

Embedded Systems

Ch 2A. Embedded Board with Linux

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Overview

- 2.1 Embedded board – EZ-X5
- 2.2 EZ-X5 Booting with Windows
- 2.3 EZ-X5 Booting with Linux
- 2.4 ARM Linux Installation with Linux

2.1 Embedded Board – EZ-X5

- EZ-X5 by falinux.com
 - Intel PXA255-400 을 탑재한 보드
 - 일반 사용자들도 쉽게 접할 수 있게 설계 개발된 제품
 - 3개의 시리얼포트
 - 이더넷 통신환경
 - 하드웨어 디버깅을 할 수 있는 JTAG 포트
 - 그래픽환경(GUI)을 위해 터치패드와 최대 1024x768 을 지원할 수 있는 LCD 인터페이스
 - 리눅스를 탑재
 - 좀더 많은 어플리케이션을 원활하게 이용하기 위해 64Mbyte의 램과 롬을 기본 탑재
 - 160핀의 보드커넥터는 PXA255에서 지원하는 대부분의 신호선을 연결
 - 개발관련 자료가 풍부



EZ-X5 (II)

■ Specifications

- PCB 100 mm x 140 mm
- MCU 400MHz PXA255 ARM RISC Chip ARM10
- RAM 64 Mbytes SDRAM **최대** 128 MBytes
- ROM1 512Kbytes Boot Flash **최대** 8 MBytes
- ROM2 64Mbyte NAND-Flash **최대** 256 MByte
- Ethernet CS 8900 10-Mbps
- Serial RS – 232C 3Port Full UART-1
- USB USB Client
- LCD 640x480 TTL-Port **최대** 1024x768
- Touch **4선식**
- LED Debugging 4 Bits
- JTAG ON – Board JTAG Convertor
- Extension Connector 160-pins Board to board Connector

EZ-X5 (III)

■ Connections

■ USB cable

- Power applied from PC to Ez Board
- Ez Board is the USB client, PC is the USB host

■ Serial cable

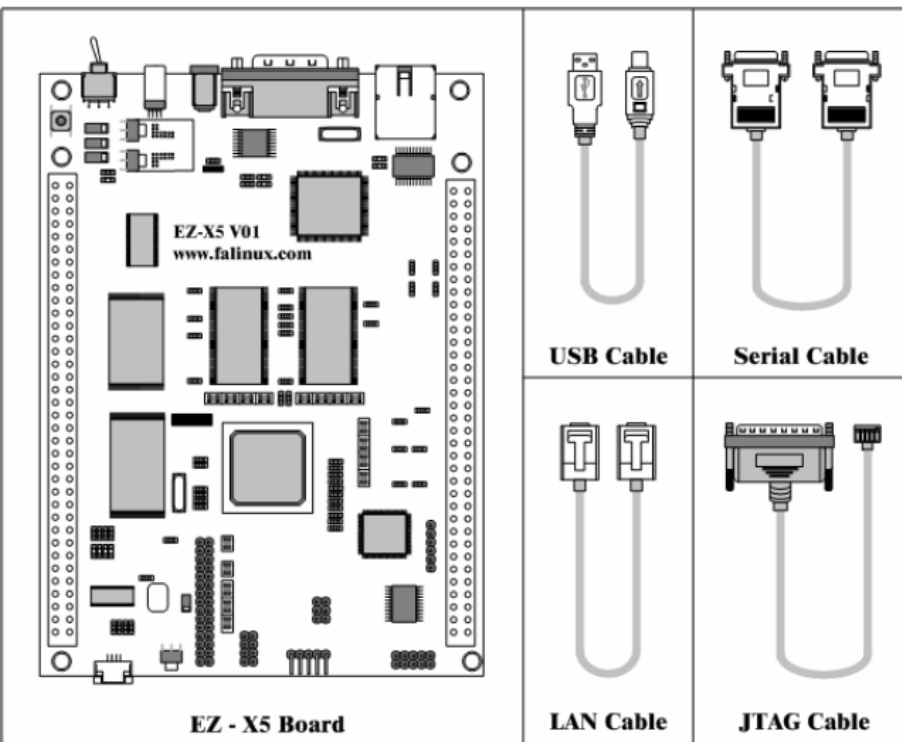
- RS-232C Serial connection to PC
- Ez Board console
- PC with hyperterm or minicom

■ LAN cable

- Ethernet connection for networking
- Network File System

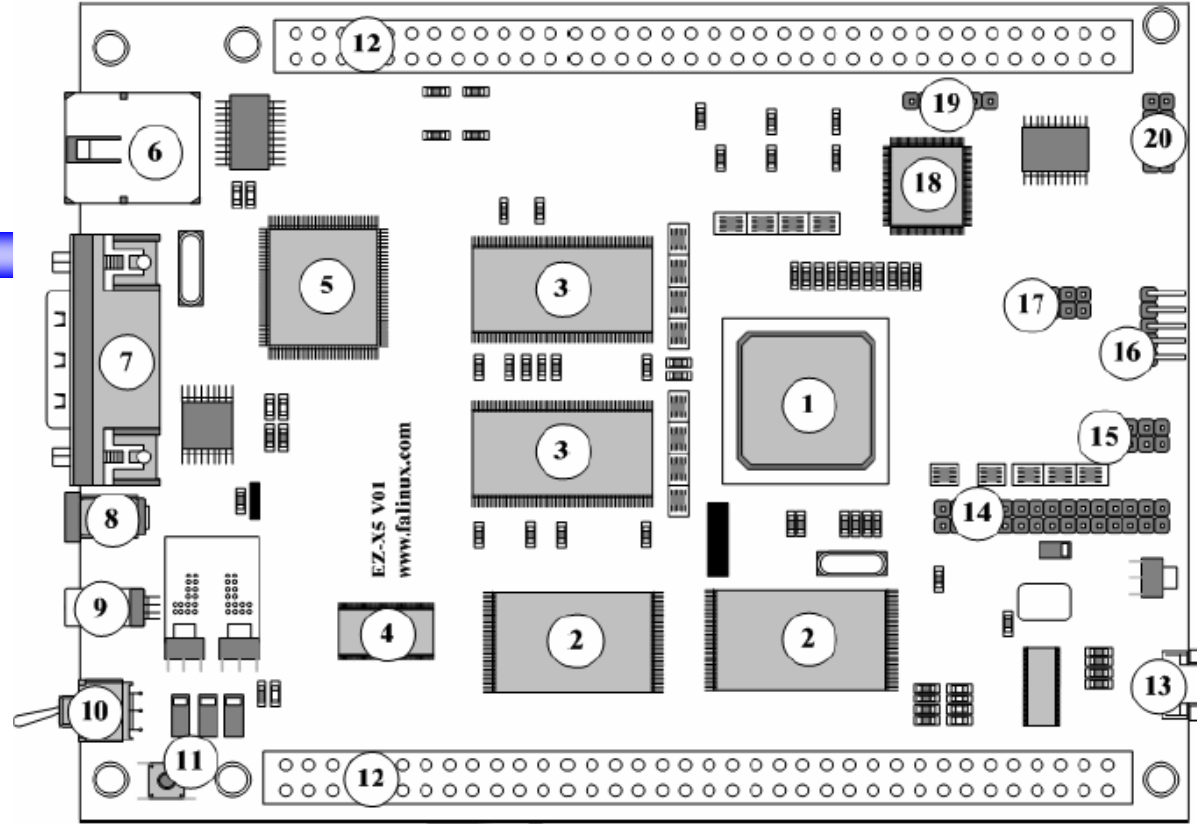
■ JTAG cable

- JTAG connection to the parallel port in PC
- System test and debug
- Flash program



EZ-X5 (IV)

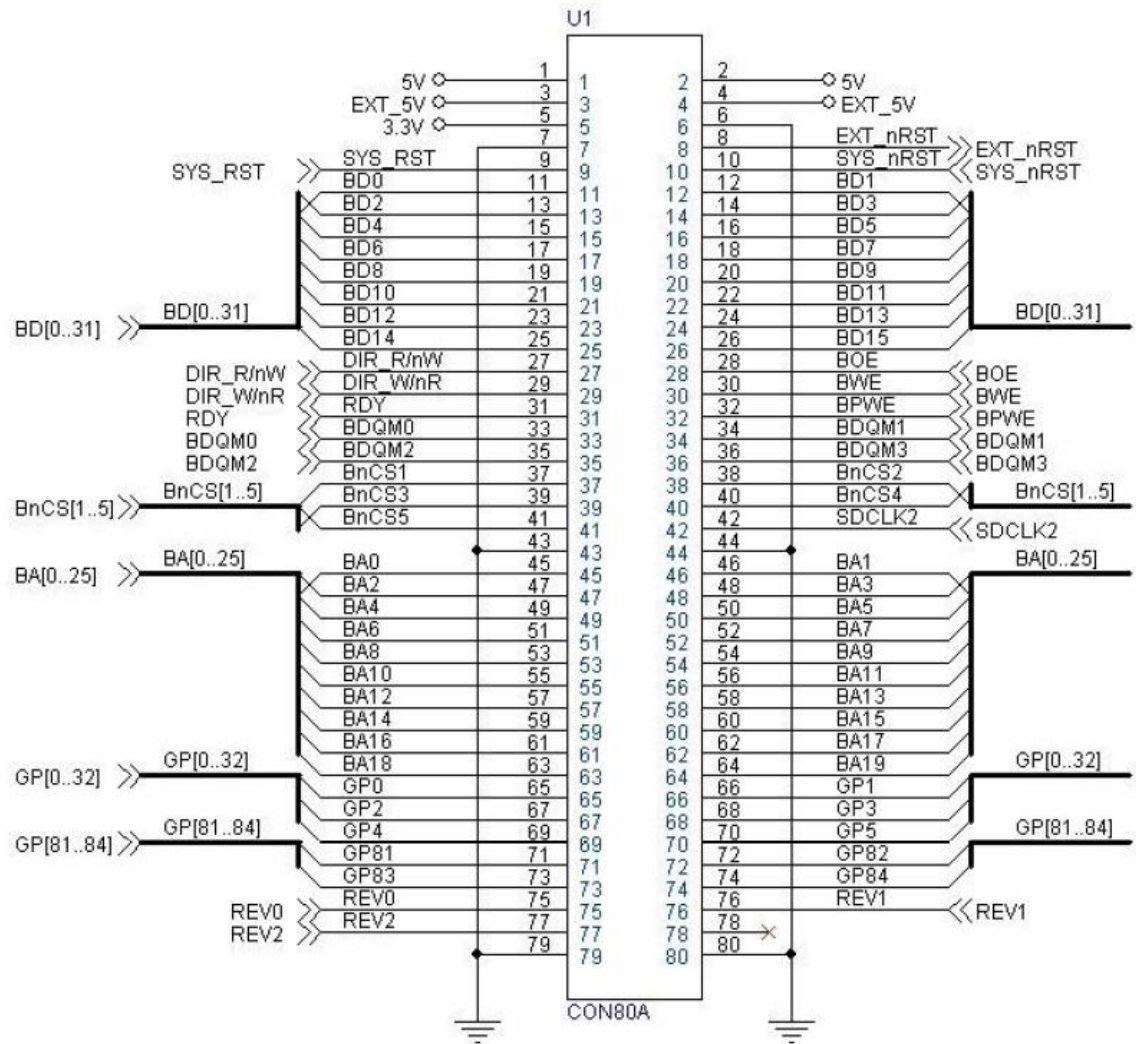
Major parts & connectors



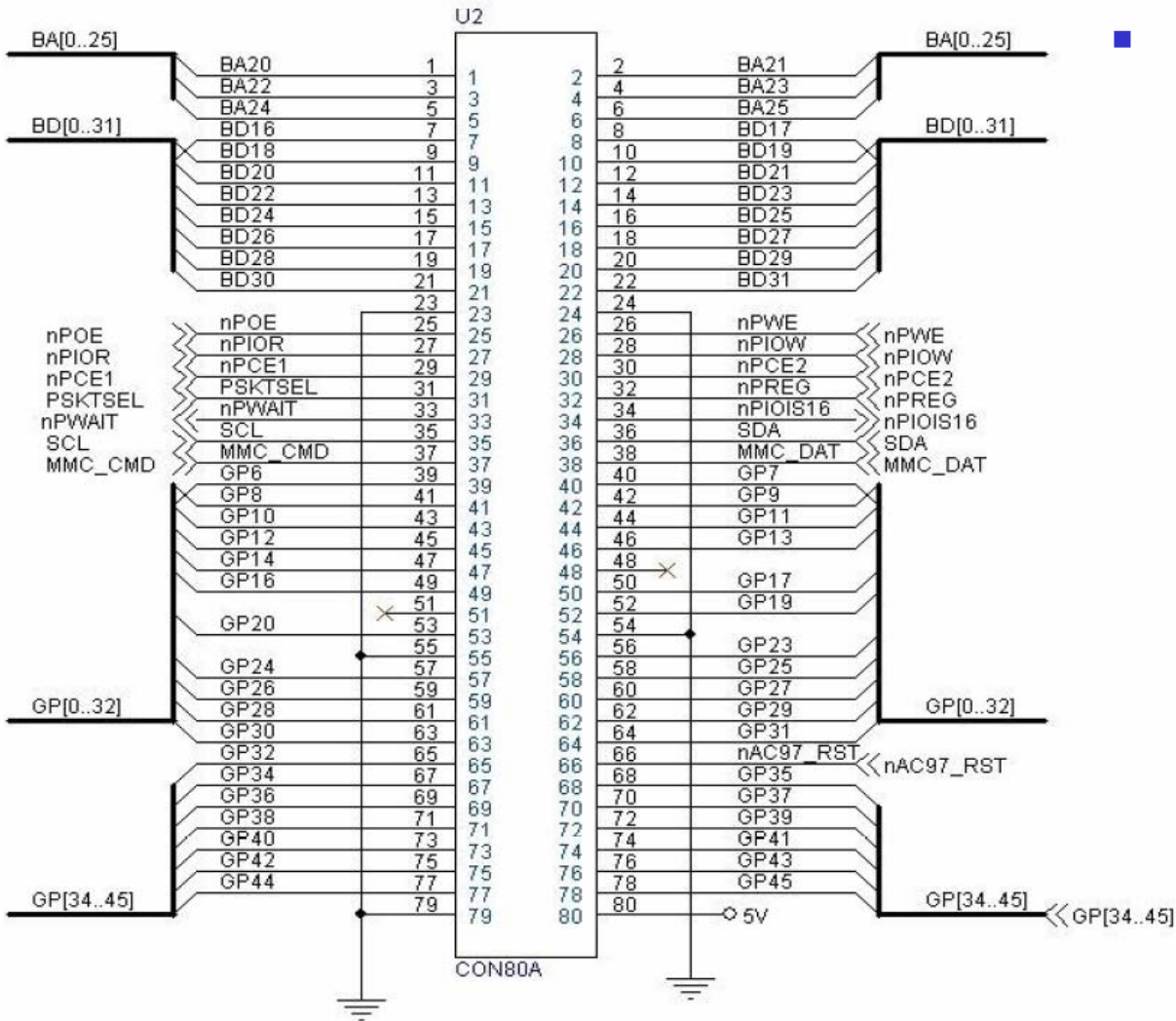
- 1. PXA255 ARM RISC chip 400MHz
- 2. 64Mbytes NAND Flash
- 3. 32MBytes SDRAM x2
- 4. 512KBytes Boot Flash
- 5. CS8900 Ethernet Chip
- 6. RJ45 LAN connector
- 7. Serial connector
- 8. 5V adapter jack
- 9. USB client
- 10. Power switch
- 11. Reset switch
- 12. Extension connector x2
- 13. JTAG connector
- 14. USB host
- 15. USB client
- 16. JTAG connector
- 17. USB client
- 18. CPLD
- 19. USB client
- 20. USB client

EZ-X5 (V)

- Connector U1 pin descriptions (Switch side)
 - BD: Buffered Data
 - BA: Buffered Address
 - BnCS: Buffered Chip Select Not
 - GP: General Purpose Input Output
 - SYS_RST: System Reset
 - EXT_RST: External Reset
 - BOE: Buffered Output Enable
 - BWE: Buffered Write Enable
 - BPWE: Buffered PCMCIA Write Enable
 - BDQM: Buffered Data Query Mode



EZ-X5 (VI)



Connector U2 pin descriptions (Ethernet side)

- nPOE: PCMCIA Output Enable Not
- nPWE: PCMCIA Write Enable Not
- nPIOR: PCMCIA IO Read
- nPIOW: PCMCIA IO Write
- npCE: PCMCIA Chip Enable
- PSKSEL: PCMCIA Socket Select
- nPREG: PCMCIA Register
- nPWAIT: PCMCIA Wait
- nPIOIS16: PCMCIA IO Size 16
- SCL: I2C Clock
- SDA: I2C Data
- MMC_CMD: MMC Command
- MMC_DAT: MMC Data

2.1.2 Software in EZ-X5

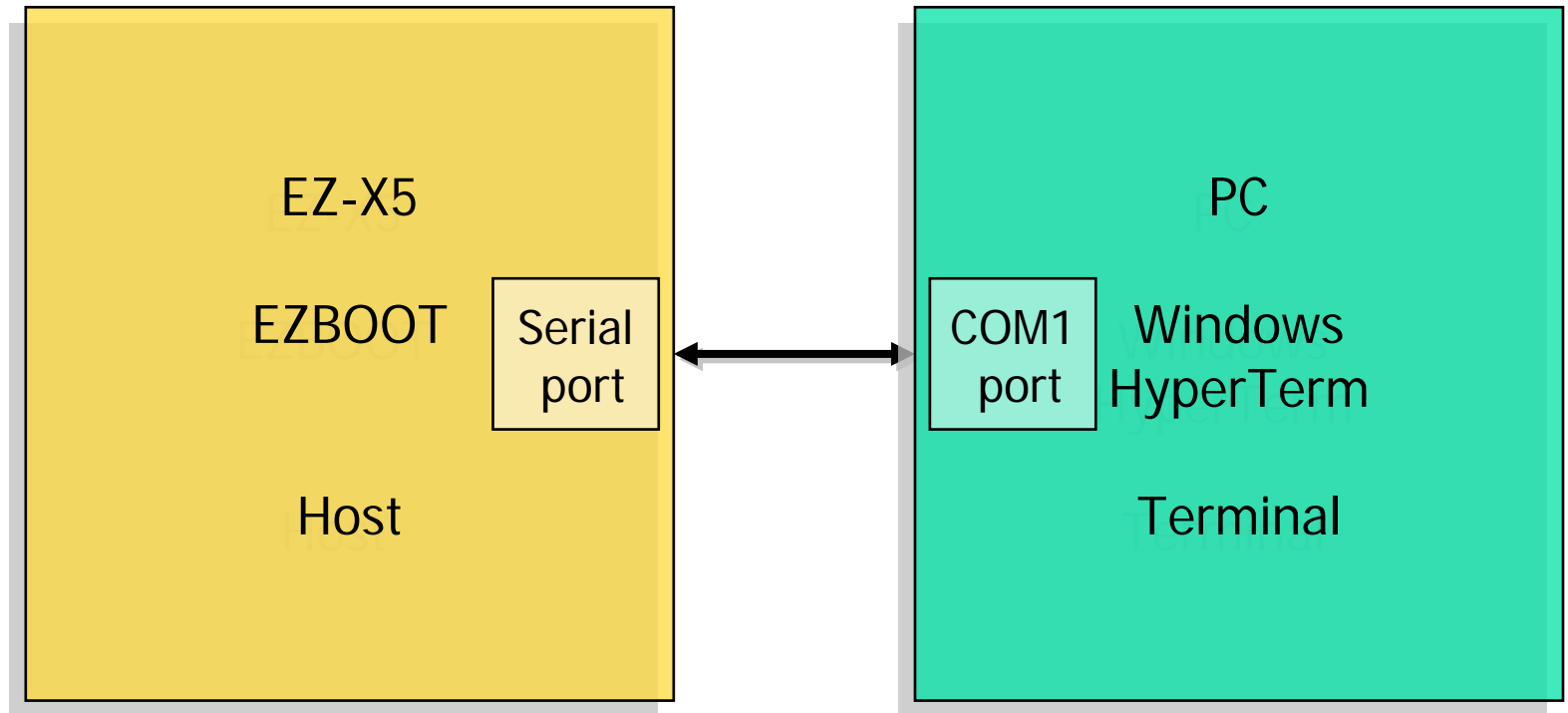
- Program storage
 - RAM – Loss of contents when power-off
 - Flash – No loss when power off. Preinstalled software can reside.
- Current software in Flash
 - Monitor program in Boot Flash
 - EZBOOT.X5 ver. 1.0
 - Linux Kernel and operating system in NAND Flash
 - zImage.x5: ARM Linux kernel
 - Ramdisk.x5.gz: Compressed Ramdisk image
- More info
 - *<http://www.falinux.com>*

2.2 EZ-X5 Booting with Windows

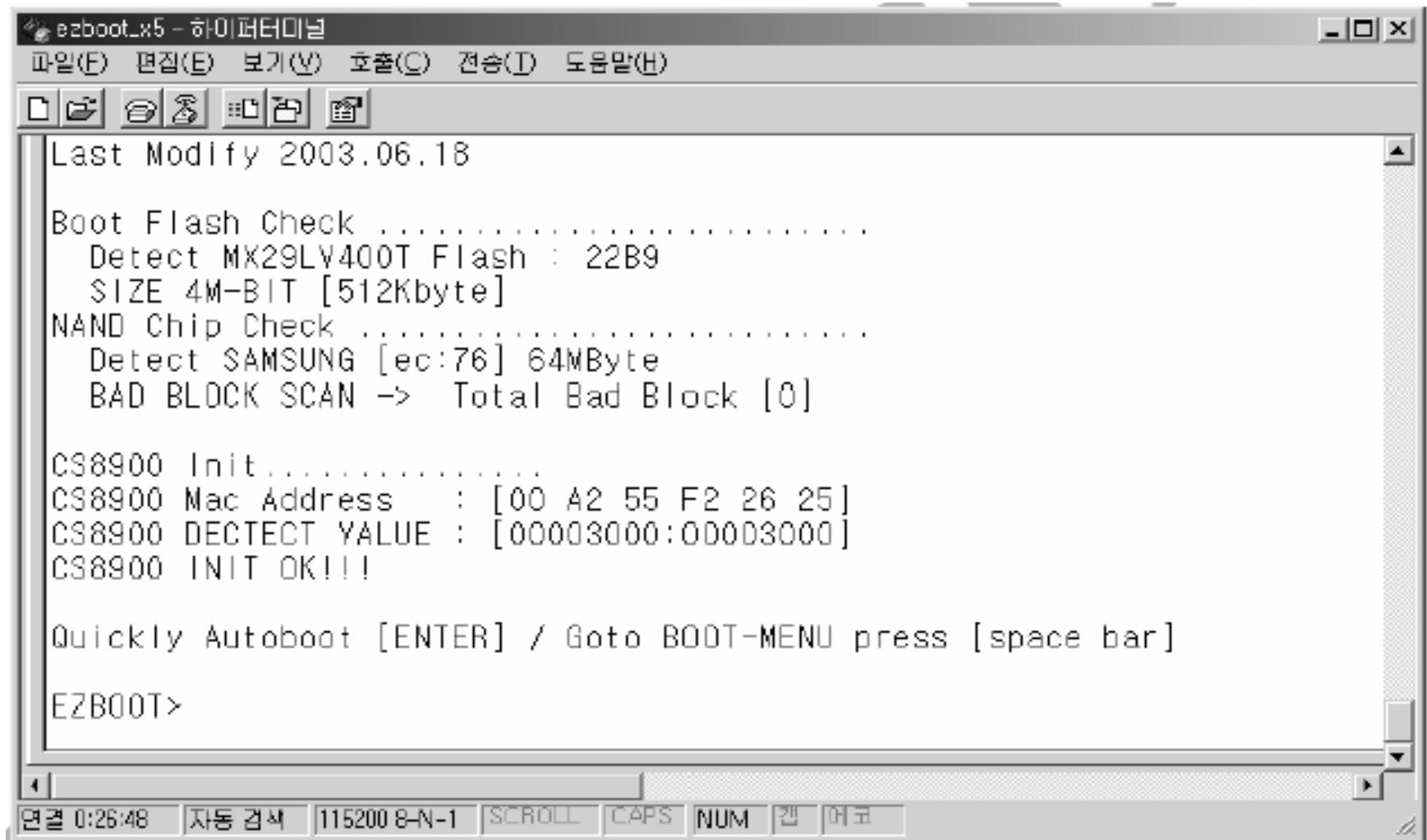
- EZ-X5
 - EZBOOT and Linux require a serial console
 - Assume: Kernel and Ramdisk are already installed.
- PC
 - Hyper Terminal
 - Text-based serial communication software
 - Using COM1 or COM2
 - Included in Windows OS
 - 시작 – 프로그램 – 보조프로그램 – 통신 – 하이퍼터미널
 - **설정**
 - **새연결**
 - Select COM1 [or COM2] depending on EZ-X5 serial connection
 - Port **설정**
 - 115200 bps, 8 data, no parity, 1 stop, no flow control
 - Save session

EZ-X5 Booting with Windows (II)

- Connection



EZ-X5 Booting with Windows (III)



The screenshot shows a HyperTerminal window titled "ezboot_x5 - 하이퍼터미널". The window contains the following text output from the EZBOOT utility:

```
Last Modify 2003.06.18

Boot Flash Check .....
  Detect MX29LV400T Flash : 22B9
  SIZE 4M-BIT [512Kbyte]
NAND Chip Check .....
  Detect SAMSUNG [ec:76] 64MByte
  BAD BLOCK SCAN -> Total Bad Block [0]

CS8900 Init.....
CS8900 Mac Address   : [00 A2 55 F2 26 25]
CS8900 DECTECT VALUE : [00003000:00003000]
CS8900 INIT OK!!!

Quickly Autoboot [ENTER] / Goto BOOT-MENU press [space bar]

EZBOOT>
```

At the bottom of the window, there is a status bar with the following information: 연결 0:26:48, 자동 검색, 115200 8-N-1, SCROLL, CAPS, NUM, and other keyboard function keys.

EZ-X5 Booting with Windows (IV)

- Test with EzBoot
 - Press space bar within 10 sec.
 - Prompt of "EZBOOT> " appears
- Termination of Hyper Terminal
 - File – Exit or
 - Alt+F4
- *100 Reasons why the System is not Working*
 -
 -

2.3 EZ-X5 Booting with Linux

```
[configuration]
Filenames and paths
File transfer protocols
Serial port setup
Modem and dialing
Screen and keyboard
Save setup as dfl
Save setup as..
Exit
Exit from Minicom
```

```
A - Serial Device      : /dev/ttyS0
B - Lockfile Location  : /var/lock
C - Callin Program     :
D - Callout Program    :
E - Bps/Par/Bits       : 115200 8N1
F - Hardware Flow Control : No
G - Software Flow Control : No

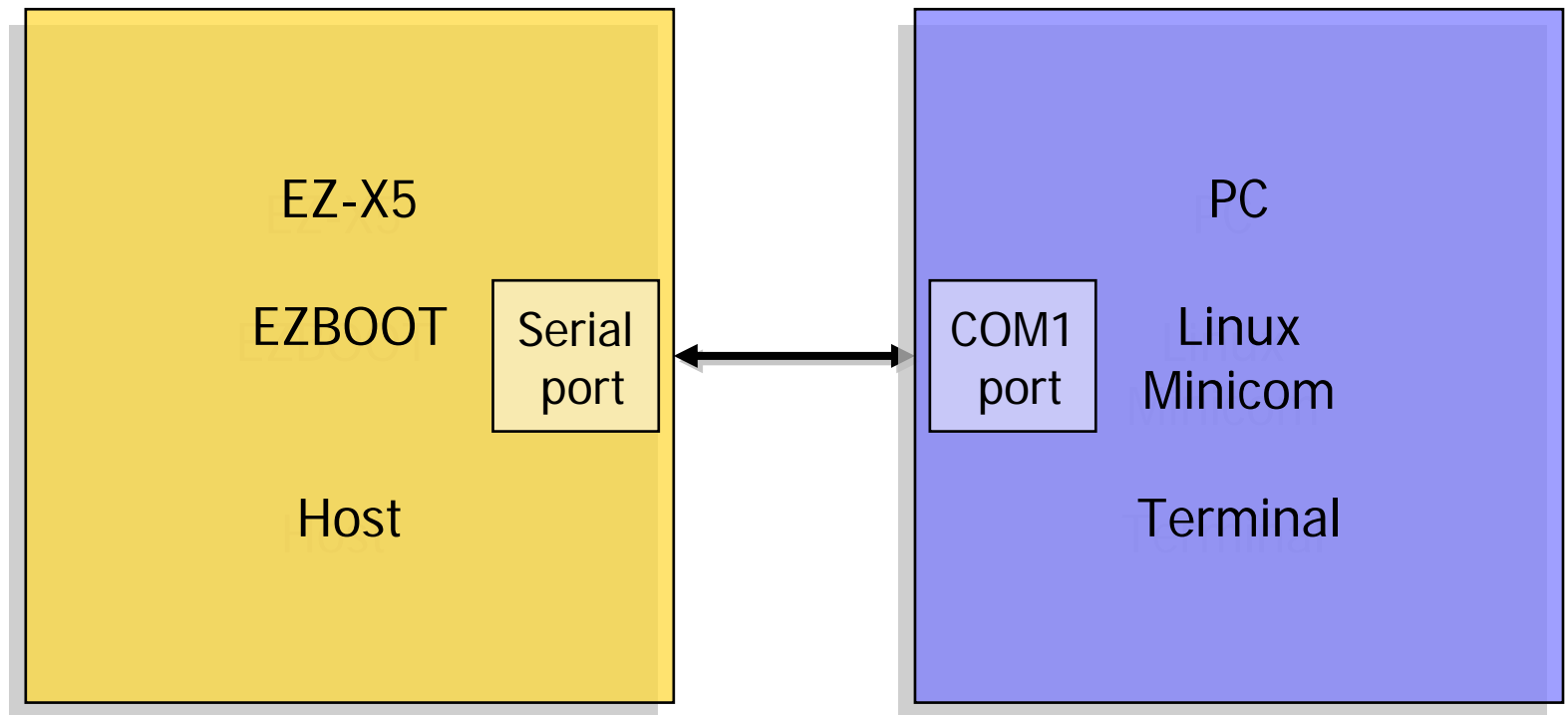
Change which setting? █

Screen and keyboard
Save setup as dfl
Save setup as..
Exit
Exit from Minicom
```

- PC using Linux
 - [Re]Boot PC to run Linux!
 - Minicom
 - Linux terminal emulator
 - Setting
 - Acquire root privilege: #su
 - #minicom -s
 - Serial port setup
 - Serial device: /dev/ttyS0
 - Bps/par/bits: 115200 8N1
 - Hardware flow control: No
 - Software flow control: No
 - Save setup as dfl
 - Exit

EZ-X5 Booting with Linux (II)

- Connection



EZ-X5 Booting with Linux (III)

```
root@jdt: /root
Welcome to minicom 1.83.1

OPTIONS: History Buffer, F-key Macros, Search History Buffer, I18n
Compiled on Jun  1 2001, 04:11:00.

Press CTRL-A Z for help on special keys

.qT<S7=45<S<=<<L1<V1<\4<&c1<E1<Q<.

WELCOME EZBOOT Ver 2.2.....
Program By You Young-chang, fooji ( J.D&T Co.,Ltd )
Last Modify 2002.10.10

Flash Information:
"Intel 3V StrataFlash 28F128J3A" detected at 00000000.
Total size is 16MB(128Mb * 1)

CS8900 Init.....
CS8900 Mac Address   : [00 D0 CA F2 26 25]
CS8900 DECTECT VALUE : [00003000]
CS8900 INIT OK!!!

Quickly Autoboot [ENTER] / Goto BOOT-MENU press [space bar].

EZBOOT>
CTRL-A Z for help |115200 8N1 | NOR | Minicom 1.83.1 | VT102 | offline
[영어] [완성] [두벌식]
```

EZ-X5 Booting with Linux (IV)

- Help on EzBoot
 - Type 'help' or '?'
 - EZBOOT> help
- Termination of minicom
 - Ctrl+a, q
 - Pop-up window: Leave without reset? Yes <Enter>
- Help on minicom
 - Ctrl+a, z

2.4 ARM Linux Installation with Linux

- Purpose
 - Install the Linux software in the Flash of EZ-X5, which is composed of zImage and ramdisk.gz using Linux PC
- 1. 프로그램 복사
 - Mount the CDROM in then PC with Linux
 - # mount /dev/cdrom /mnt/cdrom
 - Mount: block device /dev/cdrom is write-protected, mounting read-only
 - #
 - Copy all the files in /sw/image
 - # cd mnt/cdrom/sw
 - # ls -la
 - # cp -a image /tmp/image
 - Check if zImage.x5 and ramdisk.x5.gz exist in /tmp/image

ARM Linux Installation with Linux (II)

■ 2. Loading zImage/ramdisk into EZ-X5

- Start the minicom in PC Linux
- Type 'zfk'/'zfr' command
 - Z: Serial z-modem protocol
 - F: Flash
 - K: Kernel image
 - R: Ramdisk image
- Press <Ctrl+a>, s
; Send
 - Select Upload – zmodem
 - Select file: zImage
- Writing: |=====
 - Press any key to continue

```
EZBOOT>zfk
..B01000000659652
```

```
[Select]
Directory: /tmp/image
[.]
[image]
blob
ezboot
ezflash
ramdisk.gz
zImage
```

[Upload]

```
zmodem
ymodem
xmodem
kermit
ascii
```

```
[zmodem upload - Press CTRL-C to quit]
Sending: zImage
Bytes Sent: 605908 BPS:9327
Transfer complete
READY: press any key to continue...█
```

ARM Linux Installation with Linux (III)

- 3. Running ARM Linux
 - Three ways to start
 - Power ON
 - Press Reset switch
 - Key in "rst" in EZBOOT
 - Login
 - EZ-X5 Login: root
 - Password: [Enter]
; Just press enter key

```
root@jdt: /root
INIT: version 2.84 booting
INIT: Entering runlevel: 3
Starting system logger: syslogd
Starting INET services: inetd

Welcome to J.D&T EZ-X5 ( www.falinux.com )
XScale(PXA255) Linux
ez-x5 login: root
[root@ez-x5 /root]$ cd /
[root@ez-x5 /]$ ls
bin          home         mnt          sbin         var
dev          lib          proc         tmp          usr
etc          lost+found  root

[root@ez-x5 /]$ cd etc
[root@ez-x5 /etc]$ ls
HOSTNAME      hosts.allow  issue.net    nsswitch.conf  security
ae.rc         hosts.deny  ld.so.cache  passwd          services
ae2vi.rc     inetd.conf  ld.so.conf   profile         shadow
fstab        inittab     localtime    protocols       timezone
group        inputrc     modules      rc.d
host.conf    ioctl.save  motd         resolv.conf
hosts        issue       networks     rpc
[root@ez-x5 /etc]$
```

ARM Linux Installation with Linux (IV)

- What you've done:

- EZ-X5

- NAND Flash

Ramdisk image at 0x0010 0000

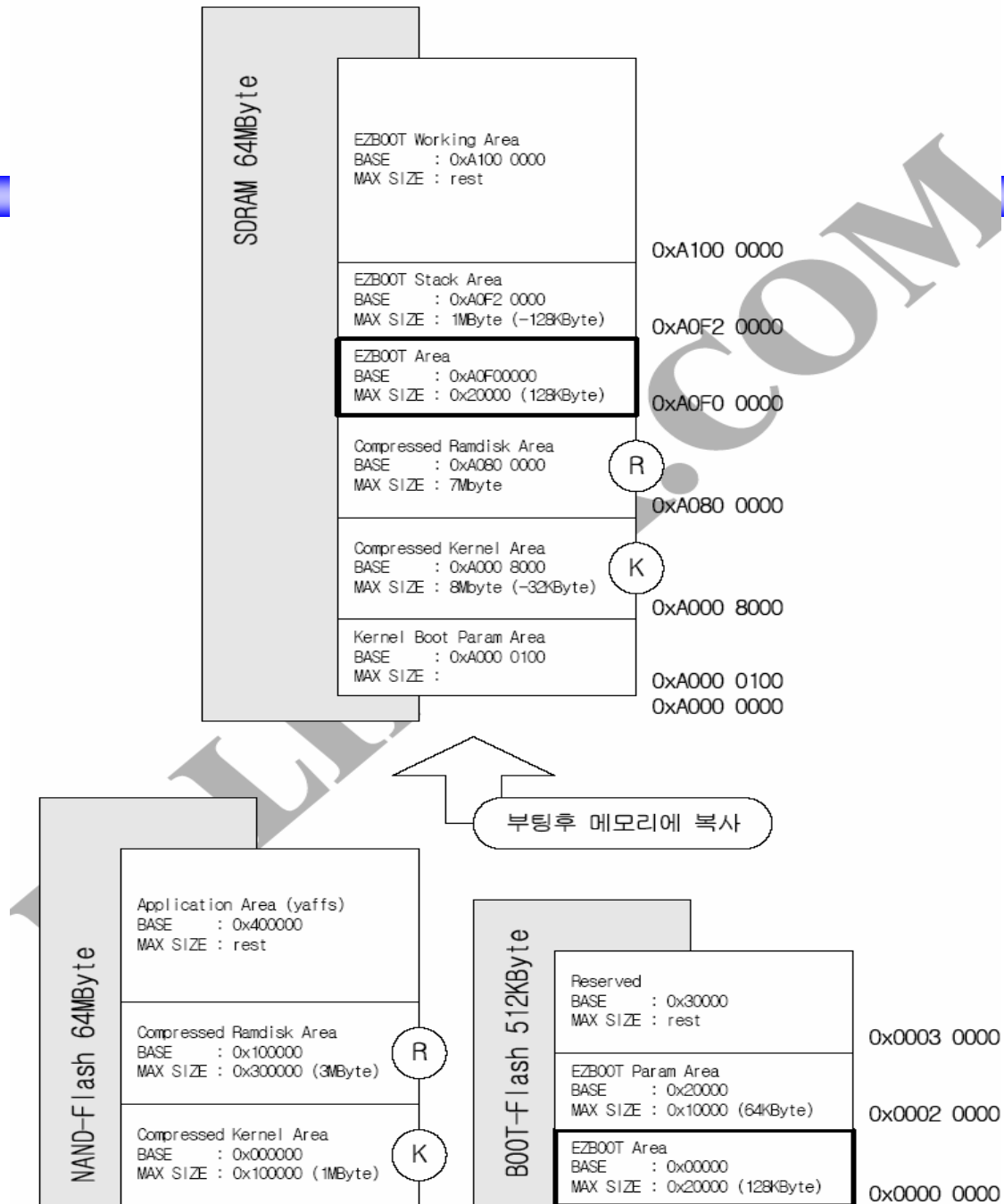
Kernel image at 0x0000 0000

- Boot Flash

Bootloader at 0x0000 0000

ARM Linux Installation with Linux (V)

- Memory map



Reference

- EZ-X5 User's Manual, Ch. 1-4, <http://www.falinux.com>

