileName       "eddy-os-2.5.X.X.bin"
    filesystemFileName   "eddy-fs-2.5.X.X.bin"
```

9.2.2 Installing Eddy DK Board Driver

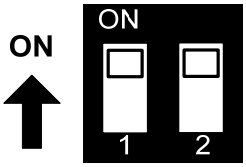
To detect the Eddy-DK board via USB you need to install the Eddy-DK board driver for Windows as follows.

1) Turn off Eddy-DK board.
2) Connect USB cable to both the Eddy-DK board and PC.
3) Set USB as a standby mode by pulling the right side switch down from the S6 dip switch on the Eddy-DK board.



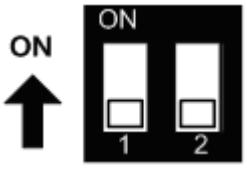


4) Turn on Eddy-DK board.
5) If Eddy-DK board is recognized on your PC, maybe a dialogue box will be pop-up for installing new hardware. Choose the recommended mode install the software automatically then click Next.
6) Click Continue Anyway to proceed with installation.
7) Complete the found task. Click Finish to successfully install the driver.
8) Pull up both of S6 Dip switch on Eddy DK v2.1 board.

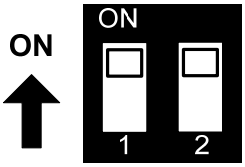


9.2.3 System recovery execution via USB

1) Tu rn off Eddy-DK board.
2) Connect USB cable to both the Eddy-DK board and PC.
3) Set USB as a standby mode by pulling the right side switch down from the S6 dip switch on the Eddy-DK board.



4) Turn on Eddy-DK board.
5) After 5 seconds change flash writing mode by pulling up both of S6 Dip switch on Eddy-DK board.



6) Start upgrade by double-clicking Eddy_burning_SerialFlash.bat file. You need to wait some time for seeing the log File after executing the batch file.

7) With the successful log message as below you can check the result of the upgrade. If you cannot see the successful log message, you can refer to next chapter to fix the problem.

```
…
u-boot file: eddy-bl-2.x.x.x.bin
…
-I- === Load the bootstrap: xxxxflash_at91sam9xxxek in the first sector ===
GENERIC::SendFile ./eddy-bs-2.x.x.x.bin at address 0x0
…
```

8) With the successful log message, confirm whether the new firmware works properly or not by rebooting Eddy DK v2.1 board.

9.2.4 Solving problems during System recovery execution via USB

1) If you use firmware file name wrongly, log file will pop up as below.In this case, you should check whether the file names of firmware copied is same with the firmware names in Eddy_burning_xxxxFlash.bat or Eddy_burning_xxxxFlash.tcl files.

```
…
script file : Eddy_burning_xxxxFlash.tcl
u-boot file: eddy-bl-2.x.x.x.bin
-E- Script File Eddy_burning_xxxxFlash.tcl returned error : could not read "eddy-bl-2.x.x.x.bin": no such file or directory - could not read "eddy-bl-2.x.x.x.bin": no such file or directory
    while executing
"file size $ubootFileName"
    invoked from within
```

2) If your PC connects to Eddy-DK board wrongly, log file will pop up as below. In this case, you need to check the connection.

```
-I- Waiting ...
-E- Connection \usb\ARM0 not found
-E- Connection list : COM2 COM3 COM4 COM5
```

3) If you get as below log file, you need to check the S6 dip switch. It should be pulled up.

```
…
-I- Loading applet isp-dataflash-at91sam9g20.bin at address 0x20000000
-E- Script File Eddy_burning_DataFlash.tcl returned error : Error Initializing xxxxFlash Applet
(Can't detect known device) - Error Initializing xxxxFlash Applet (Can't detect known device)
    while executing
"error "Error Initializing xxxxFlash Applet ($dummy_err)""
    (procedure "xxxxFLASH::Init" line 13)
    invoked from within
"xxxxFLASH::Init 1 "
```

9.3 Product Specification

9.3.1 Eddy CPU v2.1 Specifications

Item	Classification	Specification	
		Eddy-CPU v2.1	Eddy-CPU v2.5
Hwrdware	CPU	ARM926EJ-S (210 MHz)	AT91SAM9G20 (400 MHz)
	Memory	8MB Data Flash, 32 MB SDRAM	
	External I/F	19 Bit / 16 Bit Data Bus	
	Ethernet I/F	10/100 Base-T Auto MDI/MDIX	
	UARTs	4 Port, Support up to 921.6 Kbps (1 : Full Signal, 2,3,4, : RxD, TxD, RTS, CTS only)	
	USB 2.0 FS	2 Host /1 Device Port, 2.0 FS (12Mbps)	
	ADC	4-Channel 10 Bit ADC	
	TWI(I2C)	Master, Multi-Master and Slave Mode	
	SPI	8- to 16-bit Programmable Data Length Four External Peripheral Chip Selects	
	GPIO	Max. 56 Programmable I/O Pins	
	Power Input	3.3 V (200 mA Max)	
	Dimensions	25 x 48.5 x 6.2 mm	
	Weight	8.3 g	
Network	Protocol	TCP, UDP, Telnet, ICMP, DHCP, TFTP, HTTP, SNMP 1&2, SSH, SSL	
	Ethernet	10/100Mbps MAC / PHY	
	Network Connection	Static IP, DHCP	
Software	O/S	Linux Kernel 2.6.21	
	Mgt Tools	SNMP, Web, PortView	
	Uploads	TFTP, FTP, Web	
	Dev Tools	LemonIDE & SDK	
Environmental	Operating Temp	-40 ~ 85 ℃	
	Storage Temp	-60 ~ 150 ℃	
	Humidity	5 ~ 95% Non-Condensing	
Approvals	CE Class A, FCC Class A, RoHS compliant		

9.3.2 Eddy DK v2.1 Specificatons

Classification	Specification
NAND Flash	256MB, 8bit I/F
SD Card Connector	Push Type, Up to 16 GB MMC / SD Card / MC supported
USB Connector	1 x Device 2 x HOST, Dual-Port
LCD Module	128 x 64 Dots Matrix Structure
KEY	4 x 4 Matrix
Battery Holder	3V Lithium Battery, 235 mAh
LED	Power, Ready, 20 Programmable IO, Console & Serial TxD, RxD
I2C Interface	16bit I2C BUS GPIO
SPI Interface	2 Kbit EEPROM
MCI Interface	SD Card, MMC Socket
ADC Interface	Temp / Light Sensor
Digital I/O	8 Port Input, 8 Port Output
Switch	- Serial or GPIO Select - RS422/485 Select - DIO : Common VCC or GND Select - Programming
Jumper Switch	Boot Mode Select, JTAG Select
Serial Port	2 x RS232 DB9 Male 2 x RS422/485 Terminal Block (RS422 & RS485 Selected by S/W)
Console Port	DB9 Male
LAN Port	2 x RJ45
ICE Port	Used for Flash Programming
Reset Button	Factory Default & Warm Boot
Input Power	9-48VDC
Dimensions	240 x 180 mm

9.3.3 Eddy-S4M v2.1 Specifcatons

	Classification	Specification
Hardware	CPU	ARM9260B-CJ (210 MHz)
	Memory	AT45DB642D, 8MB Data Flash IS42S16160B, 32 MB SDRAM
	Ethernet MC/PHY	10/100 Base-T MAC KSZ8041NLi PHYceiver Auto MDI/MDIX
	Serials	Port 0,1 : RS232 (DB9 male) Port 0 : Full Signal Port 1 : TxD, RxD, RTS, CTS only Port 2,3 : COMBO (Terminal Block 5pin) * COMBO : RS422/RS485 is S/W selectable
	USB 2.0 FS	3 Host /1 Device Port, 2.0 FS (12Mbps) Extension Port using GL850A USB Hub chip
	RTC	Real Time Clock, RTC DS1340U-33+ Connected to I2C I/F
	Battery Holder	CR1220(38mAh) 3V Lithium Battery
	ADC	4-Channel 10 Bit ADC
	TWI(I2C)	Master, Multi-Master and Slave Mode
	SPI	8 to 16-bit Programmable Data Length Four External Peripheral Chip Selects
	MCI	SD Spec V2.0 [SDHC], MMC Spec V4.2 support USB to SD Controller , 16GB, 12Mbits/s
	GPIO	Max. 34 Programmable I/O Pins
	LED	Ready LED
Software	Protocol	TCP, UDP, Telnet, ICMP, DHCP, TFTP, HTTP, SNMP1&2, SSH, SSL
	Network Connection	Static IP, DHCP
	O/S	Linux Kernel 2.6.21
	Mgt Tools	SNMP, Web, PortView
	Uploads	TFTP, FTP, Web
	Dev Tools	LemonIDE & SDK
Physical characteristics	Power Input	3.3 V (200mA Max)
	Dimensions	59.75 x 61.80 x 4 mm
	Weight	15 g
Environment	Operating Temp	-40 ~ 85° C
	Storage Temp	-66 ~ 150° C
	Humidity	5 ~ 95% Non-Condensing
CE Class A, FCC Class A, RoHS compliant		

9.3.4 Eddy-S4M-DK v2.1 Specifcatons

Classification	Specification
Serial Port	2 x RS232 DB9 Male 2 x RS422/485 5pin Terminal Block (S/W Selectable & with Auto toggle)
SD Card Connector	Push Type, Up to 16 GB MMC / SD Card / MC supported
MCI Interface	SD Card, MMC Socket
ADC Interface	Light Sensor
USB Connector	1 x Device, 2 x HOST, Dual-Port
LAN Port	RJ45 with transformer
Console Port	DB9 Male
Switch	Power ON/Off switch Serial RS422/485 Termination resistor configuration switch Input switch for testing GPIO (Off : Low, ON : High)
LED	RDY, Power, 34 Programmable IO, Console & Serial TxD, RxD LED
JTAG Port	Used for downloading code and single-stepping through programs
Reset Button	Factory Default & Warm Boot (If you posh more than 5, active Factory default)
JIG connection socket	2 2x23pin socket, which connect JIG board to confirm problems
Expansion Header	2x22pin Header, used to test GPIO of Eddy-S4M
Input Power	5 VDC
Dimensions	160 x 120 mm

9.3.5 Eddy-S4M-JIG v2.1 Specifcatons

Classification	Specification
USB Connector	USB HOST
LAN Port	RJ45
Reset Button	Factory Default & Warm Boot
Expansion Header	2 2x23pin, used to connect most functions of S4M to externalS4M
Input Power	5 VDC
Dimensions	70 x 105 mm

9.3.6 Eddy-WiFi v2.1 Specifcatons

Classification	Specification
Standard	802.11b, 802.11g
Modulation	802.11g: OFDM 802.11b: CCK,DQPSK, DBPSK
Frequency Band	802.11b/g:ISM band 2.4GHz ~ 2.4884GHz
Output Power	802.11g: 14 dBm 802.11b: 17 dBm
RX sensitivity	802.11g: -68m @54Mbps 8% PER 802.11b: -85dBm @11Mbps 8% PER
Security	WEP 64/128, WPA, WPA2
Working distance	60 - 120m, depending on surrounding environment
Data Rate	802.11b : 11, 5.5, 2, 1 Mbps 802.11g : 54, 48, 36, 24,18,12,11, 9, 6, 5.5, 2 , 1 Mbps
Power consumption	TX : 450mA, RX : 300mA
Host interface	USB2.0
Antenna	ANT 2.4Ghz, 2DB RP-SMA Female
Antenna Cable	RF 100mm SMA B/H
Dimension	54 x 25 x 6mm
Operating Temp	0 ~ 55° C
Humidity	5 ~ 90% Non-Condensing
Operating Voltages	3.3V±5%
Weight	10g
Approvals	CE Class A, FCC Class A, RoHS Compliant

9.3.7 Eddy-BT v2.1 Specifcatons

Classification	Specification
Interface	Bluetooth v2.0+ EDR Class 1
Profile	SPP (Serial Port Profile)
Max, TX Power	+18dBm
RX sensitivity	-88dBm
Power	Supply voltage: 3.3V DC Supply current::10mA 60mA
Operating Temp	Operating temperature: -30 ~ 80 °C
Storage Temp	Storage temperature: -40 ~ 85 °C
Humidity	Humidity : 90% (Non-condensing)
Working distance	Stub Antenna (+1dBi) - Stub Antenna (+1dBi) 100 meters Stub Antenna (+1dBi) - Dipole Antenna (+3dBi) 150 meters Dipole Antenna (+3dBi) - Dipole Antenna (+3dBi) 200 meters Dipole Antenna (+3dBi) - Dipole Antenna (+5dBi) 300 meters Dipole Antenna (+3dBi) - Patch Antenna (+9dBi) 500 meters Dipole Antenna (+5dBi) - Dipole Antenna (+5dBi) 400 meters Dipole Antenna (+5dBi) - Patch Antenna (+9dBi) 600 meters Patch Antenna (+9dBi) - Patch Antenna (+9dBi) 1,000 meters
Approvals	CE Class A, FCC Class A, RoHS Compliant

9.4 Ordering Infomation

Product	Version	Descriotion
Eddy-CPU	2.1	Embedded CPU Module
Eddy-CPU	2.5	Embedded CPU Module
Eddy-DK	2.1	Eddy V2.1 Development Kit
Eddy-S4M	2.1	Embedded CPU Module (Mini PCI Type)
Eddy-S4M-DK	2.1	Eddy-S4M v2.1 Development Kit
Eddy-S4M-JIG	2.1	Eddy-S4M v2.1 JIG Board
Eddy-WiFi	2.1	802.11 b/g WiFi Module
Eddy-BT	2.1	Bluetooth 2.0 Class 1