7188E Series

7188E Series Hardware User's Manual

7188E Series New Features
1. Virtual COM Technology
2. Ethernet I/O Technology
3. Web-server Technology
4. MiniOS7 & Xserver Inside
5. I/O Expansion Bus Inside
6. Time to market & Cost Effective Solution

⟶

Your Powerful Tools

↓

Create New Ideas

↓

Create New Applications
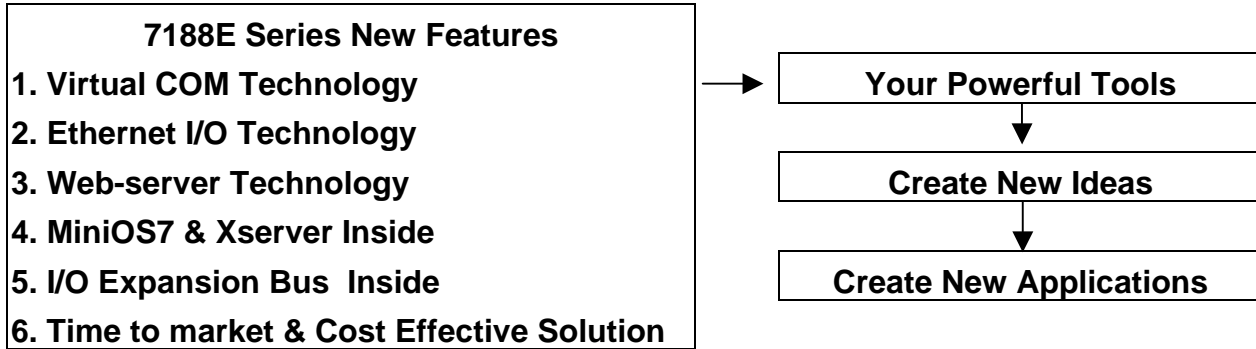
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Table of Contents

1. Introduction

1.1 Package List & Release Note

Package List

In addition to this manual, the package includes the following items:

- One 7188E hardware module
- One hardware user's manual (this manual)
- One software user's manual
- One release note
- One software utility disk or CD
- One download cable, CA0910

Note:

If any of these items are missed or damaged, contact the local distributors for more information. Save the shipping materials and cartons in case you want to ship in the future.

Release Note:

It is recommended to read the **release note & README.TXT** first. The release note is given in the shipping. The README.TXT is given in the CD\README.TXT. Some important information is given in the release note & CD\README.TXT

Order Information:

Call distributor for details.

More Quick Start:

Step 1: Refer to section 3 of this manual for general quick start

Step 2: Refer to **CD\napdos\7188e\document\7188E_Quick_Start.pdf** for module specific quick start. The special modules are given as follows:

- 7188E1, 7188E2, 7188E3, 7188E4, 7188E5, 7188E8
- 7188EX, 7188EA
- 7188EX+X???

It is recommended to begin with quick start to get complete information.

Firmware of Default Shipping:

MiniOS7 → CD\napdos\7188e\minios7\???.img

Firmware → CD\napdos\7188e\TCP\vxcomm\Server(7188e)*.* → by model no.

1.2 Why Ethernet Solutions?

"Embedded Internet" and "Embedded Ethernet" are hot topics today. Nowadays Ethernet protocol has become the de-facto standard for local area networks. Via the Internet, connectivity is occurring everywhere, from home appliances, to vending machines, to testing equipment, to UPS...etc. Many embedded designers now face the dilemma of adding an Ethernet interface to their products (either for use with local networks or for connecting to the Internet). Solutions to this problem include both hardware and software. Connecting via Ethernet requires a communication protocol called TCP/IP. The installed base of Ethernet networks is huge and growing. Most office building, factories, and new homes have an installed Ethernet network. With Ethernet, the network is always available. Using Ethernet for network in industrial areas is appealing because the required cabling is already installed.

The 7188E series are a series of embedded controllers designed to meet the most common requirements of Internet/Ethernet applications. They can be used to replace the PC or PLC in harsh environments.

The 7188E series provides one on-board 10BASE-T port that is directly driven by a NE2000 compatible Ethernet controller. The 10BASE-T port is equipped with a RJ-45 connector. The 10BASE-T interface supports a maximum of 100 meters cable (22 AWG to 26 AWG) length between devices and hubs. To link the 7188E and other devices through a 10BASE-T hub, simply use two straight-through cables: one cable connects to 7188E; the other cable connects the hub to the other device.

1.3 Why VxComm Technology?

There are many RS232 devices in the factory. Linking all these RS232 devices to a central computer is important in industry automation. There are many different approaches to link these devices together. Some important approaches are given as follows:

● Old approach: Using multi-serial-ports card
● Improved approach: Using RS-485 network (RS-485 to RS-232 converter)
● New approach: Using Ethernet network (Ethernet to RS-232 converter)

1.3.1 Using Multi-Serial-Ports Cards

These multi-serial-ports cards can be installed into the central computer and linked to the RS-232 devices as follows:
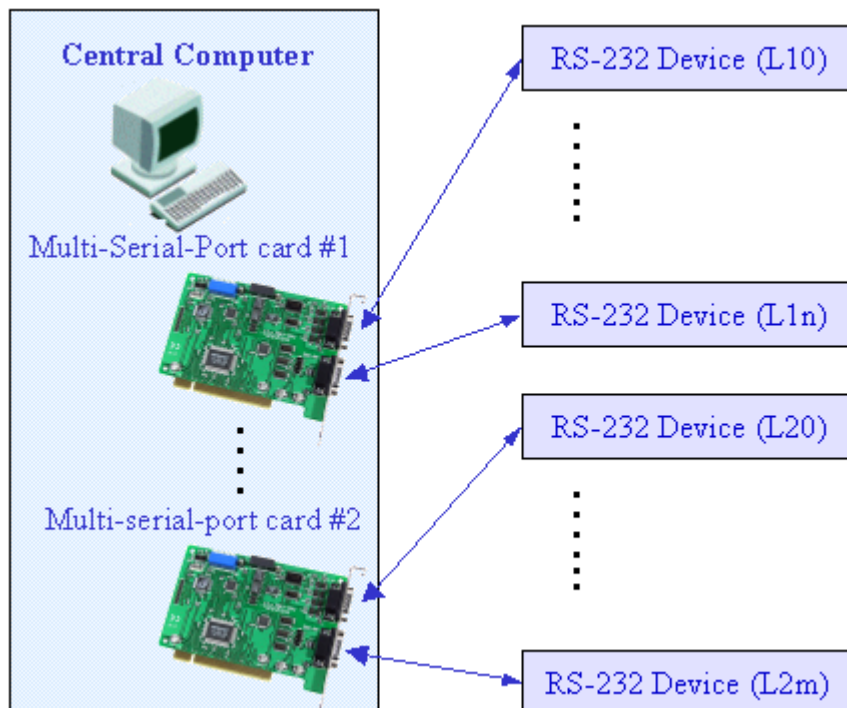
If the RS-232 devices are very close to the central computer, this approach will work even if the wiring is complicated. Unfortunately, these RS-232 devices are always distributed in factories. So the connection wires, L10…L1n & L20…L2m, are very expensive and difficult to maintain.

1.3.2 Using a RS-485 Network

The 752N family is designed as a RS-232 to RS-485 converter. Therefore, they can be used to link these RS-232 devices to a central computer as follows:
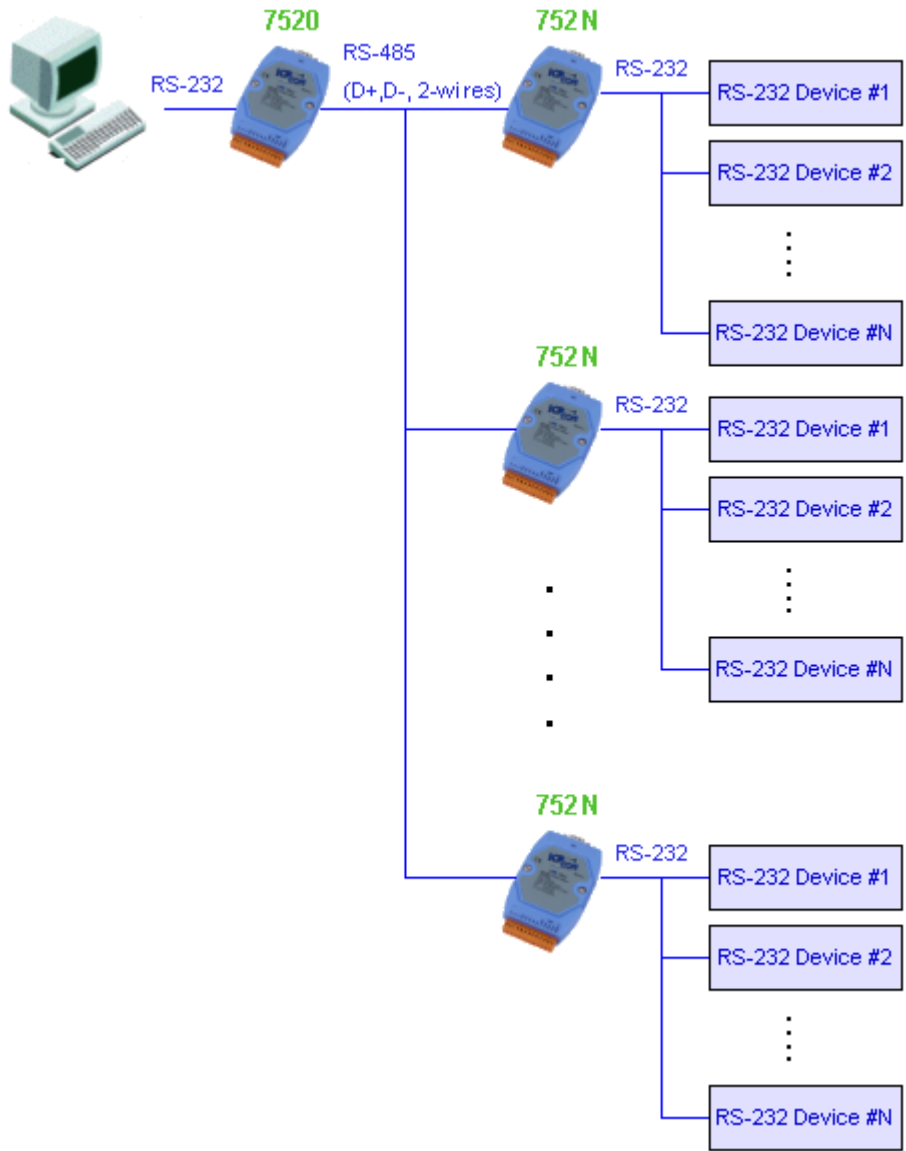
Even though these RS-232 devices are distributed in the factory, the RS-485 network is simple and easy to maintain. Therefore, RS-485 network is a very successful approach. Refer to "7188XA/B/C & 7521/2/3 Series User's Manual" for more information about 752N family.

1.3.3 Using an Ethernet Network

The 7188E family is designed as a RS-232 to Ethernet converter. So it follows that they can be used to link these RS-232 devices to central computer as follows:

Compared to the RS-485 network, these Ethernet network hubs are already in existence for system network. Therefore, the RS-232 devices can find the closest 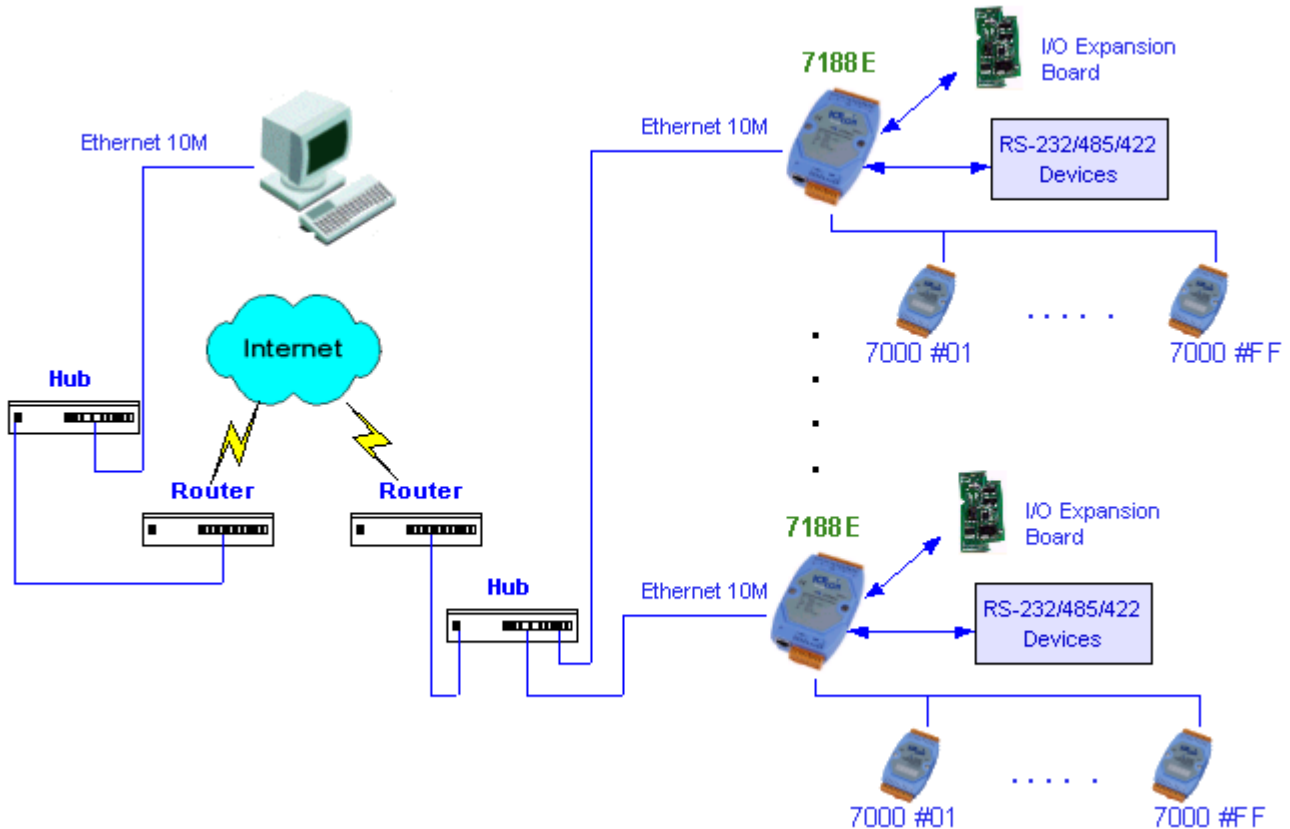hub and link to the central computer with the help of the 7188E family. The Ethernet network is extremely popular and already existing for most applications, hence, this approach is a very successful. Refer to "7188E Series Software User's Manual" for more information about the 7188E family.

When linking these devices together, users must write a program to read/write to the 7188E family. In general, it is more difficult to write a TCP/IP program than a COM 1/2 program. **Therefore**, **the VxComm technology is developed to virtualize COM-ports of the 7188E to become COM 3/4/5…/256 of the central computer.** Then users can write a COM port program to link these RS-232 devices need not to concern themselves with any TCP/IP problem.

In some factories, there are old systems still running and in case. These old systems only support COM port applications. Therefore, the Vxcomm technology can be used to upgrade these old systems to support Ethernet network.

To recap, the VxComm technology is useful as follows:

- **Provides a much easier interface for software programmers.**
- **Keeps the old systems going without program modification**

The block diagram of VxComm technology for 7188E/8000E family is given as follows:
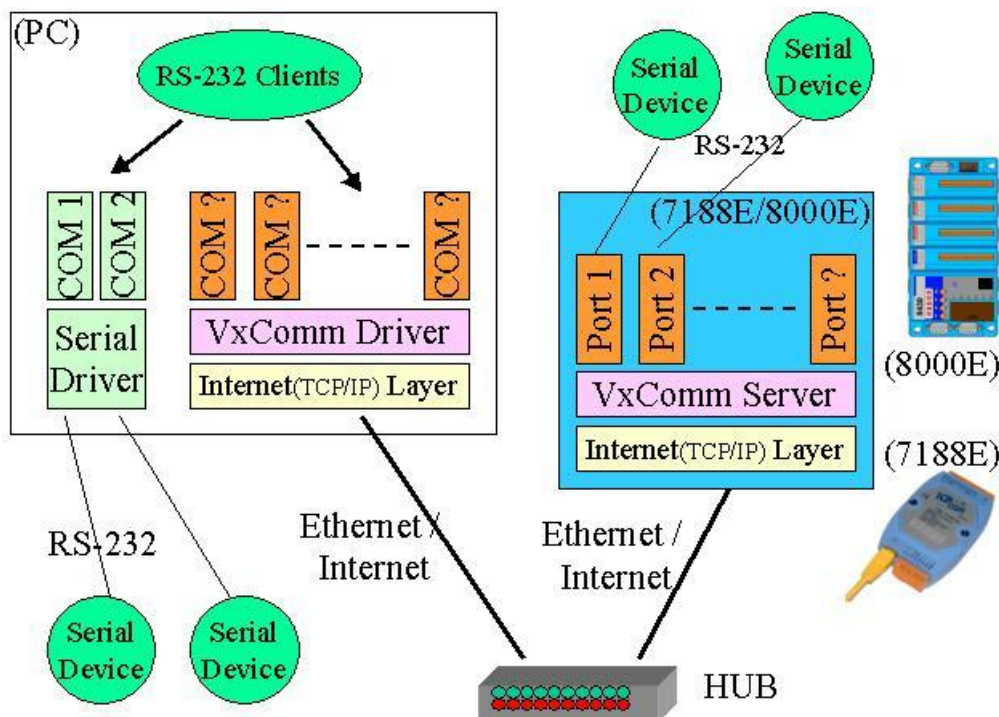
The VxComm technology can be used to virtualize COM ports of the 7188E/8000E to become a COM port of PC. With the help of VxComm driver, users can access the remote COM port of the7188E/8000E just as them would access the PC's COM 1/2.

Note:
1. The 7188E family includes 7188E1/2/3/4/5/8/X/A.
2. The 8000E family now includes 8430/8830/8431/8831
3. **The VxComm driver now supports Windows NT/2000/XP. We will provide the Windows 95/98 driver around Q2 ~ Q3 of 2002.**

1.4 Why Xserver Technology?

Ethernet is extremely popular, so you can find it nearly everywhere. For industry applications, there are some important issues that are given as follows:
- Linking RS232 devices to Ethernet network
- Reading analog/digital input signals from Ethernet network
- Sending analog/digital output control to Ethernet network
- Standing alone operation
- True distributed computation.
- Working stably and reliably as PLC
- Easy programming and maintenance

The Xserver is designed to solve all the above problems

1 Linking RS232 devices to Ethernet network
   The Xserver provides port 10000 for serial port configuration and port 10001 to 10008 for data sending/receiving. So its built-in function is to link RS-232 devices.
2 Reading analog/digital input signals from Ethernet network
3 Sending analog/digital output control to Ethernet network
   The Xserver supports easy interface to the 7000 family. So its basic function is to link to 7000 family for analog/digital I/O. The Xserver also support an I/O expansion bus for user's special devices.
4 Standing alone operation.
5 True distributed computation.
   The Xserver supports a loop-scan function and a timer trigger function to assist Xserver in data acquistition, data analysis and performing immediate, real-time control. The event-trigger function makes Xserver send a TCP/IP packet to destination immediately when an emergency is occurred. In general, Xserver can make the 7188E/8000E work perfectly for both data acquisition and control application.
6 Working stably and reliably as PLC
   The most important codes of Xserver are provided by ICPDAS. We have spent thousands of hours designing and testing this server. Consequently, this server is as stable as PLC without any user's additional programs. If users add their tailor made additions, the dual-watchdog mechanism and well-designed user interface will make this new Xserver stable enough for

any purpose.
7   Easy programming and maintenance
    The Xserver supports easy interfaces to our 7000 family. Its basic function
    is to link to the 7000 family for analog/digital I/O.

The block diagram of the Xserver for 7188E/8000E Family is given as follows:
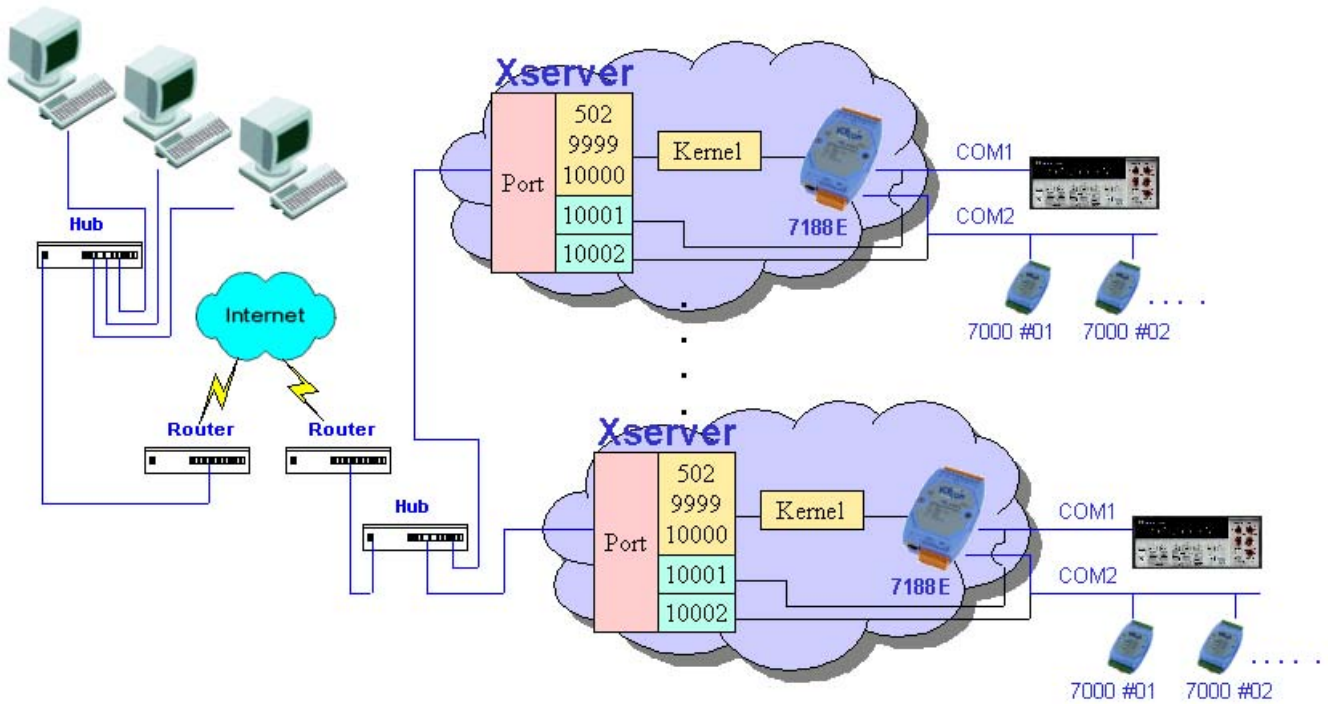
The Xserver is a programmable server designed for the 7188E/8000E family. With the help of Xserver, the user can easily write a tailor-made program for data acquisition and control within a stable system.

Note:
1. The 7188E family includes 7188E1/2/3/4/5/8/X/A.
2. The 8000E family now includes 8430/8830/8431/8831
3. **The Xserver supports standard TCP/IP protocol. So it can be used in any O.S. that supports TCP/IP protocol. Windows 95/98/NT/2000/XP/CE and Linux support TCP/IP protocol are all suitable environments for our Xserver.**

1.5 Why Web Server Technology?

The standard HTML browsers, for example, IE or Netscape, are popular and easy to use. Users can access 7188EA using standard browsers as follows:

Step 1: Use standard browser, IE or Netscape, to access 7188EA as follows:

Step 2: Click **I-7188EA WEB SERVER DEMO** to enter D/I/O page as follows:
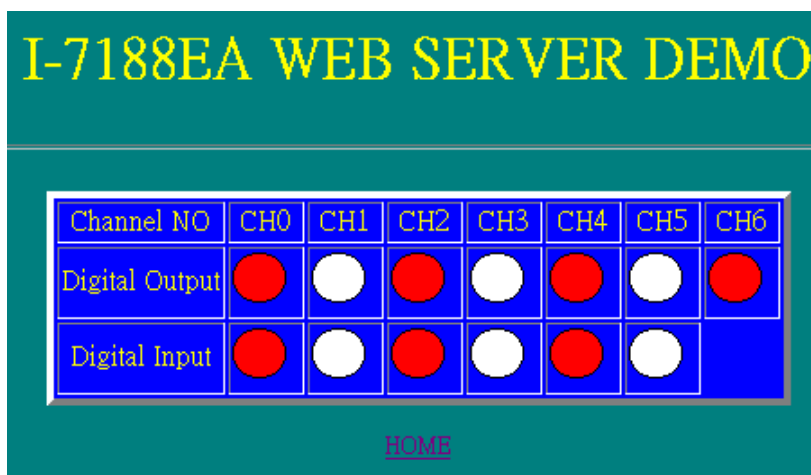
Step 3: Click D/O icon to toggle its state and the state of D/I will be shown in the screen.

Note: we can **not** provide an easy interface for user's special design web-page now. But user can design his web page in PC & email to service@icpdas.com. We will convert it to destination file free of charge. We will provide an easy interface for user's special web-server around **Q2 ~ Q3 of 2002.**

1.6 7188EX, 7188EA & 7188EN Series

I-7188EX is powered by an 80188-40 processor with 512K bytes of static RAM, and 512K bytes of Flash memory. One serial RS-232 port and one RS-485 port are provided. Ethernet support is provided by a NE-2000 compatible controller with 16K bytes of on-chip buffer memory and 10Base-T media interface. The I-7188EX also provides 14 user defined I/O pins. A cost-effective I/O expansion board with A/D, D/A, relays drivers and protected inputs is available. The I-7188EX also supports battery back-up SRAM boards and Flash-Rom boards, providing non-volatile mass storage from 128K bytes megabytes to 64 megabytes. The 10BASE-T port is equipped with a RJ-45 connector. The 10BASE-T interface supports a maximum of 100 meters cable(22 AWG to 26 AWG) length between the I-7188EX and network hubs.

Compared to the I-7188EX, the I-7188EA adds seven open-collector output channels and six digital Input channels. The I/O Expansion bus has been occupied by a DI/O expansion board.

The I-7188EX, an Embedded Internet/Ethernet Controller, focuses on embedded control applications while the I-7188EN, an Internet Communication Controller, focuses on communication applications. Depending on different embedded firmware programs, the Internet Communication Controller can be used as either one Device Server, one Addressable Ethernet to RS-232/485/422 Converter, or one Embedded Internet/Ethernet Controller. Users should refer to comparison table to choose optimal product. Currently, we offer a wide range of Internet Communication Controllers, such as I-7188E1/E2/E3/E4/E5/E8. Except the RTC circuitry, the basic hardware of I-7188EN is similar to I-7188EX. Since there are too many Configurations for the I-7188EN series product, an OEM or ODM version is welcomed.

Note:
1. **7188E1/2/4/5/8** → **Internet Communication Controllers**
2. **7188E3/7188E3-232** → **Internet Communication Controllers with D/I/O**
3. **7188EA** → **Embedded Internet/Ethernet Controllers with D/I/O**
4. **7188EX/7188EX-256** → **Expandable Embedded Internet/Ethernet Controllers**
5. **OEM or ODM is welcome**

2. Typical Applications of 7188E Series

2.1 RS-232/485/422 Devices Networking

2.1.1 Using Virtual COM Technology

The 7188E1/2/3/4/5/8 are designed for linking RS-232/485/422 device to Ethernet network. With the help of VxComm utility, the built-in COM port of 7188E can be virtualized to standard COM port of host-PC as follows:
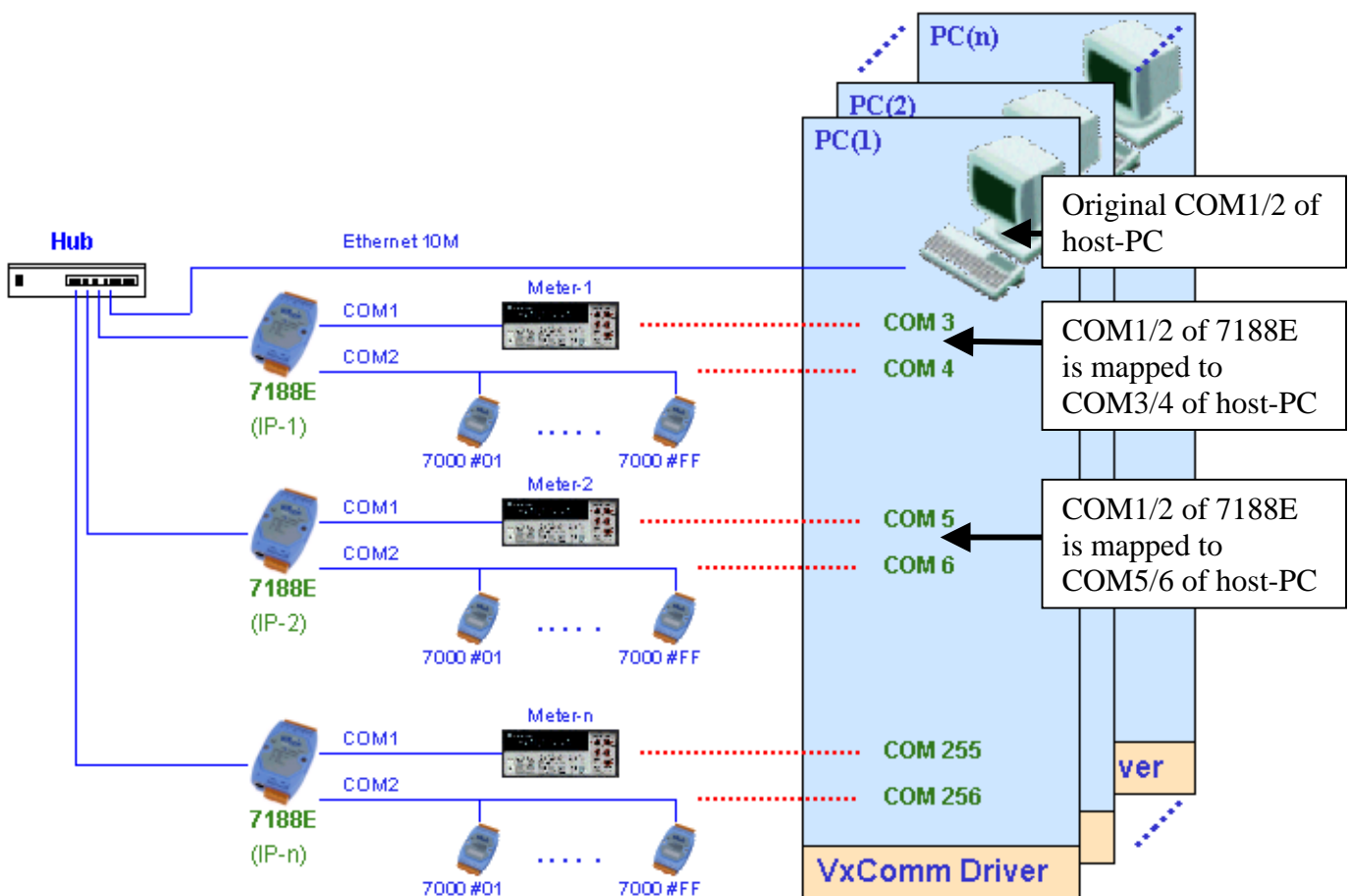
In the above configuration, the Meter-1 is virtualized to become COM3 of host-PC. Therefore the original program designed for MS-COMM standard can access meter **without any modification.**

2.1.2 Using Xserver Technology

Xserver supports below ports to service request from clients.

- Port-502: Read/write to devices using Modbus protocol.
- Port-9999: Read/write the expansion board mounted on the 7188E.
- Port-10000: Read/write the configuration of all COM ports of 7188E.
- Port-10001: Read/write to COM1 of 7188E series.
- Port-10002: Read/write to COM2 of 7188E series.
- ……….
- Port-10008: Read/write to COM8 of 7188E series
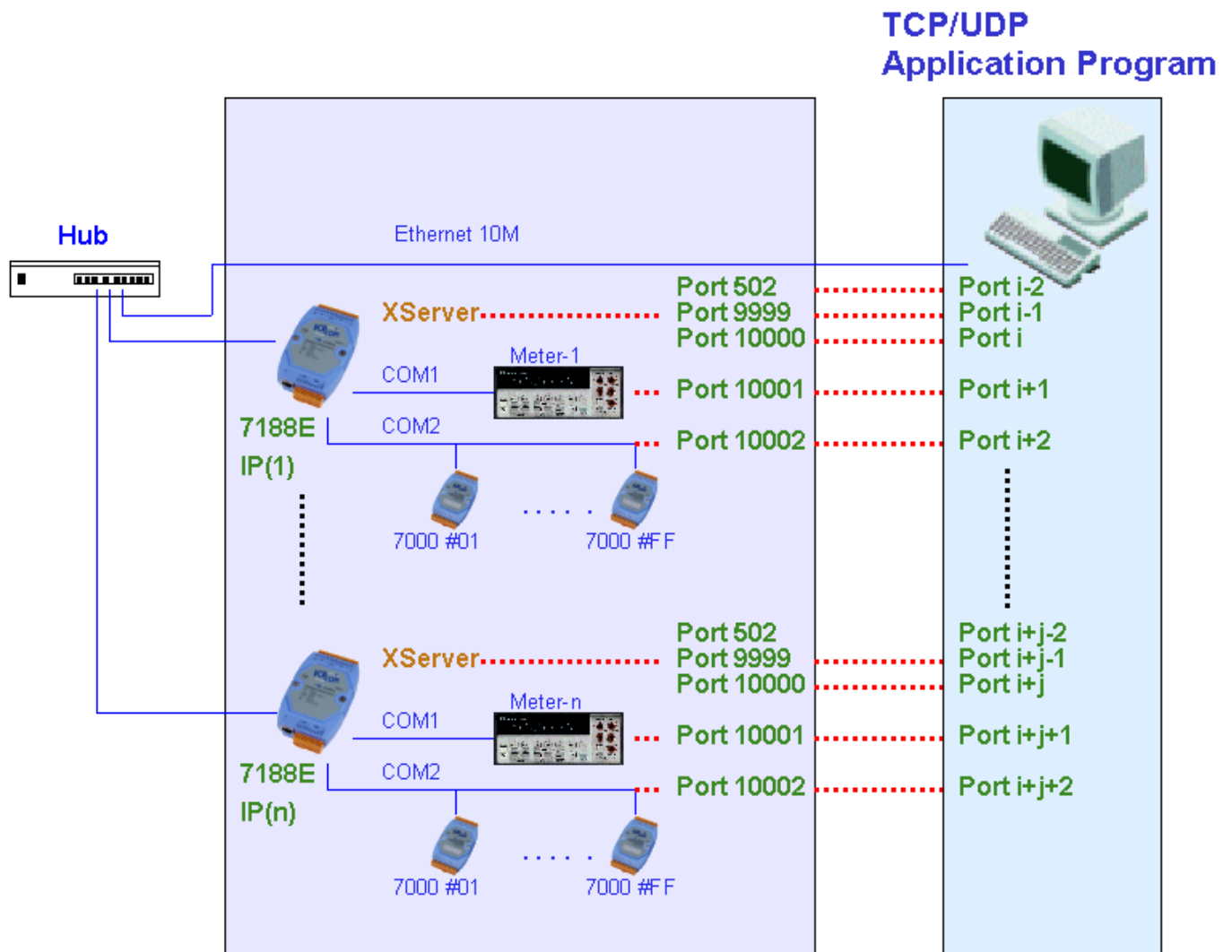
When one client program in PC sends a TCP/IP packet to 7188E, if port=502, 9999 or 10000, the Xserver will recognize the packet is a command to control and re-configure the relative devices or COM ports. If port=10001, the Xserver will pass the data to COM1 and send the response from COM1 back to the client program in PC. This procedure is given as follows:

Step 1: Client program in PC sends TCP/IP packets to the 7188E.
Step 2: If port=(10000 + N), the Xserver sends this command to COM-port N of the 7188E.
      If port =502, 999, 10000, the Xserver will control and re-configure the relative devices or COM ports.
Step 3: If port=(10000 + N), the Xserver sends the responses of COM ports back to the client program in PC.
      If port =502, 9999 or 10000, the Xserver sends the return-code back to the client program in PC.

The Xserver approach supports user-defined command and stands alone capability. Using this application, users can design a new user-defined command for port 502, 9999 and 10000, and write a data acquisition and data compression routine in USER.C for high speed applications as follows:

Step 1: Client program in PC sends TCP/IP packets to the 7188E (port=10000).
Step 2: The Xserver recognizes the packets as user-defined commands.
Step 3: The Xserver sends the compressed-data saved in memory to the client program in PC

Note:
1. The Xserver will automatically, and continually, perform data acquisition and data compression all the time
2. Refer to Sec. 2.4 for more information.

2.2 Ethernet I/O Applications

The 7188E series provide 3 types of Ethernet I/O solutions. They are as follows:
1. Link to 7000 series modules
2. Install an available X??? into I/O expansion bus.
3. User designs a special design X??? and install it onto the I/O expansion bus

2.2.1 Link to 7000 series modules

The 7000 series modules provide a variety of I/O operations, for example, D/I, D/O, A/D, D/A, Counter and Frequency Measurement. The 7000 series was originally designed for the RS-485 network. Therefore, COM2 of 7188E family is designed to link to 7000 family.

Using VxComm technology, old programs in PC can be upgraded from RS-485 network to Ethernet network without any program modification. Refer to Sec 2.1.1 for more information.

Using Xserver technology, the client program in PC can send TCP/IP packets to 7188E. The data in the TCP/IP packets can be converted to RS-485 commands and sent to the 7000 family. Also, the response from RS-485 network will be converted to TCP/IP packets and sent back to the client program in PC.

2.2.2 Install one X??? board onto I/O expansion bus

Refer to "I/O Expansion Bus for 7188X/7188E series User's Manual (Volume 1)" and "I/O Expansion Bus for 7188X/7188E series User's Manual (Volume 2)", and users will find many X??? boards that are already and available for various I/O operations. Users can find one expansion board to fit their requirements. Or they can send mail to **service@icpdas.com**T to request new specifications. We won't guarantee that we will design it immediately, but if the specifications are well-designed and perhaps needed by other users, we will design it as a standard X??? board.

2.2.3 User designs a special X???

Refer to "I/O Expansion Bus for 7188X/7188E series User's Manual", the detailed specifications are available for use. Also, some source codes of demo programs are available for user's reference. All of these available reference aids should be **enough** for a user to independently design an X??? board.

Why does the user need to design his X??? ? The typical reasons are given as follows:

- Protects his system
- No suitable X??? is ready and available for application
- Costs are lowered
- Student design for study

This approach makes the customized-solution come true as follows:
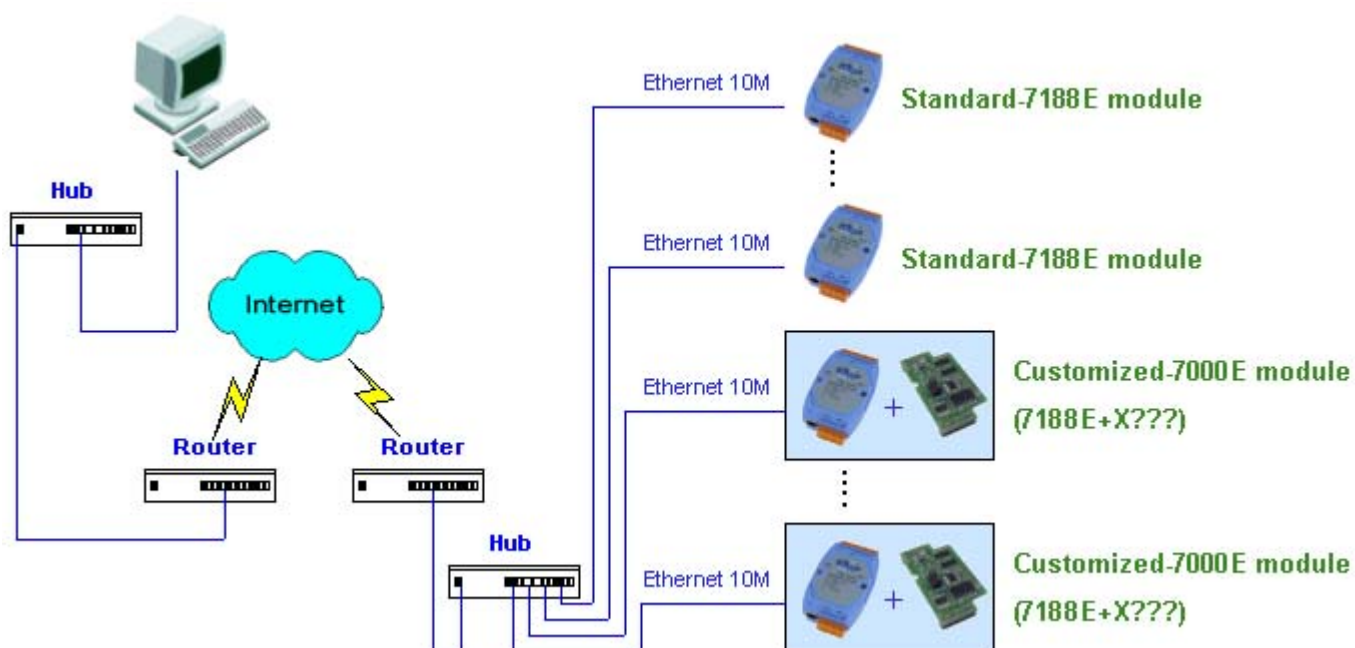
2.3   Link 7000 Series Modules to Ethernet

The 7000 family was originally designed for RS-485 network. Therefore, they are very robust and work well under the harsh environments of industry. Sometime, users need to link the 7000 family modules to Ethernet network. The possible solutions are given as follows:
- Using VxComm technology
- Using Xserver technology

The VxComm approach provides a MS-COMM-compatible interface. Therefore, the old programs may work without any modification. However, it is also limited by MS-COMM as follows:

Step 1: Sends command to module 1
Step 2: Reads response from module 1
Step 3: Sends command to module 2
Step 4: Reads response from module 2
………………………………………….
Step N: Sends command to module M
Step N+1: Reads response from module M
Step N+2: Computes results
Step N+3: Gos to step 1 for next loop

It is observable, the VxComm approach makes program read/write data one-by-one. If there are 100 sets of 7000 modules installed in the RS-485 network, the VxComm approach must read/write every 7000 module one by one. So it will take a long time. The drawbacks of this approach are given as follows:
- It may take long time if there are many 7000 modules installed in the RS-485 network
- All 7000 modules are slave devices, so they cannot take action in case of emergency event (the host-PC fails).

The Xserver approach provides a TCP/IP protocol interface, so user can design a client using the popular TCP/IP protocol interface. The most important feature is that the Xserver can link to TCP/IP clients and controls 7000 modules without any help of client programs. In other words, the Xserver is designed to solve the 2 problems that occur in the VxComm approach..

2.3.1 Performance of Xserver of 7188E & 7050

1.CPU:AMD K6-400
2.VB5.0 utility under Windows 98
3.Test Items: (1) Xserver scans the D/I of 7050 by "$AA6" command. (RS-485)
           (2) VB utility (running on PC) scans the Xserver of 7188E2 using "191" command(TCP/IP).
           (3) The time delay from signal-implementation until VB utility detection is approximate 6~12ms.
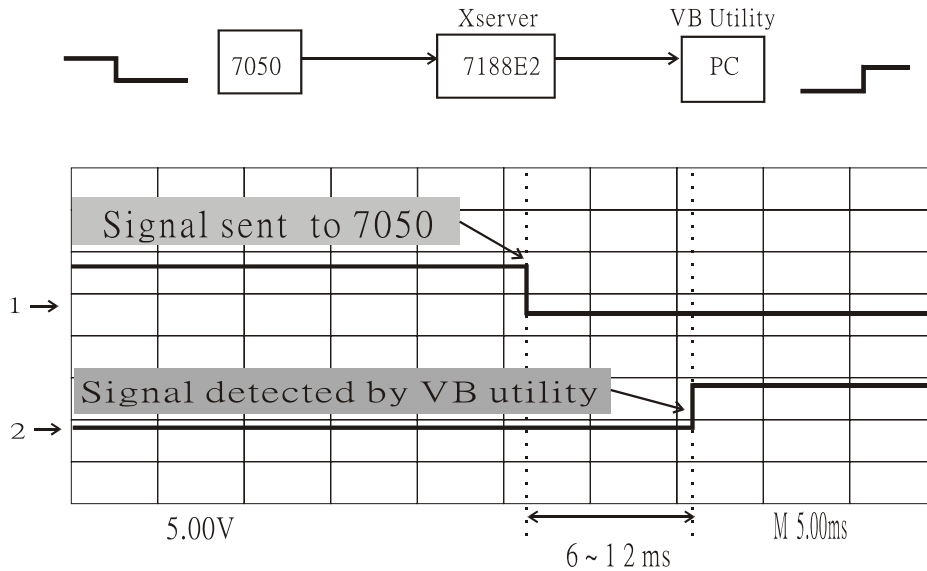
- This test is designed to measure the D/I response time of the Xserver.
- First, one 7050 is installed in COM2 of the 7188E2. One VB client is running on the PC to record the D/I state of the 7050.
- The VB client program continuously sends a TCP/IP packet to the 7188E2 until 7050's D/I state changes.
- The user-defined TCP/IP command is "191".
- The RS-485 command is "$016".
- When the D/I applied to the 7050 to change its state, the VB client program will detect this event after a delay of 6~12 ms.

```
1.CPU:AMD K6-400
2.VB5.0 utility under Windows 98
3.Test items:(1) VB utility (from PC) sends "#AA0001" command to Xserver(TCP/IP).
        (2) Xserver bypasses "#AA0001" to 7050(RS-485).
        (3) 7050 set D/O activates.
        (4) 7050 replies ">" to Xserver(RS-485).
        (5) Xserver echoes ">" to Xserver(TCP/IP) .
        (6) If VB utility receives ">",connection is established.
        (7) T1=(1) ~ (3)
        (8) T2=(4) ~ (6)
```
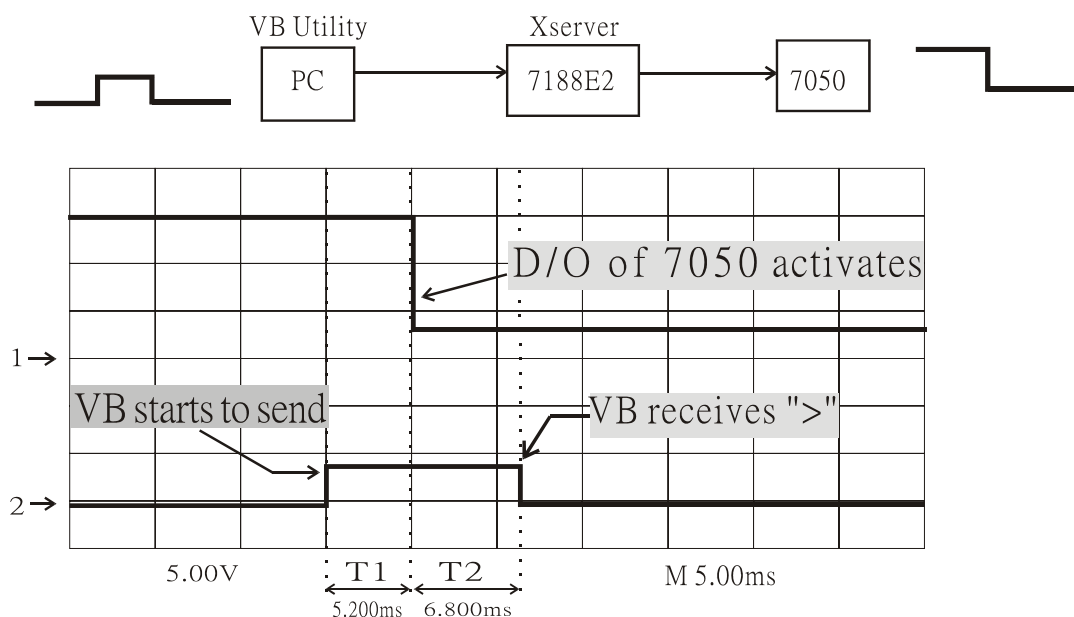

- This test is designed to measure the D/O response time of Xserver.
- One 7050 is installed in the COM2 of 7188E2. One VB client from the PC controls the D/O state of the 7050.
- The VB client program can send TCP/IP packets to the 7188E2 to control the D/O state of the 7050.
- The VB client sends TCP/IP command "#AABBDD" to port-10002 of the 7188E2.
- The 7188E2 will bypass this "#AABBDD" to 7050.
- When the VB client program sends TCP/IP command, "#AABBDD", the 7050 will change its D/O state after approximate 5.2 ms. The 7050 will reply ">" to the VB client program. The VB client will receive this ">" response after approximate 6.8 ms.

By referring to Section 4, the user can design an Xserver to perform data compression. This enables the VB client to send one TCP/IP command to read all I/O points installed in the RS-485 network. Also, the Xserver can respond to any emergency, based on the user's specially designed programs.

2.4 Control Thousands of I/O by Single-PC

The block diagram of a typical Xserver demo program, demo22, is given as follows:

Host-PC

Ethernet 10M

Host-PC

Ethernet 10M

Host-PC

Ethernet 10M

HUB

7188E2

RS-485

7018   7018

Access thousands

of analog signals

by one host-PC

7188E2

RS-485

7033   7033

Features:

● data acquisition
● data averaging
● data compression

7188E2

RS-485

7018 7033   7018 7033
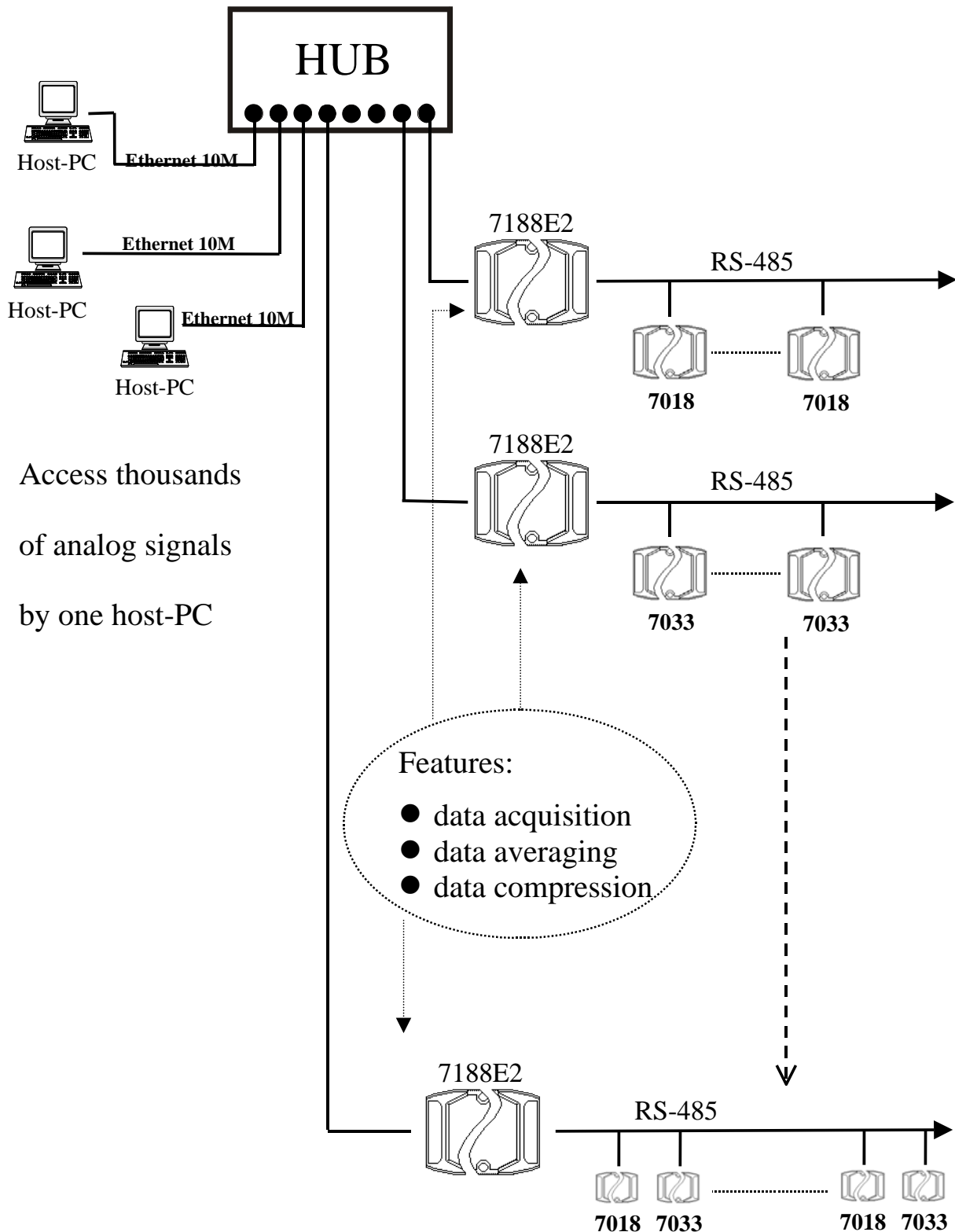
Demo22 provides the following functions:
- Provides a configuration file for system configuration
- Based on configuration file, performs data acquisition when the timer is up
- Based on configuration file, performs data averaging
- Based on configuration file, performs digital filtering (slew-rate control)
- Based on configuration file, performs data compression

    With the help of Xsever (demo22), one PC can link to multiple 7188E2 modules. In turn, every 7188E2 can link to multiple 7000 modules. PC need only send one TCP/IP command to the 7188E2, then the 7188E2 will send back all I/O points installed in the RS-485 network. Therefore, the PC sends one TCP/IP packet to read back hundreds of I/O points installed in the 7188E2. This Lets one PC controls thousands of I/O points easily.

	Xserver Approach	VxComm Approach
Interface	TCP/IP protocol	MS-COMM
One command	Access hundreds of I/O points	Access multi-I/O points of single 7000 module
Auto data acquisition	Yes	No
Auto data averaging	Yes	No
Auto digital filtering	Yes	No
Auto data compression	Yes	No
Old application program	Need to modify	Can be executed without any modification

2.5 Connect RS-232/422/485 Devices & I/O Signals

Sometimes user needs to connect the RS-232/422/485 device and D/I/O signals at the same time. The possible solutions are given as follows:

752N/7188EN family	Connect 7000 D/I/O modules to Com2	Interface to local RS-232/485/422 devices			On board D/I/O	
		RS-232	Com2=RS-485	RS-422/485	DI	DO
7188E1	No Com2	1	0	0	0	0
7188E2	Yes	1	1	0	0	0
7188E3	Doesn't need	1	1	1	4	4
7188E3-232	Doesn't need	2	1	0	4	4
7188E4	Yes	3	1	0	0	0
7188E5	Yes	4	1	0	0	0
7188E8	Yes	7	1	0	0	0
7188EX-256+X503 or 7188EX+X503	Yes	2	1	0	0	0
7188EX-256+X509 or 7188EX+X509	Doesn't need	3	1	0	4	4
We welcome ODM X??? designs. Please send specifications to service@icpdas.com						

Refer to Sec. 5.5 for more information
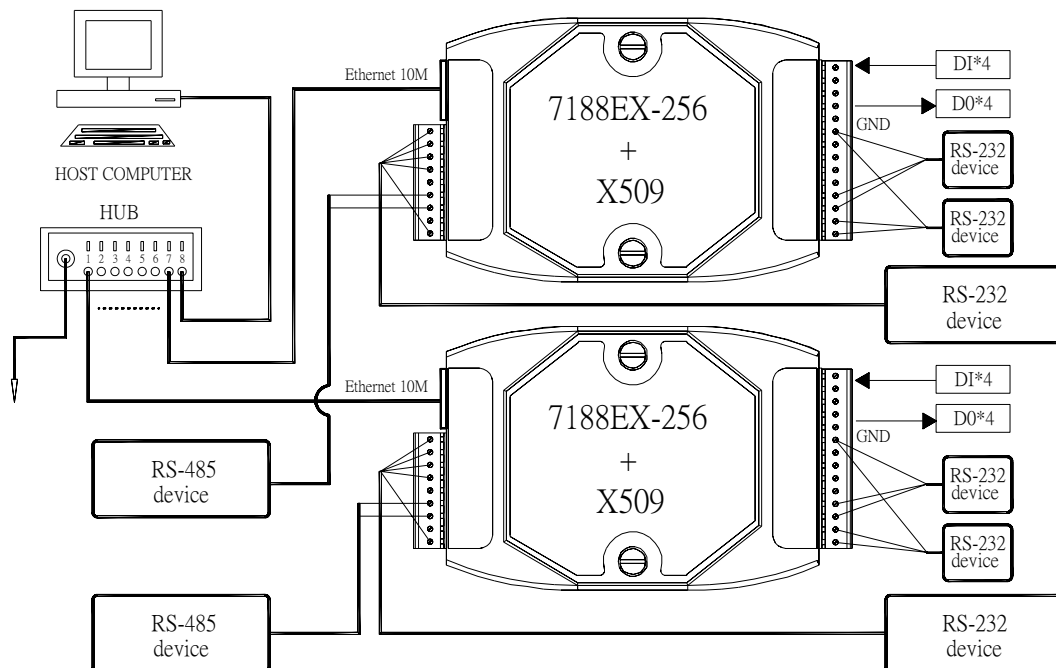
2.6 Configurable Ethernet Data Logger

Step 1: Using the VxComm driver, 7188E+7000 modules can be virtualized to become COM ports of host-PC. Refer to Sec. 2.1.1 for more information.

Step 2: 7000 utility supports log function as follows:
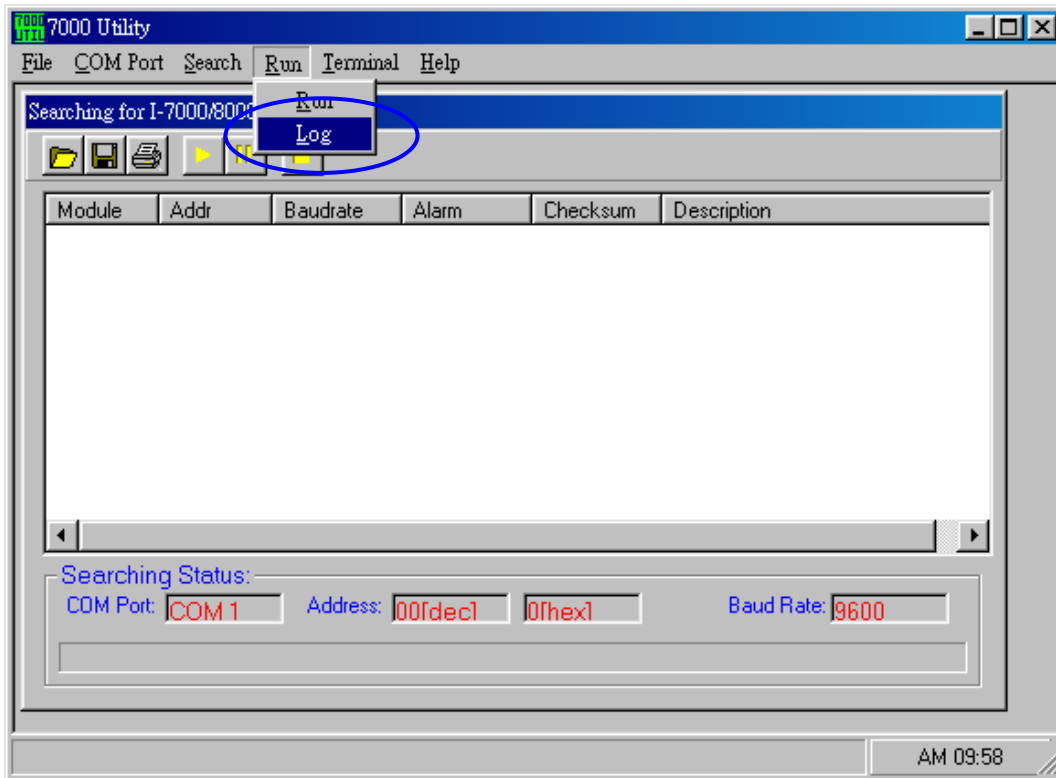
Step 3: Users can configure the system connection as follows:
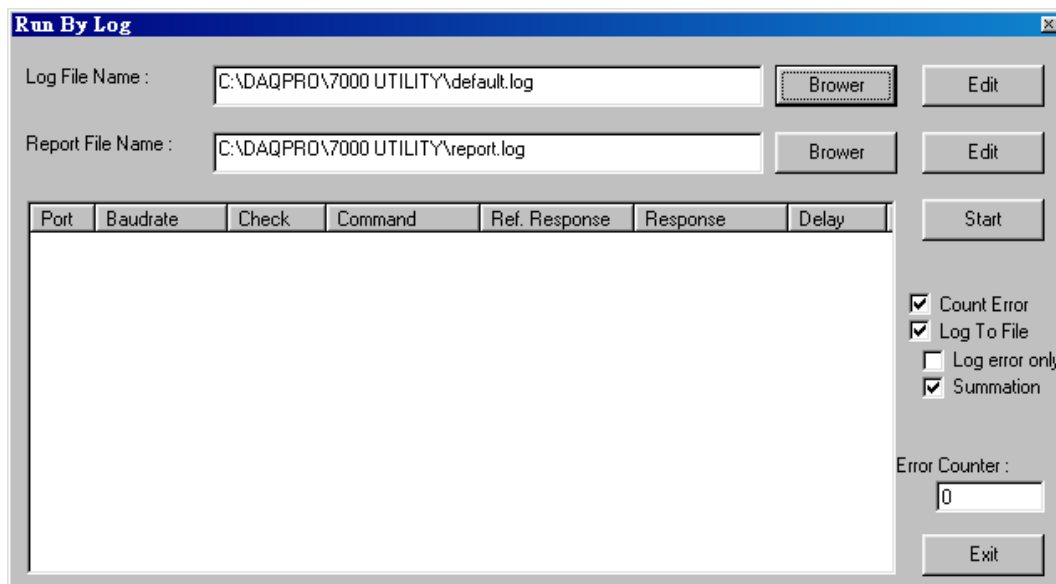
Step 4: Use Excel to read the log data as follows:

With the help of **VxComm technology**, the **log functions of 7000 utility** and **Excel**, users can analyze the signal data coming from Ethernet network without writing any programs. Refer to the on-line help of the 7000 utility for more information about log function as follows:

3. Diagnostics of the 7188E Series

3.1 Apply Power to 7188E

Indicator LED
VxComm running: **On/Of**f
Xserver running: **On/Off**
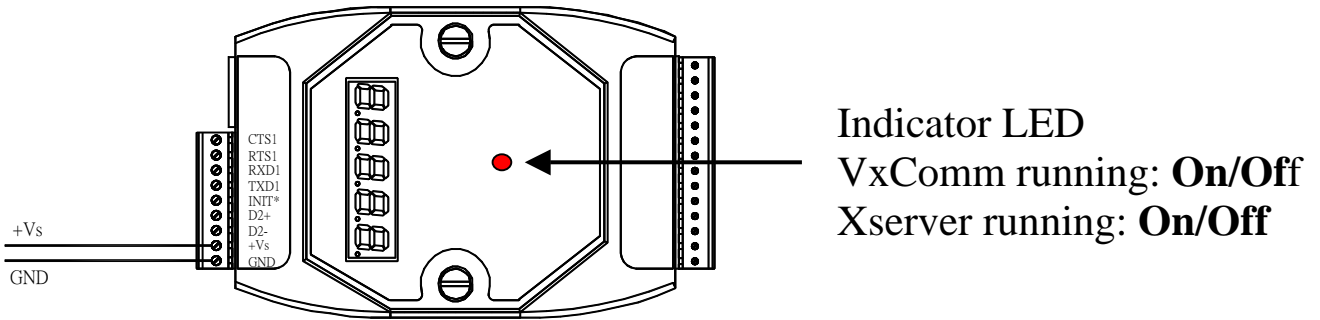
Step 1: Apply power (+Vs, GND) to 7188E, +Vs can be anywhere from +30V to +10V.

The IP is
192.168.255.1

The connected-client and debug information

Com8: data=8, odd parity, stop=1

Com2: data=7, even parity, stop=2

Com1: data=8, no parity, stop=1

Baud rate of Com1=9600   Baud rate of Com2=9600
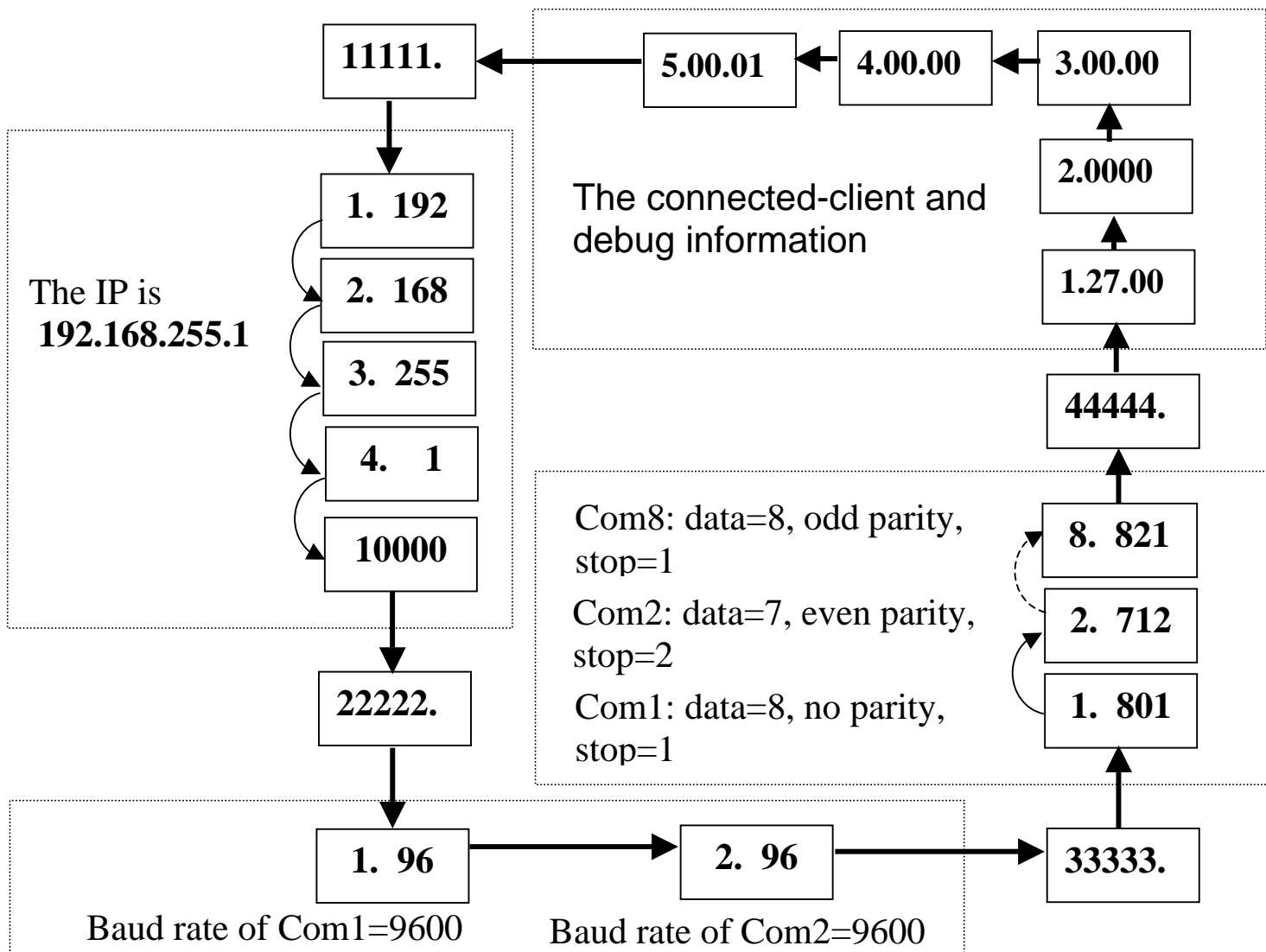
Step 2: Checking the 5-digits of the 7-SEG LED will show as follows.
Note: Only the display-version modules have 5-digits 7-SEG LED.

Important information related to the 7188E series can be classified as follows:
- Group-ID 11111 :IP information for the 7188E
- Group-ID 22222: The Baud Rate of all COM ports
- Group-ID 33333: COM port configuration
- Group-ID 44444: Connected-client and debug information of this 7188E

The format of the 7188E series IP-information is as follows:
- 5-digit LED Group-ID: 11111
- LED-1: indicator, which can be either 1,2,3 or 4
- LED-2~5: IP address
- TCP command port (Default=10000)

The LED will initially show Group-ID first, and then show its IP address as indicated in the above diagram. If the user changes the IP address, the value displayed will change immediately. The default shipping IP = 192.168.255.1 and the LED-display sequence is shown in the above diagram.

The COM port Baud Rate format is follows:
- 5-digit LED Group-ID : 22222
- LED-1: COM port number
- LED-2~5: The Baud rate determined as (Baud Rate/100)

LED-1 displays the COM port number, with LED-2~5 showing its Baud Rate. The Baud Rate = (value shown by LED-2~5) * 100. Therefore, a displayed value of 1.96 means that the Baud Rate of COM1=9600bps; a displayed value of 2.1152 means that the Baud Rate of COM2=115200bps. All 7188E COM port Baud Rates will be shown in sequence.

The COM ports configurations are as follows:
- 5-digit LED Group ID: 33333
- LED-1: COM port number

- LED-3: data bit: 5 , 6 , 7 or 8
- LED-4: parity bit, 0=no parity, 1=Even parity, 2=Odd parity
- LED-5: stop bit: 1 or 2

The connected-client and debug information is as follows:

- 5-digit LED Group ID : 44444
- LED-1 will display 1, 2, 3, 4 and 5 in sequence.
- When LED-1 is 1, LED-2/3 indicates the number of free sockets available on (default is 27 for 7188EX/A), and LED-4/5 shows the number of sockets being used by clients (default is 0) , e.g. 12600
- When LED-1 is 2, LED-2~5 indicates how many times the 7188E has been reset, e.g. 20002 (The 7188E is reset for 2 times)
- While LED-1 is 3, the information indicates that how many Ethernet packets enter into 7188E at present.
- While LED01 is 4, the information indicates that the status of internal Flag used to allow the Ethernet packets can be send is 0 or 1.
- When LED01 is 5, the information indicates that the reset number of Ethernet chip, 8019s.

When the 7188E is first powered-up or just been reset, the reset state=1. If any one client connects to this 7188E, the reset-state will be changed to 0, free-sockets will be decreased and used-sockets will be increased. If the free-sockets number is reduced to 0, then no extra clients can link to this 7188E.**The default number of free-sockets is 27 for 7188E2/X/A. Therefore, the server (Vxcomm/Xserver) allows 27 clients link to one 7188E2/X/A.**

If the 5-digit LEDs do not shown as above, you can do the following steps:
- Power off
- Connect INIT* to VS+
- Power on and double check

Step 3: There is a red indicator-LED in the 7188E as follows:
- VxComm is running: **On/Off**
- Xserver is running: **On/Off**

The default shipping of 7188E will be Xserver or VxComm inside, so the red indicator-LED of 7188E will be ON 0.5 second then OFF 0.5 second periodically.

If the LED is always ON, you can do the following steps:

- Power off
- Connect INIT* to VS+
- Power on and double check

Step 4: Power off.

3.2 Linking to Program-development PC

To Ethernet 10M hub

CA0910

RXD
TXD

+Vs

GND

CTS1
RTS1
RXD1
TXD1
INIT*
D2+
D2-
+Vs
GND
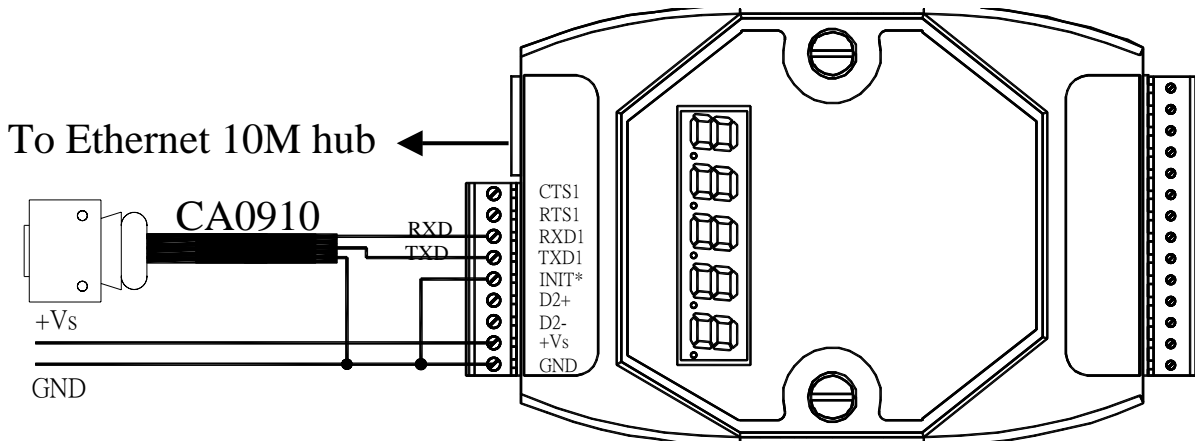
Step 1: Connect download-cable, CA0910, to 7188EN & COM1/2 of program-development PC as shown in the above diagram.

Step 2: Connect INIT*-pin to GND-pin as shown in the above diagram.

Step 3: Refer to Sec. 2.2 to install 7188X.EXE to program-development PC

Step 4: Apply power (+Vs, GND) to 7188EN, +Vs can be anywhere from +30V to +10V.

Step 5: Checking the 5-digits of the 7-SEG LED will continuously show as follows:

Hour.Minute.Second

Note: Only with display version modules have 5-digits of 7-SEG LED.

Step 6: Execute 7188X.EXE /C#, and change baud rate to 115200, N81. "/C#" is the COM port of the program-development PC.

Step 7: Press [Enter] twice in the program-development PC as follows:

```
ICP_DAS MiniOS7 for I-7188e Ver. 1.00 build 006,Mar  7 2001 15:36:43
SRAM:256K, FLASH MEMORY:256K
Serial number= 5A 5A 5A 5A 5A 5A 5A 5A
i7188e>

i7188e>

i7188e>
```

Note: The 7188EN series does not equip a hardware serial number, so the serial number is 5A. For the 7188EA and 7188EX, the hardware serial number will be shown in the above screen.

Step 8: Read configuration of the 7188E as follows:

```
i7188e>ip
IP=192.168.255.1
i7188e>mask
MASK=255.255.0.0
i7188e>gateway
Gateway=192.168.0.1
i7188e>setcom 1
Current set is: 9600,8,0,1 [checksum:AE,OK]

i7188e>_
```

Reading configuration command
- ip
- mask
- gateway
- mac
- setcom port

Note: You can change the configuration of 7188E as follows:

```
i7188e>ip 192.168.41.4
Set IP=192.168.41.4
[ReadBack]IP=192.168.41.4
i7188e>mask 255.255.255.0
Set MASK=255.255.255.0
[ReadBack]MASK=255.255.255.0
i7188e>gateway 192.168.41.1
Set GATEWAY=192.168.41.1
[ReadBack]Gateway=192.168.41.1
i7188e>setcom 1 115200,n,8,1
Current set is: 9600,8,0,1 [checksum:AE,O
Set to: 115200,8,0,1 [checksum:CC,OK]

i7188e>
```

Setting configuration command
- ip [new ip]
- mask [new mask]
- gateway [new gateway]
- mac [new mac]
- setcom port
  [baud][data_bit][parity][stop_bit]

Parameters of **"setcom"** are as follows:
    port: 1-8
    baud: 2-921600
    databit:
        7, 8: for COM1 and COM2
        5,6,7,8: for COM3 ~ COM8
    parity:
        N, n: None parity
        E, e: Even parity
        O, o: Odd parity
        M, m: Mark, parity=1
        S, s: Space, parity=0
    stopbit:
        1: for COM1, COM2
        1, 2: for COM3 ~ COM8

Step 9: Disconnect INIT*-pin form GND-pin.
Step 10: Power off then power on.
Step 11: Execute **ping 192.168.255.1 –t**   in host-PC as follows:
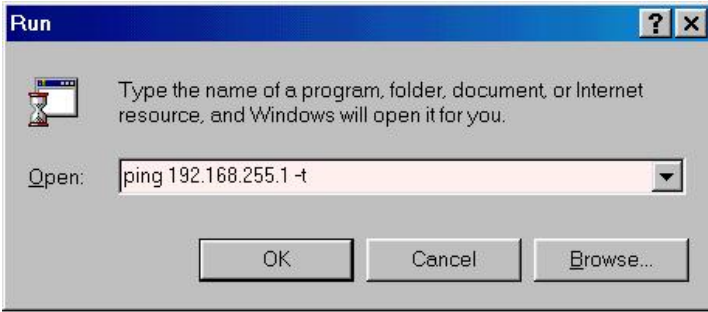
← Execute Ping 192.168.255.1 in host-PC
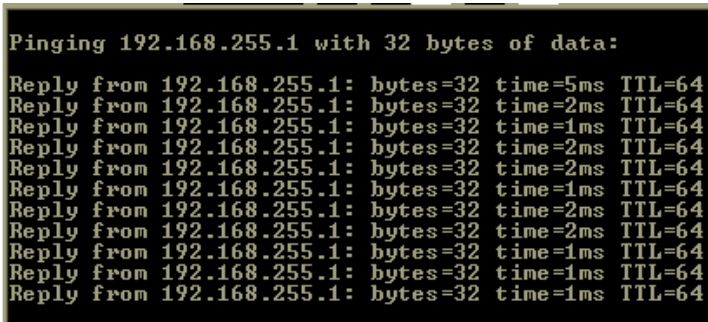
← Ping results must be smooth & continuous

Note:
- **192.168.255.1** is the default IP of the 7188E. Users can change IP (step 8).
- If host-PC cannot ping the 7188E without problems, please refer to step 8 to change the configuration of the 7188E. So it is compatible with host-PC (the mask of the 7188E must be compatible with the mask of host-PC)
- The MAC address of the 7188E should be unique in the same network. Refer to step 8 for changing the MAC address of 7188E.
- Every MAC address of the 7188E is unique in the default shipping.

In general, if host-PC can ping the 7188E smoothly and continuously, all other software and drivers for the 7188E will work fine. Therefore, users should make sure host-PC can ping the 7188E smoothly before any further testing.

3.3 Configure Wizard

The most important step when using the 7188E family is to set the IP, mask and gateway correctly. This is not an easy job for newcomers. Therefore, we've designed a configure wizard to automatically set the configuration of the 7188E.

Step 1: Refer to Sec. 3.2 for wire connection of 7188E.

Step 2: Install configure wizard as follows: (refer to Section 1.3 of "7188E Series Software User's Manual" for more information)
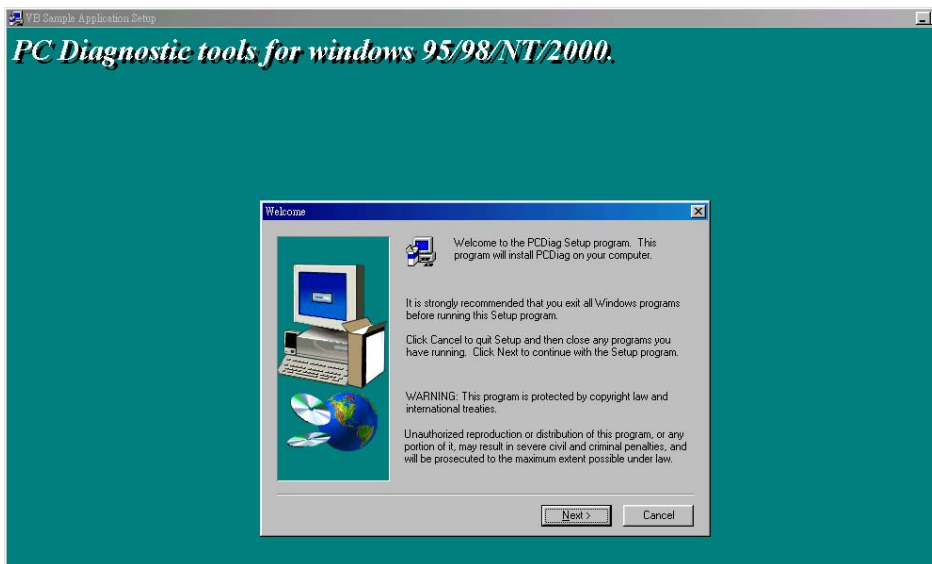
Step 3: Run the configure wizard as follows:
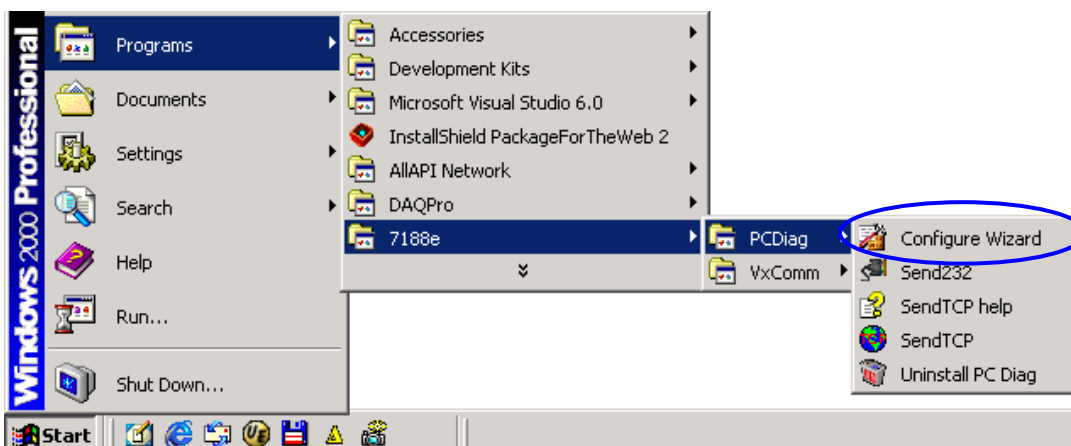
Step 4: The starting page of the Configure Wizard is given as follows:

Click Custom to continue.

Step 5: Step2 of the Configure Wizard is as follows:
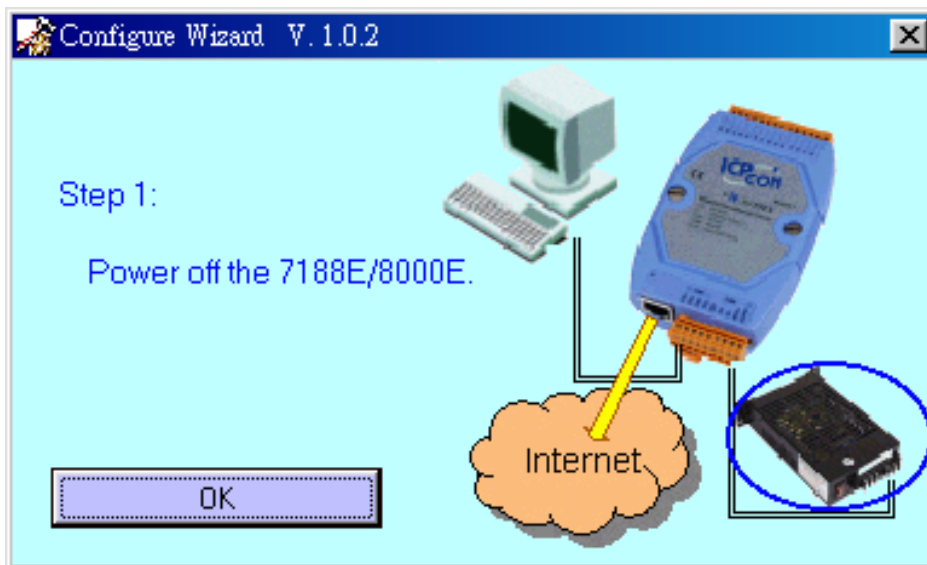
Power off the 7188E/8000E

Step 6: Step2 of the Configure Wizard is as follows:
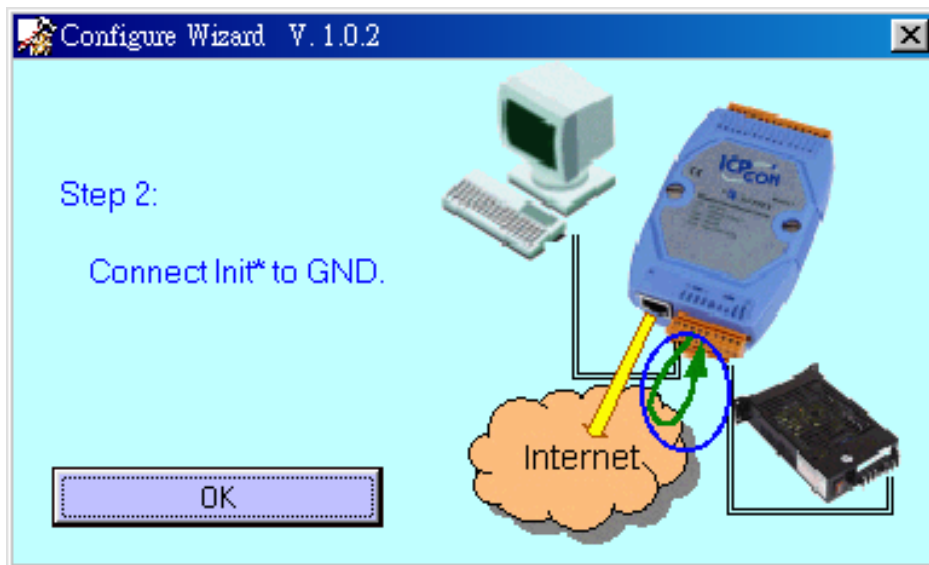
Connect INIT*-pin of 7188E/8000E to GND-pin of 7188E/8000E

Step 7: Step3 of the Configure Wizard is as follows:
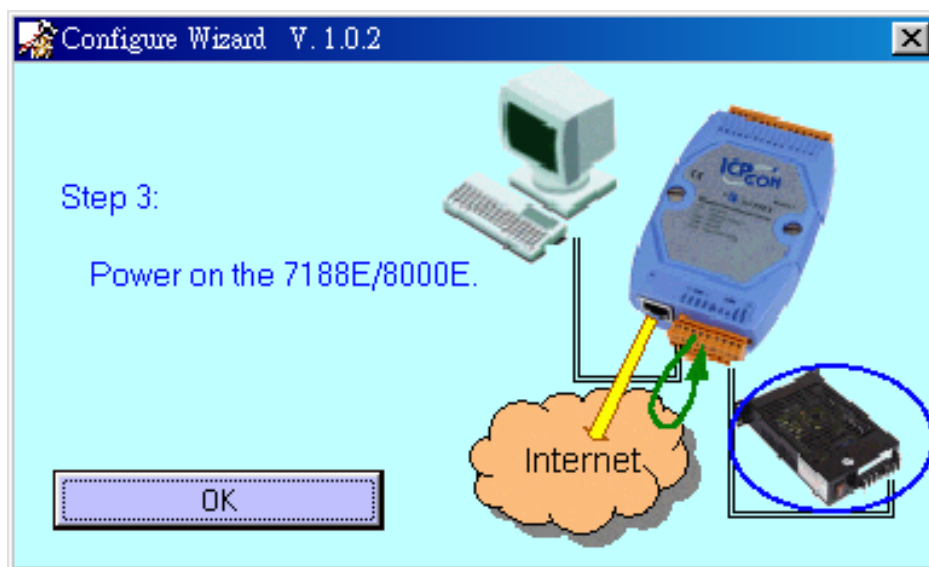
Apply power to 7188E/8000E

Step 8: Step4 of the Configure Wizard is as follows:
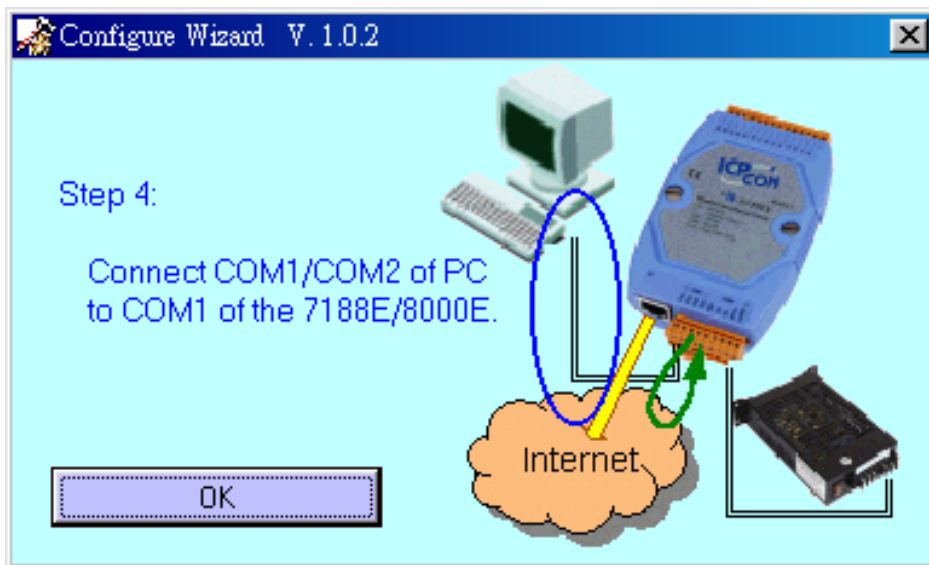
Connect CA0910 to 7188E/8000E & PC (refer to Sec. 3.2)

Step 9: Currently, the Configure Wizard will get the host-PC's configuration as follows:
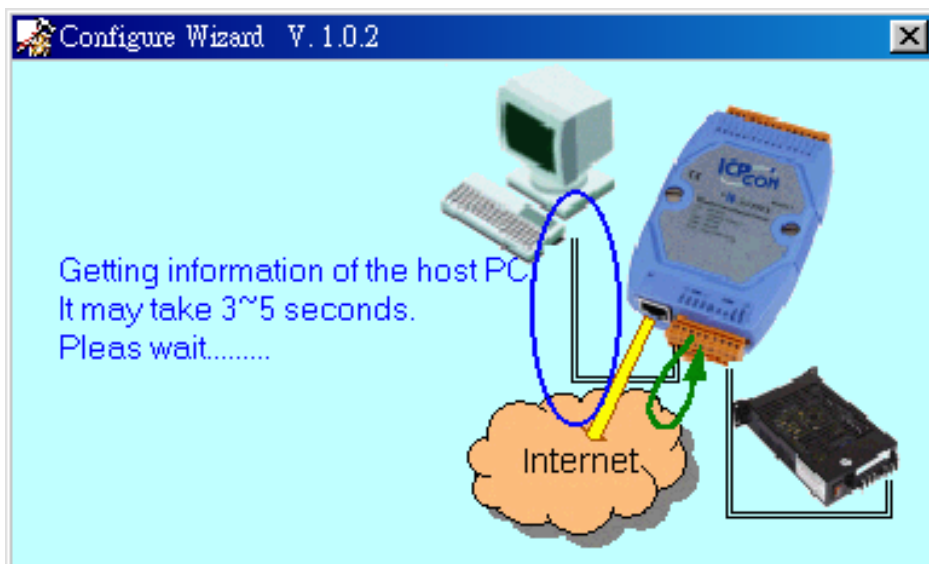
Step 10: **The host-PC's configuration** and **the recommended configuration of this 7188E** are given as follows:
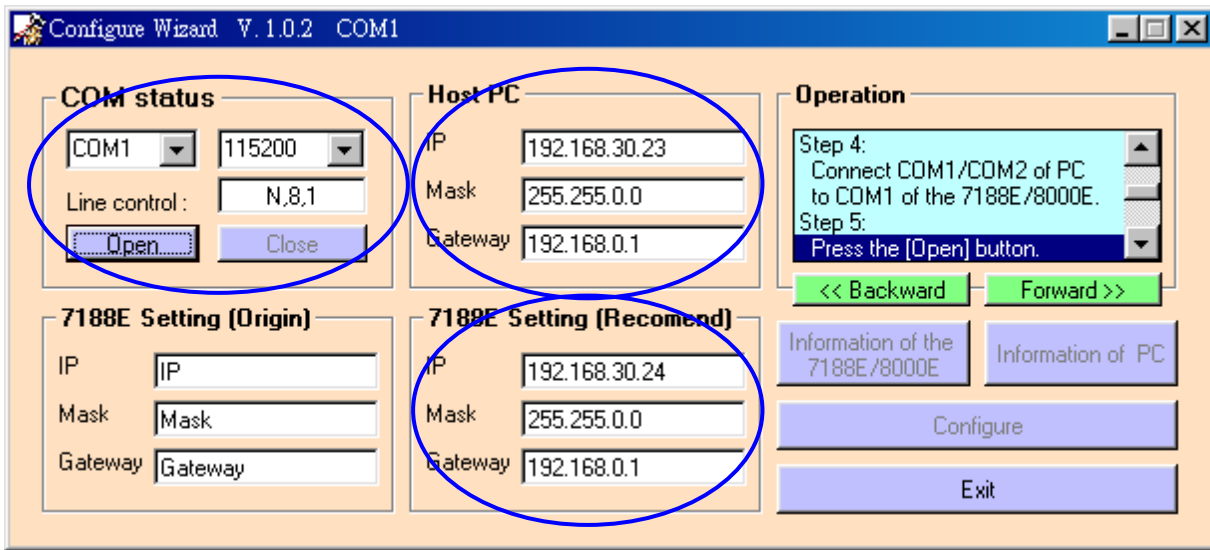
Select the correct COM status of host-PC
Then Click Open

Step 11: Now the current configuration of this 7188E is given as follows:
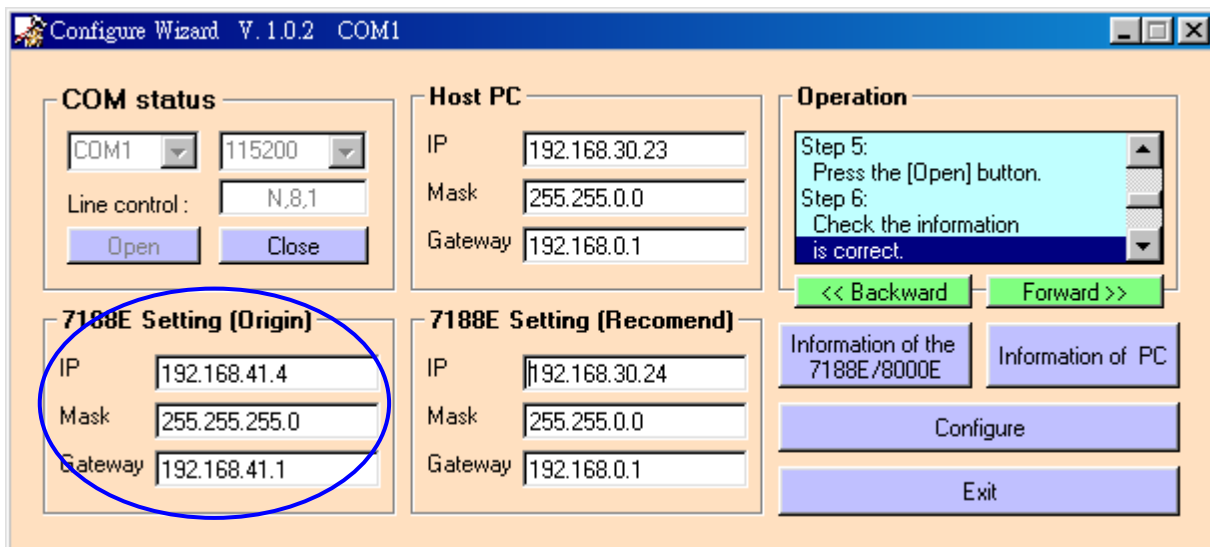
Click Configure to set the new configuration of this 7188E

Step 12: Click "Yes" to confirm the setting as follows:
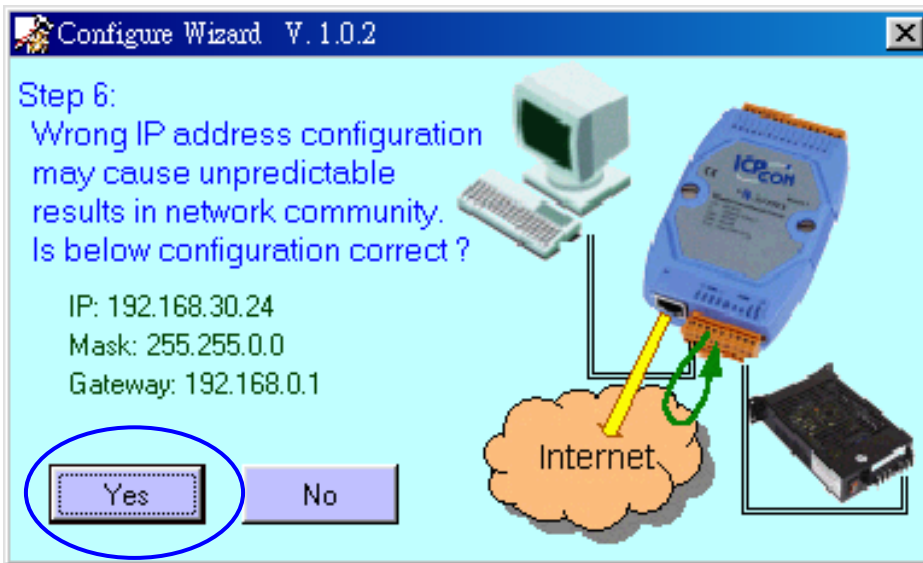
Step 13: Step8 of the Configure Wizard is as follows:
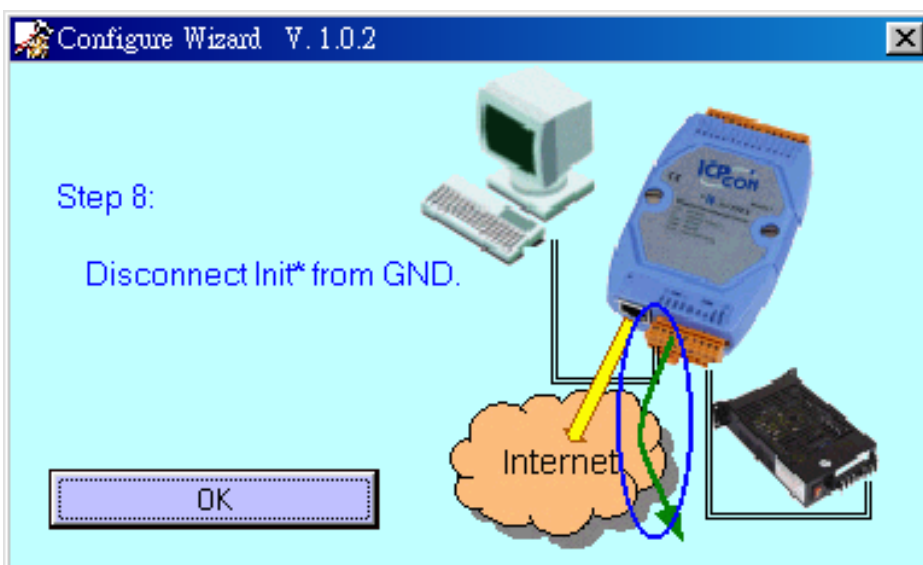
Disconnect INIT*-pin from GND-pin of 7188E
Click OK

Step 14: Step9 of the Configure Wizard is as follows:
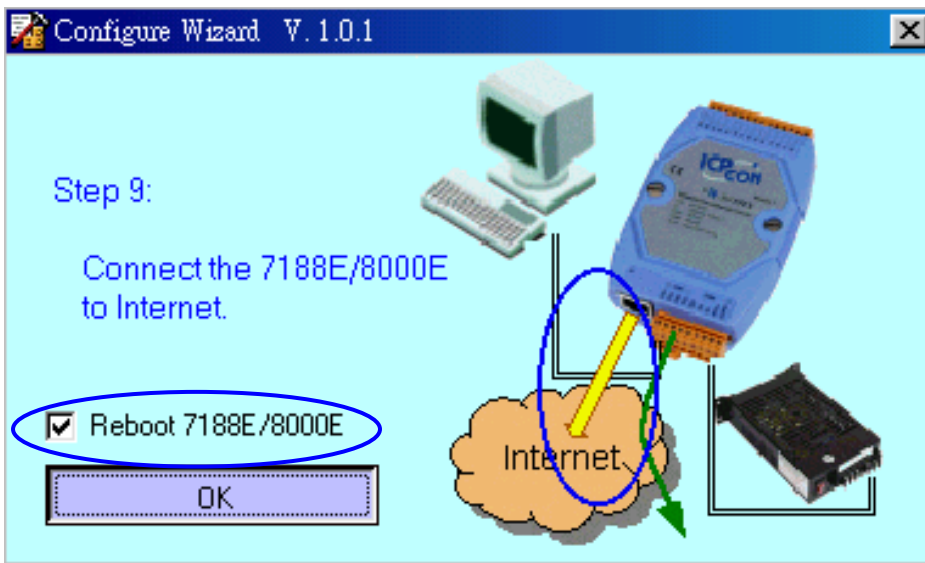
Enable Reboot 7188E/8000E
Click OK

Step 15: The setting of 7188E is successful as follows:
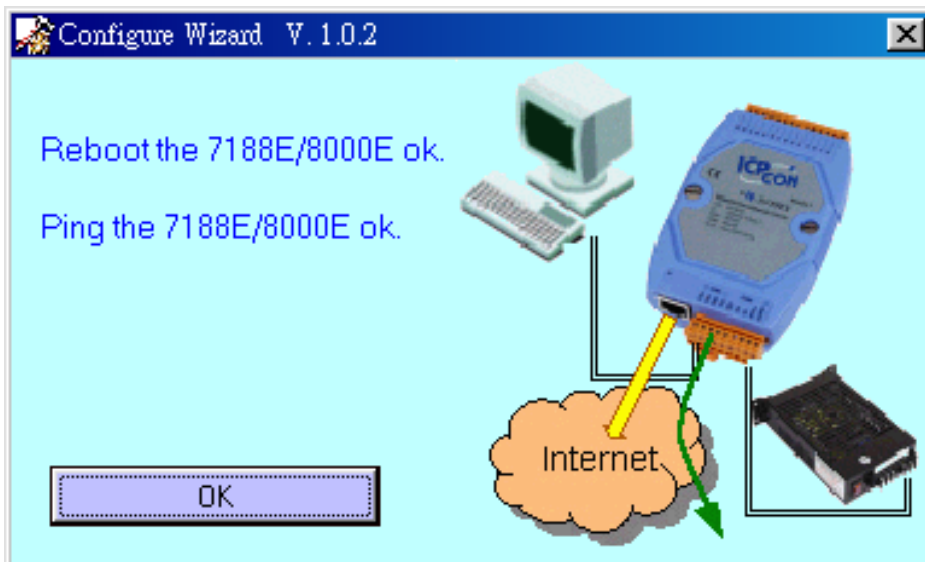
4. I/O Expansion Bus for 7188E series

I/O Expansion Bus (before mounting):

I/O Expansion Bus

7188E series

I/O Expansion Bus

I/O expansion module
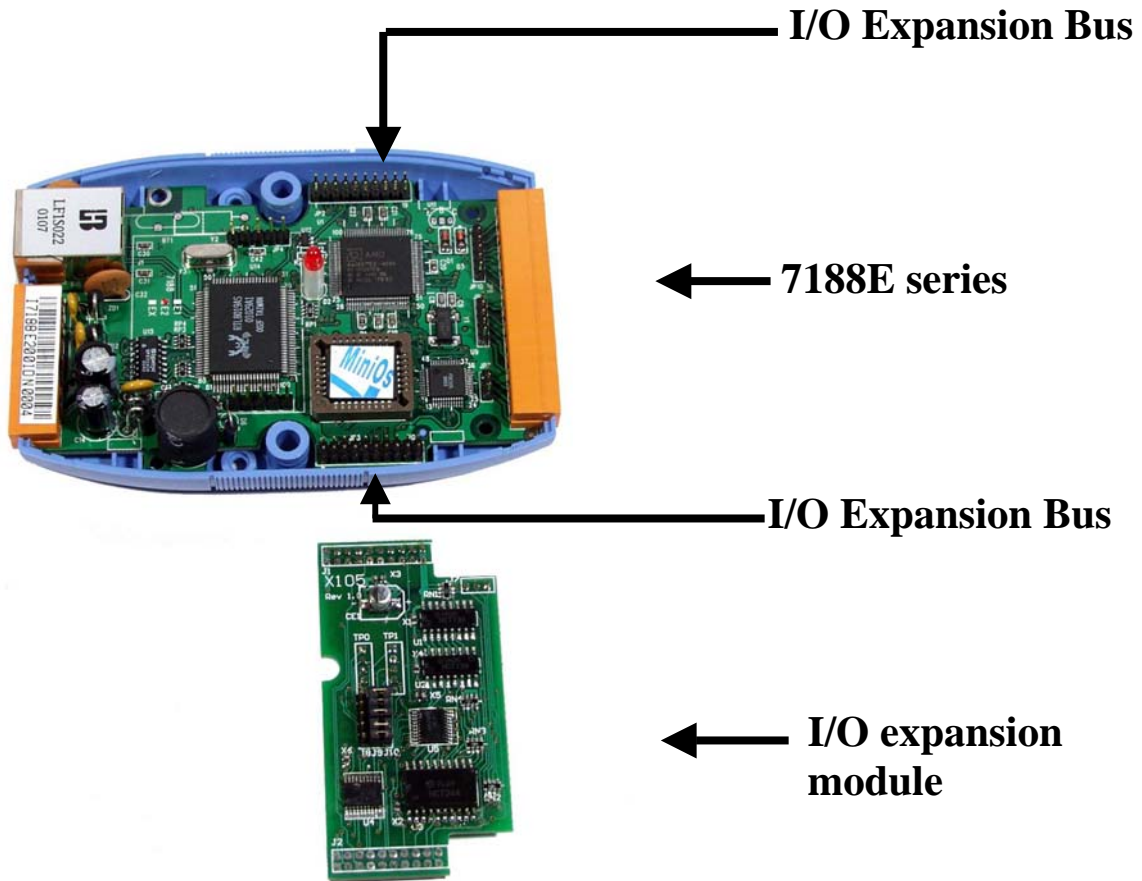
I/O Expansion Bus (after mounting)

The I/O expansion bus of the 7188X/7188E series can be divided into 3 groups as follows:

1. Power supply and reset signals: VCC, GND, RESET, /RESET

2. Parallel Bus:

   - System clock: CLOCKA

   - Asynchronous ready control: ARDY

   - Address bus: A0 ~ A6, A7 (7188XC & 7521 series without A7)

   - Data bus: D0 ~ D7

   - Interrupt control: INT0, INT1, INT4 (7188XC & 7521 series without INT4)

   - Chip select & read/write strobe: /CS, /WR, /RD

3. Serial Bus: TO_0, TO_1, TI_0, TI_1, SCLK, DIO9, DIO4, DIO14

Note:
- Only one X??? can be installed onto the I/O expansion bus.
- Refer to CD\napdos\7188x\manual\hardware**iobus2_e.pdf** for more I/O expansion modules.
- Refer to CD\napdos\7188x\manual\hardware**X-performance** for more performance information about I/O expansion boards.
- The **7188XA** support I/O expansion bus but no support user defined pins, therefore 7188XA only support X002 & X600 series.
- The 7522/7523/7524/7527 do not support I/O expansion bus.
  (There is a X??? installed in the I/O expansion bus)
- The 7188E1/7188E2 do not support I/O expansion bus.
  (There is no I/O expansion bus inside)
- The 7188E3/7188E3-232/7188E4/7188E5/7188E8 does not support I/O expansion bus. (There is a X??? installed in the I/O expansion bus)

4.1 Definition

The definition of I/O expansion bus is given as following:

J1 pin definition & description:

No	Name	Description
1	GND	Ground of PCB
2	GND	Ground of PCB
3	CLOCKA	Synchronous clock output of CPU
4	ARDY	Asynchronous ready input (active low)
5	INT0	Interrupt request input of channel 0 (asynchronous, active high)
6	INT1	Interrupt request input of channel 1 (asynchronous, active high)
7	VCC	Power supply of PCB
8	RESET	System reset (active high)
9	GND	Ground of PCB
10	/RESET	System reset (active low)
11	TO_1	Timer output 1 of CPU(can be used as programmable D/I/O)
12	TO_0	Timer output 0 of CPU(can be used as programmable D/I/O)
13	TI_1	Timer input 1 of CPU(can be used as programmable D/I/O)
14	TI_0	Timer input 0 of CPU(can be used as programmable D/I/O)
15	SCLK	Common serial clock output of 7188 series
16	DIO9	Programmable D/I/O bit
17	DIO4	Programmable D/I/O bit
18	DIO14	Programmable D/I/O bit
19	VCC	Power supply of PCB
20	VCC	Power supply of PCB

- CLOCKA: 20M for 7188XC, 40M for 7188XA/B & 7188EA/X
- ARDY: let this pin OPEN for no wait states applications
- INT0, INT1: let these two pins OPEN for no interrupt applications
- TO_0, TO_1: can be used as CPU's timer output or programmable D/I/O
- TI_0, TI_1: can be used as CPU's timer input or programmable D/I/O
- DIO4, DIO9, DIO14: programmable D/I/O bit
- SCLK: the 7188X/7188E series use this signal as a CLOCK source to drive all on-board serial devices, so it is always be programmed as D/O. Changing this signal to other configuration will cause serious errors. Users can use this signal to drive external serial devices without any side effects.

Note: Pin number of the TO_0, TO_1, TI_0, and TI_1 of the 7188EX and 7188XB are different.

J2 pin definition & description:

No	Name	Description
1	A0	Address bus
2	D0	Data bus
3	A1	Address bus
4	D1	Data bus
5	A2	Address bus
6	D2	Data bus
7	A3	Address bus
8	D3	Data bus
9	A4	Address bus
10	D4	Data bus
11	A5	Address bus
12	D5	Data bus
13	A6	Address bus
14	D6	Data bus
15	A7 or N/C	**This pin is reserved & must be N/C for 7188XC & 7521 series**
16	D7	Data bus
17	INT4 or N/C	Interrupt request input of channel 3(asynchronous, active high), **this pin is reserved & must be N/C for 7188XC & 7521 series**
18	/WR	Write strobe output(synchronous, active low)
19	/CS	Chip select output(synchronous, active low)
20	/RD	Read strobe output(synchronous, active low)

- Address bus(output): A0 ~ A6, A7
- Data Bus (tri-state, bi-direction): D0 to D7
- INT4: let this pin OPEN for no interrupt applications
- /CS, /RD, /WR: These 3 signals will be synchronous to CLOCKA(in J1.3) & asynchronous to ARDY(J1.4)
- The CS\ will be active if program inport/outport from I/O address 0 to 0xff.
- **The pin_15 & pin_17 are reserved by 7188XC & 7521 series. Users must leave these two pins N/C for 7188XC & 7521 series.**

4.2 Parallel Bus

4.2.1 Timing Diagram
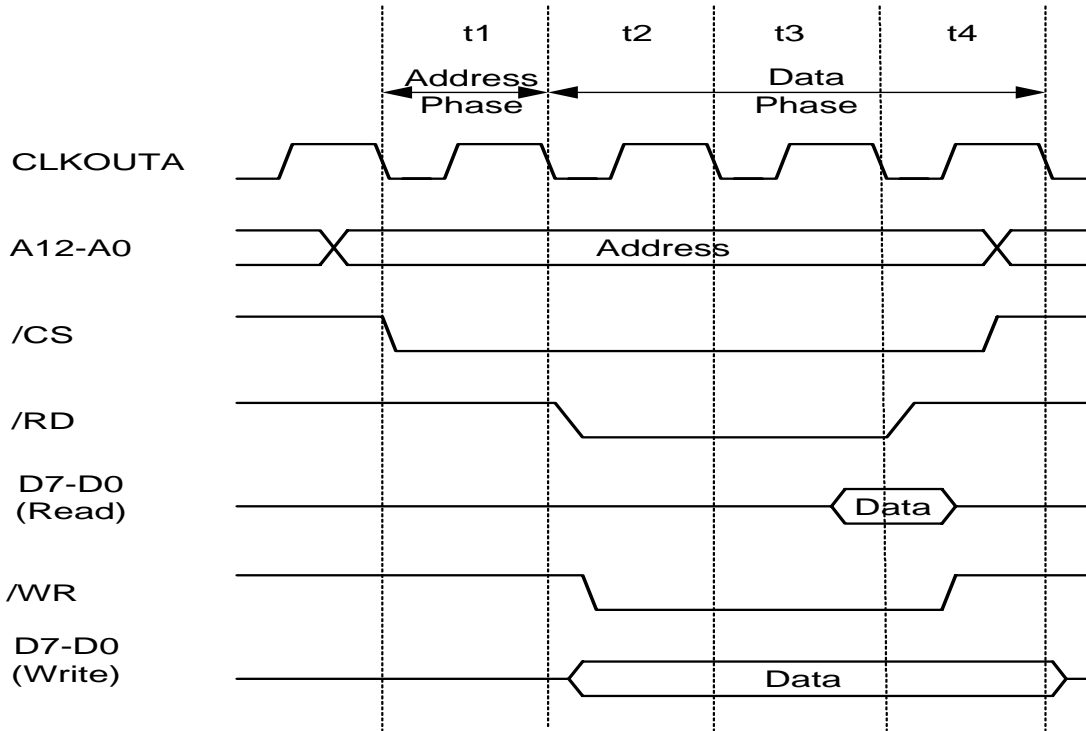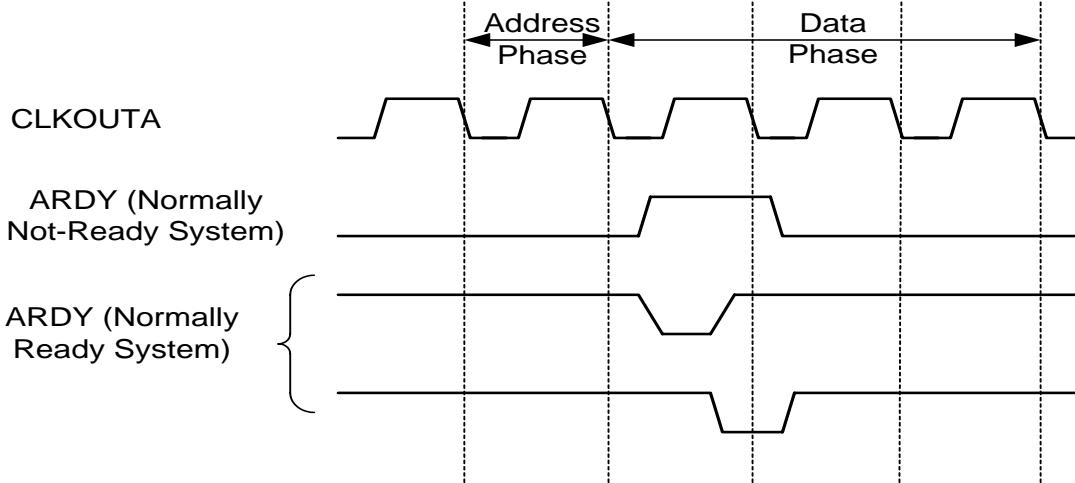
4.2.2 Address decode & D/I CKT
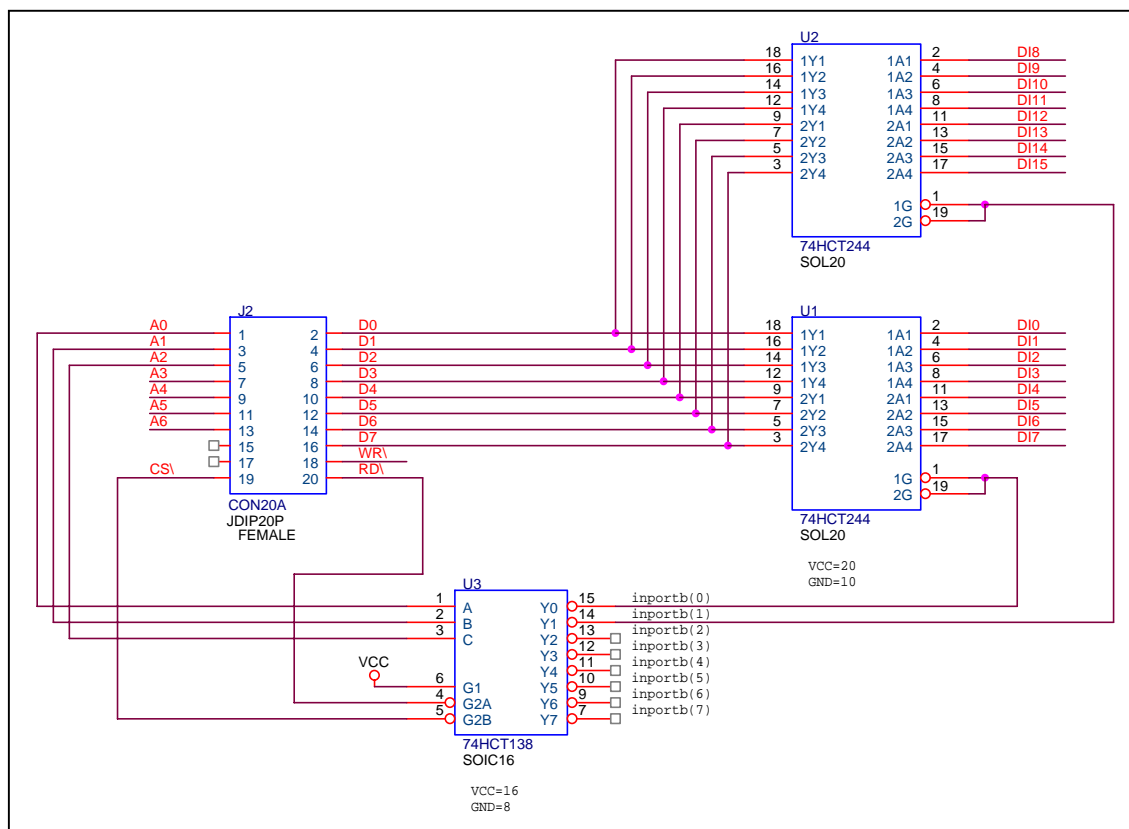
The CS\ will be active if program inport/outport from I/O address BASE+0 to BASE+0xff.

Read DI 0 to 7   → DI_0_7=inportb(BASE+0);

Read DI 8 to 15 → DI_8_15=inportb(BASE+1);

The power-up default value of BASE is 0.

It is **not** recommended to change the value of BASE from 0 to another value.

4.2.3 Address decode & D/O CKT
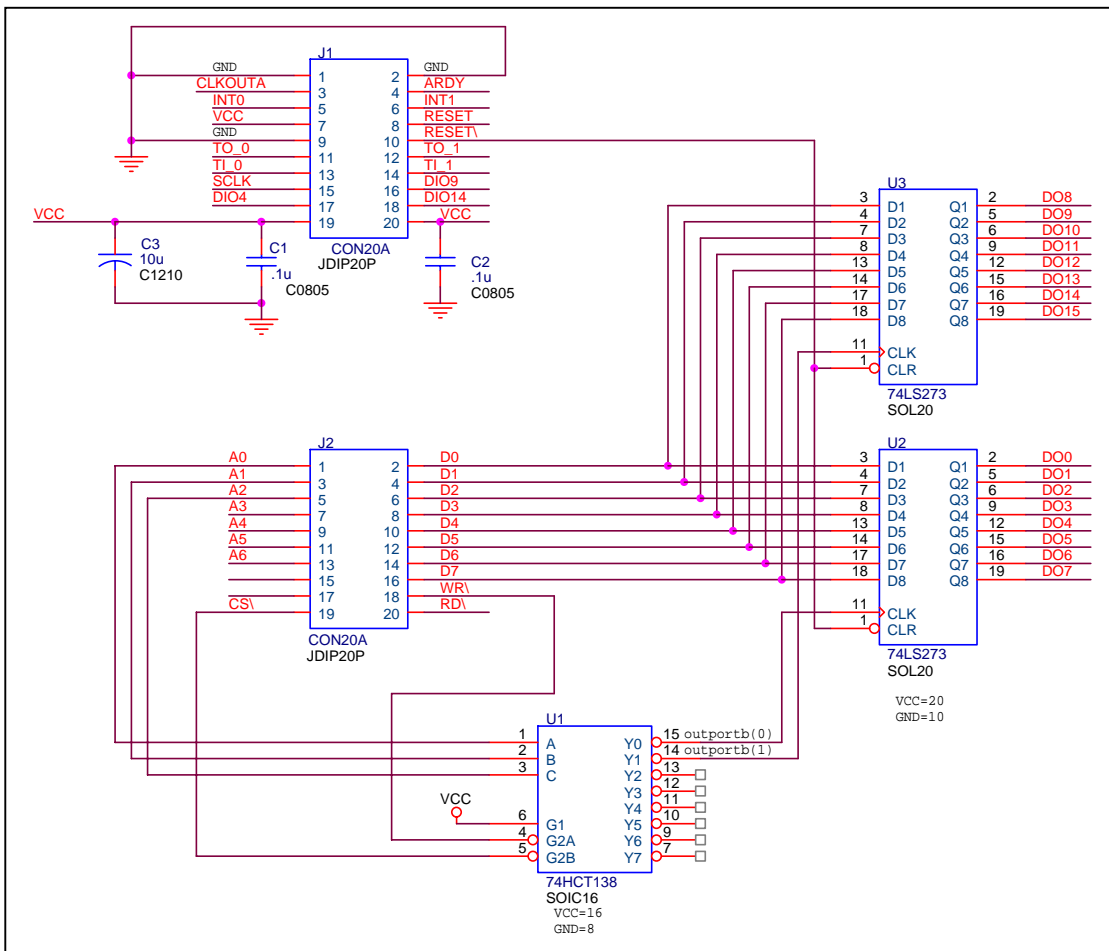
The CS\ will be active if program inport/outport from I/O address BASE+0 to BASE+0xff.

Write value_1 to DO 0 to 7   → outportb(BASE+0,value_1);

Write value_2 to DO 8 to 15 → outportb(BASE+1,value_2);

The power-up default value of BASE is 0.

It is **not** recommended to change the value of BASE from 0 to another value.

4.2.4 8254 & interrupt
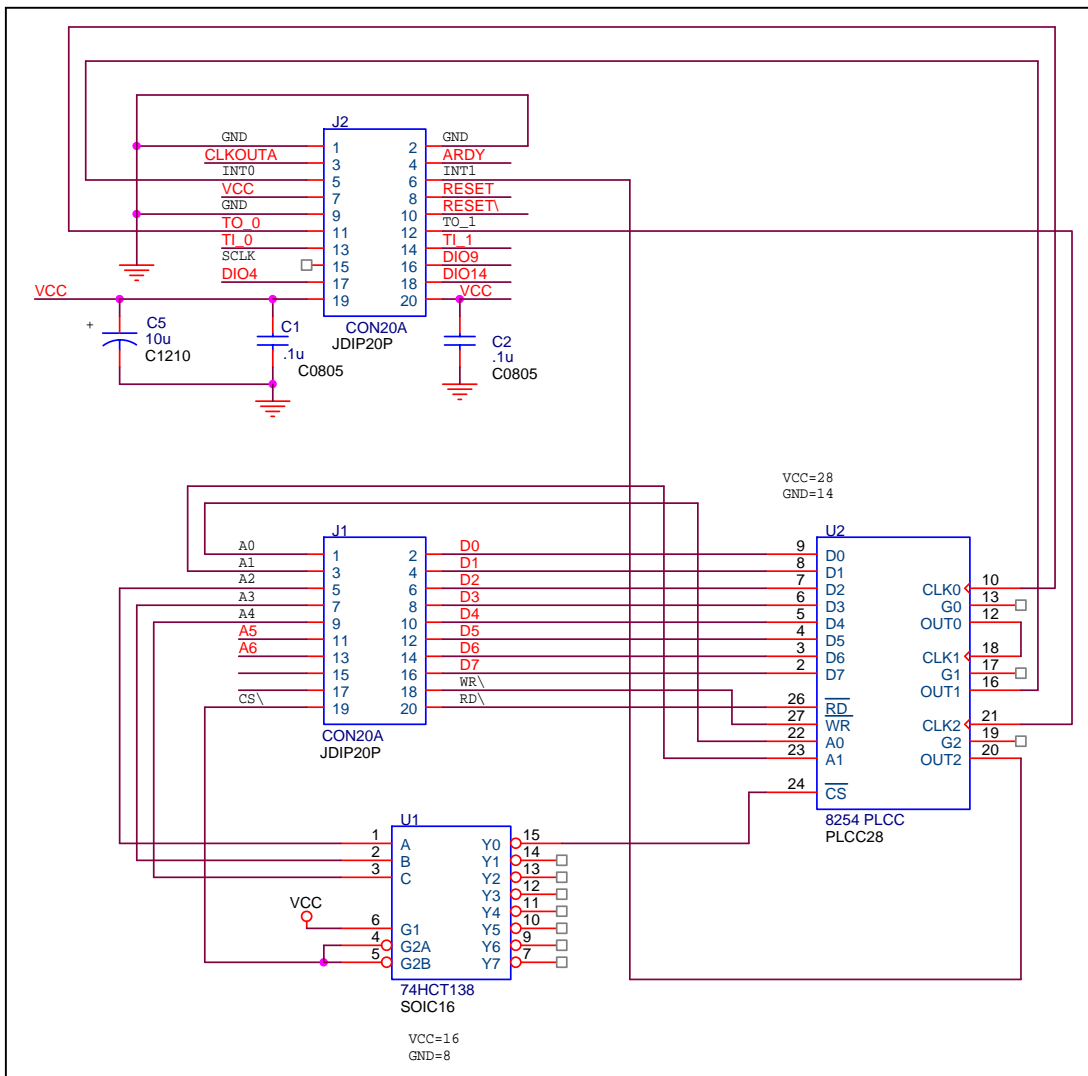
The addressing space of 8254 is from BASE+0 to BASE+3 as follows:

Timer/Counter_0 → BASE+0

Timer/Counter_1 → BASE+1

Timer/Counter_2 → BASE+2

Control Word   → BASE+3

The power-up default value of BASE is 0.

It is **not** recommended to change the value of BASE from 0 to another value.

4.2.5 16550 & interrupt
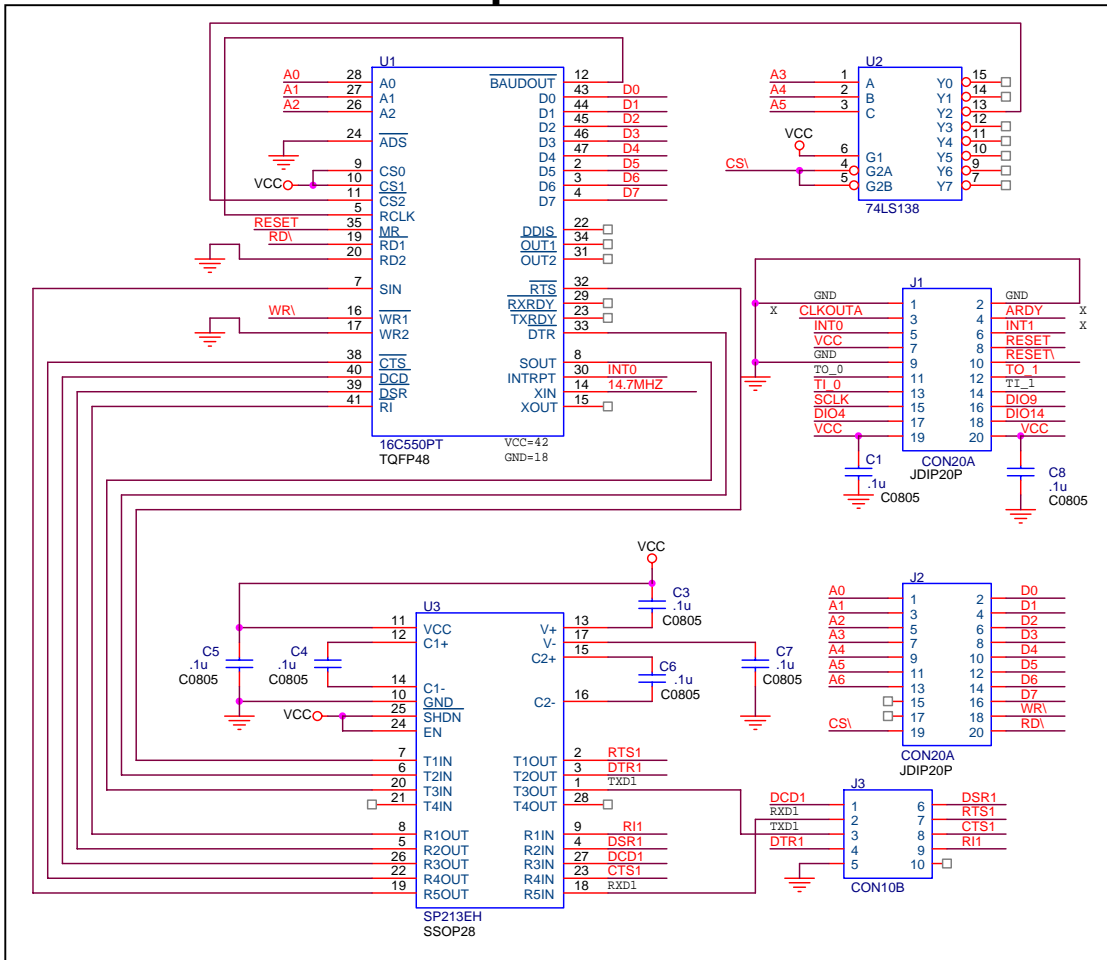
The address space of 16550 is from BASE+0x10 to BASE+0x17 as follows:

Txbuf=BASE+0x10	/* tx buffer	*/
Rxbuf=BASE+0x10	/* rx buffer	*/
Dll=BASE+0x10	/* baud lsb	*/
Dlh=BASE+0x11	/* baud msb	*/
Ier=BASE+0x11	/* int enable register	*/
Fcr=BASE+0x12	/* FIFO control register	*/
Iir=BASE+0x12	/* Interrupt Identification Register	*/
Lcr=BASE+0x13	/* line control register	*/
Dfr=BASE+0x13	/* Data format register	*/
Mcr=BASE+0x14	/* modem control register	*/
Lsr=BASE+0x15	/* line status register	*/
Msr=BASE+0x16	/* modem status register	*/
Scr=BASE+0x17	/* Scratch register	*/

The power-up default value of BASE is 0. It is **not** recommended to change it to another value. It is compatible with **COM3** of 7188XB/C & 7188E library.

4.3 Serial Bus

Pin	Name	default	D/I/O mode	Normal mode
J1.11	TO_0	D/I	I/O_10	Timer output channel_0
J1.12	TO_1	D/I	I/O_1	Timer output channel_1
J1.13	TI_0	D/I	I/O_11	Timer input channel_0
J1.14	TI_1	D/I	I/O_0	Timer input channel_1
J1.15	SCLK	D/O	I/O_26	UZI, don't change to this mode
J1.16	DIO9	D/I	I/O_9	A19, don't change to this mode
J1.17	DIO4	D/I	I/O_4	DT/R, don't change to this mode
J1.18	DIO14	D/I	I/O_14	MCS0, don't change to this mode

Every pin can be configured by mode control register & direction control register as follows:

Mode control register=0xff70	Direction control register=0xff72	Programmable Function
0	0	Normal mode
0	1	D/I with pull-up/pull-down resistor(10K)
1	0	D/O
1	1	D/I without pull-up/pull-down register(10K)

After the I/O pins are configured, user can read /write to **data register, 0xff74**, to access these I/O pins. Refer to Sec. 4.3.1 or Sec. 4.3.2 for demo program.

4.3.1 Using the SCLK

The 7188 series uses this signal as a CLOCK source to drive all on-board serial devices, so it always should be programmed as D/O. Changing this signal to other configurations will cause serious errors. User can use this signal to drive external serial devices without any side effects. The software driver provides two subroutines to set SCLK high or low as follows:

ClockLow();   /* SCLK=0=Low */
ClockHigh();   /* SCLK=1=High*/

4.3.2 Using the D/I/O 4

```c
SetDio4Dir(int dir)   /* select D/I or D/O first */
{
 if(dir){ /* set to input */
   outport(0xff70,inport(0xff70)&(~(1<<4)));   /* set MODE to 0 */
   outport(0xff72,inport(0xff72)|(1<<4));       /* set DIR  to 1 */
 }
 else {   /* set to output */
   outport(0xff70,inport(0xff70)|(1<<4));       /* set MODE to 1 */
   outport(0xff72,inport(0xff72)&(~(1<<4)));   /* set DIR  to 0 */
 }
}
OutDio4(int data)     /* set the D/O_4 ON or OFF */
{
 if(data)    /* set D/O_4 ON */
   outport(0xFF74,inport(0xFF74)|(1<<4));
 else        /* set D/O_4 OFF */
   outport(0xFF74,inport(0xFF74)&~(1<<4));
}
GetDio4(void)              /* read the status of D/I_4 */
{
  return inport(0xFF74)&0x0010;
}
```

4.3.3 Using the D/I/O 14

SetDio14Dir(int dir) /* select D/I or D/O first */
```
{
  if(dir){ /* set to input */
    outport(0xff70,inport(0xff70)&(~(1<<14)));  /* set MODE to 0 */
    outport(0xff72,inport(0xff72)|(1<<14));   /* set DIR  to 1 */
  }
  else {   /* set to output */
    outport(0xff70,inport(0xff70)|(1<<14));   /* set MODE to 1 */
    outport(0xff72,inport(0xff72)&(~(1<<14)));  /* set DIR  to 0 */
  }
}
```

OutDio14(int data)   /* set the D/O_14 ON or OFF */
```
{
  if(data)   /* set D/O_14 ON */
    outport(0xFF74,inport(0xFF74)|(1<<14));
  else        /* set D/O_14 OFF */
    outport(0xFF74,inport(0xFF74)&~(1<<14));
}
```

GetDio4(void)   /* read the status of D/I_14 */
```
{
  return inport(0xFF74)&0x4000;
}
```

I/O Expansion Board for prototype & testing

Model	Description	Size	Used with I-7188XA/XB/XC/EX
X000	Prototype Board (Small size)	64mm x 32mm	XA/XC
X001	Prototype Board (Large size)	64mm x 70mm	XA/XC
X002	Prototype Board	114mm x 170mm	XA/XB/XC/EX
X003	Self-test board for 7188XC	64mm x 32mm	XC
X004	Self-test board for 7188XB	64mm x 36mm	XB
X005	Prototype Board (Small size)	38mm x 64mm	XB/EX
X006	Prototype Board (Large size)	72mm x 65mm	XB/EX

I/O Expansion Board for D/I, D/O, Timer/Counter

Model	Description	D/I	D/O	Relay Output	Counter /Timer	Used with I-7188XA /XB/XC/EX
X100	DI/O expansion board	8 (Non-isolated)	-	-	-	XC
X101	DI/O expansion board	-	8 Non-isolated	-	-	XC
X102	Relay expansion board	-	-	2	-	XC
X103	DI/O expansion board	7 (Isolated)	-	-	-	XC
X104	DI/O expansion board	8 (Non-isolated) (each channel can be programmed to DI/DO)		-	-	XC
X105	DI/O expansion board	8 (8 Channels can be programmed to DI/DO)		-	-	XC
X106	DI/O expansion board	Can be used as 2 channels DO or 3 channels DI		-	-	XC
X107	DI/O expansion board	6	7	-	-	XB/EX
X400	Timer/ Counter expansion Board	-	-	-	3 channels 16-bit timer / counter	XC

I/O Expansion Board for A/D, D/A

Model	Description	A/D Channels	Input Range	A/D bits	D/A Channels	Output Range	D/A bits	Used with I-7188XA /XB/XC/EX
X200	A/D expansion board	1	0~2.5V	12 bits	-	-	-	XC
X300	D/A expansion board	-	-	-	2	0~4.095 V	12 bits	XC
X301	A/D, D/A expansion board	1	0~2.5V	12 bits	1	0~4.095 V	12 bits	XC

I/O Expansion Board for RS-232/422

Model Number	Description	RS-232 /RS-422 Channels	Communication speed	Used with I-7188XA /XB/XC/EX
X500	RS-232d	1 (Can be used for Modem)	115.2K	XC
X501	RS-232	Supports one channel 5-wire RS-232 (RTS, CTS, TXD, RXD, GND)	115.2K	XC
X502	RS-232	Supports one channel 5-wire RS-232 (RTS, CTS, TXD, RXD); one channel 3-wire RS-232 (RXD,TXD, GND)	115.2K	XC
X503	RS-232	Supports one channel 5-wire RS-232 (RTS, CTS, TXD, RXD, GND)	115.2K	XB/EX
X504	RS-232	Supports two channel RS-232; one 5-wire RS-232 (RTS, CTS, TXD, RXD, GND) and one 9-wire RS-232	115.2K	XB/EX
X505	RS-232	Supports three-channel 5-wire RS-232 (RTS, CTS, TXD, RXD, GND)	115.2K	XB/EX
X506	RS-232	Supports six-channel 3-wire RS-232 (TXD, RXD, GND)	115.2K	XB/EX
X507	RS-422/485 with D/I/O	Supports one channel RS-422/485, 4-channel D/I and 4-channel D/O	115.2K	XB/EX
X508	RS-232 with D/I/O	Supports one channel RS-422/485, 4-channel D/I and 4-channel D/O	115.2K	XB/EX
X509	RS-232 with D/I/O	Supports 2-channel RS-232, 4-channel D/I and 4-channel D/O	115.2K	XB/EX

Memory Expansion Boards

Model Number	Description	Flash Disk	Battery Backup SRAM Disk	Used with I-7188XA / XB/ XC/ EX
X600	Flash ROM Expansion Board	4M bytes NAND Flash	-	XA/XB/XC/EX
X601	Flash ROM Expansion Board	8M bytes NAND Flash	-	XA/XB/XC/EX
X602	Flash ROM Expansion Board	16M bytes NAND Flash	-	XA/XB/XC/EX
X603	Flash ROM Expansion Board	32M bytes NAND Flash	-	XA/XB/XC/EX
X607	Battery Backup SRAM Board	-	128K Bytes	XA/XB/XC/EX
X608	Battery Backup SRAM Board	-	512K Bytes	XA/XB/XC/EX

Refer to **"CD\napdos\7188x\manual\hardware\iobus_e.pdf"** for more I/O expansion modules

5. Hardware information

5.1 Features

- CPU: AMD's embedded CPU, Am188™ES: 40M, or compatible.
- SRAM: 512K bytes or 256K bytes
- Flash ROM: 512K bytes or 256K bytes
- Built-in EEPROM
- Built-in RTC & NVRAM for 7188EA, 7188EX, 7188EX-256
- Built-in COM port: COM1=RS-232, COM2=RS-485 (7188E1 only provides COM1)
- Built-in I/O Expansion Bus Interface (7188EX, 7188EX-256)
- Built-in watchdog timer for harsh environments
- Built-in power protection circuit
- Built-in RS-485 network protection circuit for RS-485 port
- Built-in self-tuner ASIC controller on RS-485 port
- Program download from PC
- Built-in 5-digit LED display interface (only for with-display version)
- Built-in 64-bit hardware serial number for 7188EA, 7188EX , 7188EX-256
- Built-in OS: MiniOS7 of ICP DAS
- ODM wanted

5.2 Pin Assignment

i-7188E1

Internet Communication Controller
CPU 80188-40
E1   : Ethernet 10 Base T
COM1 : RS-232

E1   1 — COM1 — 9

CTS1 RTS1 RXD1 TXD1 INIT* (R)Vs+ (B)GND
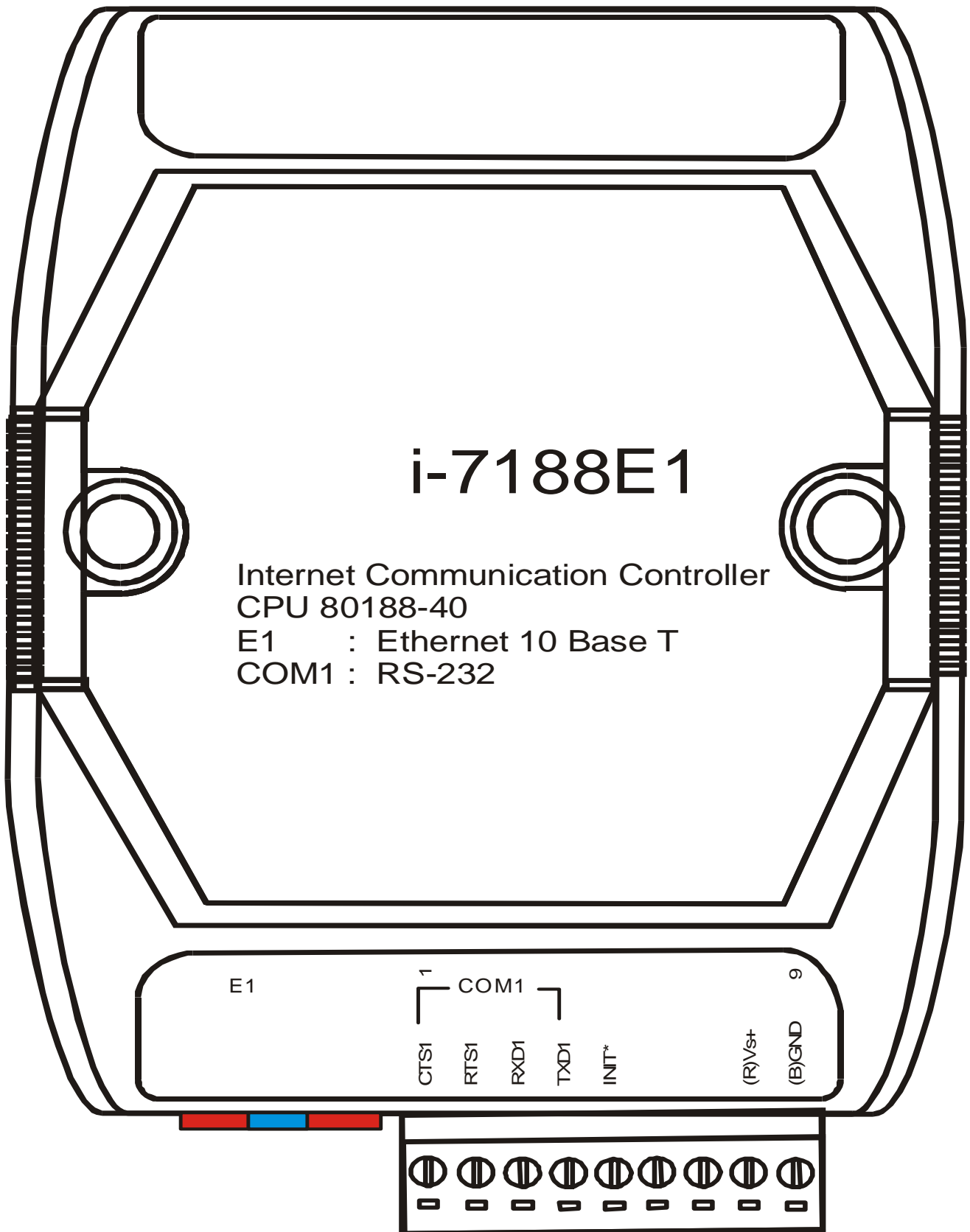
Pin assignment of 7188E1:

Pin	Name	Description
1	CTS1	CTS pin of COM1 (RS-232)
2	RTS1	RTS pin of COM1 (RS-232)
3	RXD1	RXD pin of COM1(RS-232)
4	TXD1	TXD pin of COM1(RS-232)
5	INIT*	Initial pin for enable/disable AUTOEXEC.BAT
6	N/C	
7	N/C	
8	VS+	V+ of power supply (+10 to +30VDC unregulated)
9	GND	GND of power supply

E1: 10BaseT connector

Note:
1. 7188E1 = 7188E2 remove COM2
2. 7188E1D = 7188E2D remove COM2
3. 7188E1/7188E1D does not support I/O Expansion Bus. So you cannot install any X???? into 7188E1/7188E1D.
4. The GND-signal of COM1 is shared with pin-9, GND.
5. The wire connection of CA0910 to PC & 7188E series is given as follows:
6. Refer to Sec. 5.5 for application wiring.

I-7188E2

Internet Communication Controller
CPU 80188-40
E1   : Ethernet 10 Base T
COM1 : RS-232
COM2 : RS-485

E1   COM1   COM2

CTS1 RTS1 RXD1 TXD1 INT* D2+ D2- (R)Vs+ (B)GND
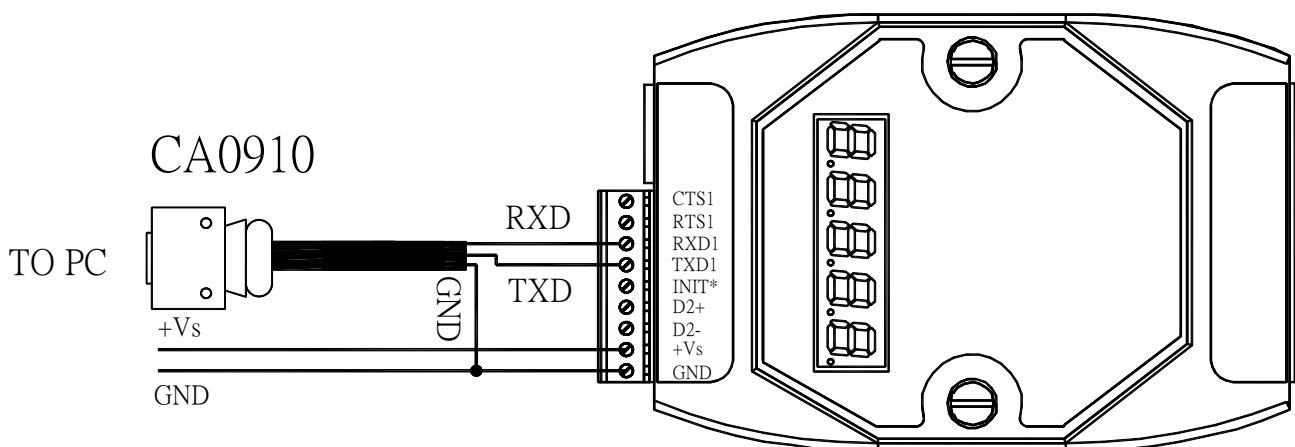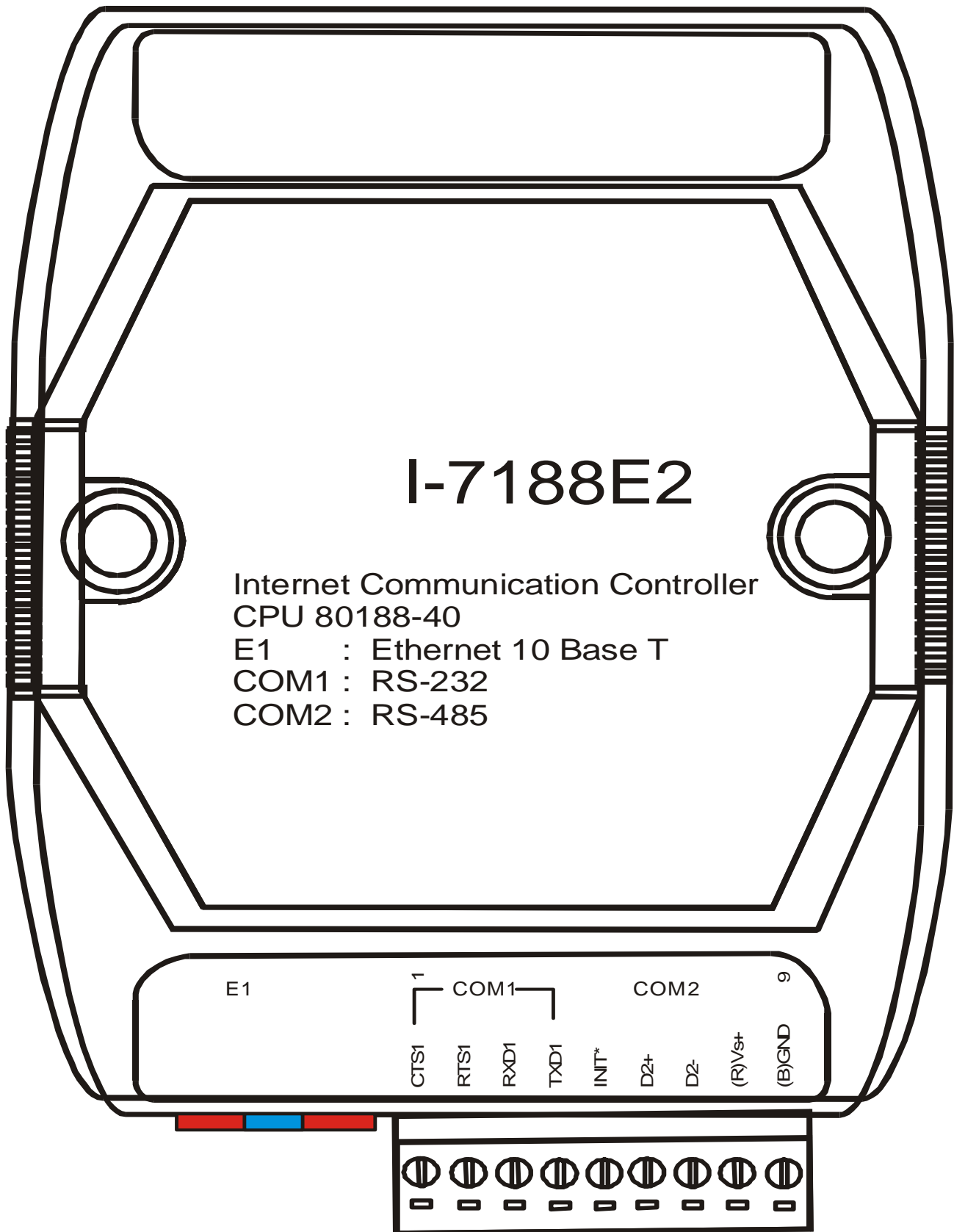
Pin assignment of 7188E2:

Pin	Name	Description
1	CTS1	CTS pin of COM1 (RS-232)
2	RTS1	RTS pin of COM1 (RS-232)
3	RXD1	RXD pin of COM1(RS-232)
4	TXD1	TXD pin of COM1(RS-232)
5	INIT*	Initial pin for enable/disable AUTOEXEC.BAT
6	D2+	Data+ pin of COM2 (RS-485)
7	D2-	Data- pin of COM2 (RS-485)
8	VS+	V+ of power supply (+10 to +30VDC unregulated)
9	GND	GND of power supply

E1: 10BaseT connector

Note:
1. 7188E2/7188E2D does not support I/O Expansion Bus. So you cannot install any X???? into 7188E2/7188E2D.
2. The GND-signal of COM1 is shared with pin-9, GND.
3. Refer to Sec. 5.2 for wire connection of CA0910 to PC & 7188E
1. Refer to Sec. 5.5 for application wiring.

i-7188E3

Internet Communication Controller
CPU 80188-40
E1   : Ethernet 10 Base T
COM1 : RS-232
COM2 : RS-485
COM3 : RS-422/485

DQ3 DO2 DO1 DO0 PWR GND DI3 DI2 DI1 DI0 RXD3- RXD3+ TXD3- TXD3+

COM3

23 (X507) 10

E1 COM1 COM2

CTS1 RTS1 RXD1 TXD1 INT* D2+ D2- (R)Vs+ (B)GND

1 9
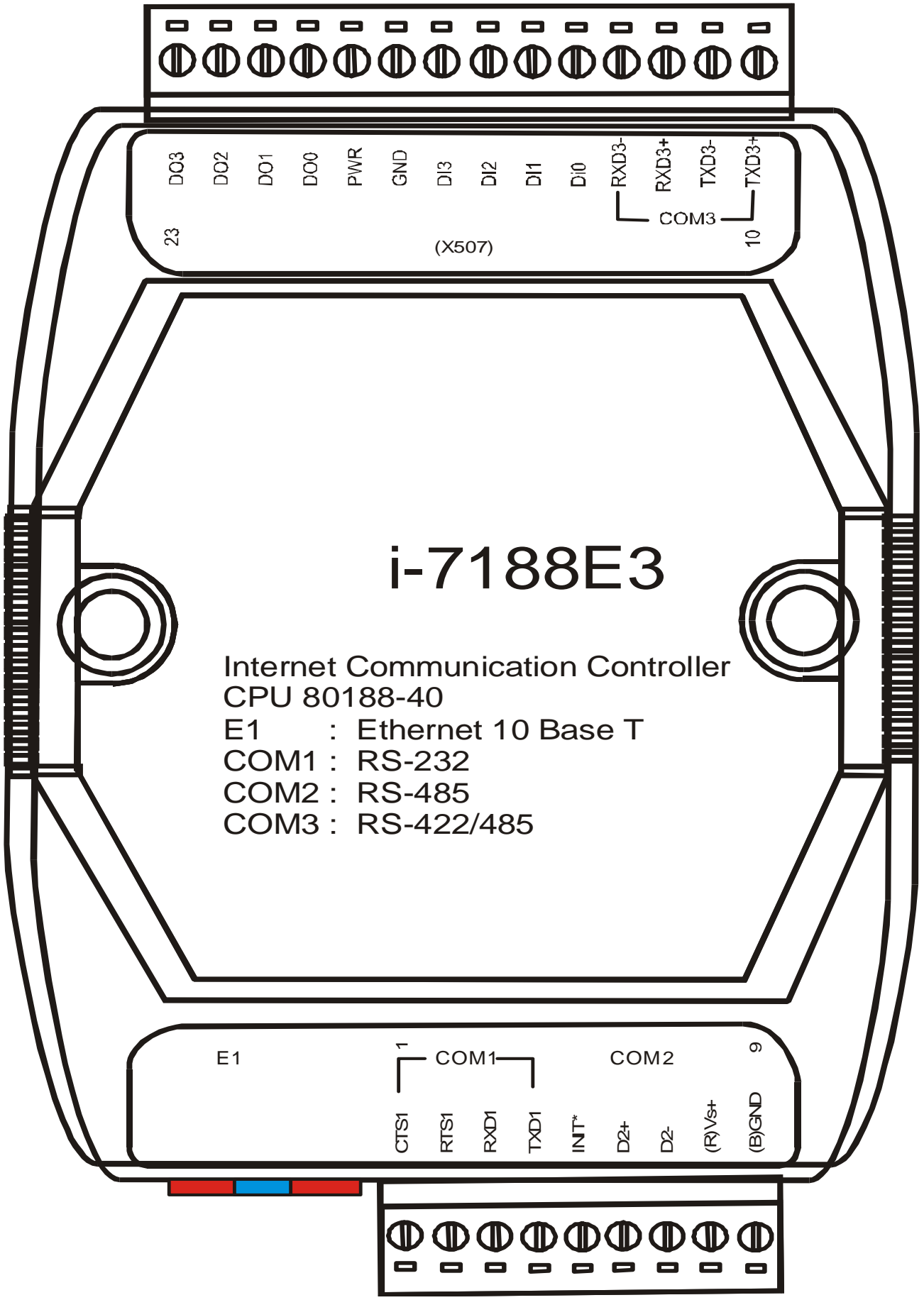
Pin assignment of 7188E3:

Pin	Name	Description
1	CTS1	CTS pin (RS-232) or TXD+ pin (RS-485/RS-422) of COM1
2	RTS1	RTS pin (RS-232) or TXD- pin (RS-485/RS-422) of COM1
3	RXD1	RXD pin (RS-232) or RXD+ pin (RS-422) of COM1
4	TXD1	TXD pin (RS-232) or RXD- pin (RS-422) of COM1
5	INIT*	Initial pin for enable/disable AUTOEXEC.BAT
6	D2+	Data+ pin of COM2 (RS-485)
7	D2-	Data- pin of COM2 (RS-485)
8	VS+	V+ of power supply (+10 to +30VDC unregulated)
9	GND	GND of power supply
10	TXD3+	TXD+ pin of COM3 (RS-422/RS-485)
11	TXD3-	TXD- pin of COM3 (RS-422/RS-485)
12	RXD3+	RXD+ pin of COM3 (RS-422)
13	RXD3-	RXD- pin of COM3 (RS-422)
14	DI0	Digital Input, 3.5V ~ 30V, channel 0
15	DI1	Digital Input, 3.5V ~ 30V, channel 1
16	DI2	Digital Input, 3.5V ~ 30V, channel 2
17	DI3	Digital Input, 3.5V ~ 30V, channel 3
18	GND	GND of Digital Output
19	PWR	Power of Digital Output
20	DO0	Digital Output, 100 mA, 30V max., channel 0
21	DO1	Digital Output, 100 mA, 30V max., channel 1
22	DO2	Digital Output, 100 mA, 30V max., channel 2
23	DO3	Digital Output, 100 mA, 30V max., channel 3

E1: 10BaseT connector

Note:
1. 7188E3/7188E3D does not support I/O Expansion Bus. So you cannot install any X???? into 7188E3/7188E3D
2. The GND-signal of COM1 is shared with pin-9, GND.
3. Refer to Sec. 5.2 for wire connection of CA0910 to PC & 7188E.
4. Refer to Sec. 5.5 for application wiring.

Top terminal labels (left to right):

23 — DO3, DO2, DO1, DO0, PWR, GND, DI3, DI2, DI1, DI0, RXD3, TXD3, RTS3, CTS3 — 10

COM3

(X508)

I-7188E3-232

Internet Communication Controller
CPU 80188-40
E1   :   Ethernet 10 Base T
COM1 :   RS-232
COM2 :   RS-485
COM3 :   RS-232

Bottom labels:

E1   1   COM1   COM2   9

CTS1, RTS1, RXD1, TXD1, INIT*, D2+, D2-, (R)Vs+, (B)GND

Pin assignment of 7188E3-232:

Pin	Name	Description
1	CTS1	CTS pin of COM1 (RS-232)
2	RTS1	RTS pin of COM1 (RS-232)
3	RXD1	RXD pin of COM1(RS-232)
4	TXD1	TXD pin of COM1(RS-232)
5	INIT*	Initial pin for enable/disable AUTOEXEC.BAT
6	D2+	Data+ pin of COM2 (RS-485)
7	D2-	Data- pin of COM2 (RS-485)
8	VS+	V+ of power supply (+10 to +30VDC unregulated)
9	GND	GND of power supply
10	CTS3	CTS pin of COM3 (RS-232)
11	RTS3	RTS pin of COM3 (RS-232)
12	TXD3	TXD pin of COM3 (RS-232)
13	RXD3	RXD pin of COM3 (RS-232)
14	DI0	Digital Input, 3.5V ~ 30V, channel 0
15	DI1	Digital Input, 3.5V ~ 30V, channel 1
16	DI2	Digital Input, 3.5V ~ 30V, channel 2
17	DI3	Digital Input, 3.5V ~ 30V, channel 3
18	GND	GND of Digital Output
19	PWR	Power of Digital Output
20	DO0	Digital Output, 100 mA, 30V max., channel 0
21	DO1	Digital Output, 100 mA, 30V max., channel 1
22	DO2	Digital Output, 100 mA, 30V max., channel 2
23	DO3	Digital Output, 100 mA, 30V max., channel 3

E1: 10BaseT connector

Note:
1. 7188E3-232/7188E3D-232 does not support I/O Expansion Bus. So you cannot install any X???? into 7188E3-232/7188E3D-232.
2. The GND-signal of COM1 is shared with pin-9, GND.
3. Refer to Sec. 5.2 for wire connection of CA0910 to PC & 7188E.
4. Refer to Sec. 5.5 for application wiring.

i-7188E4

Internet Communication Controller
CPU 80188-40
E1   : Ethernet 10 Base T
COM1 : RS-232
COM2 : RS-485
COM3~4 : RS-232

Pin assignment of 7188E4:

Pin	Name	Description
1	CTS1	CTS pin of COM1 (RS-232)
2	RTS1	RTS pin of COM1 (RS-232)
3	RXD1	RXD pin of COM1(RS-232)
4	TXD1	TXD pin of COM1(RS-232)
5	INIT*	Initial pin for enable/disable AUTOEXEC.BAT
6	D2+	Data+ pin of COM2 (RS-485)
7	D2-	Data- pin of COM2 (RS-485)
8	VS+	V+ of power supply (+10 to +30VDC unregulated)
9	GND	GND of power supply
10	CTS3	CTS pin of COM3 (RS-232)
11	RTS3	RTS pin of COM3 (RS-232)
12	TXD3	TXD pin of COM3 (RS-232)
13	RXD3	RXD pin of COM3 (RS-232)
14	GND3	GND pin of COM3 (RS-232)
15	GND4	GND pin of COM4 (RS-232)
16	RXD4	RXD pin of COM4 (RS-232)
17	TXD4	TXD pin of COM4 (RS-232)
18	RTS4	RTS pin of COM4 (RS-232)
19	CTS4	CTS pin of COM4 (RS-232)
20	DSR4	DSR pin of COM4 (RS-232)
21	DTR4	DTR pin of COM4 (RS-232)
22	DCD4	DCD pin of COM4 (RS-232)
23	RI4	RI pin of COM4 (RS-232)

E1: 10BaseT connector

Note:
1. 7188E4/7188E4D does not support I/O Expansion Bus. So you cannot install any X???? into 7188E4/7188E4D.
2. The GND-signal of COM1 is shared with pin-9, GND.
3. Refer to Sec. 5.2 for wire connection of CA0910 to PC & 7188E.
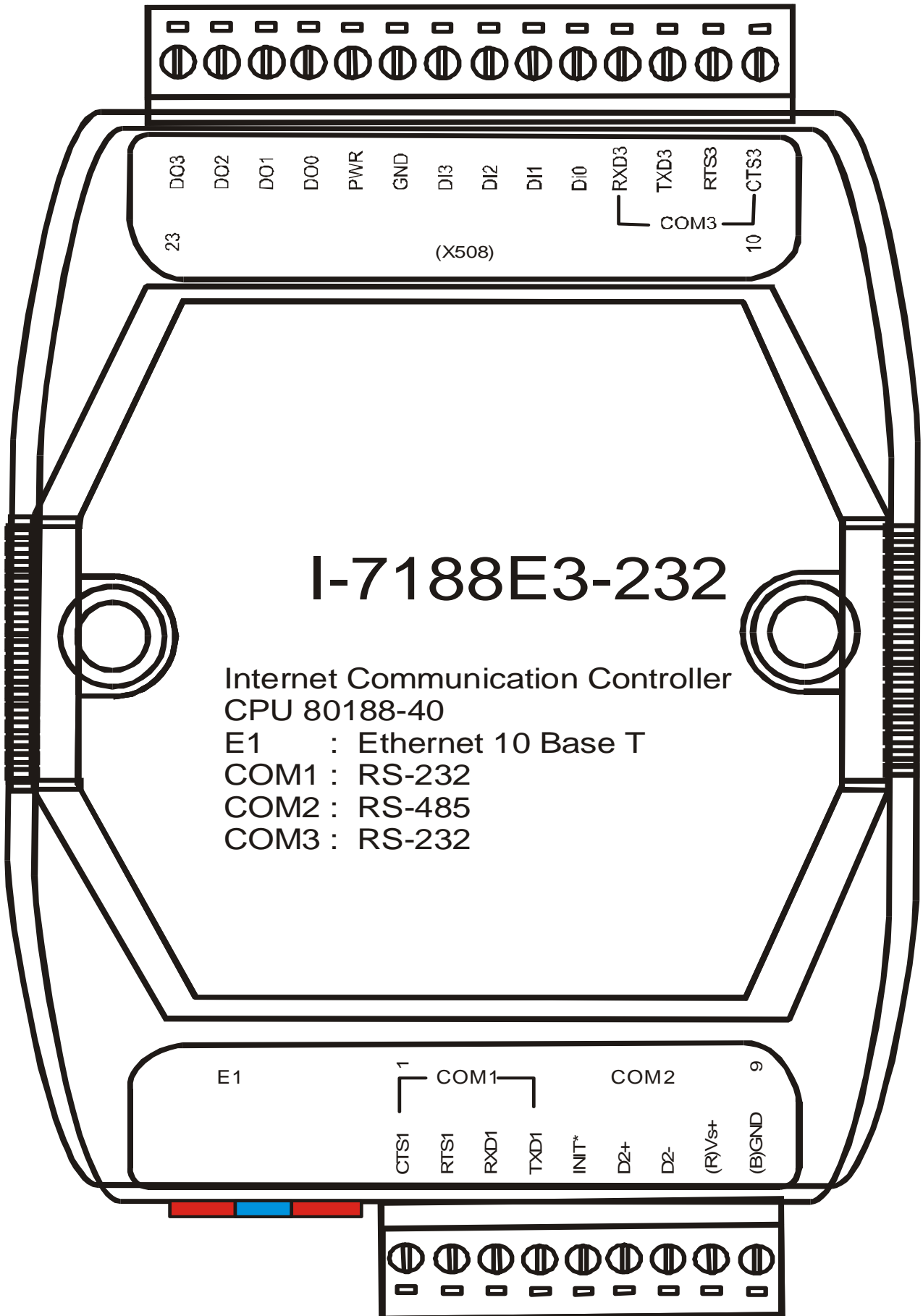4. Refer to Sec. 5.5 for application wiring.
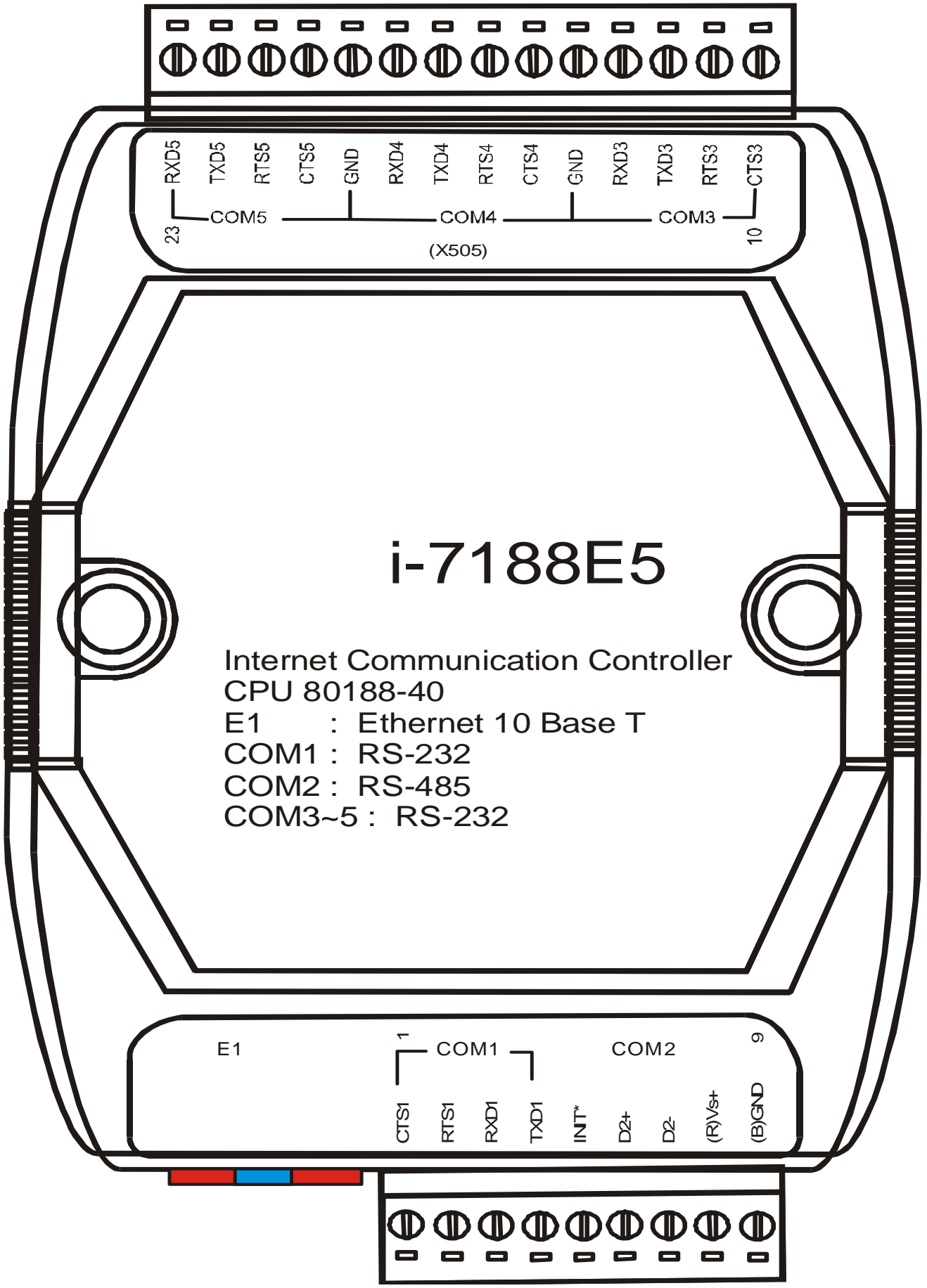
i-7188E5

Internet Communication Controller
CPU 80188-40
E1 : Ethernet 10 Base T
COM1 : RS-232
COM2 : RS-485
COM3~5 : RS-232
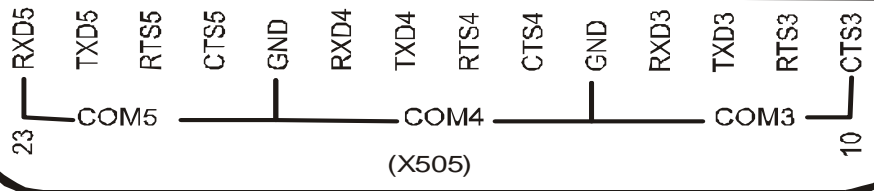
Pin assignment of 7188E5:

Pin	Name	Description
1	CTS1	CTS pin of COM1 (RS-232)
2	RTS1	RTS pin of COM1 (RS-232)
3	RXD1	RXD pin of COM1(RS-232)
4	TXD1	TXD pin of COM1(RS-232)
5	INIT*	Initial pin for enable/disable AUTOEXEC.BAT
6	D2+	Data+ pin of COM2 (RS-485)
7	D2-	Data- pin of COM2 (RS-485)
8	VS+	V+ of power supply (+10 to +30VDC unregulated)
9	GND	GND of power supply
10	CTS3	CTS pin of COM3 (RS-232)
11	RTS3	RTS pin of COM3 (RS-232)
12	TXD3	TXD pin of COM3 (RS-232)
13	RXD3	RXD pin of COM3 (RS-232)
14	GND	GND pin of COM3/COM4 (RS-232)
15	CTS4	CTS pin of COM4 (RS-232)
16	RTS4	RTS pin of COM4 (RS-232)
17	TXD4	TXD pin of COM4 (RS-232)
18	RXD4	RXD pin of COM4 (RS-232)
19	GND	GND pin of COM4/5 (RS-232)
20	CTS5	CTS pin of COM5 (RS-232)
21	RTS5	RTS pin of COM5 (RS-232)
22	TXD5	TXD pin of COM5 (RS-232)
23	RXD5	RXD pin of COM5 (RS-232)

E1: 10BaseT connector

Note:
1. 7188E5/7188E5D does not support I/O Expansion Bus. So you cannot install any X???? into 7188E5/7188E5D.
2. The GND-signal of COM1 is shared with pin-9, GND.
3. Refer to Sec. 5.2 for wire connection of CA0910 to PC & 7188E.
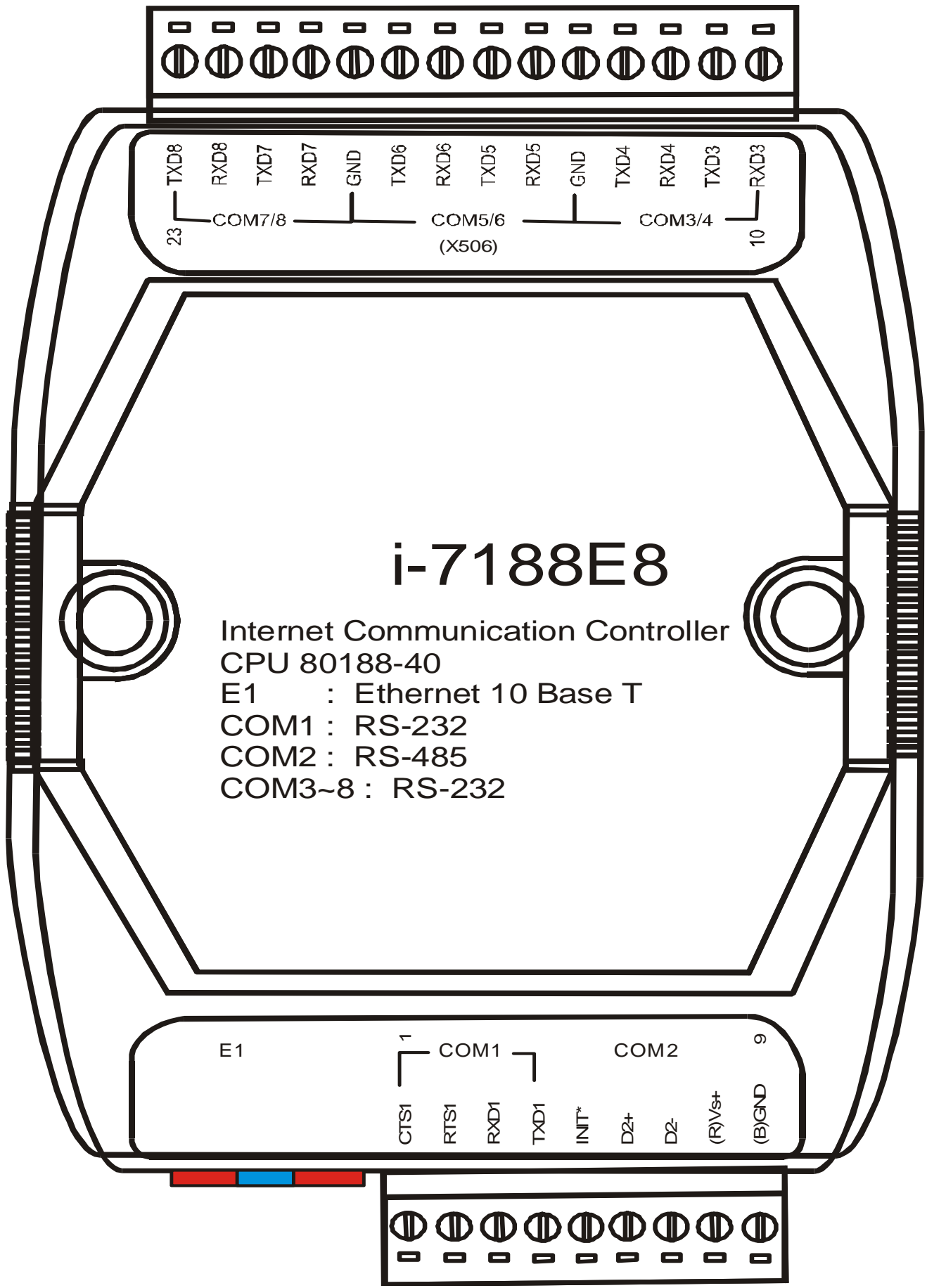
i-7188E8

Internet Communication Controller
CPU 80188-40
E1 : Ethernet 10 Base T
COM1 : RS-232
COM2 : RS-485
COM3~8 : RS-232

Pin assignment of 7188E8:

Pin	Name	Description
1	CTS1	CTS pin of COM1 (RS-232)
2	RTS1	RTS pin of COM1 (RS-232)
3	RXD1	RXD pin of COM1(RS-232)
4	TXD1	TXD pin of COM1(RS-232)
5	INIT*	Initial pin for enable/disable AUTOEXEC.BAT
6	D2+	Data+ pin of COM2 (RS-485)
7	D2-	Data- pin of COM2 (RS-485)
8	VS+	V+ of power supply (+10 to +30VDC unregulated)
9	GND	GND of power supply
10	RXD3	RXD pin of COM3 (RS-232)
11	TXD3	TXD pin of COM3 (RS-232)
12	RXD4	RXD pin of COM4 (RS-232)
13	TXD4	TXD pin of COM4 (RS-232)
14	GND	GND pin of COM3/4/5/6 (RS-232)
15	RXD5	RXD pin of COM5 (RS-232)
16	TXD5	TXD pin of COM5 (RS-232)
17	RXD6	RXD pin of COM6 (RS-232)
18	TXD6	TXD pin of COM6 (RS-232)
19	GND	GND pin of COM5/6/7/8 (RS-232)
20	RXD7	RXD pin of COM7 (RS-232)
21	TXD7	TXD pin of COM7 (RS-232)
22	RXD8	RXD pin of COM8 (RS-232)
23	TXD8	TXD pin of COM8 (RS-232)

E1: 10BaseT connector

Note:
1. 7188E8/7188E8D does not support I/O Expansion Bus. So you cannot install any X???? into 7188E8/7188E8D.
2. The GND-signal of COM1 is shared with pin-9, GND.
3. Refer to Sec. 5.2 for wire connection of CA0910 to PC & 7188E.
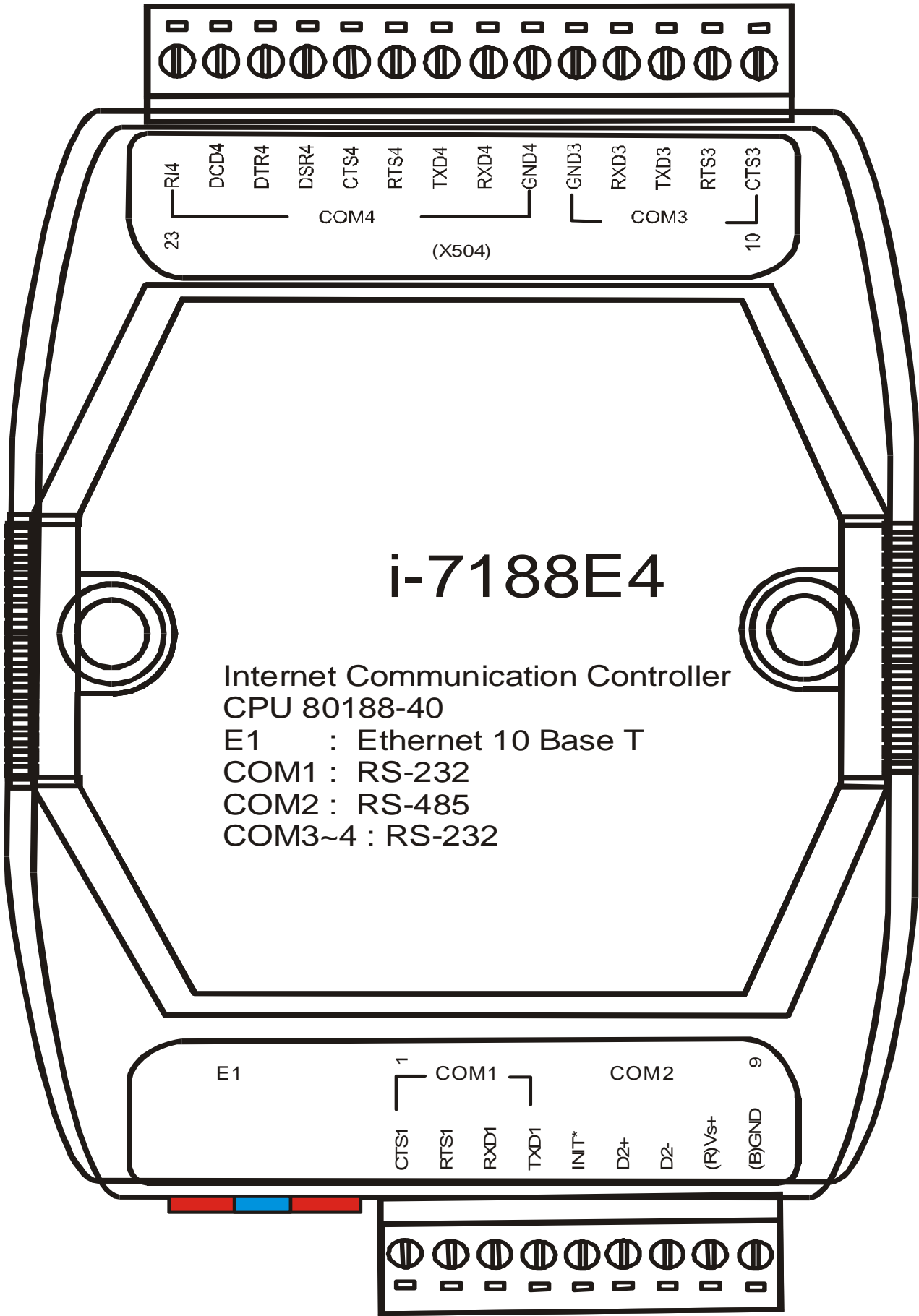4. Refer to Sec. 5.5 for application wiring.

i-7188EA

Embedded Internet/Ethernet Controller
CPU 80188-40
E1   : Ethernet 10 Base T
COM1 : RS-232
COM2 : RS-485
DI:3.5V~30V   DO:100mA, 30V max

Top connector (X107):

DI0 DI1 DI2 DI3 DI4 DI5 PWR DO0 DO1 DO2 DO3 DO4 DO5 DO6
23 — DI — — DO — 10

Bottom connector:

E1   1 — COM1 —   COM2   9
CTS1 RTS1 RXD1 TXD1 INT* D2+ D2- (R)Vs+ (B)GND
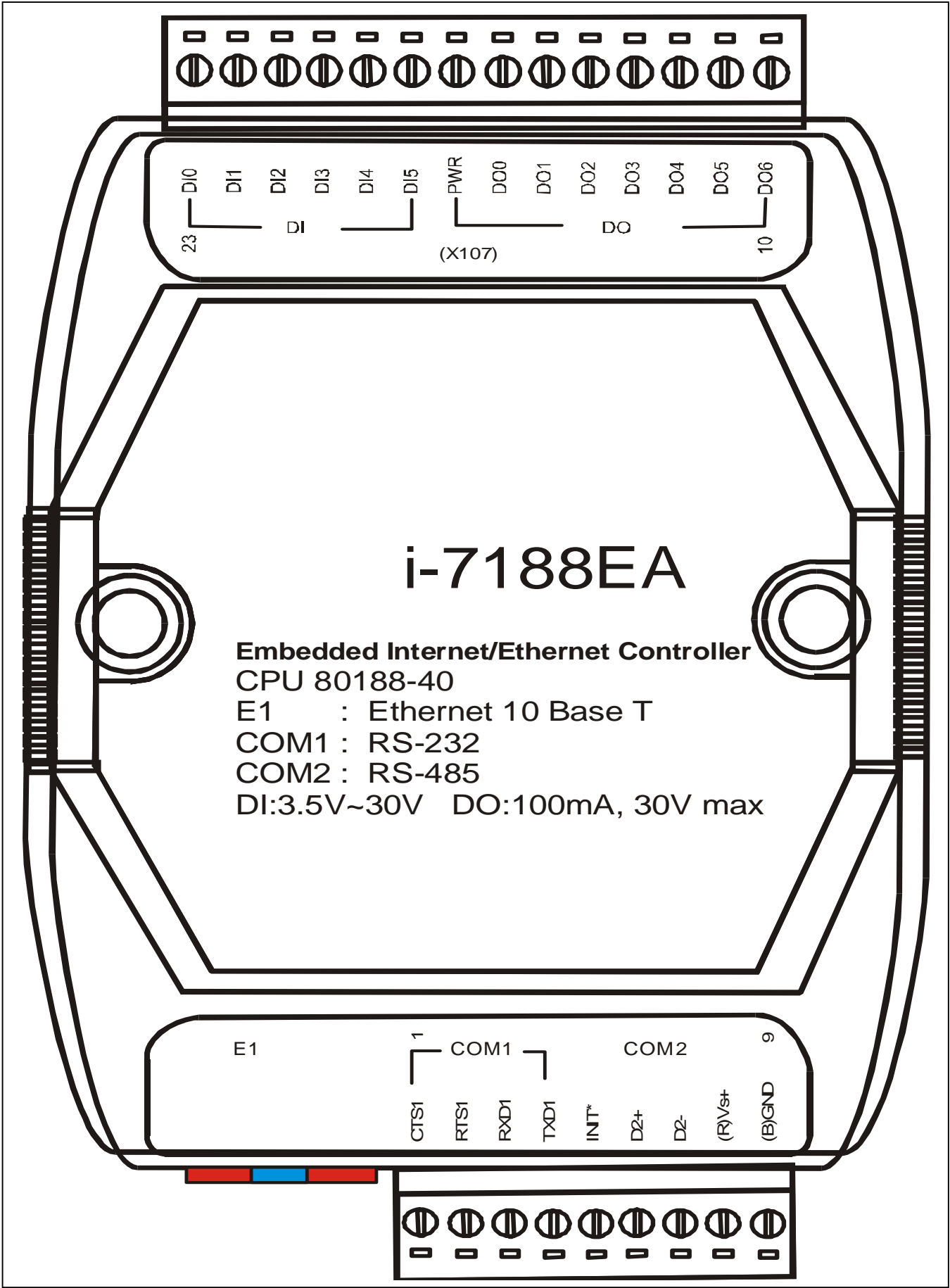
Pin assignment of 7188EA:

Pin	Name	Description
1	CTS1	CTS pin of COM1 (RS-232)
2	RTS1	RTS pin of COM1 (RS-232)
3	RXD1	RXD pin of COM1(RS-232)
4	TXD1	TXD pin of COM1(RS-232)
5	INIT*	Initial pin for enable/disable AUTOEXEC.BAT
6	D2+	Data+ pin of COM2 (RS-485)
7	D2-	Data- pin of COM2 (RS-485)
8	VS+	V+ of power supply (+10 to +30VDC unregulated)
9	GND	GND of power supply
10	DO6	Digital Output, 100 mA, 30V max., channel 6
11	DO5	Digital Output, 100 mA, 30V max., channel 5
12	DO4	Digital Output, 100 mA, 30V max., channel 4
13	DO3	Digital Output, 100 mA, 30V max., channel 3
14	DO2	Digital Output, 100 mA, 30V max., channel 2
15	DO1	Digital Output, 100 mA, 30V max., channel 1
16	DO0	Digital Output, 100 mA, 30V max., channel 0
17	PWR	Power of Digital Output
18	DI5	Digital Input, 3.5V ~ 30V, channel 5
19	DI4	Digital Input, 3.5V ~ 30V, channel 4
20	DI3	Digital Input, 3.5V ~ 30V, channel 3
21	DI2	Digital Input, 3.5V ~ 30V, channel 2
22	DI1	Digital Input, 3.5V ~ 30V, channel 1
23	DI0	Digital Input, 3.5V ~ 30V, channel 0

E1: 10BaseT connector

Note:
1. 7188EA/7188EAD does not support I/O Expansion Bus. So you cannot install any X???? into 7188EA/7188EAD.
2. The GND-signal of COM1 is shared with pin-9, GND.
3. DI base address: **1**.
4. DO base address: **0**.
5. Refer to Sec. 5.2 7188E1 for wire connection of CA0910 to PC & 7188E.
6. Refer to Sec. 5.5 for application wiring.

Terminal block numbers (top, left to right): 23 22 21 20 19 18 17 16 15 14 13 12 11 10

i-7188EX

Embedded Internet/Ethernet Controller
CPU 80188-40
E1   :   Ethernet 10 Base T
COM1 :   RS-232
COM2 :   RS-485
10~23 :   User Define I/O Pin

E1   COM1   COM2   9

CTS1 RTS1 RXD1 TXD1 INT* D2+ D2- (R)Vs+ (B)GND
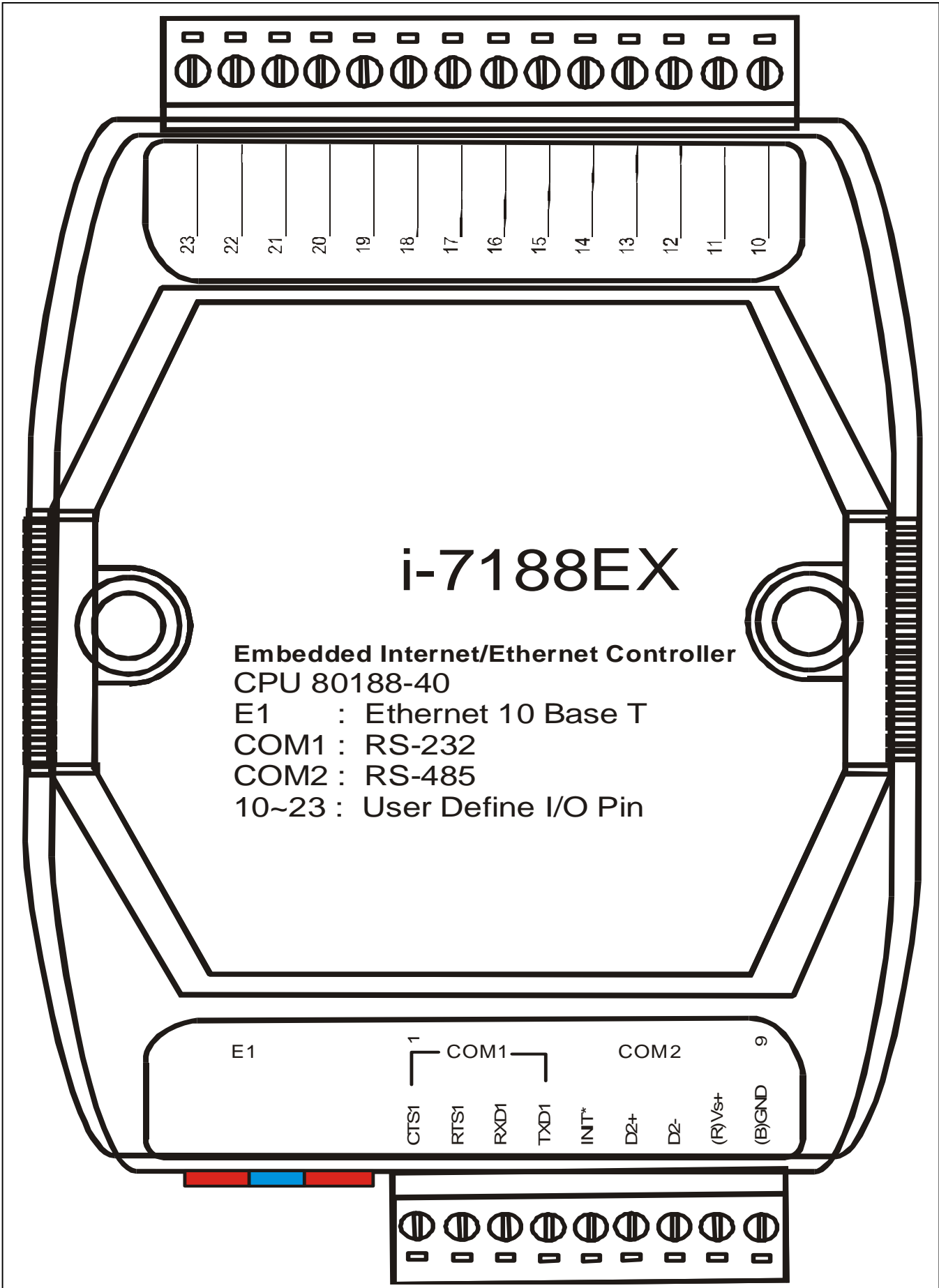
Pin assignment of 7188EX:

Pin	Name	Description
1	CTS1	CTS pin of COM1 (RS-232)
2	RTS1	RTS pin of COM1 (RS-232)
3	RXD1	RXD pin of COM1(RS-232)
4	TXD1	TXD pin of COM1(RS-232)
5	INIT*	Initial pin for enable/disable AUTOEXEC.BAT
6	D2+	Data+ pin of COM2 (RS-485)
7	D2-	Data- pin of COM2 (RS-485)
8	VS+	V+ of power supply (+10 to +30VDC unregulated)
9	GND	GND of power supply
10		User define pin 10
11		User define pin 11
12		User define pin 12
13		User define pin 13
14		User define pin 14
15		User define pin 15
16		User define pin 16
17		User define pin 17
18		User define pin 18
19		User define pin 19
20		User define pin 20
21		User define pin 21
22		User define pin 22
23		User define pin 23

E1: 10BaseT connector

Note:
1. The 7188EX/7188EXD is designed to add an X???? to I/O Expansion Bus.
2. The GND-signal of Com1 is shared with pin-9, GND.
3. Refer to Sec. 5.2 7188E1 for wire connection of CA0910 to PC & 7188E.
4. Refer to Sec. 5.5 for application wiring.

5.3 Specifications

General environment
- Operating temperature: -25°C to +75°C
- Storage temperature: -40°C to +85°C
- Humidity: 0 to 90 %
- Built-in Watch Dog Timer (1.6 seconds)
- Built-in power protection & network protection circuit
- Program download from PC
- Built-in I/O expansion bus interface for 7188EX(D) & 7188EX-256(D)

5.3.1 Specifications for 7188EX(D), 7188EX-256(D) & 7188EA(D)

System
- Module name: Embedded controller
- CPU: Am188™ES, 40M Hz, or compatible
- SRAM: 512K bytes for 7188EX(D) & 7188EX(D)-256 & 7188EA(D)
- FLASH ROM: 512K bytes for 7188EX(D) & 7188EA(D)
                256K bytes for 7188EX-256(D)
- COM port: COM1=RS-232, COM2=RS-485
- Built-in RTC, NVRAM & EEPROM
- Program download from COM1
- Built-in 64-bits hardware unique serial number

Real Time Clock
- Year-2000 compliance
- Gives seconds, minutes, hours, date of the month
- Gives month and year, **from 1980 to 2079**
- NVSRAM: 31 bytes, battery backup, data valid up to 10 years

EEPROM
- 2048 bytes (8 blocks, each block has 256 bytes)
- Data retention > 100 years
- 1,000,000 erase/write cycles

Flash Memory
- 512K bytes or 256K bytes
- Erase unit is one sector(64K bytes)
- 100,000 erase/write cycles

COM1
- RS-232: TXD,RXD,RTS,CTS,GND
- Communication speed: 115200 max.
- Program download port

COM2
- RS-485: Data+, Data-, self-tuner ASIC inside
- Communication speed: 115200 max.

Display
- 7-segment LED: 5-digit (for 7188EAD, 7188EXD, 7188EXD-256)

Power
- Power requirements: 10 to 30VDC(non-regulated)
- Power consumption: 2.0W for 7188EX
    3.0W for 7188EXD
    2.0W for 7188EX-256
    2.0W for 7188EXD-256
    2.0W for 7188EA
    3.0W for 7188EAD

D/I/O:
- D/I: 6 channels, 3.5V ~ 30V max. Base address: 1
- D/O: 7 channels, 100mA, 30V max. Base address: 0

5.3.2 Specifications for 7188E1/2/3/4/5/8(D)

System
- Module name: Embedded controller
- CPU: Am188™ES, 40M Hz, or compatible
- SRAM: 256K bytes
- FLASH ROM: 512K bytes
- Built-in EEPROM
- Program download from PC

EEPROM
- 2048 bytes (8 blocks, each block has 256 bytes)
- Data retention > 100 years
- 1,000,000 erase/write cycles

Flash Memory
- 256K bytes
- Erase unit is one sector (64K bytes)
- 100,000 erase/write cycles

COM1
- RS-232: TXD,RXD,RTS,CTS,GND
- Communication speed: 115200 max.
- Program download port

COM2 for 7188E2/3/4/5/8(D)
- RS-485: D2+, D2-
- Communication speed: 115200 max.
- Directly connect to I7000 RS-485 network

Display
- 7-segmemt LED: 5-digit (for 7188E1/2/3/4/5/8D)

Power
- Power requirements: 10 to 30VDC(non-regulated)
- Power consumption: 2.0W for 7188E1/2/3/4/5/8
                      3.0W for 7188E1/2/3/4/5/8D

Comparison table of 7188E1/2/3/4/5/8(D).

Model Number	7188E1	7188E2	7188E3	7188E3-232	7188E4	7188E5	7188E5-485	7188E8
CPU (80188)	40M	40M	40M	40M	40M	40M	40M	40M
SRAM	256K	256K	256K	256K	256K	256K	256K	256K
Flash	512K	512K	512K	512K	512K	512K	512K	512K
Ethernet Port	10 BaseT	10 BaseT	10 BaseT	10 BaseT	10 BaseT	10 BaseT	10 BaseT	10 BaseT
COM 1 Port	RS-232 (Note1)	RS-232 (Note1)	RS-232 (Note1)	RS-232 (Note1)	RS-232 (Note1)	RS-232 (Note1)	RS-232 (Note1)	RS-232 (Note1)
COM 2 port	-	RS-485 (Note3)	RS-485 (Note3)	RS-485 (Note3)	RS-485 (Note3)	RS-485 (Note3)	RS-485 (Note3)	RS-485 (Note3)
COM 3 port	-	-	RS-422 (Note5)	RS-232 (Note1)	RS-232 (Note1)	RS-232 (Note1)	RS-232 (Note3)	RS-232 (Note2)
COM 4 port	-	-	-	-	RS-232 (Note4)	RS-232 (Note1)	RS-232 (Note3)	RS-232 (Note2)
COM 5 port	-	-	-	-	-	RS-232 (Note1)	RS-232 (Note3)	RS-232 (Note2)
COM 6 port	-	-	-	-	-	-	-	RS-232 (Note2)
COM 7 port	-	-	-	-	-	-	-	RS-232 (Note2)
COM 8 port	-	-	-	-	-	-	-	RS-232 (Note2)
DI	-	-	4	4	-	-	-	-
DO	-	-	4	4	-	-	-	-
RTC	N	N	N	N	N	N	N	N
Embedded O.S.	MiniOS7	MiniOS7	MiniOS7	MiniOS7	MiniOS7	MiniOS7	MiniOS7	MiniOS7

Note1: RS-232, TXD, RXD, RTS, CTS, GND
Note2: RS-232, TXD, RXD, GND
Note3: RS-485, D2+, D2-; Self-tuner inside
Note4: RS-232, TXD, RXD, RTS, CTS, GND, DCD, DTR, DSR, RI
Note5: RS-422: TXD+, TXD-, RXD+, RXD-

Comparison table of 7188, 7188EA, 7188EX and 7188EX-256:

	7188	7188EA	7188EX	7188EX-256
CPU clock	40M	40M	40M	40M
SRAM	256K	512K	512K	256K
Flash ROM	256K/512K	512K	512K	512K
COM1	RS-232 or RS-485	RS-232	RS-232	RS-232
COM2	RS-485, non-isolated	RS-485, self-tuner inside, non-isolated	RS-485, self-tuner inside, non-isolated	RS-485, self-tuner inside, non-isolated
COM3	RS-232	No Com3	No Com3	No Com3
COM4	RS-232	No Com4	No Com4	No Com4
RTC	Yes	Yes	Yes	Yes
EEPROM	2K bytes	2K bytes	2K bytes	2K bytes
D/I(3.5V~30V)	0	6 channels	0	0
D/O(150mA, 30V)	0	7 channels	0	0
User Defined pins	0	0	14 pins	14 pins
Hardware Serial Number inside	No	Yes	Yes	Yes
Operation system	MiniOS7	MiniOS7	MiniOS7	MiniOS7
Programming language	TC, MSC, BC	TC, MSC, BC	TC, MSC, BC	TC, MSC, BC
Program download	Yes	Yes	Yes	Yes
I/O extension bus	No	No	Yes	Yes
Ethernet interface	No	10M,10BaseT	10M,10BaseT	10M,10BaseT

5.4 Block Diagram

```
+-----------------------------------------------------------------------+
|                                                                       |
|                 +---------------------------------------------+       |
|                 | SRAM:      512K for 7188EX(D)                |       |
|                 |            256K for 7188EX(D)-256            |       |
|                 | Flash-ROM: 512K for 7188EX(D)               |       |
|                 |            256K for 7188EX(D)-256            |       |
|                 +---------------------------------------------+       |
|                                      ^                                 |
|   +-----------+          +-----------v-----------+    +-----------+    |
|   |  COM1     |<-------->|                       |<-->| RTC &     |    |
|   |  RS-232   |          |                       |    | NVSRAM    |    |
|   +-----------+          |                       |    +-----------+    |
|                          |       80188-40        |                     |
|   +-----------+          |    watchdog timer     |    +-----------+    |
|   |  COM2     |<-------->|     16 bits timer     |<-->| EEPROM    |    |
|   |  RS-485   |          |  hardware serial no.  |    |  (2K)     |    |
|   +-----------+          |                       |    +-----------+    |
|   +-----------+          |                       |    +-----------+    |
|   |I/O Expansion|<------>|                       |    | 5-digit LED|   |
|   |   Bus     |          |                       |--->| (7188EXD) |    |
|   +-----------+          |                       |    |(7188EXD-256)|  |
|   +-----------+          |                       |    +-----------+    |
|   |   E1      |<-------->|                       |                     |
|   | 10BaseT   |          +-----------^-----------+                     |
|   +-----------+                      | +5V                             |
|                          +-----------^-----------+                     |
|   7188EX                 | +10V to +30V          |                     |
|   7188EXD                | power converter       |                     |
|   7188EX-256             +-----------------------+                     |
|   7188EXD-256                                                          |
+-----------------------------------------------------------------------+
```

7188EA/7188EAD

7188EX/7188EXD

```
                      ┌─────────────────────┐
                      │ SRAM: 512K,         │
                      │ Flash-ROM: 512K     │
                      └─────────┬───────────┘
                                ↕
┌──────────────┐                          ┌──────────────┐
│ COM1         │←──────→┌──────────────┐→│ RTC &        │
│ RS-232       │        │              │  │ NVSRAM       │
└──────────────┘        │  80188-40    │  └──────────────┘
┌──────────────┐        │  watchdog    │  ┌──────────────┐
│ COM2         │←──────→│  timer       │←→│ EEPROM       │
│ RS-485       │        │  16 bits     │  │ (2K)         │
└──────────────┘        │  timer       │  └──────────────┘
┌──────────────┐        │  hardware    │  ┌──────────────┐
│ I/O Expansion│←──────→│  serial no.  │  │ 5-digit      │
│ Bus          │        │              │─→│ LED          │
└──────────────┘        │              │  │ (7188EXD)    │
┌──────────────┐        │              │  └──────────────┘
│ E1           │←──────→│              │
│ 10BaseT      │        └──────┬───────┘
└──────────────┘               ↑ +5V
                      ┌─────────────────────┐
                      │ +10V to +30V        │
                      │ power converter     │
                      └─────────────────────┘
```

D/I/O ↔ I/O Expansion Bus

7188E1/7188E1D
7188E2/7188E2D

```
                      ┌─────────────────────┐
                      │ SRAM: 256K          │
                      │ Flash-ROM: 256K     │
                      └─────────┬───────────┘
                                ↕
┌──────────────┐                          ┌──────────────┐
│ COM1         │←──────→┌──────────────┐←→│ EEPROM       │
│ RS-232       │        │              │  │ (2K)         │
└──────────────┘        │  80188-40    │  └──────────────┘
┌──────────────┐        │  watchdog    │  ┌──────────────┐
│ COM2         │        │  timer       │  │ 5-digit LED  │
│ RS-485       │←──────→│  16 bits     │─→│ (7188E1D)    │
│ for 7188E2(D)│        │  timer       │  │ (7188E2D)    │
└──────────────┘        │              │  └──────────────┘
┌──────────────┐        │              │
│ I/O Expansion│←──────→│              │
│ Bus          │        │              │
└──────────────┘        │              │
┌──────────────┐        │              │
│ E1           │←──────→│              │
│ 10BaseT      │        └──────┬───────┘
└──────────────┘               ↑ +5V
                      ┌─────────────────────┐
                      │ +10V to +30V        │
                      │ power converter     │
                      └─────────────────────┘
```

```
                     ┌──────────────────────────┐
                     │ SRAM: 256K               │
                     │ Flash-ROM: 256K          │
                     └────────────┬─────────────┘
                                  ↕
┌───────────────┐        ┌────────────────┐        ┌─────────────────┐
│ COM1          │◄──────►│                │◄──────►│ COM3            │
│ RS-232        │        │                │        │ RS-422/RS-232   │
└───────────────┘        │                │        └─────────────────┘
┌───────────────┐        │                │        ┌─────────────────┐
│ COM2          │◄──────►│  80188-40      │◄──────►│ COM4~8          │
│ RS-485        │        │  watchdog timer│        │ RS-232          │
└───────────────┘        │  16 bits timer │        └─────────────────┘
┌───────┐ ┌───────────┐  │                │        ┌─────────────────┐
│ D/I/O │◄│I/O Expansion│◄─►│              │◄──────►│ EEPROM (2K)     │
└───────┘ │ Bus       │  │                │        └─────────────────┘
          └───────────┘  │                │        ┌─────────────────┐
          ┌───────────┐  │                │───────►│ 5-digit LED     │
          │ E1        │◄─►│              │        │ (7188END)       │
          │ 10BaseT   │  │                │        └─────────────────┘
          └───────────┘  └───────┬────────┘
                                 ↑ +5V
                     ┌───────────────────────┐
                     │ +10V to +30V          │
                     │ power converter       │
                     └───────────────────────┘
```

7188EN/7188END

5.5 The Wire Connection of 7188EN Series

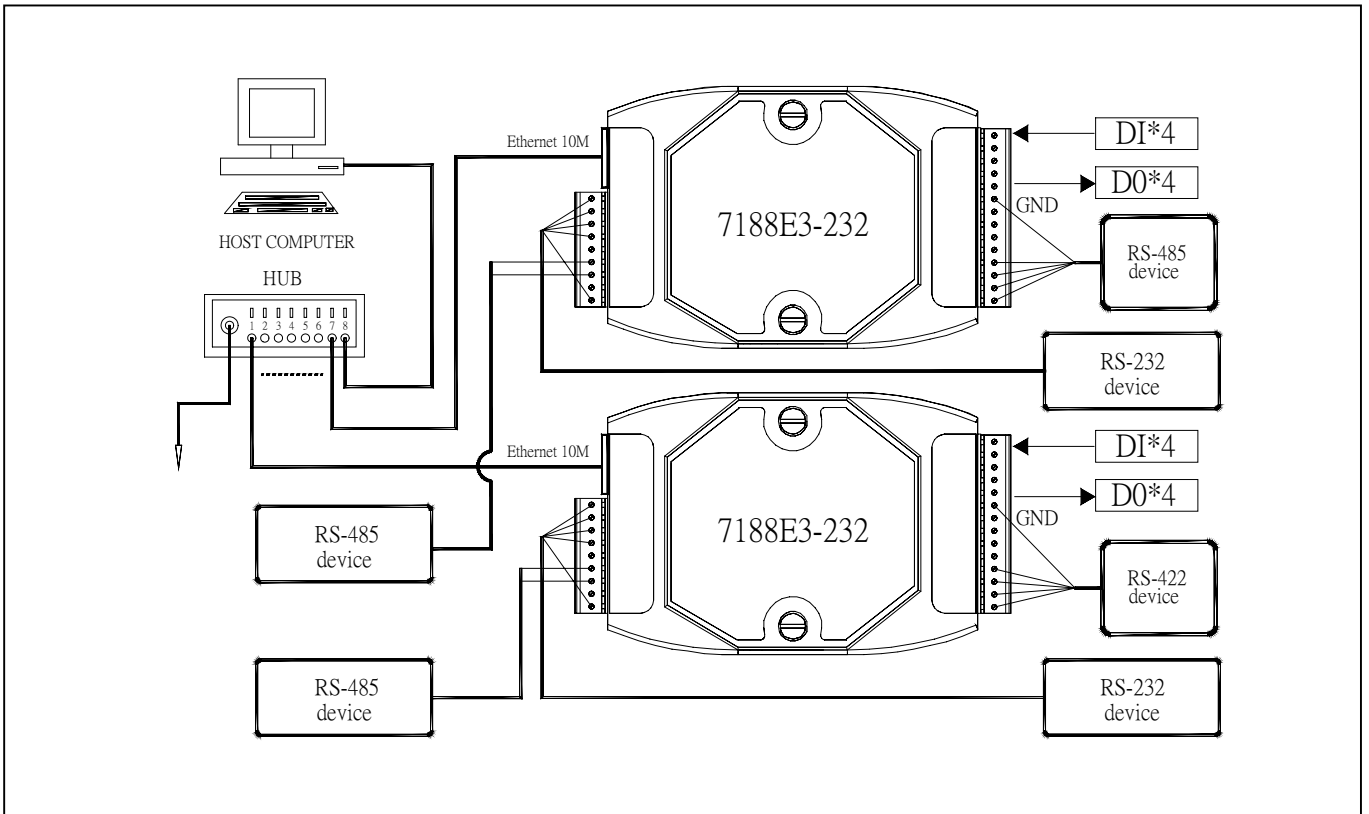The 7188EN family can be used as communication controller as follows:

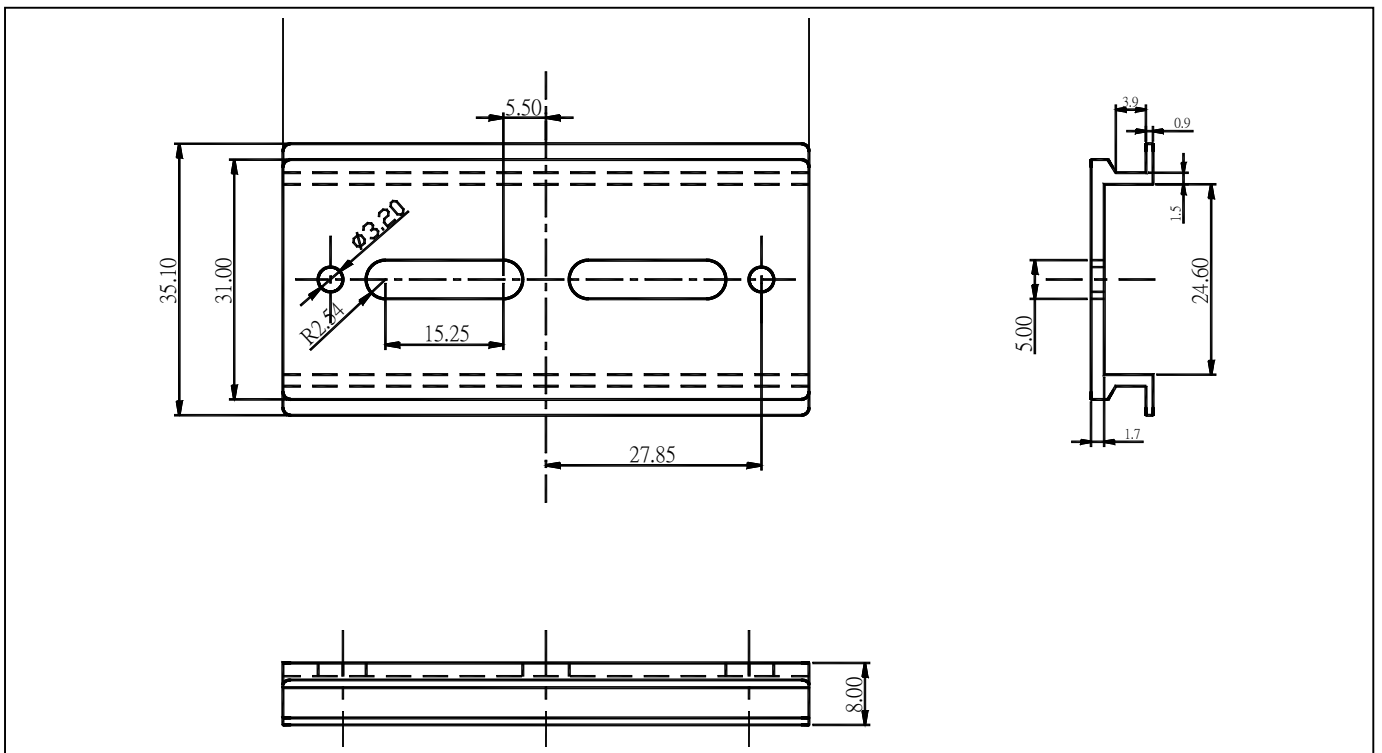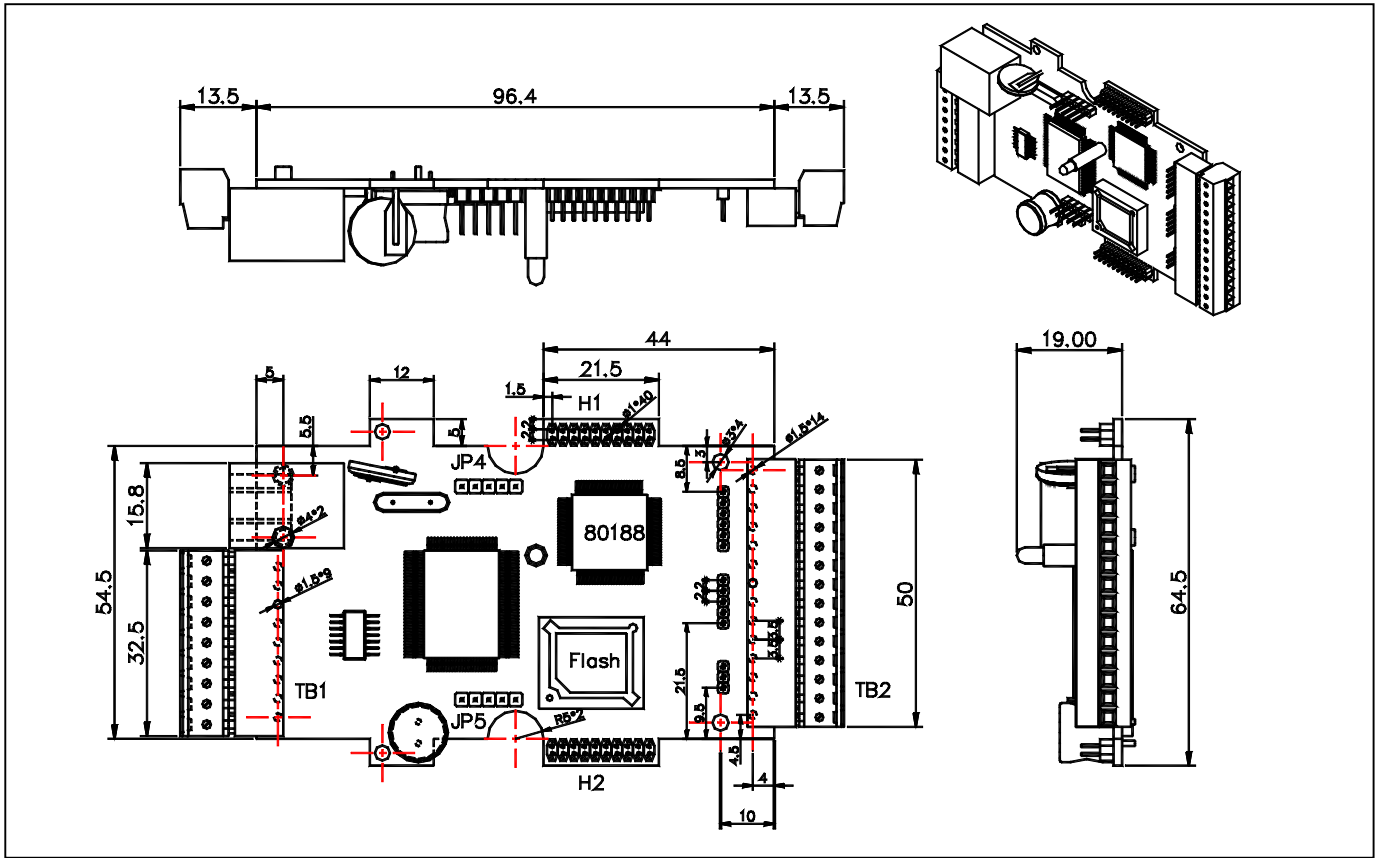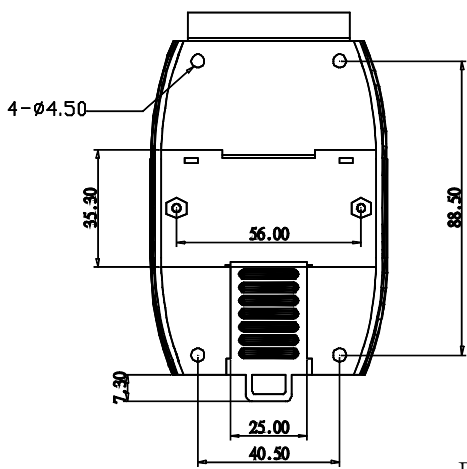| 7521/7188E1 family	Network Interface To Host-PC	Interface to local RS-232/485/422 devices			Local D/I/O	
		RS-232	RS-485	RS-422	DI	DO
7188E1	Ethernet 10M	1	0	0	0	0
7188E2	Ethernet 10M	1	1	0	0	0
7188E3	Ethernet 10M	1	1	1	4	4
7188E3-232	Ethernet 10M	2	1	0	4	4
7188E4	Ethernet 10M	3	1	0	0	0
7188E5	Ethernet 10M	4	1	0	0	0
7188E8	Ethernet 10M	7	1	0	0	0
7188EX-256+X503 or 7188EX+X503	Ethernet 10M	2	1	0	0	0
7188EX-256+X509 or 7188EX+X509	Ethernet 10M	3	1	0	4	4
We welcome ODM X??? designs. Please send specifications to service@icpdas.com						

The wire connection of 7188E1 family is given as following:

Ethernet 10M

HOST COMPUTER

HUB

1 2 3 4 5 6 7 8

7188E3-232

DI*4

D0*4

GND

RS-485 device

RS-232 device

Ethernet 10M

RS-485 device

7188E3-232

DI*4

D0*4

GND

RS-422 device

RS-485 device

RS-232 device

Ethernet 10M

HOST COMPUTER

HUB

1 2 3 4 5 6 7 8

To Ethernet Router

7188E4

RS-232 device

RS-232 device

RS-232 device

Ethernet 10M

RS-485 device

7188E4

RS-232 device

RS-232 device

RS-485 device

RS-232 device
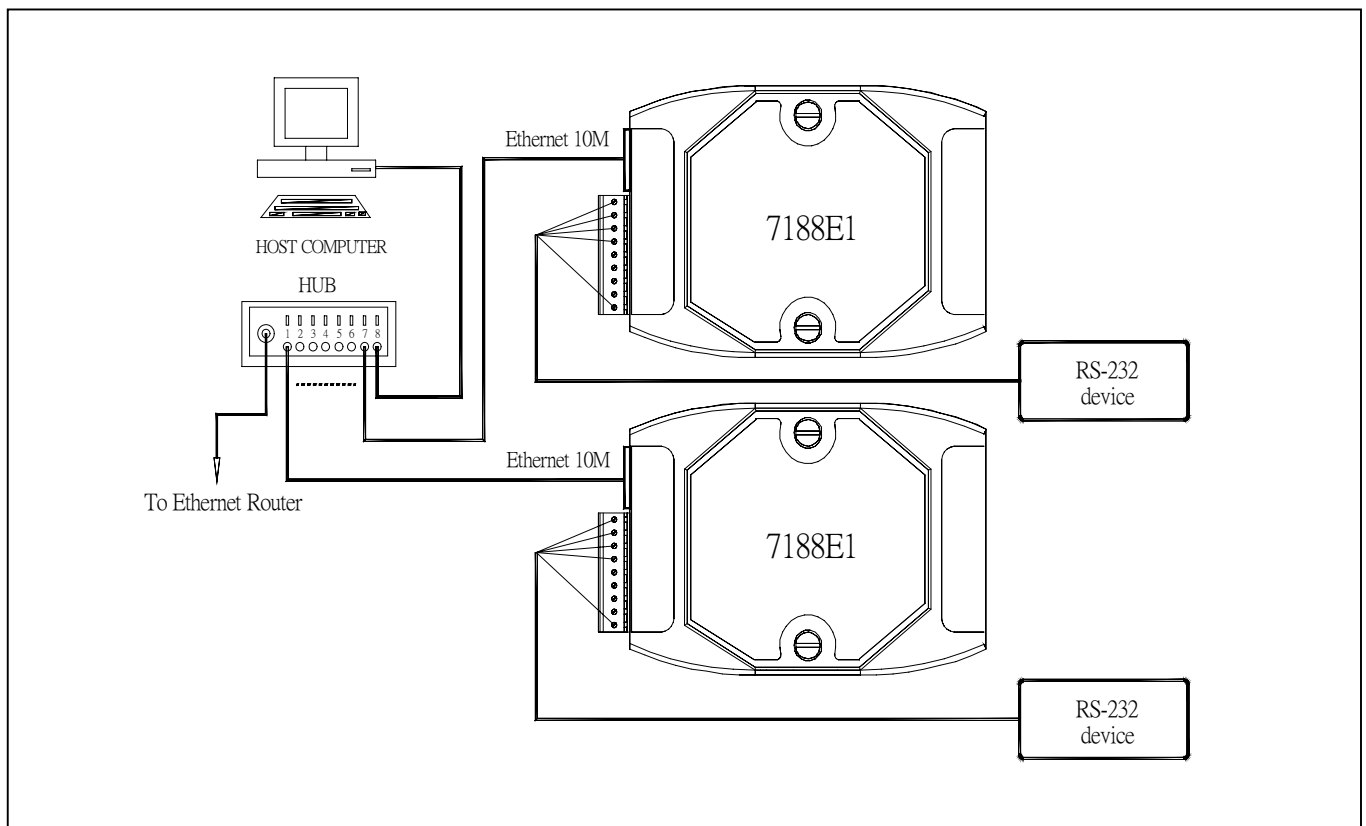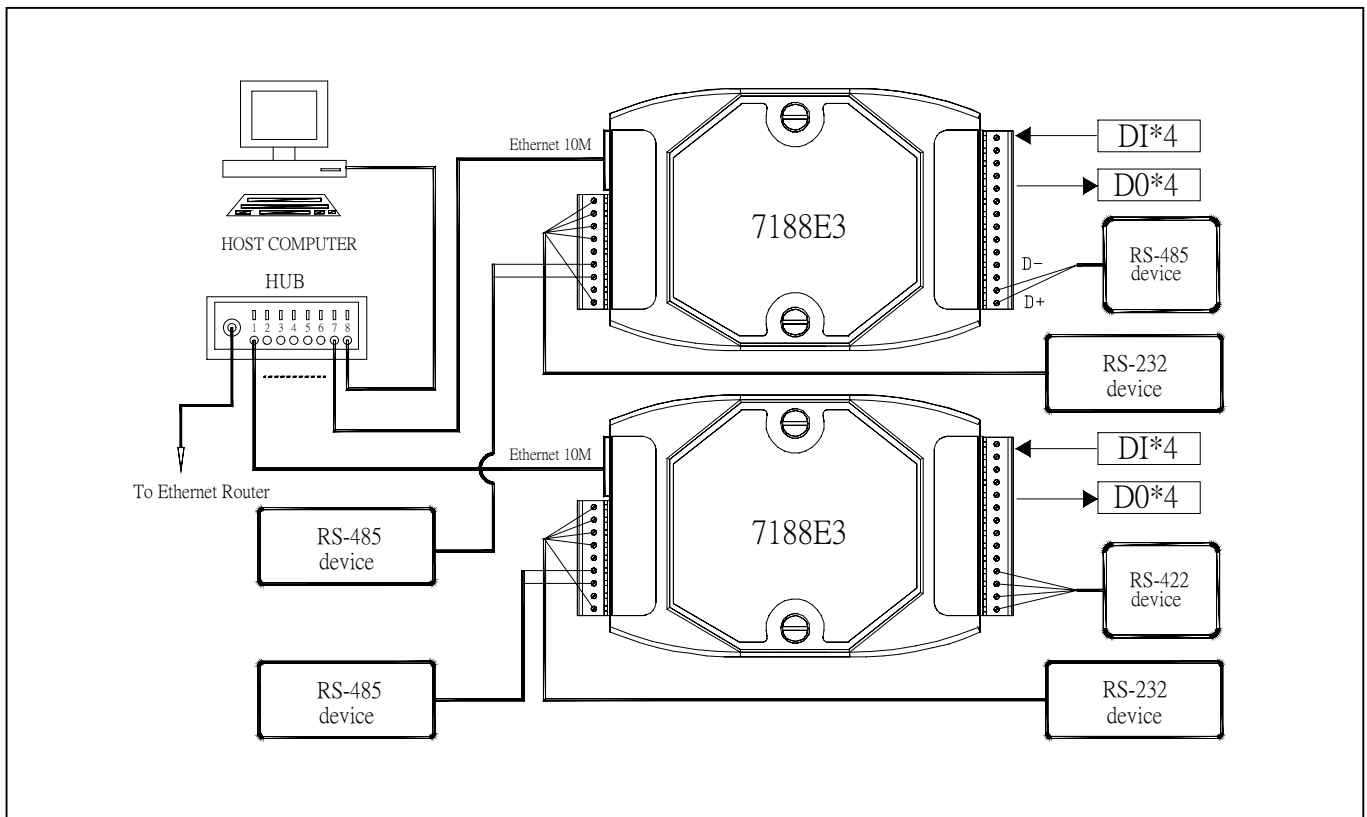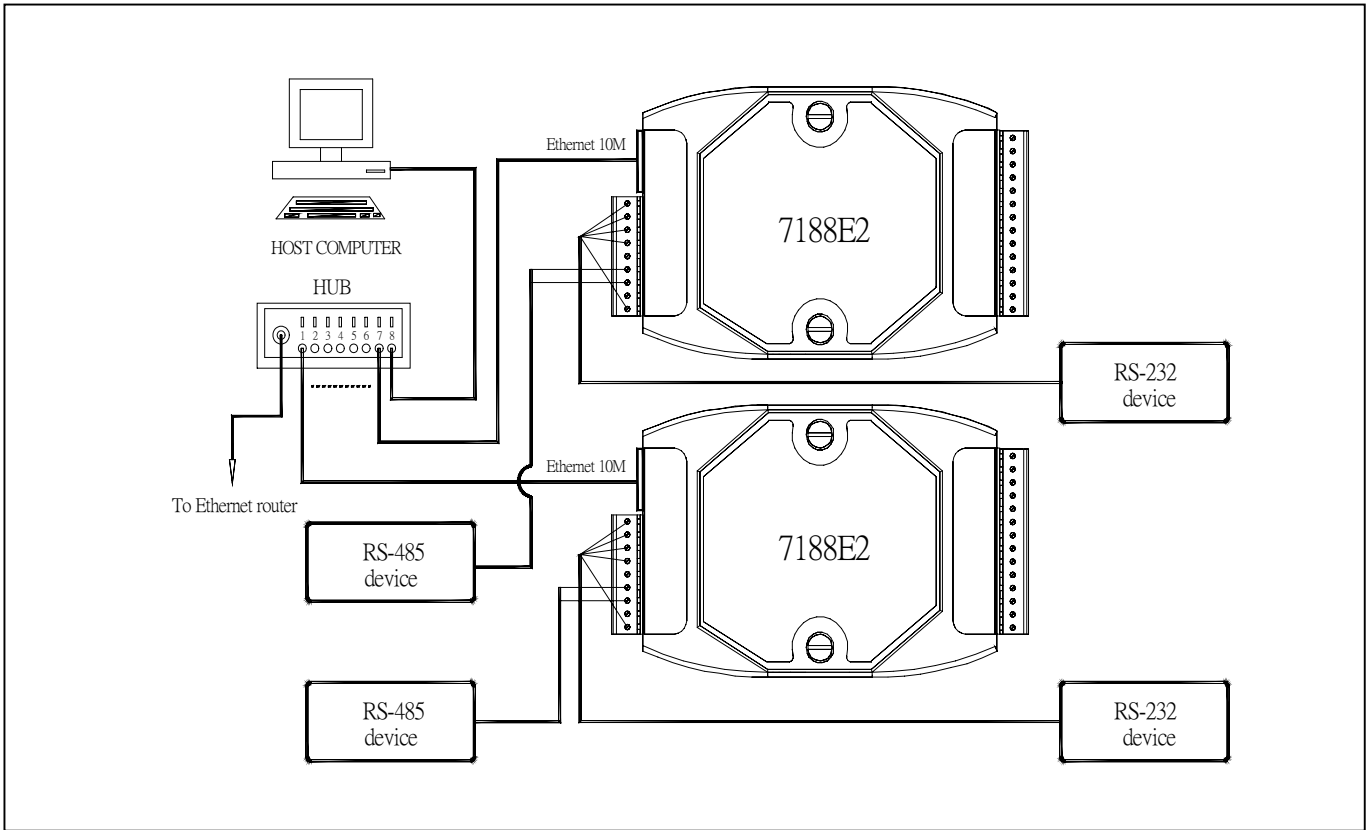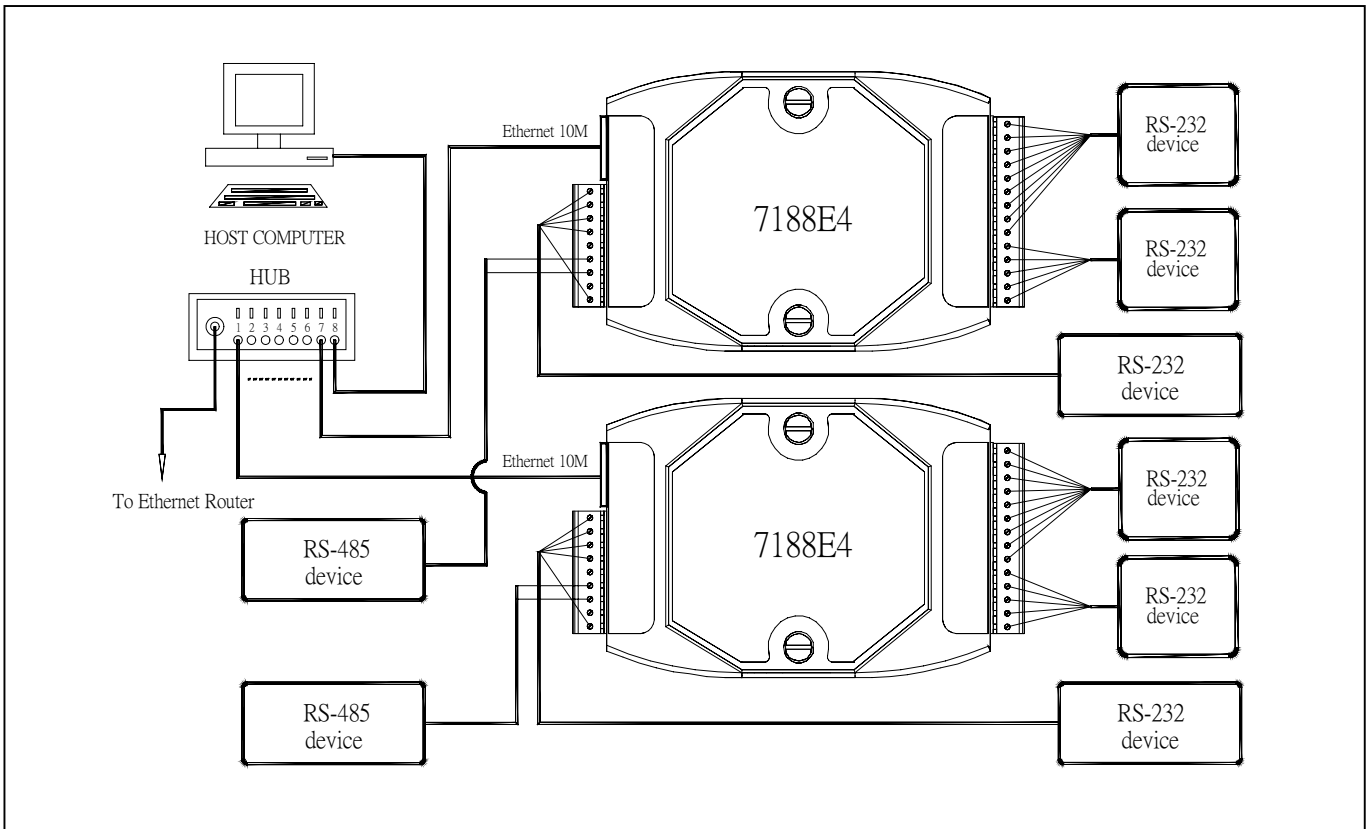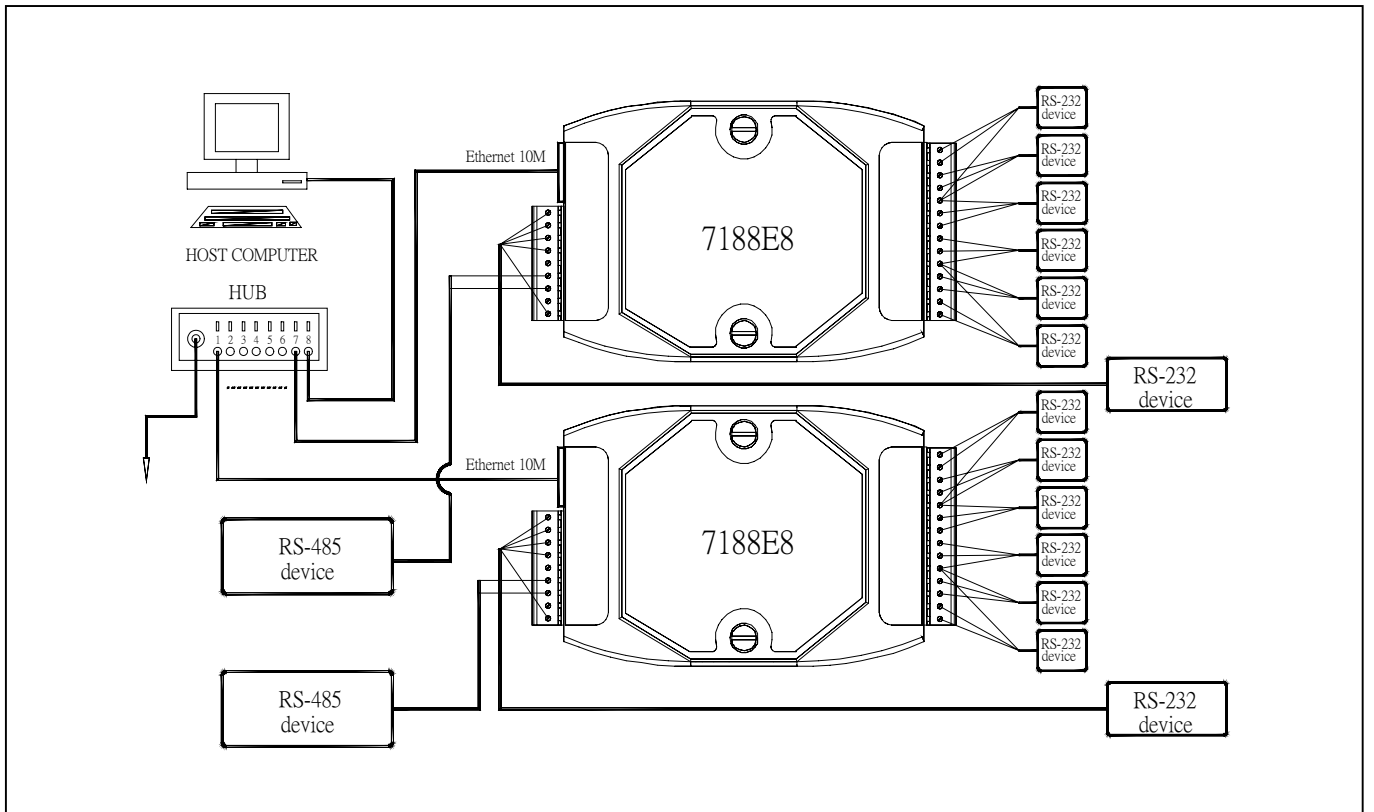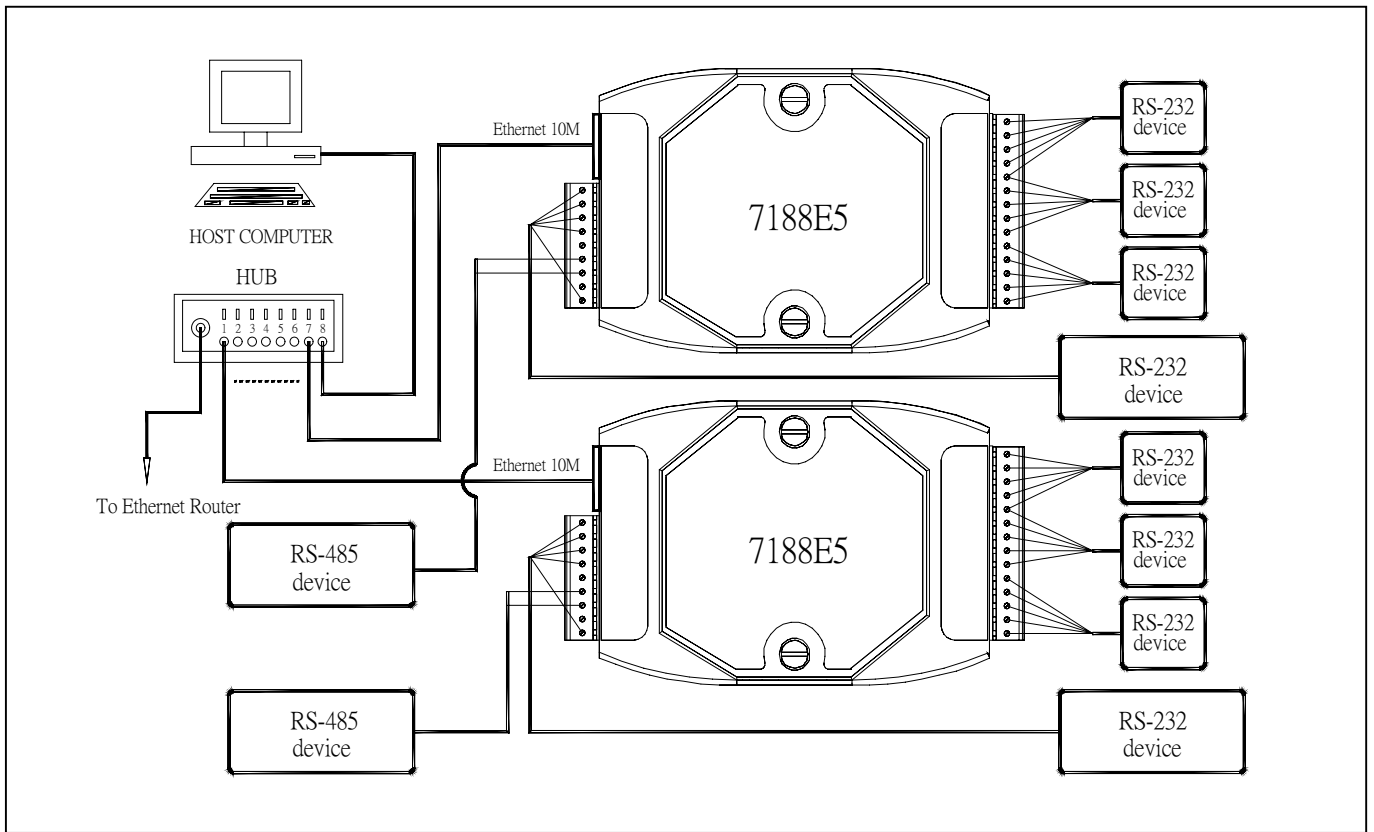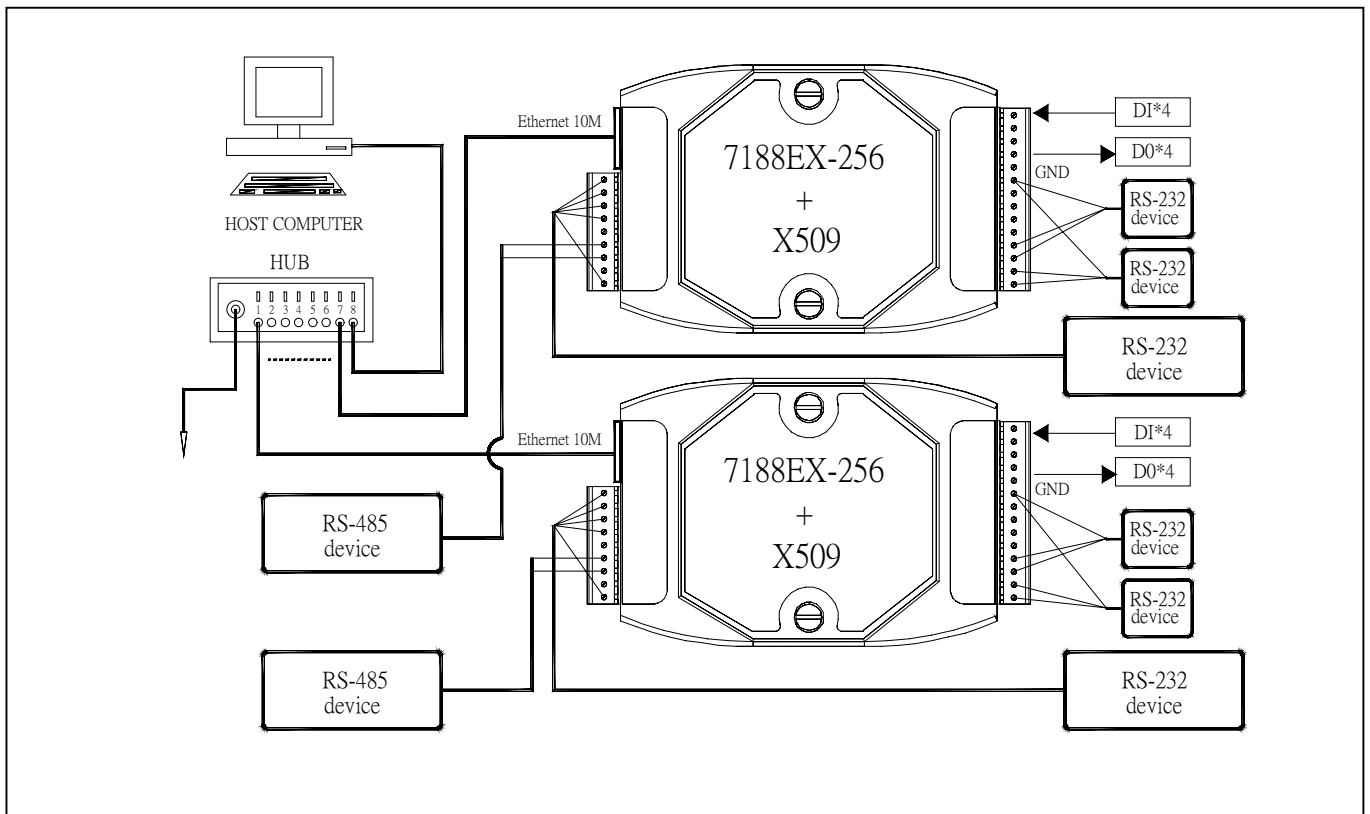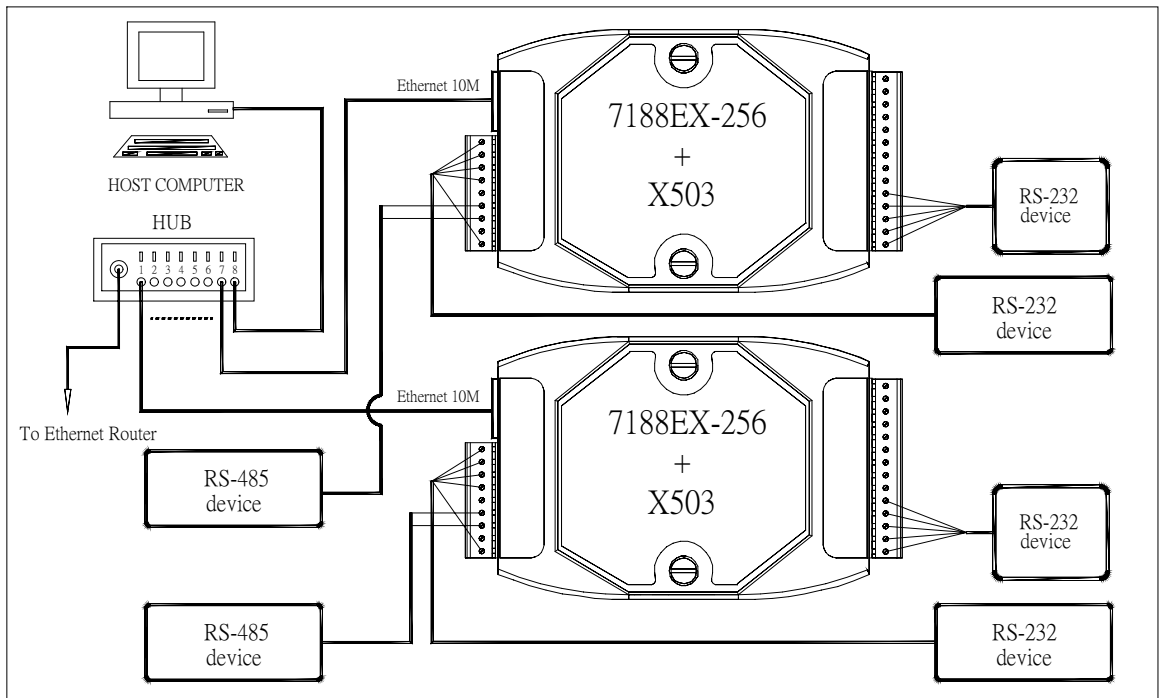
The 7521 family & 7188E family can be combined in natured as follows:
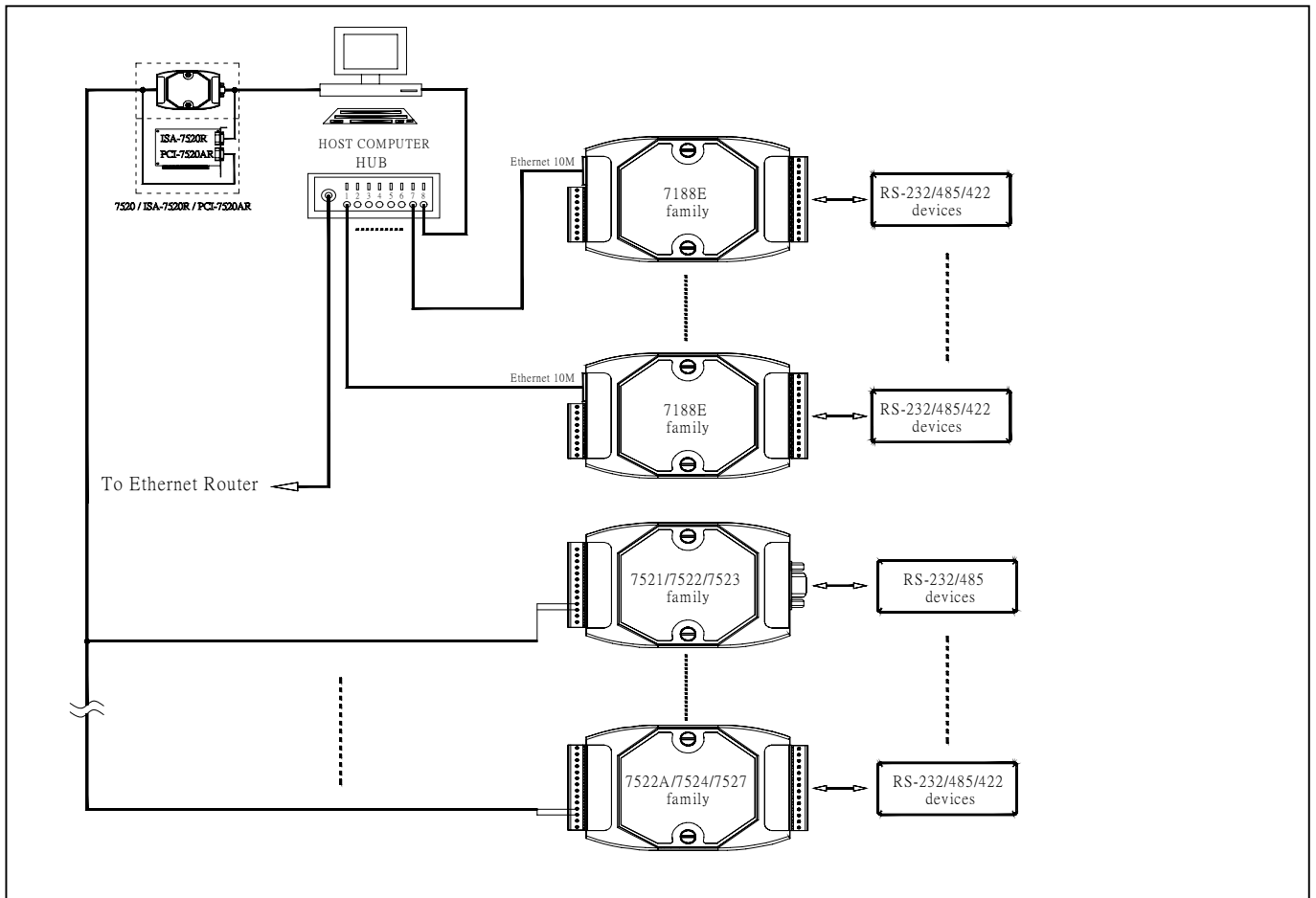
5.6 Dimension and Mounting

4-Ø4.50

35.30

56.00

88.50

7.30

25.00

40.50

Back View

29.50

2-SCREW
M3

8

33.00

Side View

Unit : mm

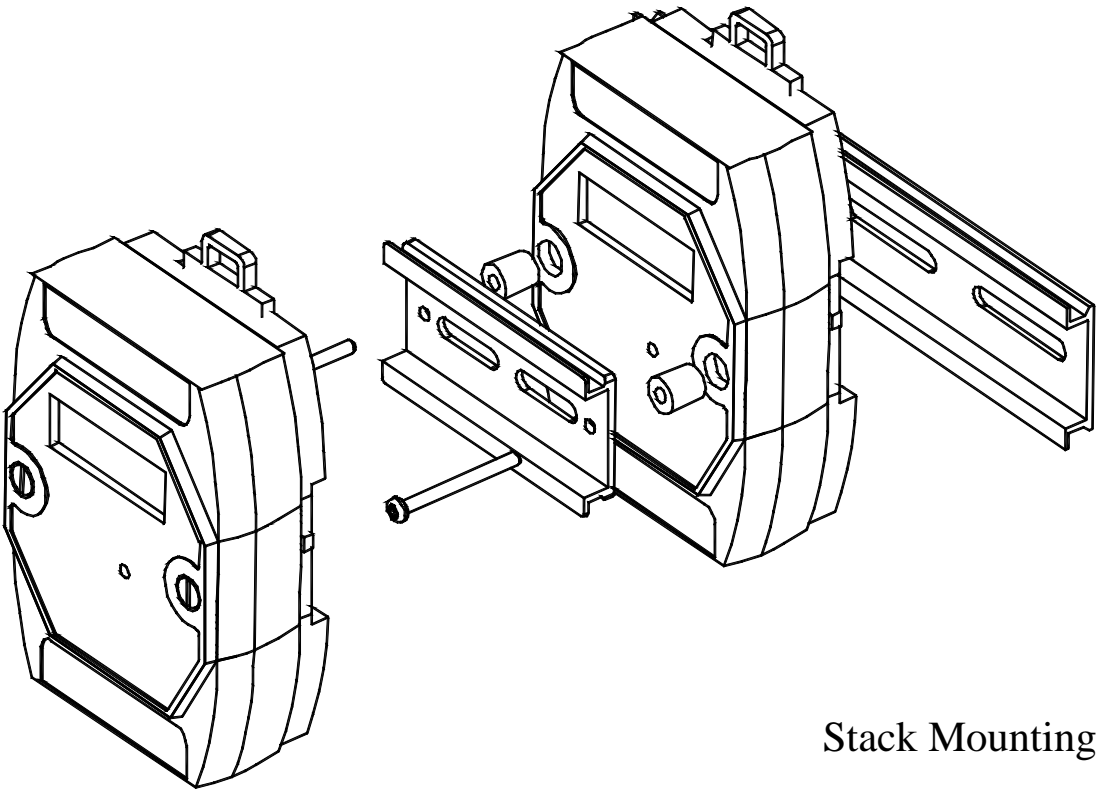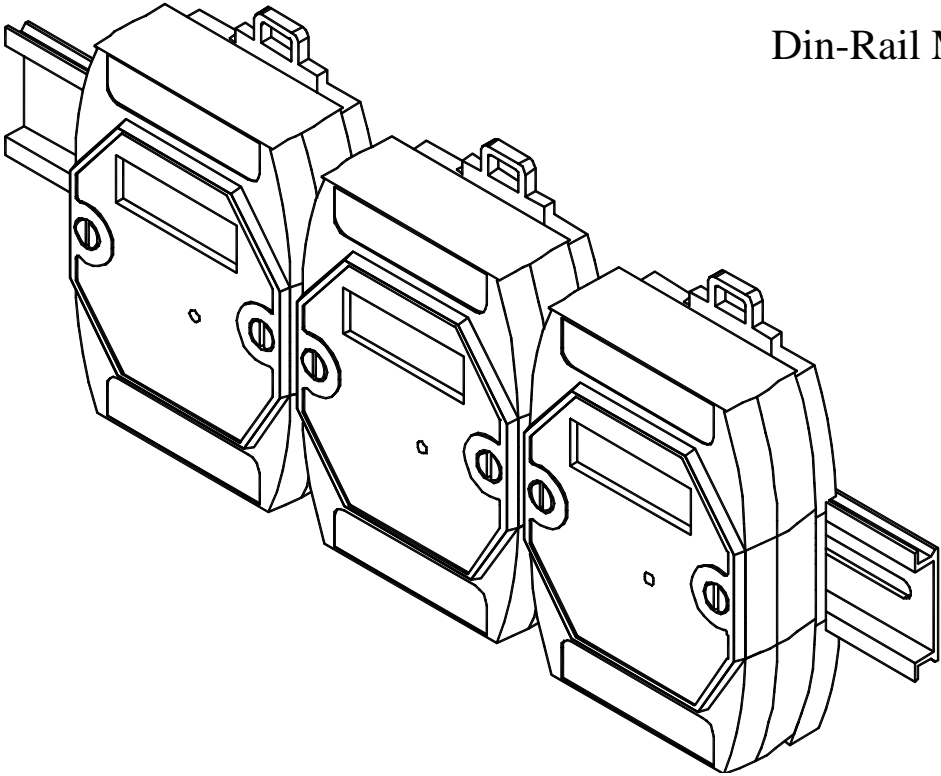72.00

33.00

25.00

Top View

50.00

10.50

56.00

111.00

58.50

72.00
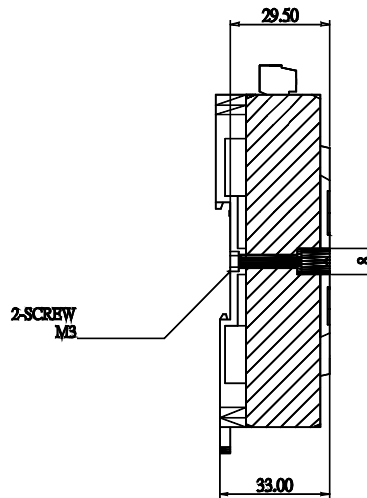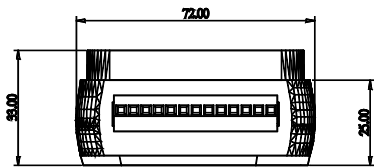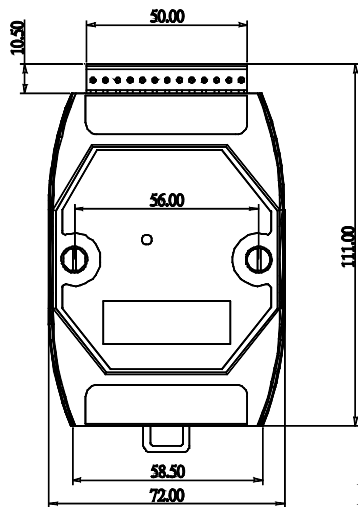
From View

Stack Mounting

Din-Rail Mounting