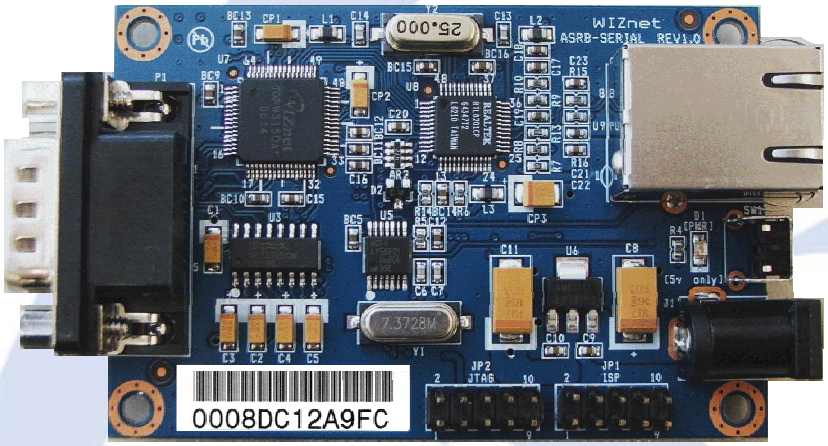
Application Specific Reference Board

For Serial Device



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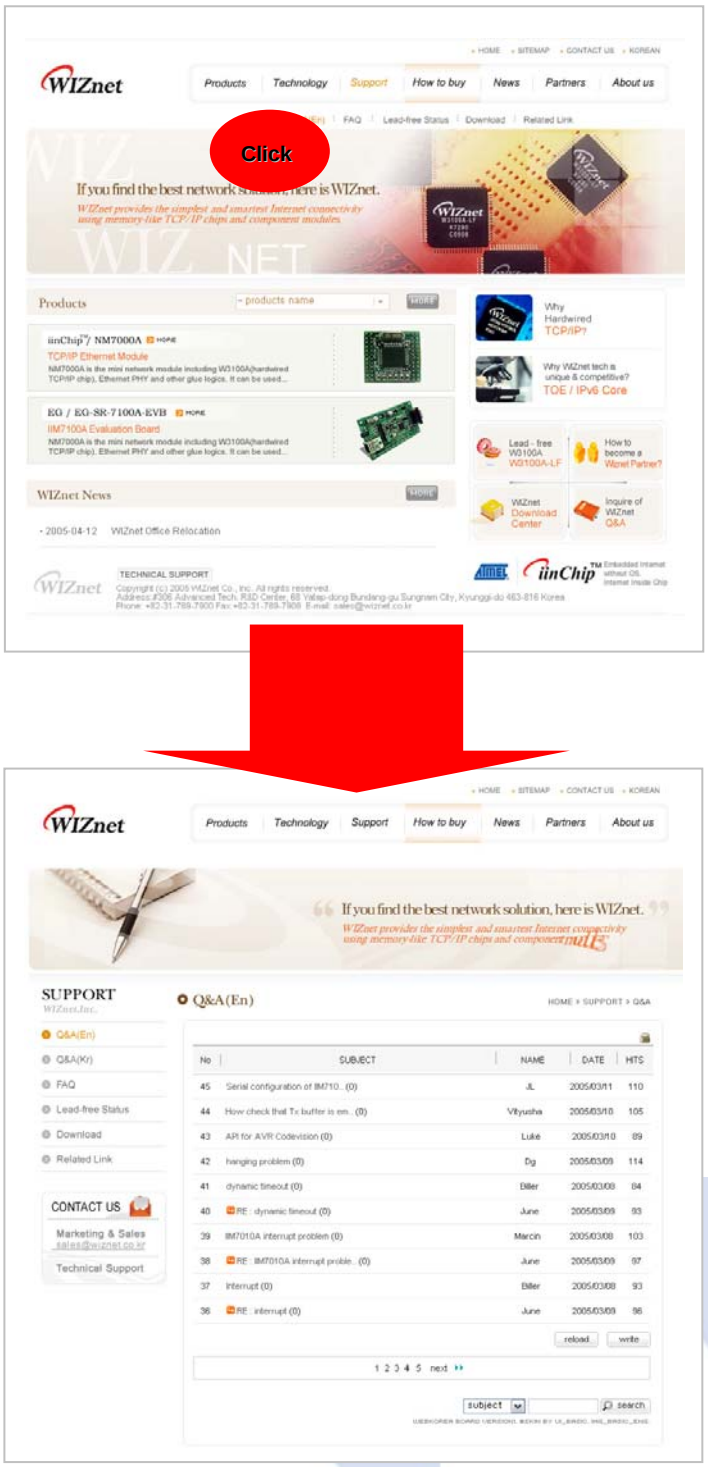
If you have any question about WIZnet Products, write them down onto our Q&A Board on our website at www.wiznet.co.kr. A WIZnet engineer will promptly provide you with an answer.



1. Introduction

The ASRB-SERIAL(Application Specific Reference Board for Serial) is a reference board that converts serial data into TCP/IP data type. It transmits the data sent from serial equipment to the Internet or TCP/IP data to the equipment.

The ASRB-SERIAL provides serial commands, with which the developers of any serial device can add local configuration capability to their products. For example, a card reader developer can program the keypad on a card reader to configure serial or network on-site without the use of a laptop or PC.

1.1. Key Features

- All-made Reference Board for Serial Device
  - Simple and quick network implementation
  - Providing all source code, hardware schematic, and reference materials that are dedicated to the function of Serial to Ethernet
  - Available of firmware customization for various serial devices
- Serial Command Support
  - Simple command frame format
  - Comprehensive & readable command set for network and serial settings
  - On-site configuration without PC
- High stability & reliability by using a W3150A+ WIZnet Chip, a fully-hardwired TCP/IP stack
- Easy and powerful configuration program
- 10/100Mbps Ethernet interface, Max. 230Kbps Serial interface
- RoHS compliant

1.2. Specification

- Hardware Architecture
  - MCU : ATmega128L
  - TCP/IP : W3150A+
  - PHY : RTL8201CP (Ethernet PHY)
  - Network Interface : 10/100 Mbps auto-sensing RJ-45 Connector
  - Serial Interface : RS 232
  - Serial Signals : TXD, RXD, RTS, CTS, GND
  - Serial Parameters
    - Parity : None, Even, Odd
    - Data Bits : 7, 8
    - Flow Control : None, RTS/CTS, XON/XOFF
    - Speed : up to 230Kbps
- Input Voltage : DC 5V
- Power Consumption : under 500mA
- Temperature : 0°C ~ 80°C (Operation), -40°C ~ 85°C (Storage)
- Humidity : 10 ~ 90%

1.3. Products Contents

	ASRB-SERIAL Board
	CD (containing f/w source code, H/W schematic and other related materials)

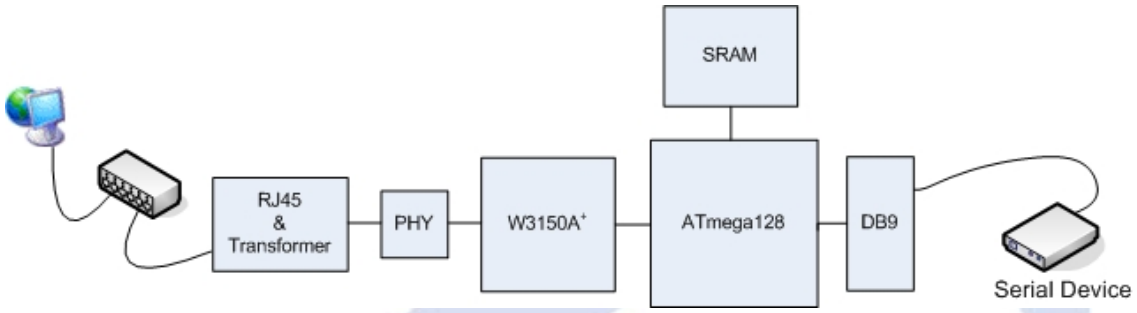
	LAN Cable **(Option)**
	5V Power Adapter **(Option)**

☞ Please immediately notify your sales representative if any of the items above is missing or damaged.

☞ If you need optional accessories, please specify your necessities in your order sheet.

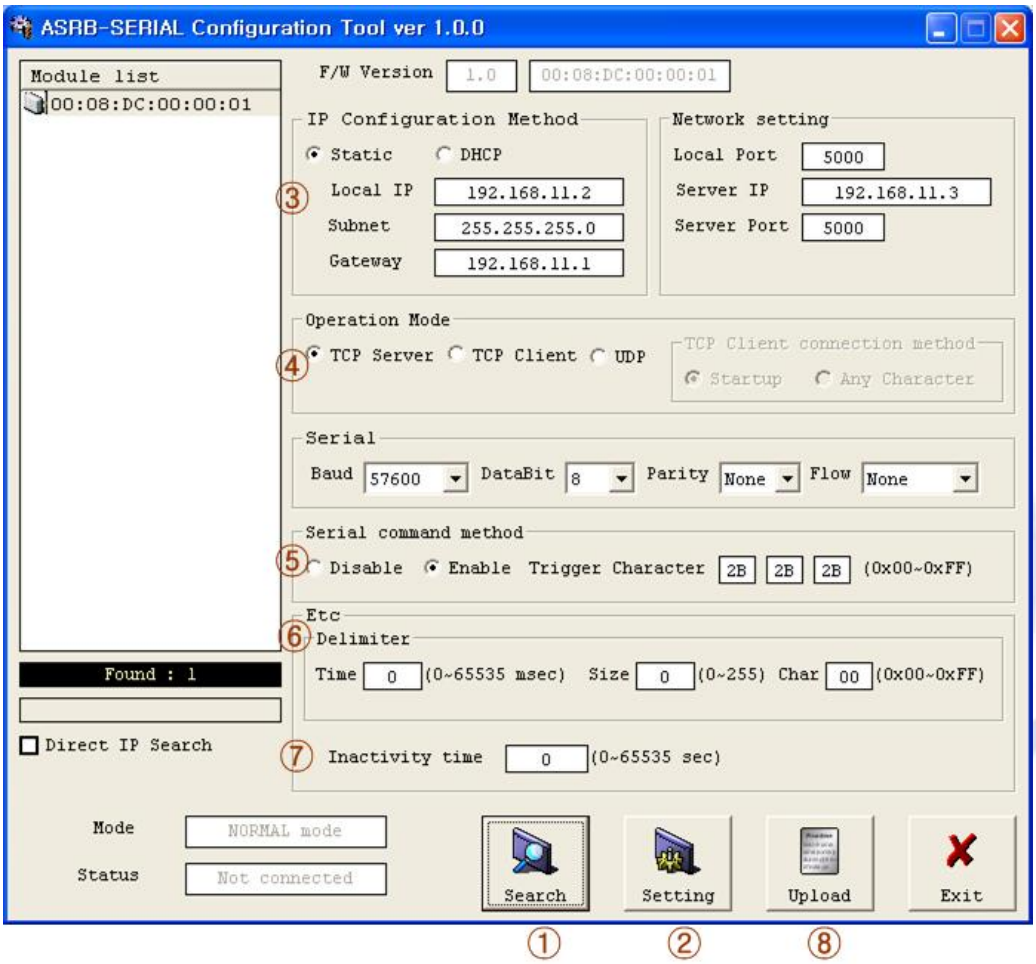
2. ASRB-SERIAL Board

2.1. Block Diagram



ASRB-SERIAL board converts serial data to Ethernet and Ethernet to Serial. When the raw data is received from serial port, it is sent to W3150A+ by MCU(ATmega128L), and transferred to network through PHY chip, Transformer and so on. The data from Ethernet is received to internal buffer of W3150A+, and delivered to serial port by MCU. The MCU will control the data according the mode set by users.

2.2. Configuration Tool



① Search

The Search function is used to search all boards existing on the same Subnet. The UDP broadcast is used for searching modules on a LAN.

The MAC address for a searched board will be listed in the "**Module list**".

If **Direct IP Search** is checked, TCP will be used for searching instead of UDP. This mode is used for searching the ASRB-SERIAL boards more in remote networks than on local networks with the same subnet. An IP address assigned to the module will be required.

② Setting

If you select one of the MAC addresses listed in the "**Module list**", the configuration value of the selected board will be displayed. After changing each value in the configuration program, click the "**Setting**" button to complete the configuration.

The module will be initialized with the new configurations.

③ IP Configuration method: Static, DHCP

Static: The IP address can be manually assigned by users.

DHCP: The board assigns IP, subnet and gateway addresses by acquiring them from the DHCP server

☞ Other configurations should be set manually except for the IP configuration of DHCP.

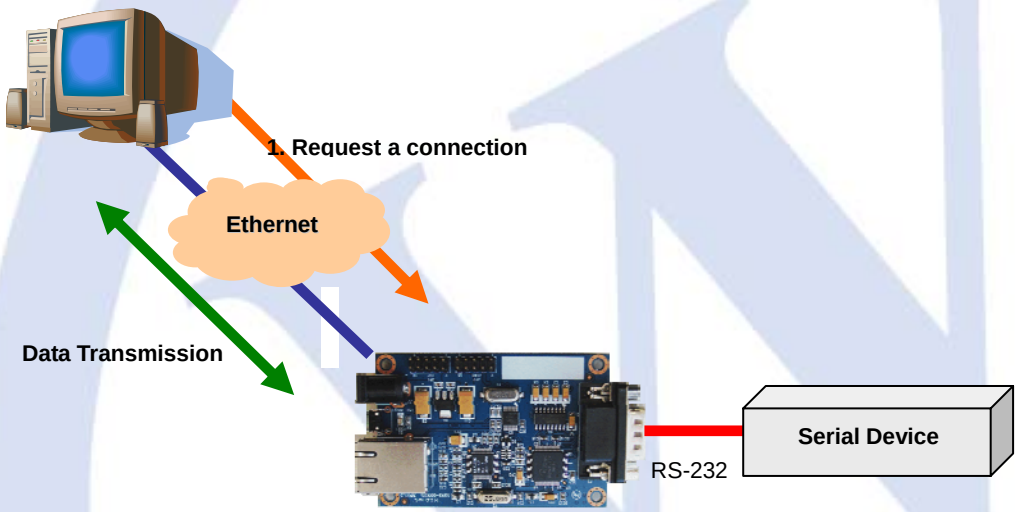
④ Operation mode: TCP server, TCP client, UDP

Three different operation modes are supported — TCP Server, TCP Client, and UDP.

The main difference between the TCP and UDP protocols is that TCP guarantees the delivery of data by requesting the recipient to send an acknowledgement to the sender. On the other hand, UDP does not require this type of verification, so data can be delivered quicker, but its delivery can not be guaranteed.

The TCP Server and TCP Client mode are related to the first step of connection establishment. Once the connection is established, data will be transparently transmitted in both directions (from Server to Client or from Client to Server).

TCP server mode



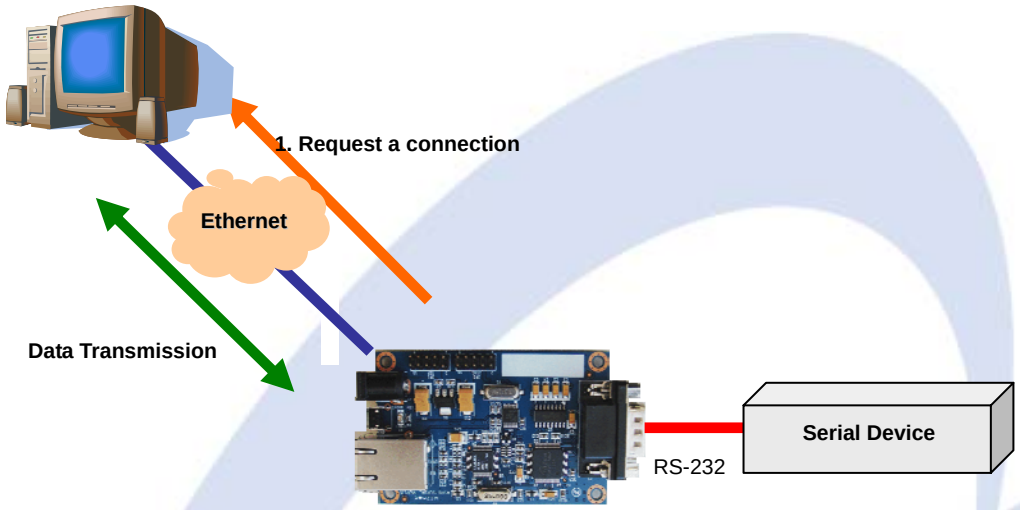
To operate this mode, the **Local IP, Subnet, gateway address and local port number** should be configured. The ASRB-SERIAL waits to be connected by the host computer, allowing the host computer to establish a connection and get data from the serial device.

As illustrated in the figure above, the data transmission is as follows:

1. The host connects to the ASRB-SERIAL which is configured as TCP Server Mode.

2. Once the connection is established, data can be transmitted in both directions - from the host to the ASRB-SERIAL, and from the ASRB-SERIAL to the host.

TCP client mode



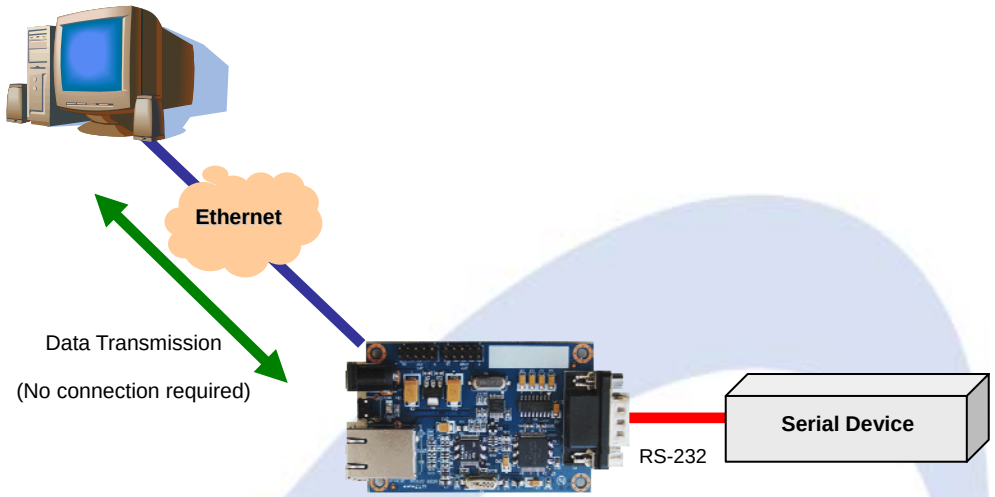
To operate this mode, the **Local IP, Subnet, gateway address, server IP, server port number** should be set. In the **TCP Client mode**, the ASRB-SERIAL proceeds active open for establishing a TCP connection to a host computer.

As illustrated in the figure above, data transmission is as follows:

1. The ASRB-SERIAL operating as TCP Client Mode establishes a connection based on the condition set in the **TCP client connection method** (**Startup, Any character**). i.e. the ASRB-SERIAL can try to connect as soon as one starts up(**Startup**), or later when data from serial device arrives. (**Any character**).

2. After the connection is established, data can be transmitted in both directions - from the host to the ASRB-SERIAL, and from the ASRB-SERIAL to the host.

UDP mode



In UDP mode, any TCP/IP connection procedure is not required.

⑤ Serial command method

With this menu, you can designate how the Serial command mode can be entered.

Serial command mode can be triggered when 3 user-defined characters are detected. It can be exited by using the WR command.

⑥ Delimiter: Time, Size, Character

You can designate how the serial data can be packed and sent to the Ethernet. There are 3 delimiters - Time, Size and Character. If all of them are set as '0', whenever the serial data arrives, they will be sent to the Ethernet without any condition. When any of the three delimiters is satisfied, data can be sent to the Ethernet.

Ex) Delimiter: Size=10, Char=0x0D

Serial data: 0123456789abc

Ethernet data: 0123456789

☞ "abc" data remains in the serial buffer of board

⑦ Inactivity time

After the connection is established, if there is not any data transmission within the time defined in "**Inactivity time"**, the connection will be automatically closed.

⑧ Upload

Upload the firmware through the network.

☞ After uploading the firmware, 10~20 seconds are required for initialization.

2.3. Serial Communication Specification

In this chapter, we describe the structure of the data frames used in issuing commands and receiving responses to and from the device.

2.3.1. Frame Format

Command Frame format

Descriptor	STX	Command code	Parameter	ETX
Length(bytes)	1	2	Variable	1

Reply Frame format

Descriptor	STX	Reply code	Parameter	ETX
Length(bytes)	1	1	Variable	1

2.3.2. STX & ETX

Setting	Comments
STX	'<' : Hex = 3Ch
ETX	'>' : Hex = 3Eh

2.3.3. Reply Code

Reply	Comments
S	Command was successful
F	Command failed
1	Invalid command
2	Invalid parameter
E	Enter serial command mode

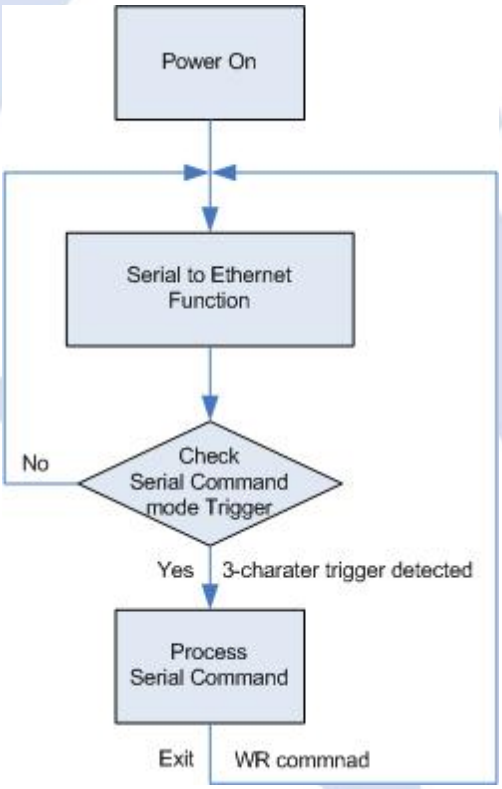
2.3.4. Command Code

Command	Parameter	Comments
WI	xxx.xxx.xxx.xxx (eg. 192.168.11.133)	Set Local IP
WS	xxx.xxx.xxx.xxx (eg. 255.255.255.0)	Set Subnet mask

WG	xxx.xxx.xxx.xxx (eg. 192.168.11.1)	Set Gateway
WP	0~65535	Set Local IP's port number
WD	0 : Static 1 : DHCP	Set the IP configuration method
WM	0 : TCP server 1 : TCP client 2 : UDP	Set the operation mode
WC	0 : startup 1 : any character	TCP client method
WB	XXXX eg. [Baudrate]0: 230400, 1: 115200, 2: 57600, 3: 38400, 4. 28800, 5: 19200, 6: 14400, 7: 9600, 8: 4800, 9: 2400 [data byte] 7 : 7bit, 8bit [parity] 0 : no parity, 1 : Odd, 2 :Even [Flow] 0 : no, 1 : Xon/Xoff, 2 :RTS/CTS	Set the serial baud rate, data, parity and flow control. 4bytes:[Baud][DataByte][parity][flow]
WT	0 : Disable 1 : Enable	Set the serial command method
WE	xxxxxx (eg. In hex format : 2B 2B 2B)	Set the command mode character
WX	xxx.xxx.xxx.xxx (eg. 192.168.11.144)	Set server IP address
WN	0~65535	Set server port number
WR		Restart
OC	XX	Set delimiter character in hex
OS	0~255	Set delimiter size
OT	0~65535	Set delimiter time
OI	0~65535	Set Inactivity timer value
Command	Parameter	Comments
RI		Get Local IP
RS		Get Subnet mask
RG		Get Gateway

RP		Get Local IP's port number
RD		Get the IP configuration method
RM		Get the operation mode
RC		Get the TCP client method
RB		Get the serial baud rate
RT		Get the serial command method
RE		Get the command mode character
RF		Get the firmware version
RX		Get the server IP address
RN		Get the server port number
QC		Get delimiter character in hex
QS		Get delimiter size
QT		Get delimiter time
QI		Get Inactivity timer value

2.4. Operation Flow



2.5. Factory Default

If power is supplied as holding the reset button, the board is initialized with the factory default value.

IP configuration	Static
Local IP address	192.168.11.2
Subnet mask	255.255.255.0
Gateway address	192.168.11.1
Local port number	5000
Server IP address	192.168.11.3
Server port number	5000
Operation mode	TCP server mode
Serial port	57600 bps 8-N-1
Serial command method	Enable

3. Demonstration and Test

In this chapter, three examples are given to show how functions of the ASRB-SERIAL can be tested. The testing environment is as follows:

Hardware

- PC having RS-232 serial port.
- ASRB-SERIAL board

Software

- Windows operating system installed on testing PC.
- ASRB-SERIAL Configuration tool
- Hyper Terminal Program

Testing Structure

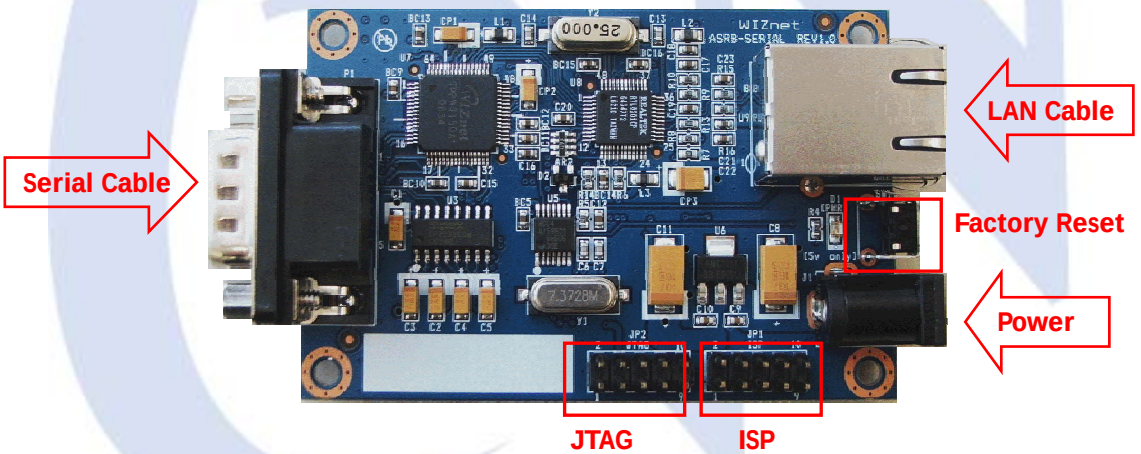
- Ethernet cross cable to connect the LAN ports of PC and ASRB-SERIAL.
- RS-232 cable to connect the COM port of PC (usually COM1 or COM2) and serial port of ASRB-SERIAL.

3.1. Hardware Installation procedure

The following items are required to get started.

- Power Cable, Serial and Ethernet Cables
- PC or Laptop with Network Interface Card (hereafter, NIC) and/or one RS232 serial port

Follow steps below to prepare the module and evaluation board for testing.



STEP 1: Connect the 5V DC power line to the power jack of the ASRB-SERIAL board.

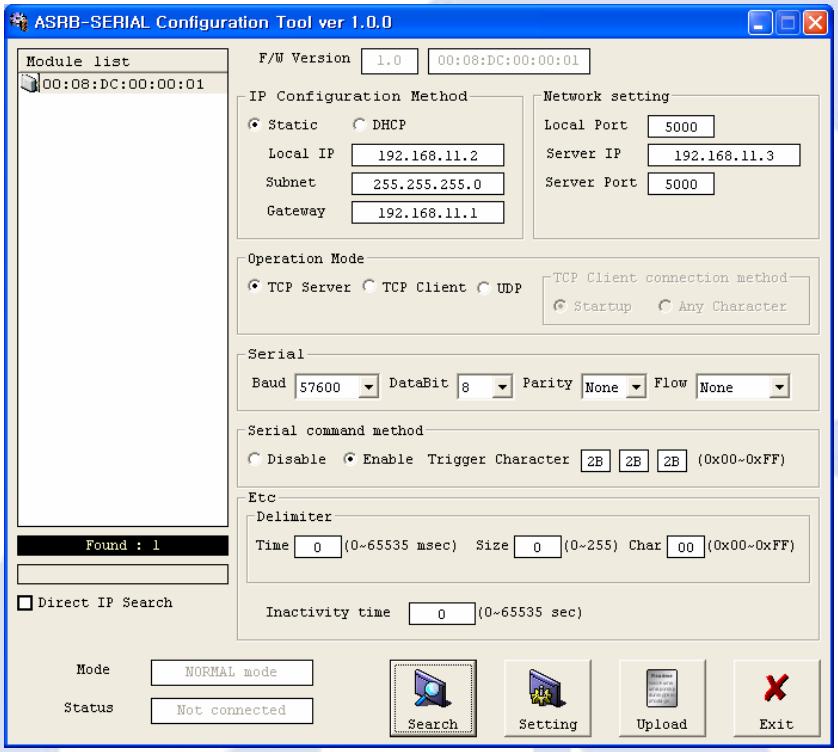
STEP 2: Use the RJ45 Ethernet cable in order to connect the board to an Ethernet network.

STEP 3: Use the serial data cable to connect the board to a serial device.

3.2. Case 1: Serial to Ethernet function test

STEP1: Power on the ASRB-SERIAL board.

STEP2: Configure the ASRB-SERIAL using configuration Tool as shown in following figure.



STEP3: Run terminal emulator program (e.g. Hyper terminal) on Test PC.

STEP4: Set the baud rate as the same value of the ASRB-SERIAL.

STEP5: Execute another Hyper terminal and set the IP address and port number.

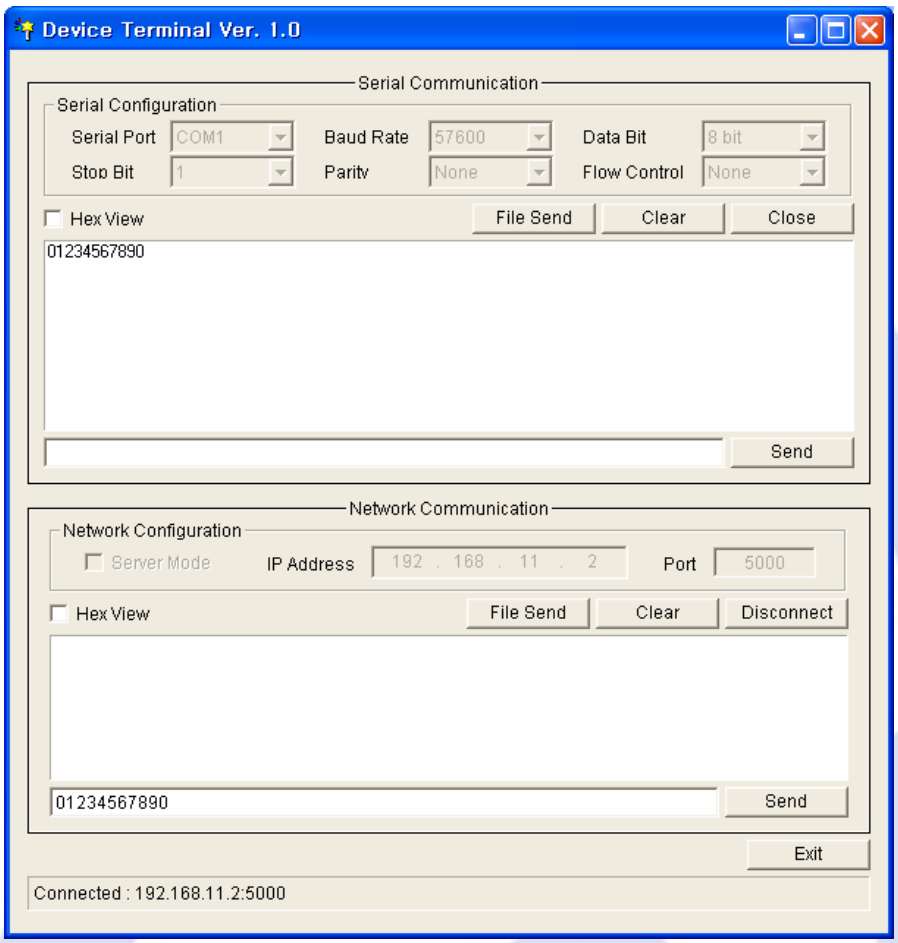
STEP6: Type some character on the serial Hyper terminal screen. In this example, "01234567890" is entered.

STEP7: Make sure this data is shown on the Network Hyper terminal window. (Serial to Ethernet)

STEP8: As the same way, type some characters on the network Hyper terminal, and then make sure these data are shown in the serial Hyper terminal window. (Ethernet to Serial)

* You can also test the function by using Device Terminal program provided by WIZnet. In this program, you can check the data communication through serial and network terminals in one

screen as shown below.



3.3. Case 2: Changing IP address using serial command mode

STEP1: Check the three trigger characters at the Configuration program. For example, assume the trigger is "2B 2B 2B"

STEP2: Check the serial port setting such as baud rate of the module.

STEP3: Start HyperTerminal program and set the serial port of the PC to the serial setting of the module checked in STEP2.

STEP4: Use HyperTerminal program to send three trigger characters to enter the serial command mode; **+++** (in hex :0x2B 0x2B 0x2B) in this case.

STEP5: Use HyperTerminal program to send "**<WI192.168.11.10>**"
(command to change the IP address as 192.168.11.10)

STEP6: HyperTerminal program displays "**<S>**"
(Indicate the command was executed successfully)

STEP7: Use HyperTerminal program to send "**<RI>**" (command to request IP address)

STEP8: HyperTerminal program displays "**<S192.168.11.10>**"

(Indicate the command was executed successfully and IP address is 192.168.11.10)

STEP9: Use HyperTerminal program to send "**<WR>**"

(command to exit serial command mode)

☞ All changes are applied after exiting the serial command mode.

4. Hardware Description of ASRB-SERIAL

4.1. Parameters

- Power 5V DC / 180mA
- Dimension 75 x 50 x 17 (L x W x H)
- Temperature Operating : 0 ~ 80 ℃
- Ethernet 10/100 Base-T Ethernet (Auto detection)
- Serial interface RS-232

4.2. Specification

- MCU ATmega128L(7.3728 MHz)
- FLASH 128Kbyte (MCU Internal)
- SRAM 4Kbyte (MCU Internal) + 32Kbyte (External)
- EEPROM 4Kbyte (MCU Internal)

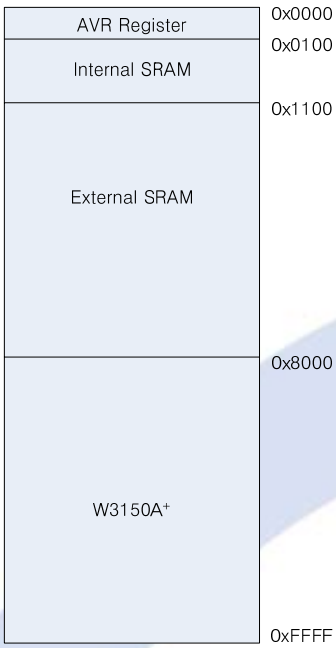
4.3. Memory Map

The ATmega128 has FLASH, SRAM and EEPROM as below.

- FLASH : 0x00000 ~ 0x1FFFF
- SRAM : 0x0100 ~ 0x10FF (The register space is below 0x0100)
- EEPROM : 0x0000 ~ 0xFFF

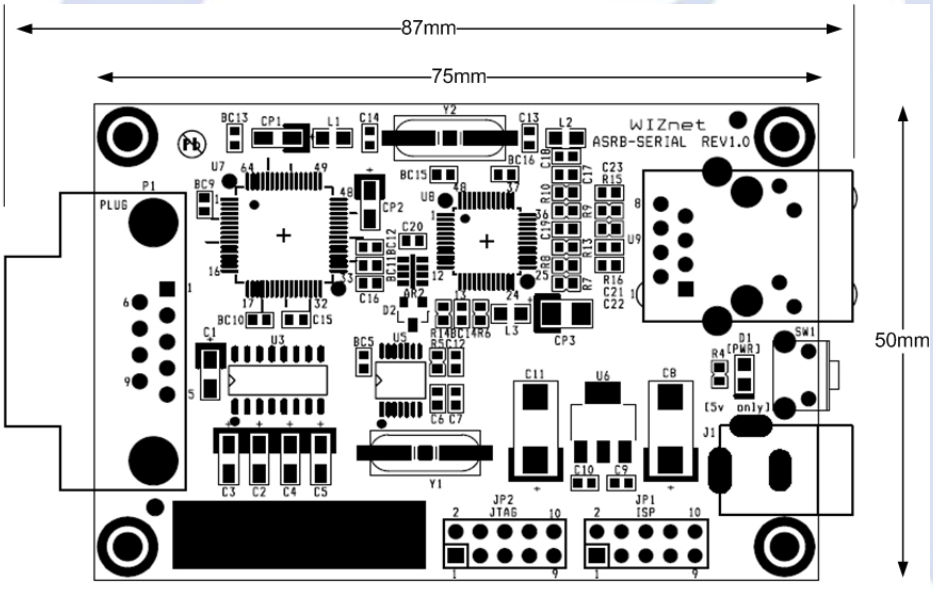
The address space of other devices is as below.

- External SRAM : 0x1100 ~ 0x7FFF
- W3150A+ : 0x8000 ~ 0xFFFF



4.4. Board Dimensions and Pin Assignment

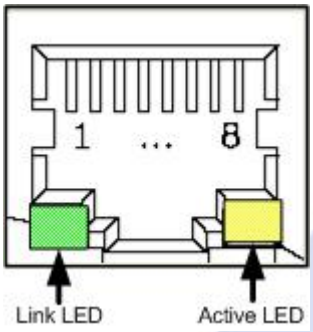
4.4.1. Dimensions



4.4.2. Pin Assignment

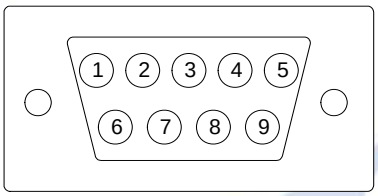
4.4.2.1. RJ45

Ethernet port Pinouts



Pin	Signal
1	TX+
2	TX-
3	RX+
6	RX-

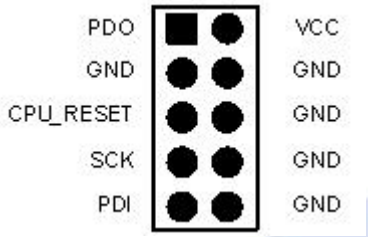
4.4.2.2. RS-232



Pin Number	Signal	Description
1	NC	Not Connected
2	RxD	Receive Data
3	TxD	Transmit Data
4	DTR	Data Terminal Ready
5	GND	Ground
6	DSR	Data Set Ready
7	RTS	Request To Send
8	CTS	Clear To Send
9	NC	Not Connected

4.4.2.3. AVR ISP

AVR ISP (JP1) Pin Mapping



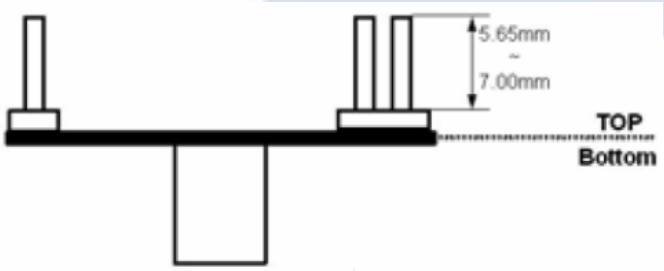
SIGNAL	Pin Number	I/O	Description
VCC	2	-	Power is delivered to the AVRISP
GND	3,4,6,8,10	-	Ground
PDO	1	Input	Commands and data from AVRISP to ASRB-SERIAL
PDI	9	Output	Data from ASRB-SERIAL to AVRISP
SCK	7	Input	Serial Clock, Controlled by AVRISP
CPU_RESET	5	Input	Reset. Controlled by AVRISP

5. Programming Guide

- ISP

The AVRISP combined with "AVR Studio" can program all AVR MCU(in this module, ATmega128) through ISP interface (JP1). The AVRISP can program both of flash and EEPROM, and support fuses and lock bit programming. For more information about AVRISP, go to ATMEL webpage (www.atmel.com)

The AVRISP usually has 6pin connector, but 10pin connector is used in this module. So, ISPGENDER is provided shown below.



For more information about this gender, refer to "ISP GENDER User Guide Vx.x.pdf"

The ATmega128 use 7.3728MHz crystal. The AVRISP frequency must be 1/4 of the MCU clock or less. We recommend use 1MHz for AVR ISP frequency.

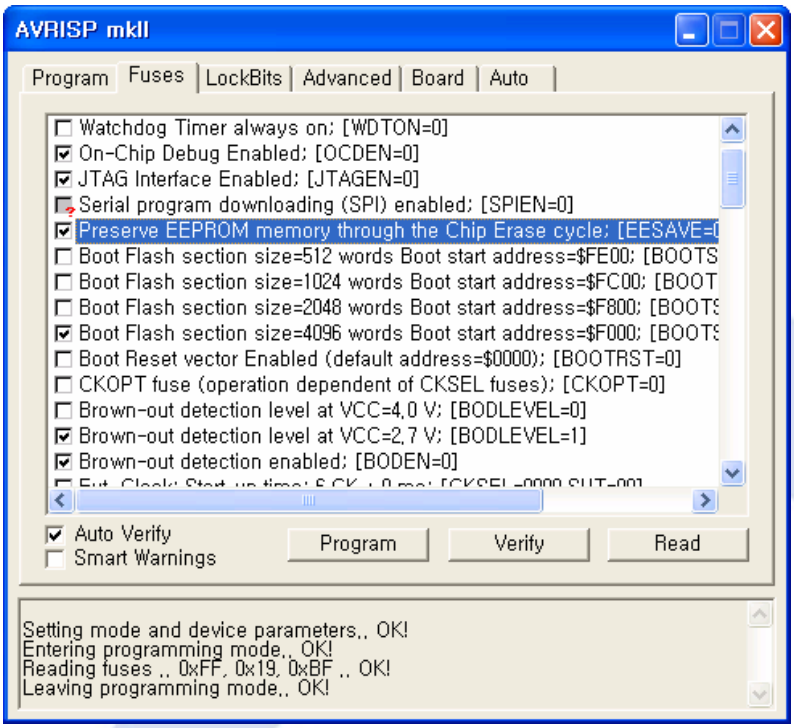
- JTAG

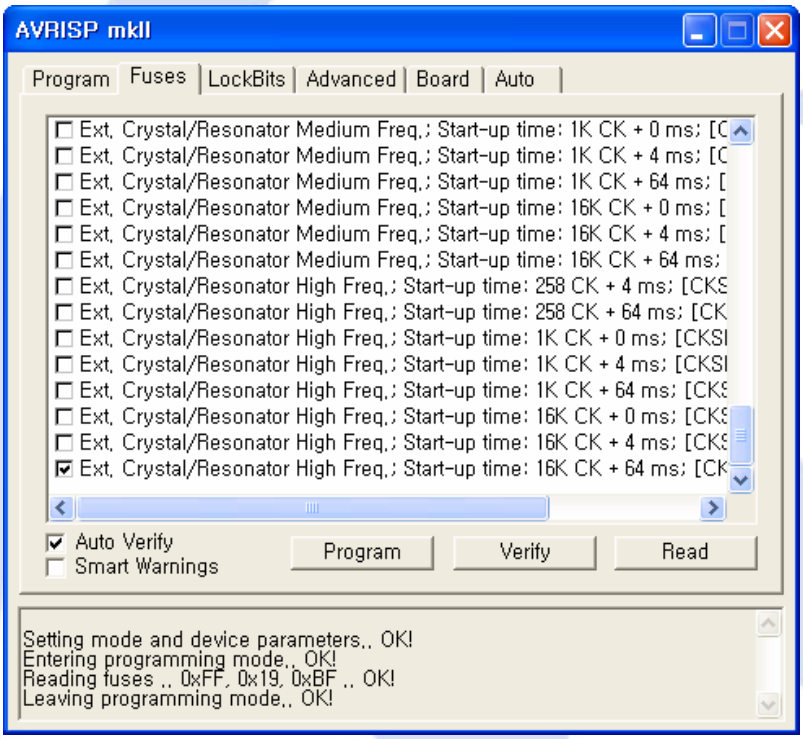
The AVR JTAGICE supports debugging through JTAG interface. It can program Flash, EEPROM, fuses and lock bit. The main function is code debugging with "AVR Studio". For more information, about AVR JTAGICE, refer to ATMEL webpage (www.atmel.com)

- Default Setting Value of ATmega128 Fuses & Lock bits

AS-RB Parallel board is provided with following setting value. In this document, the items of value '1' are displayed.

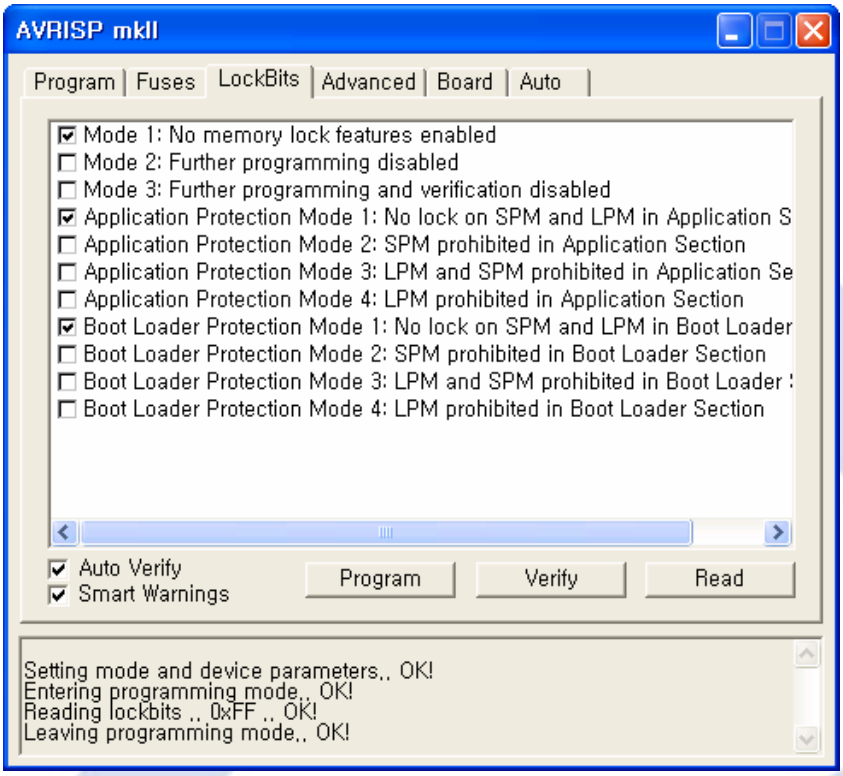
  - Fuses
    - On-Chip Debug Enabled
    - JTAG Interface Enabled
    - Preserve EEPROM memory through the Chip Erase cycle
    - Boot Flash section size=4096 words
    - Brown-out detection level at VCC=2.7V
    - Brown-out detection enabled
    - External Crystal/Resonator High Frequency. Start-up time : 16K CK + 64ms





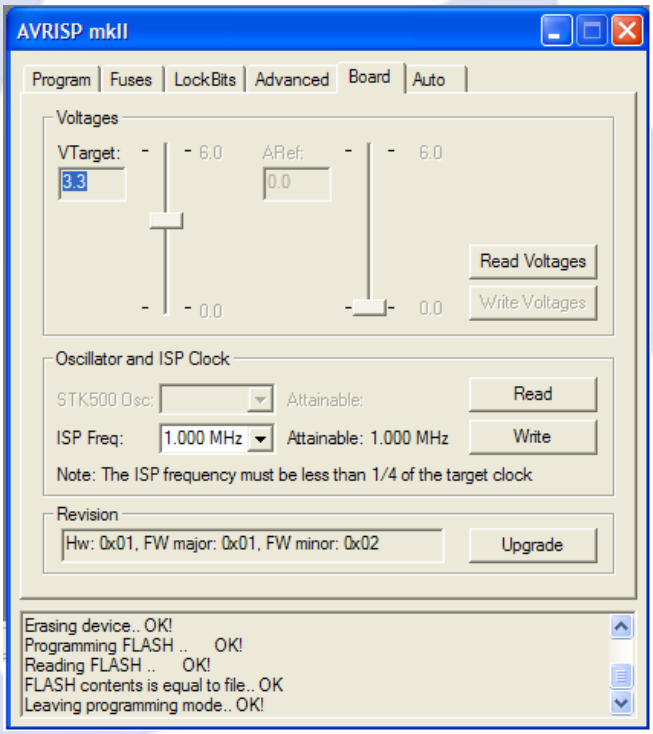
- Lock Bits
  - Mode1 : No memory lock features enable
  - Application Protection Mode 1 : No lock on SPM and LPM in Application Section
  - Boot Loader Protection Mode 1 : No lock on SPM and LPM in Boot Loader

Section



◆ Board option

– ISP frequency must be set as 1.000MHz or under.



If you don't check [Preserve EEPROM memory through the Chip Erase cycle], ASRB-SERIAL Board will lose MAC address. If the information in the EEPROM is lost, input MAC Address according to below steps.

1. If the information in the EEPROM is deleted, below message is output through serial port.

> ASRB-SERIAL Init.
> Send MAC :

2. If 'S'(upper character) is input, 'R' is output as a response.
3. Input MAC Addresss marked on the board except of ':' ex) 0008DC000001
4. If MAC address is input, 'C' is output.

6. Warranty

WIZnet Co., Ltd offers the following limited warranties applicable only to the original purchaser. This offer is non-transferable.

WIZnet warrants our products and its parts against defects in materials and workmanship under normal use for period of standard ONE(1)YEAR for the ASRB-SERIAL board and labor warranty after the date of original retail purchase. During this period, WIZnet will repair or replace a defective products or part free of charge.

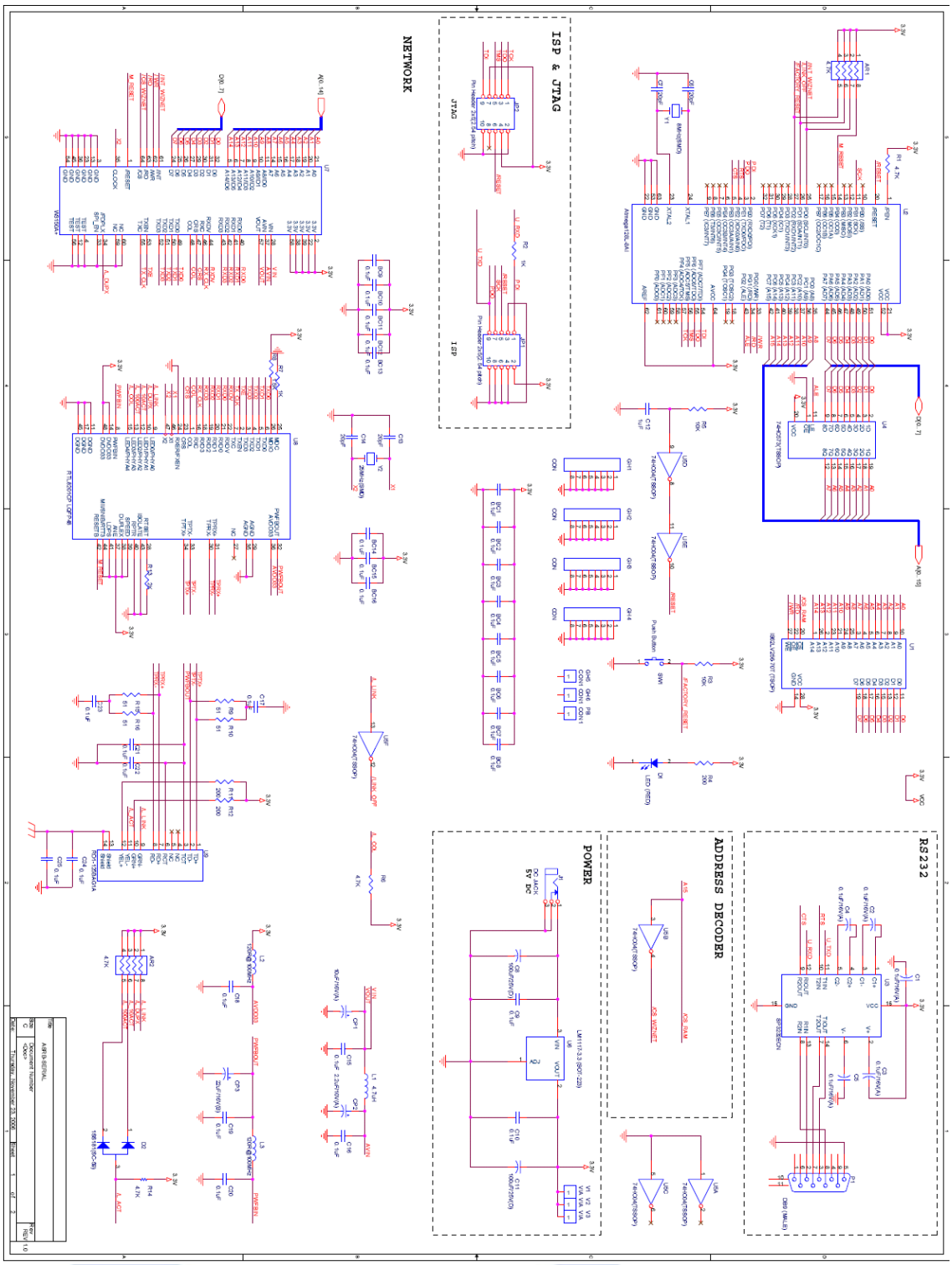
Warranty Conditions:

1. The warranty applies only to products distributed by WIZnet or our official distributors.
2. The warranty applies only to defects in material or workmanship as mentioned above in 6.Warranty. The warranty applies only to defects which occur during normal use and does not extend to damage to products or parts which results from alternation, repair, modification, faulty installation or service by anyone other than someone authorized by WIZnet Inc. ; damage to products or parts caused by accident, abuse, or misuse, poor maintenance, mishandling, misapplication, or used in violation of instructions furnished by us ; damage occurring in shipment or any damage caused by an act of God, such as lightening or line surge.

Procedure for Obtaining Warranty Service

1. Contact an authorized distributors or dealer of WIZnet Inc. for obtaining an RMA (Return Merchandise Authorization) request form within the applicable warranty period.
2. Send the products to the distributors or dealers together with the completed RMA request form. All products returned for warranty must be carefully repackaged in the original packing materials.
3. Any service issue, please contact to sales@wiznet.co.kr

Appendix A - Schematics



Appendix B - Parts List

		ASRB-SERIAL Partlist V.1.0		
Item	Q'ty	Reference	Part	Maker
1	5	R1,AR1,AR2,R6,R14	RESISTER 4.7K	
2	2	R2,R7	RESISTER 1K	
3	2	R5,R3	RESISTER 10K	
4	3	R4,R11,R12	RESISTER 200	
5	1	R8	RESISTER 1.5K	
6	4	R9,R10,R15,R16	RESISTER 51	
7	1	R13	RESISTER 2K	
8	29	BC1,BC2,BC3,BC4,BC5,BC6, BC7,BC8,BC9,BC10,BC11, BC12,BC13,BC14,BC15,BC16, C9,C10,C15,C16,C17,C18,C19, C20,C21,C22,C23,C24,C25	CAPACITOR 0.1uF	
9	4	C7,C6,C13,C14	CAPACITOR 20pF	
10	1	C12	CAPACITOR 1uF	
11	1	CP1	CAPACITOR TANTAL 10uF/16V(A case)	
12	1	CP2	CAPACITOR TANTAL 2.2uF/10V(A case)	
13	1	CP3	CAPACITOR TANTAL 22uF/16V(B case)	
14	5	C1,C2,C3,C4,C5	CAPACITOR TANTAL 0.1uF/16V(A case)	
15	2	C8,C11	CAPACITOR TANTAL 100uF/25V(D case)	
16	1	L1	INDUCTOR 4.7uH(2012 SIZE)	
17	2	L3,L2	BEAD 120R@100MHz (2012 SIZE)	
18	1	D1	CHIP LED (RED) 2012 SIZE	
19	1	D2	1SS181(SC-59)	
20	1	JP1	Pin Header 2x5(2.54 pitch)	
21	1	J1	DC JACK(5pi) 3PIN DIP	
22	1	P1	DB9 (MALE)	
23	1	SW1	RIGHT ANGLE 4PIN DIP Push Button	
24	1	U1	IS62LV256-70T (TSOP)	
25	1	U2	Atmega128L-8AU	
26	1	U3	SP3232ECN	
27	1	U4	74HC573(TSSOP)	
28	1	U5	74HC04(TSSOP)	
29	1	U6	LM1117-3.3 (SOT-223)	
30	1	U7	W3150A+	WIZNET
31	1	U8	RTL8201CP LQFP48	REALTEK
32	1	U9	RD1-125BAG1A	UDE
33	1	Y1	CRYSTAL 7.3728MHz(SMD)	
34	1	Y2	CRYSTAL 25MHz(SMD)	
35	1		PCB ASRB-SERIAL REV1.0	

*Chip R,C : 1608 size , All of the parts are Lead Free.