I-7188EF

FRnet Programmable Automation Controller

User's Manual

Warranty

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Table of Contents

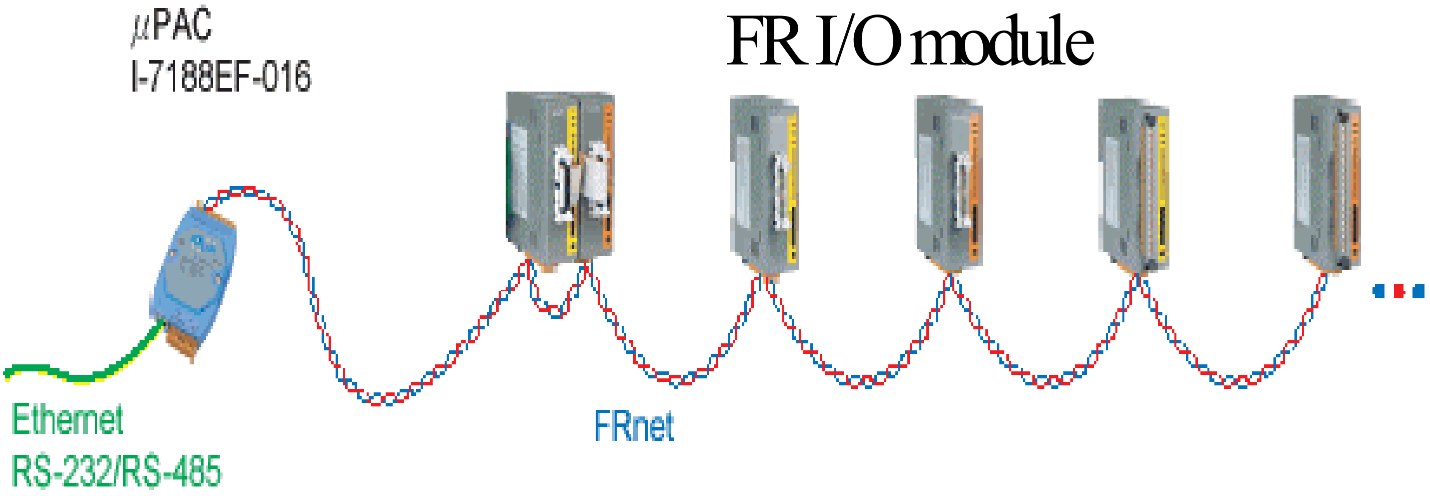
1. INTRODUCTION 5
1.1 FEATURE 8
1.2 SPECIFICATIONS 10
1.3 VIEW OF THE I-7188EF-016 13
1.4 I-7188EF-016 INSTALLATION 15
1.4.1 Mounting the I-7188EF-016 15
1.4.2 Connecting the Hardware 16
1.4.3 Connecting the FRnet Disturbed I/O Module 17
1.4.4 FRnet Disturbed I/O module 18
1.4.5 How to set the address of I/O module? 21
1.4.6 Connecting a Serial Device to COM1/COM2 22
1.5 SOFTWARE & DOCUMENT INFORMATION 23
2. CONFIGURING THE I-7188EF-016 25
2.1 CONFIGURING THE NETWORK SETTINGS 25
2.1.1 Using the “Configuration Wizard” 25
2.1.2 Using the ”MiniOS7 Utility” 29
3. HOW TO ACCESS DISTRIBUTED I/O OF 7188EF-016? 33
3.1 VIA AN ETHERNET NETWORK 33
3.2 USING THE MODBUS PROTOCOL 35
3.2.1 Introduction 35
3.2.2 Modbus Applications for I-7188EF-016 36
3.2.3 Function Codes Supported 37
3.2.4 Modbus Register address table 38
3.3 USING THE DCON PROTOCOL 40
3.3.1 Software communication interface 40
3.3.2 Using TCP/IP protocol to connect the 7188EF-016 43
3.3.3 Using Vxcomm technology to connect the 7188EF-016 45
4. SOFTWARE DEVELOPMENT TOOLKIT (DCON PROTOCOL) 49
4.1 LOCATION OF DOCUMENTS AND SOFTWARE 49
4.2 DCON UITILITY 51
4.2.1 How to use the DCON Utility? 51
4.3 DCON DLL 54
4.3.1 Procedure for using the DLL 54
4.3.2 VB Example (Reading an digital output value) 56
4.4 DCON ACTIVEX (UNFINISHED) 59
4.4.1 Procedure for using the ActiveX 59
4.4.2 VB Example (Reading an analog input value) 60

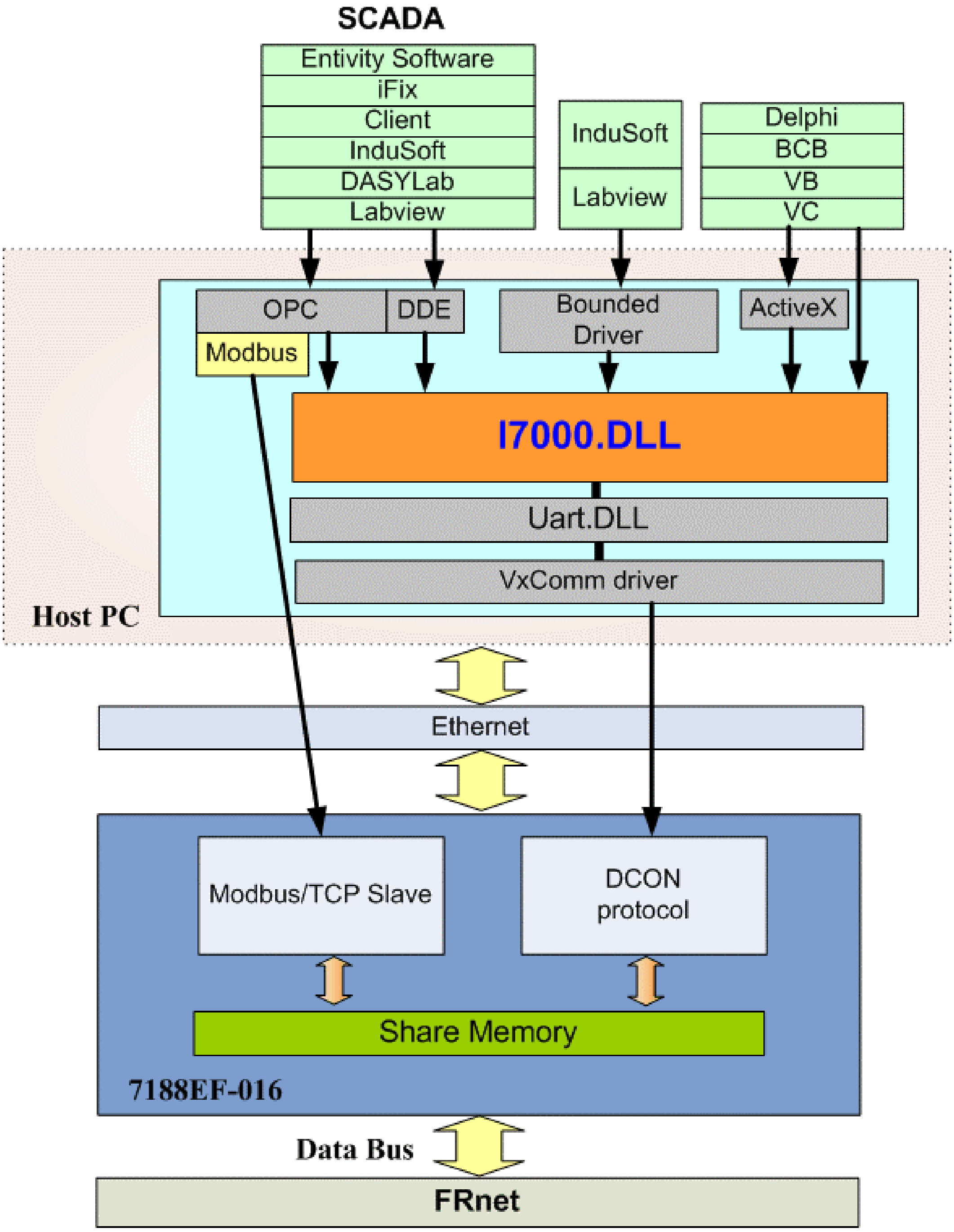
4.5 DCON LabView (Unfinished) 64
4.6 DCON Indusoft (Unfinished) 65
4.6.1 Procedure for using the Indusoft bundled driver 65
4.6.2 Indusoft Example (Reading an analog input value) 66
5. NAP OPC Server 70
5.1 Introduction 70
5.2 Procedure for using the OPC server 71
5.3 OPC Server Example using MODBUS protocol 72
Appendix A: Dimension and Mounting 76
Appendix B: LED Definitions 78
Appendix C: MiniOS7 utility 82
Appendix D: Modbus Protocol 87
◆ Modbus/TCP to Modbus/RTU protocol converter 87
◆ Modbus/RTU protocol using the VxComm technique 88
◆ Modbus utility 88
Appendix E: DCON protocol 94
◆ Command sets 95
Appendix F: VxComm Technology 111

1. Introduction

I-7188EF-016 is designed to make that the Host PC easily access the FRnet I/O module via Ethernet. I-7188EF-016 controls the distributed FR-2000 and FR I/O module via FRnet, and provides the Modbus and DCON protocol for HOST PC to access these FR I/O channels via Ethernet. Each I-7188EF-016 module is able to control up to 16 groups of FRnet distributed I/O module. Group numbers range from 0 to 15, and each group has 16 I/O channels. In other words, each I-7188EF-016 can control up to a maximum of 128 digital output channels and 128 digital input channels.

In addition to being used as a converter, I-7188EF-016 series can also be programmed as an autonomous controller to control distributed FR-2000 I/O modules via FRnet.





Package Checklist

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

- One I-7188EF-016 hardware module
- One user's manual
- One set of release notes
- One software utility disk or CD
- One CA0910 download cable

It is recommended to read the **release notes & README.TXT** file before using the controller. The release notes are included in the shipping, package and the README.TXT file can be found in the root directory of the enclosed CD. Some important information is given in the releases note and \README.TXT file.

1.1 Feature

FRnet network

FRnet is an innovative industrial field bus that the many special features, such as

- High speed deterministic I/O control
- Real I/O synchronization capability
- Non-protocol communication
- Easy used memory-mapping I/O programming
- Two wire cabling
- One FRnet port to expand distributed I/O module

Modbus protocol

- FRnet I/O mapping to Modbus addresses for Modbus/TCP client access
- Converts single Modbus/TCP to multi Modbus/RTU

  I-7188EF-016 acts in a similar and way to the I-7188E-MTCP Modbus/TCP gateway. It can easily upgrade many Modbus/RTU devices connected to the COM ports of I-7188EF-016 to give Ethernet communication abilities.

ASCII-based protocol (DCON Protocol)

I-7188EF-016 includes the DCON protocol, which is a request/reply communication protocol that is used to access the data from the module using a simple ASCII format. For example, sending the command "$01M" will query the controller name. The responding module will reply with a message similar to "!017188EF-016(cr)".

Various DCON SDK provided (free)

In order to access the FRnet I/O of the I-7188EF-016 from the host and the remote I/O modules connected to the I-7188EF-016.
Various SDKs have been provided on the CD, such as:

- DLL driver
- ActiveX component

- LabView bundled driver
- Indusoft bundled driver
- Linux driver
- OPC server

Firmware modifiable

The Modbus SDK is provided to allowing users to develop their own custom Modbus firmware.

Built-in Watchdog

The built-in watchdog circuit will reset the CPU module if a failure occurs in either the hardware or the software. If the application program does not refresh the watchdog timer within 0.8 sec, the watchdog circuit will initiate a reset of the CPU.

Ventilated housing design to work between -25°C ~+75°C

I-7188EF-016 is housed in a plastic-based shell/case with a column-like ventilator that helps to cool the working environment inside the shell/box and allows the I-7188EF-016 to operate at temperatures ranging from -25°C and +75°C.

1.2 Specifications

System

- CPU: 80188-40 or compatible
- EEPROM:
  1. 2048 bytes (8 blocks, each block contains 256 bytes)
  2. Data retention > 100 years
  3. 1,000,000 erase/write cycles
- SRAM: 512Kb
- FLASH ROM:
  1. 512Kb
  2. Erase unit is one sector (64Kb)
  3. 100,000 erase/write cycles
- Programs can be download from COM1
- Built-in 64-bit hardware unique serial number

Communication

- Ethernet Port
  - ♦ 10M /10BaseT, RJ-45 Port
- COM Port

  COM driver support interrupt & 1K QUEUE Input & Output buffer
  - ♦ **COM1:** RS232 (CTS, RTS, RXD, TXD, GND)
  - ♦ **COM2:** RS485 (Data+, Data-)
- FRnet Port
  - ♦ Communication speed: 250Kbps
  - ♦ Scan time:

    128 input / 128 output points @ 2.88 mS (I-7188EF-016L)

    128 input / 128 output points @ 0.7 mS (I-7188EF-016H)

- ♦ Communication distance

  Max. 400m (I-7188EF-016L)
  Max. 100m (I-7188EF-016H)

- ♦ Cable: CPEV 0.9 (2P Twisted-pair wire)
- ♦ Distributed I/O modules

  Max. 8 SA modules, FR-2053 (16 DI)
  Max. 8 RA modules, FR-2057 (16 DO)

- ♦ Each module of FR-2053/FR2057 module is one group.

Built-in WatchDog Timer (0.8 seconds)

Built-in power protection and network protection circuit

Real Time Clock

- Year-2000 compliant
- Displays seconds, minutes, hours, date of the month
- Displays month and year **from 1980 to 2079**
- NVSRAM: 31 bytes, battery backup, data valid for up to 10 years

Display

- 7-segment LED: 5-digit (for I-7188EFD only)

Power

- Power requirements: 10 - 30 V DC (non-regulated)
- Power consumption: 2.0W for I-7188EF-016

  3.0W for 7188EFD-016

General environment

- Operating temperature: -25°C to +75°C
- Storage temperature: -40°C to +80°C

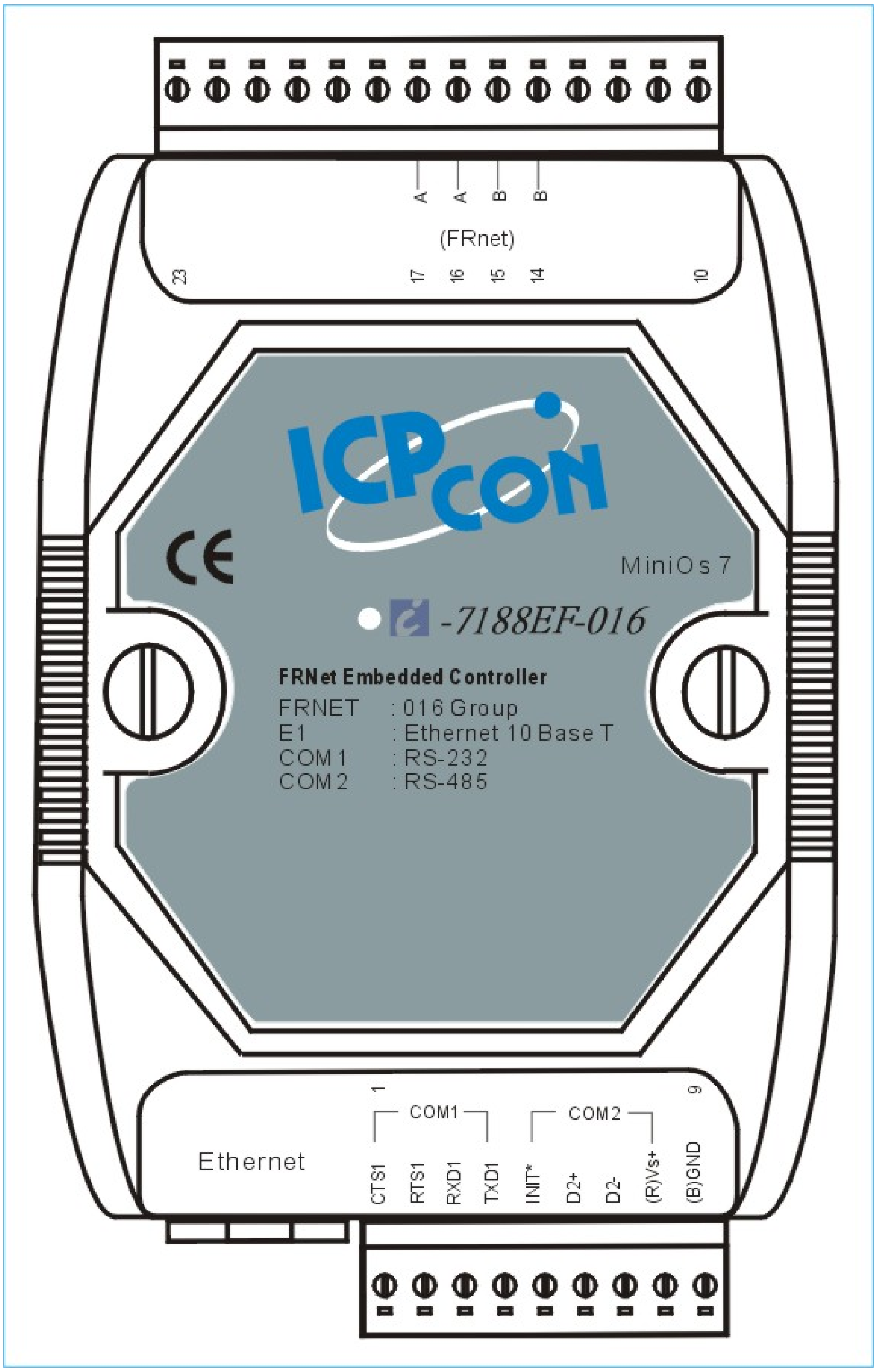
- Humidity

  1. Operating humidity: 10% ~90% RH, non-condensing
  2. Storage humidity: 5%~95% RH, non-condensing

Mechanical

- Dimensions (W × H × D): 123 × 72 × 33 mm
- Installation : DIN-Rail, Stack Mounting
- For more detailed dimensions, please refer to “Appendix A Dimensions:”

1.3 View of the I-7188EF-016



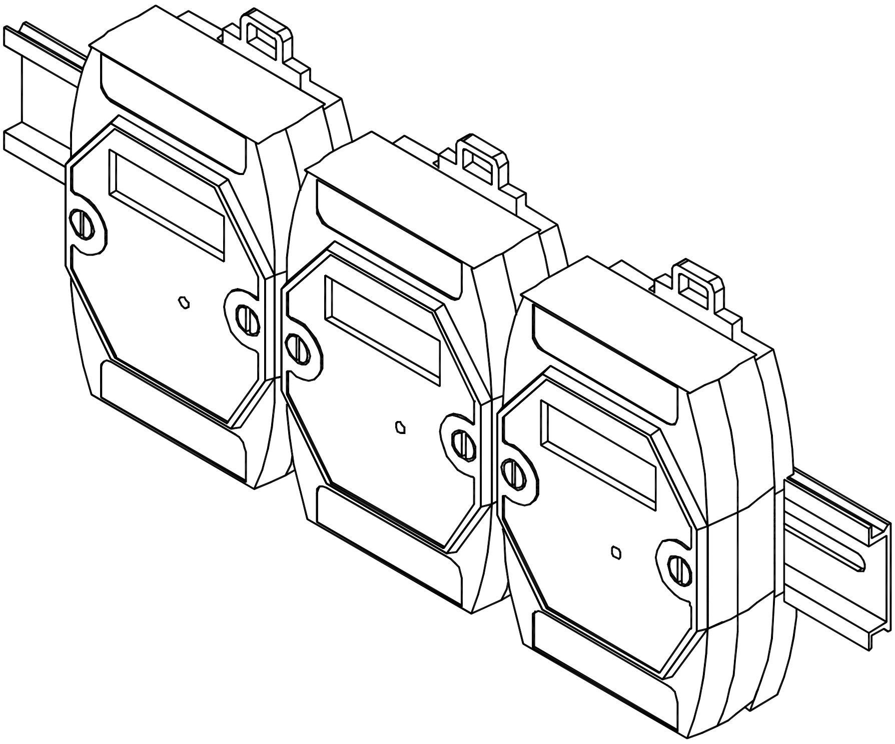
I-7188EF-016 pin assignment:

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 +30V DC unregulated)
9	GND	GND of power supply
14	B	FRnet D-
15	B	FRnet D-
16	A	FRnet D+
17	A	FRnet D+

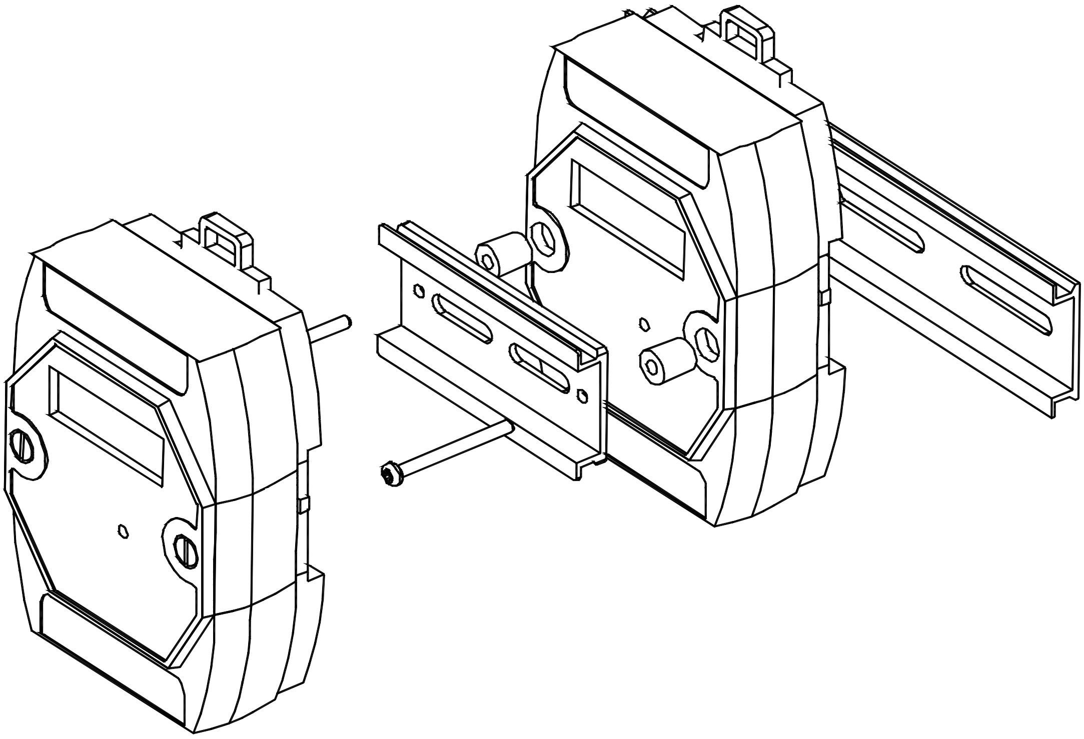
1.4 I-7188EF-016 installation

1.4.1 Mounting the I-7188EF-016

1. Din-Rail Mounting



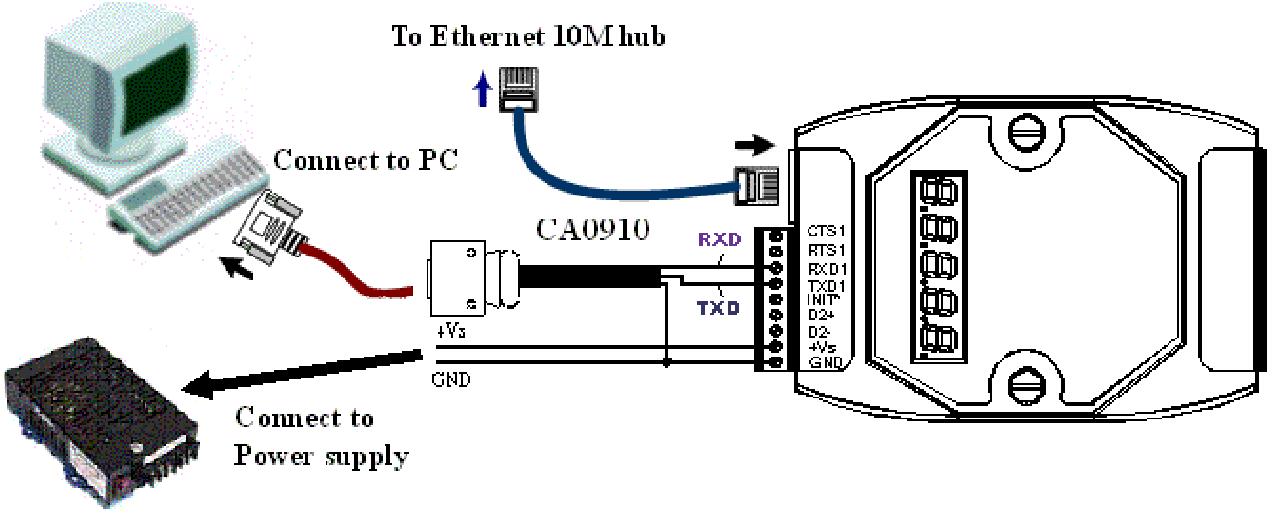
2. Stack Mounting



1.4.2 Connecting the Hardware

Step 1: Connect the CA0910 download-cable between the I-7188EF-016 and COM1/2 of the PC, as shown in the diagram below.

Step 2: Apply power (+Vs, GND) to the I-7188EF-016, +Vs can be range from +30V to +10V DC.

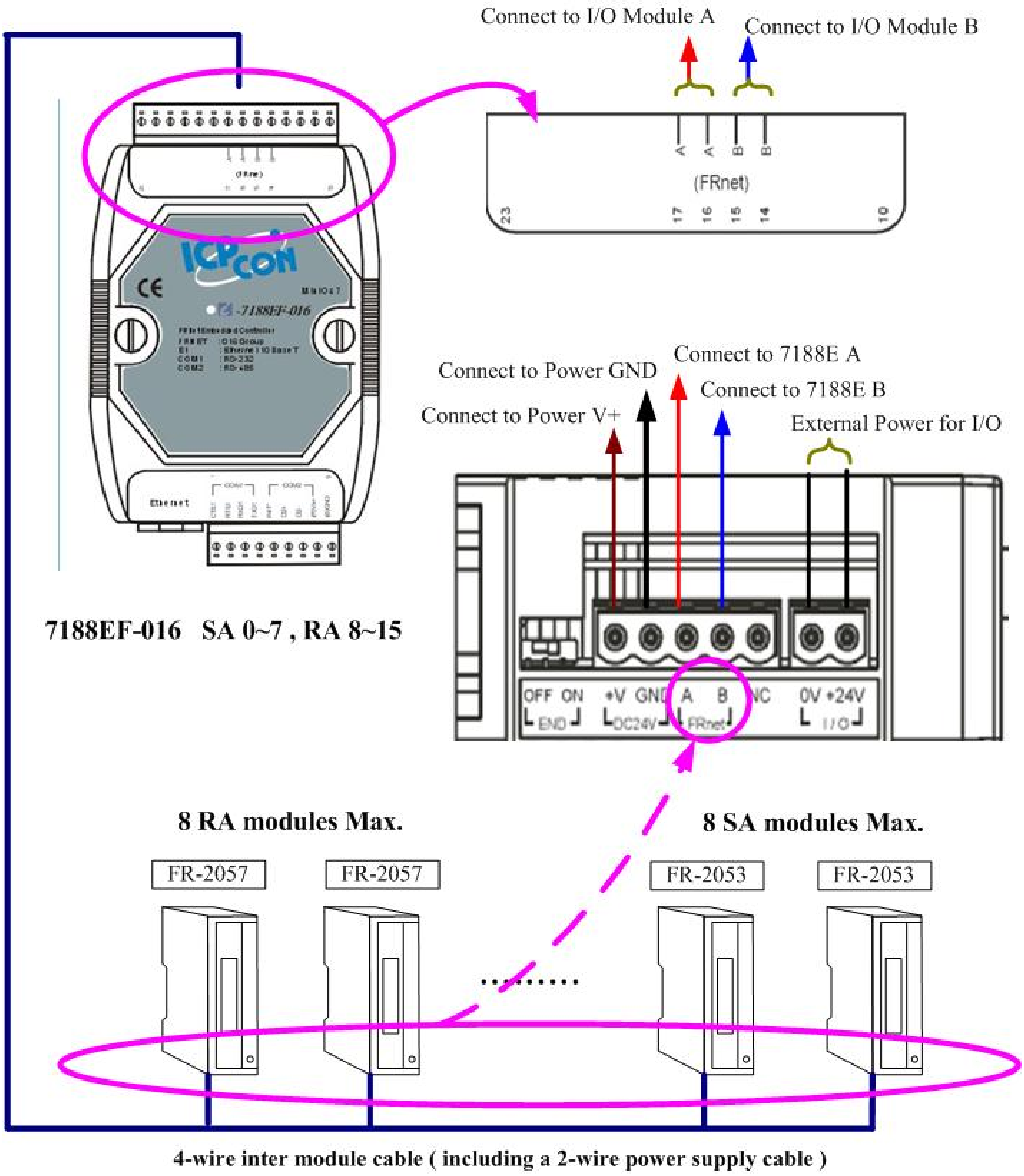


Step 3: Check that the 5-digit 7-SEG LED continuously shows the group ID information from 11111 to 44444.

Note:

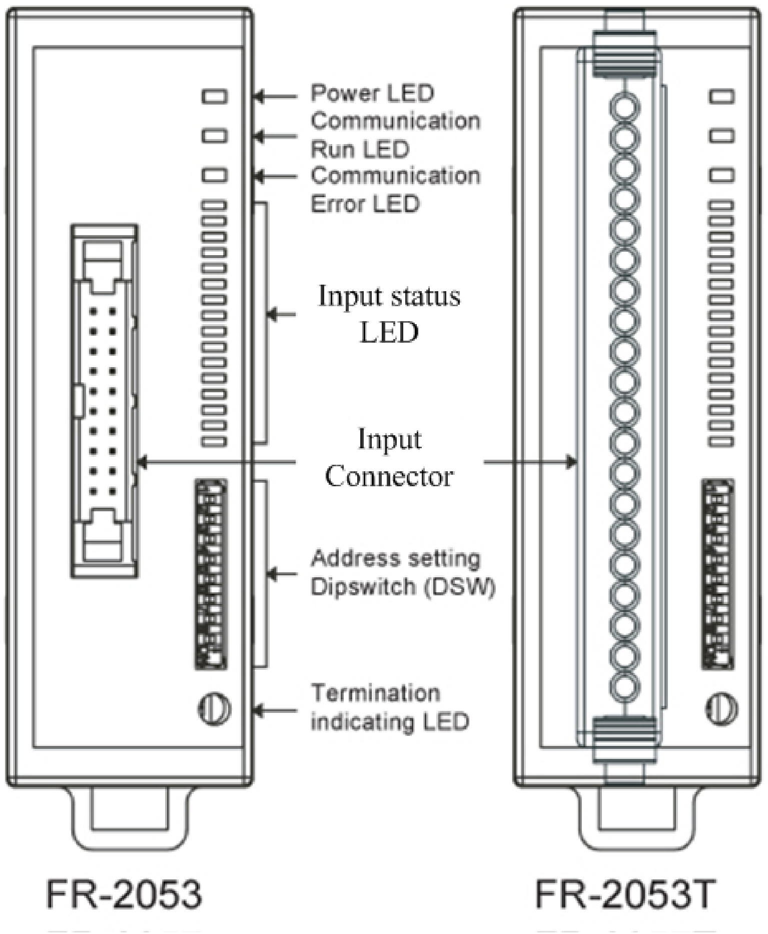
Only display versions of the module will include a 5-digit 7-SEG LED. A detailed description of the 5-digit 7-SEG LED can be found in Appendix B.

1.4.3 Connecting the FRnet Disturbed I/O Module

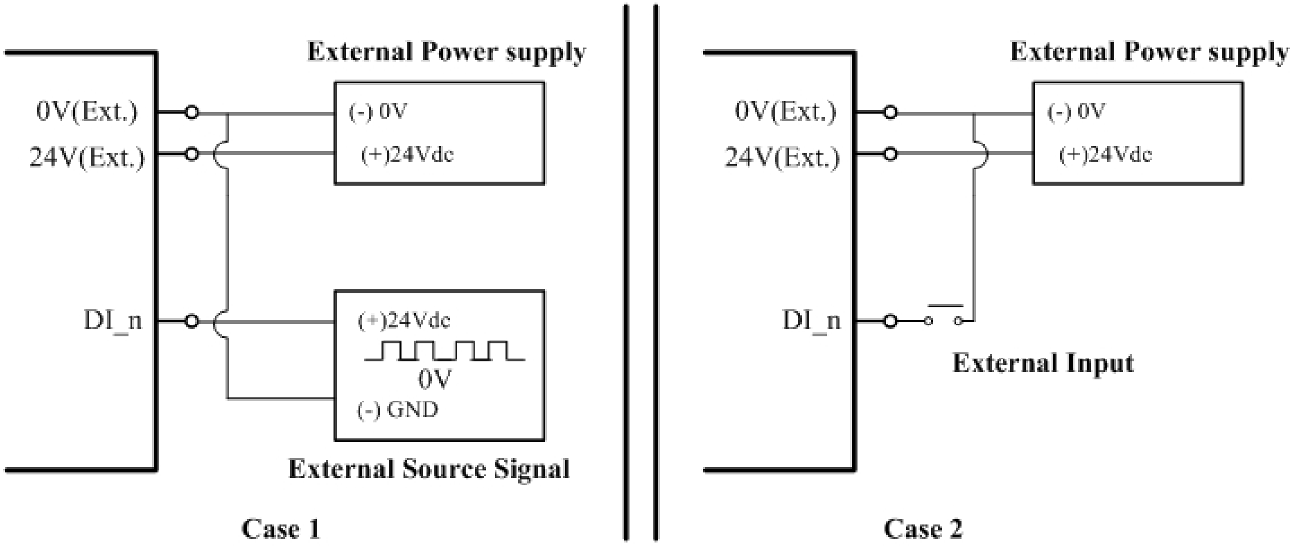


1.4.4 FRnet Disturbed I/O module

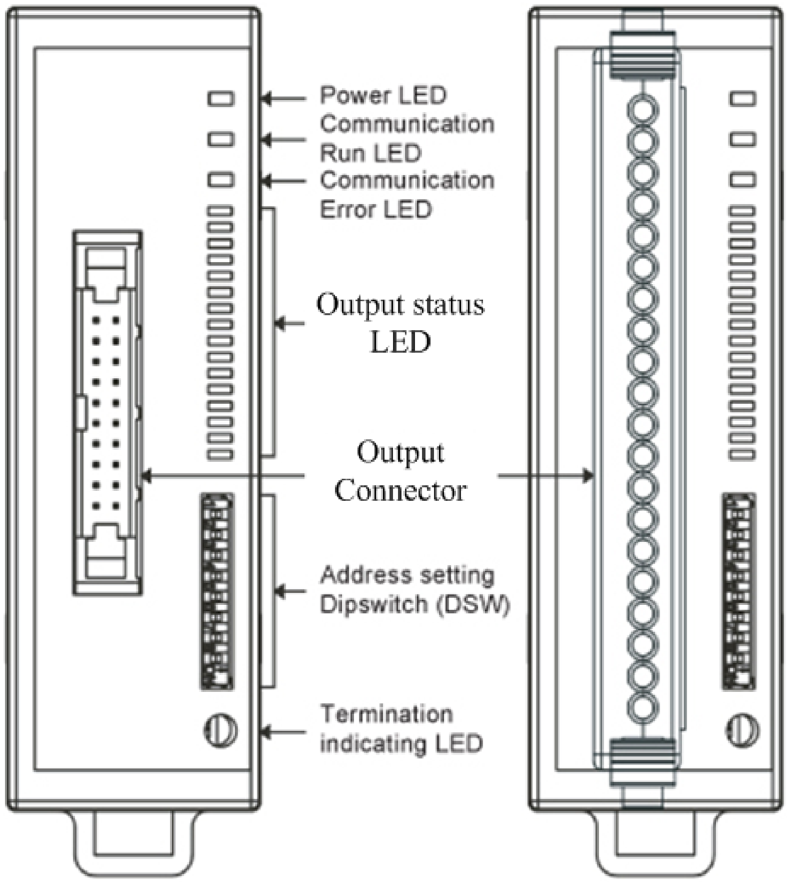
DI module: FR-2053



FR-2053 Wire connection

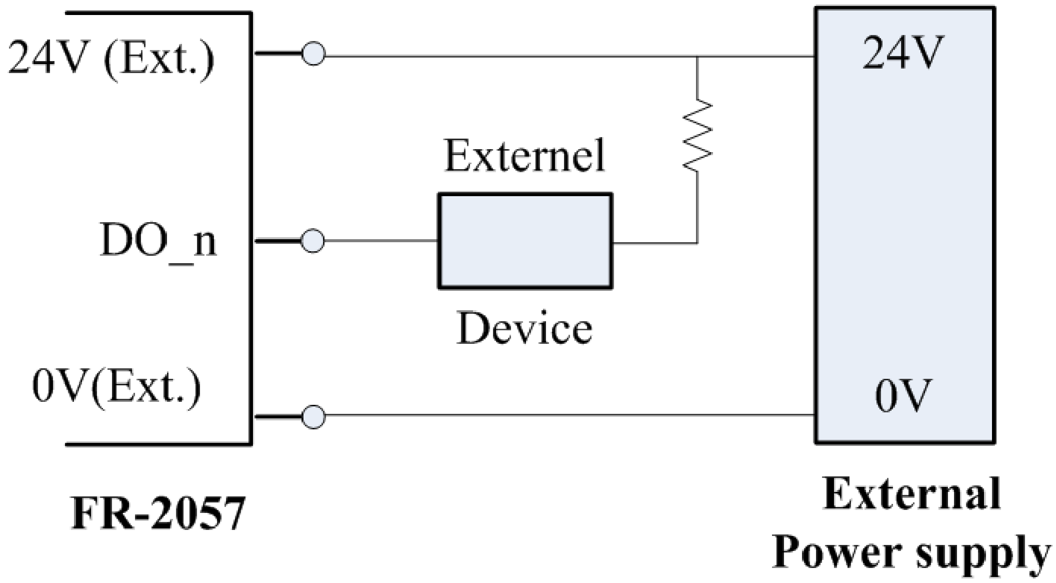


DO module: FR-2057



FR-2057 FR-2057T

FR-2057 Wire connection



Note:

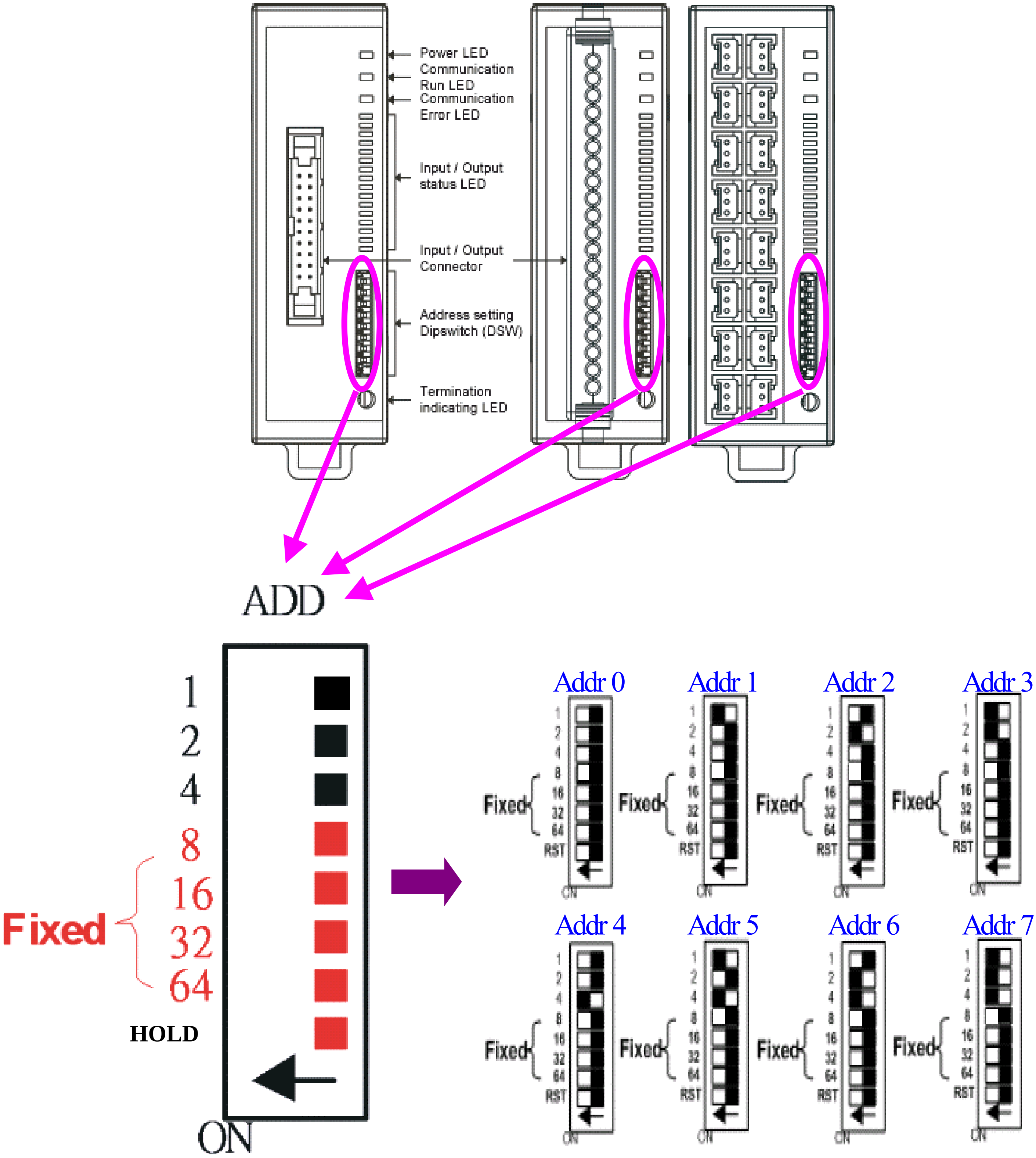
- For more detailed information regarding the FR-2053 module, please refer to CD\napdos\frnet\IO_Module\fr-2053\fr-2053.pdf
- For more detailed information regarding the FR-2057 module, please refer to cd\napdos\frnet\IO_Module\fr-2057\fr-2057.pdf

Specifications

- Power consumption: 2.0 W (Max.)
- Operating temperature: -25°C to +75°C
- Operating humidity: 10% ~ 95% RH, non-condensing
- Storage temperature: -30°C to +85°C
- Storage humidity: 5% ~ 95% RH, non-condensing
- Weight: approximately 120g
- Dimensions: 99 mm x 32 mm x 83 mm
- Input points: 16 points
- Input current: less than 6mA/channel
- Input impedance: approximately 4.1 kΩ
- Digital Level 0: 3V max.
- Digital Level 1: 24 +/- 10%
- On delay time: less than 1.0ms
- Off delay time: less than 1.0ms

1.4.5 How to set the address of I/O module?

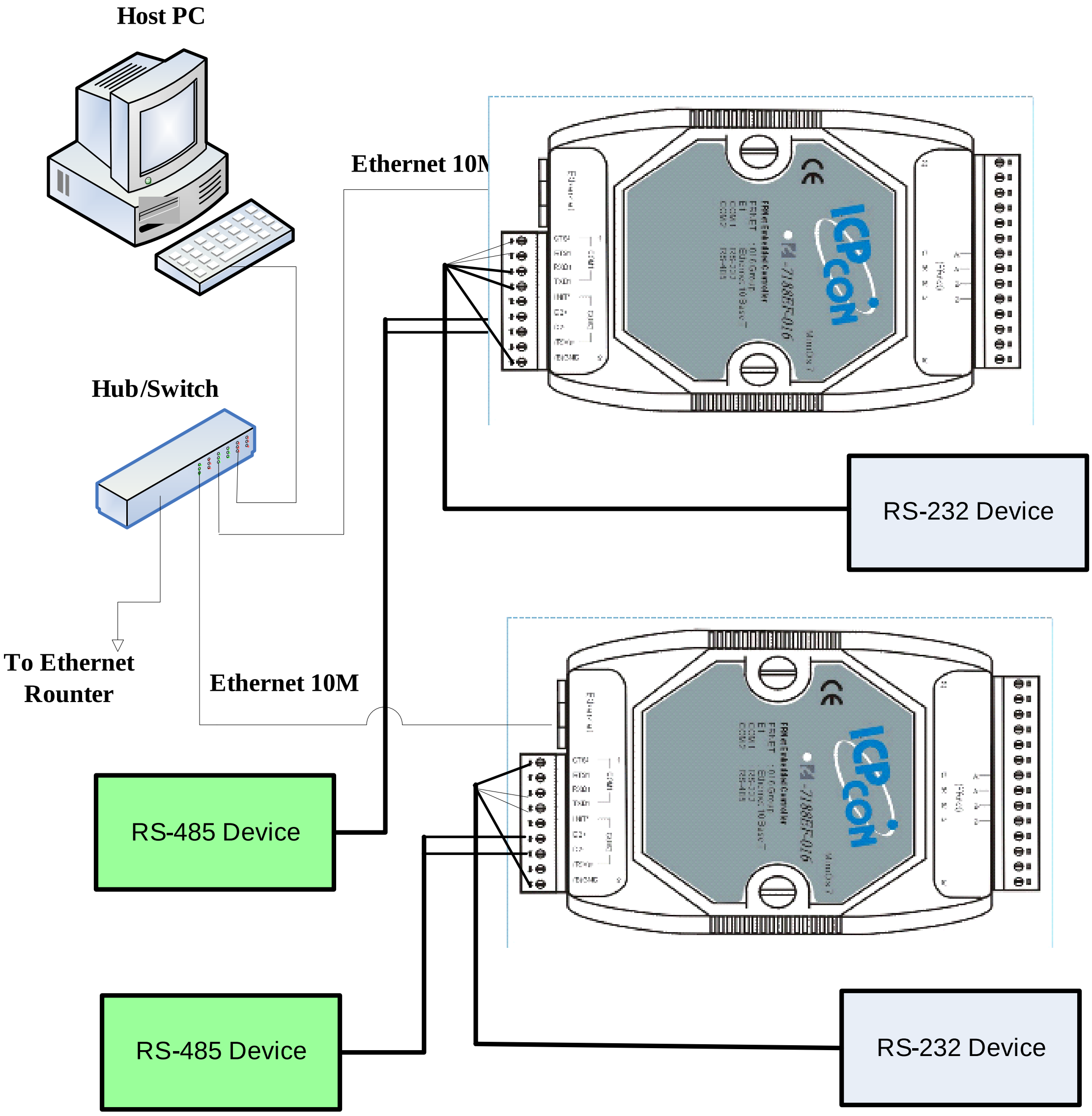
There are eight switches in the dipswitch. User uses 1, 2 and 4 switches to set the address. Refer to the following figures.



Dipswitch

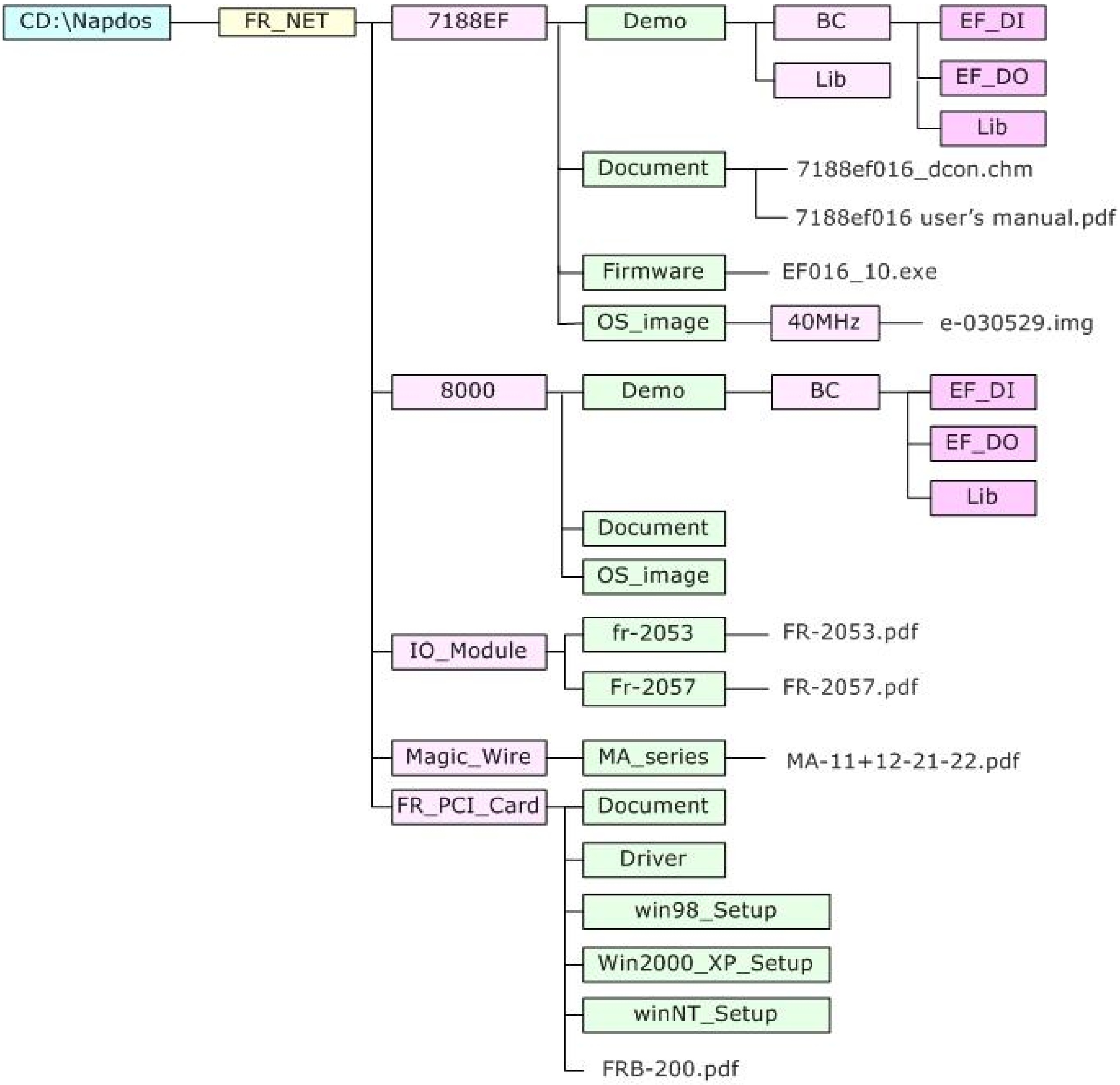
1.4.6 Connecting a Serial Device to COM1/COM2

I-7188EF-016 also has one RS-232 and one RS-485 port, whose are used to control the I/O device or ICPDAS I-7000/I-8000/I-87K data acquisition modules. Using the I-7188EF, thousands of I/O control system channels can be easily implemented



1.5 Software & Document information

The location of all documents and software related to the FRnet are shown in the following directory tree. The relevant file can quickly be located by referring to the tree.



For details regarding EF-nnnn.exe, please refer to CD:\8000\NAPDOS\FR_Net\7188EF\Firmware\Version_nnnn_Eng.txt or Version_nnnn_Chi.txt

For details regarding FRnet **distributed I/O Modules** that can be connected to I-7188EF-016. Please refer to the User Manual contained on the CD in the following locations:

User Manual
CD:\Napdos\FRnet\IO_Module\fr-2053
CD:\Napdos\FRnet\IO_Module\fr-2057
Or on the following web pages:
http://www.icpdas.com/products/Remote_IO/frnet/fr-2053.htm
http://www.icpdas.com/products/Remote_IO/frnet/fr-2057.htm

2. Configuring the I-7188EF-016

Before using the I-7188EF-016, the following settings must be configured:

- **Networking settings**: IP, Mask, and Gateway of I-7188EF-016.

Note:

The factory default settings are as follows:

- IP Address: 192.168.255.1
- Subnet Mask: 255.255.0.0
- Gateway: 192.168.0.1

The most important procedure to be completed prior to using the controller is to correctly configure the network settings.

2.1 Configuring the network settings

Network settings can only be configured via the RS-232 COM Port.
There are two tools that can be used to configure the I-7188EF-016 network settings.

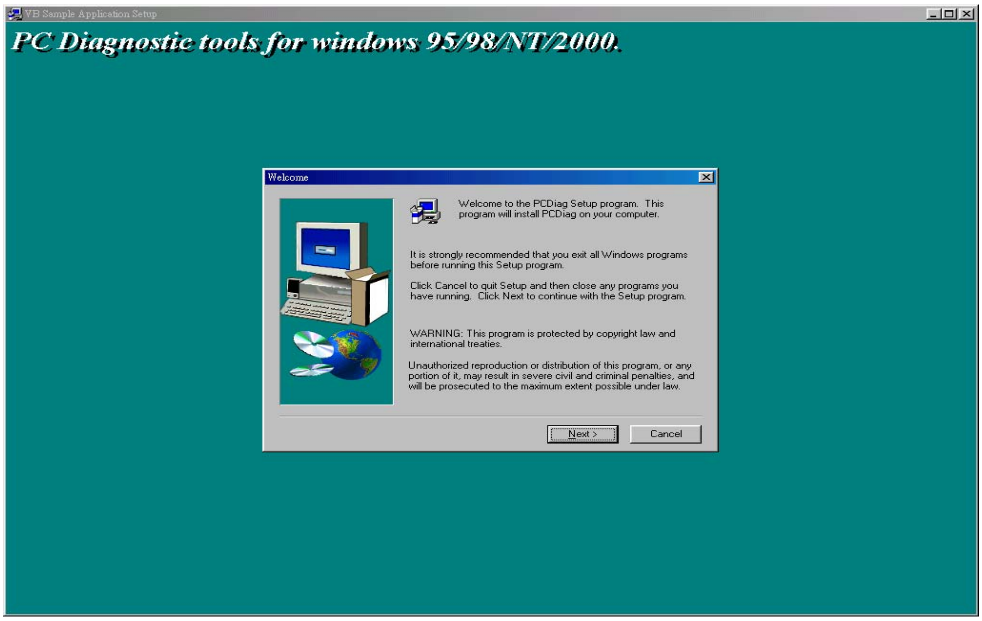
1. Configuration Wizard
2. MiniOS7 Utility.

2.1.1 Using the "Configuration Wizard"

The "Configuration Wizard" provides a step-by-step for configuring the network settings. The wizard is most useful for detecting the network settings of the host PC, and for searching the local network to locate a valid IP, Mask and Gateway address. Using the "Configuration Wizard" allows automatic detection of important settings, and reduces the need to contact system administrators for support.

Step 1: Refer to Sec.1.4.2 for details of the wire connection for the I-7188EF-016.

Step 2: Install the PCDiag application to the host PC by running!
CD:\Napdos\7188e\tcp\PCDiag



VB Sample Application Setup

PC Diagnostic tools for windows 95/98/NT/2000.

Welcome

Welcome to the PCDiag Setup program. This program will install PCDiag on your computer.

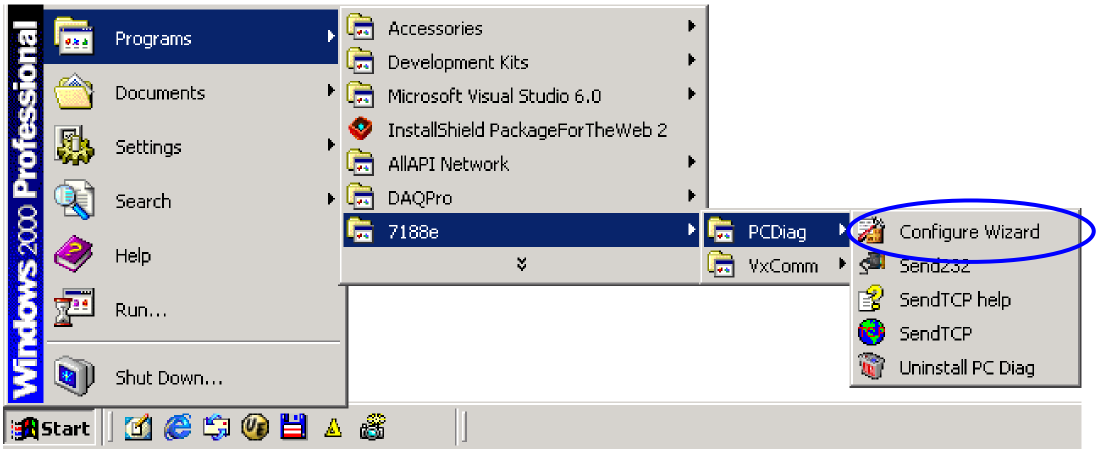
It is strongly recommended that you exit all Windows programs before running this Setup program.

Click Cancel to quit Setup and then close any programs you have running. Click Next to continue with the Setup program.

WARNING: This program is protected by copyright law and international treaties.

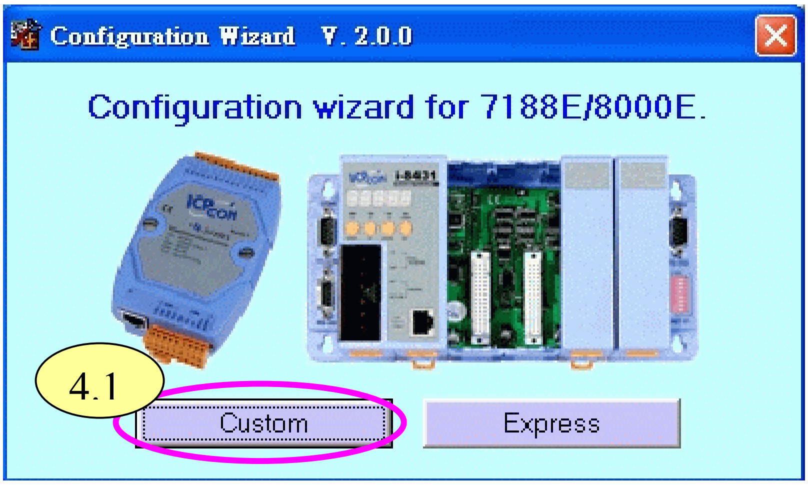
Unauthorized reproduction or distribution of this program, or any portion of it, may result in severe civil and criminal penalties, and will be prosecuted to the maximum extent possible under law.

Step 3: Run the configure wizard as follows:

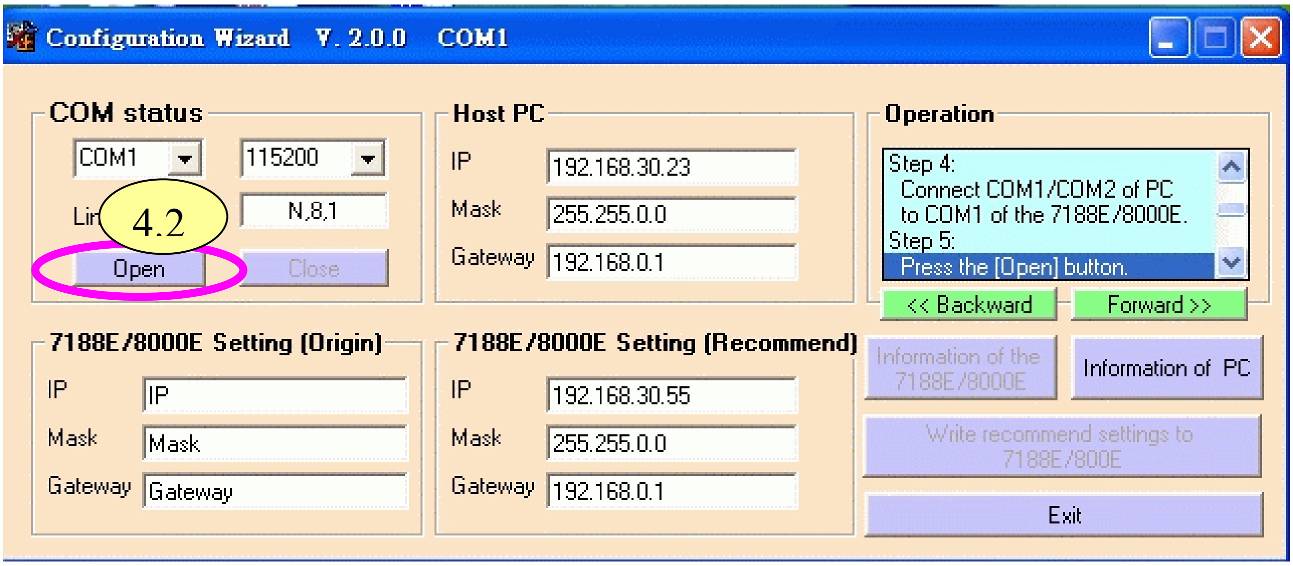


Step 4: Follow each step of the instructions provide in the "Configuration Wizard" dialog box until the following window appears.

Step 4.1: Click the "Custom" button to enter initial operation.


Configuration Wizard V. 2.0.0
Configuration wizard for 7188E/8000E.
4.1
Custom
Express

Step 4.2: Click the “open” button in the COM status section to establish a connection to the PC.


Configuration Wizard V. 2.0.0 COM1
4.2
Open
Close
<< Backward
Forward >>
Information of the 7188E/8000E
Information of PC
Write recommend settings to 7188E/800E
Exit

COM status

COM1 115200

Lin N,8,1

Host PC

IP 192.168.30.23

Mask 255.255.0.0

Gateway 192.168.0.1

Operation

Step 4:
Connect COM1/COM2 of PC
to COM1 of the 7188E/8000E.
Step 5:
Press the [Open] button.

7188E/8000E Setting (Origin)

IP IP

Mask Mask

Gateway Gateway

7188E/8000E Setting (Recommend)

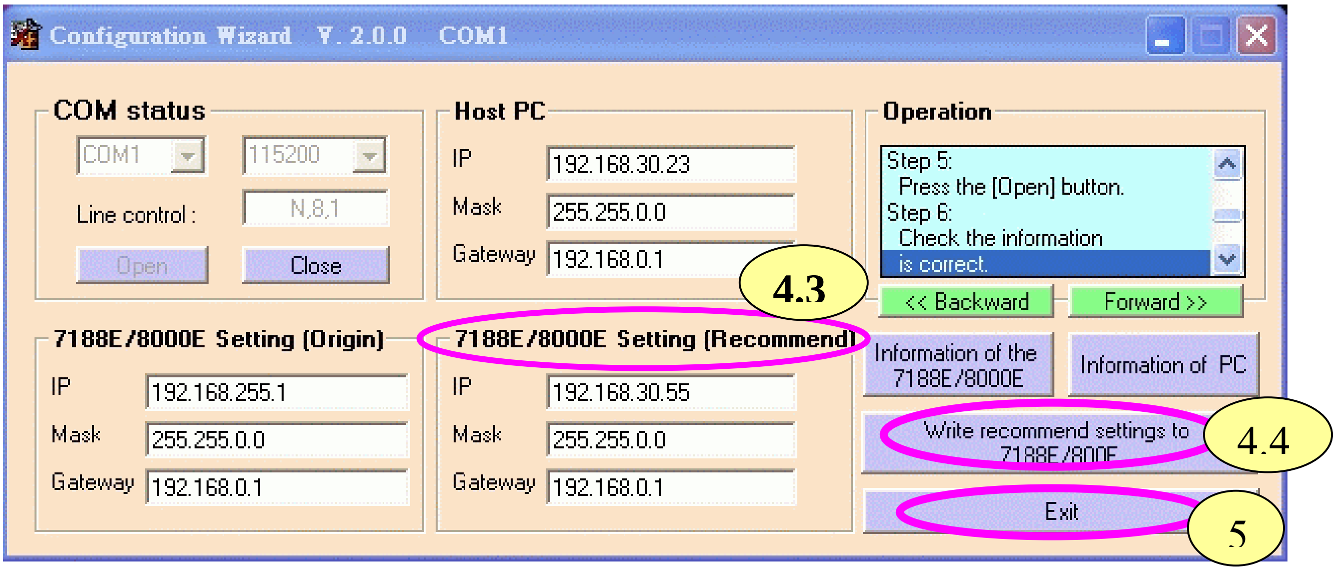
IP 192.168.30.55

Mask 255.255.0.0

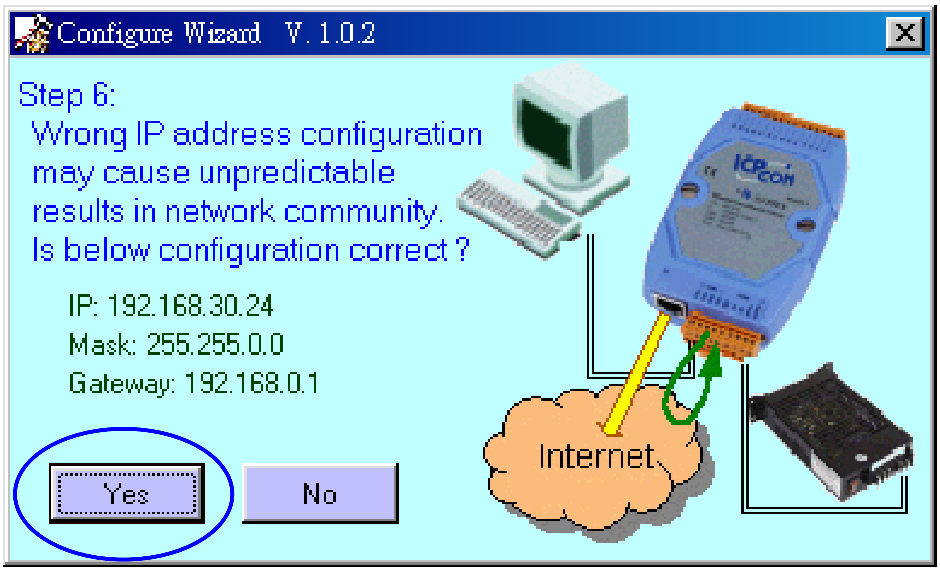
Gateway 192.168.0.1

Step 4.3: Check that a valid IP, Mask and Gateway value has been inserted into the “7188E/8000E Settings (Recommended)” fields.

Step 4.4: Click the “Write recommend settings to 7188E/800E” button to confirm the new settings. Click “YES” in the following dialog



Step 5: Exit the "Configure Wizard" and then restart the I-7188EF 016 for the new settings to take effect.



Step 6:
Wrong IP address configuration may cause unpredictable results in network community.
Is below configuration correct ?

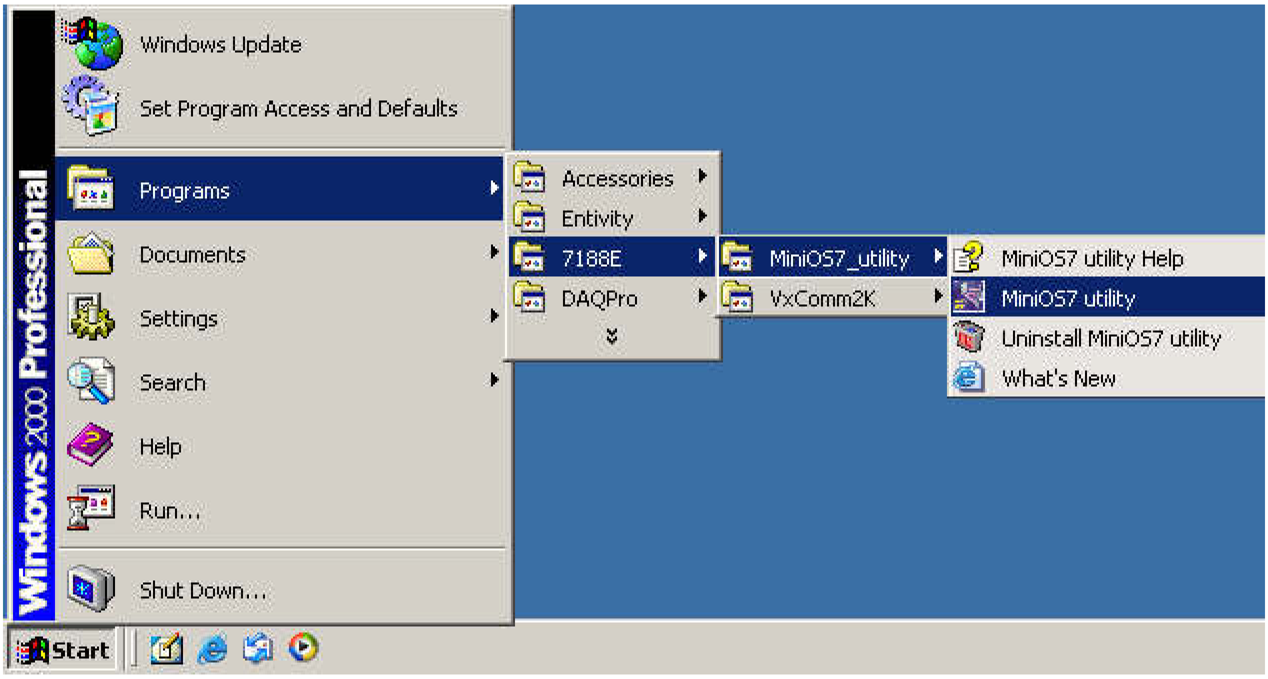
IP: 192.168.30.24
Mask: 255.255.0.0
Gateway: 192.168.0.1

2.1.2 Using the ”MiniOS7 Utility”

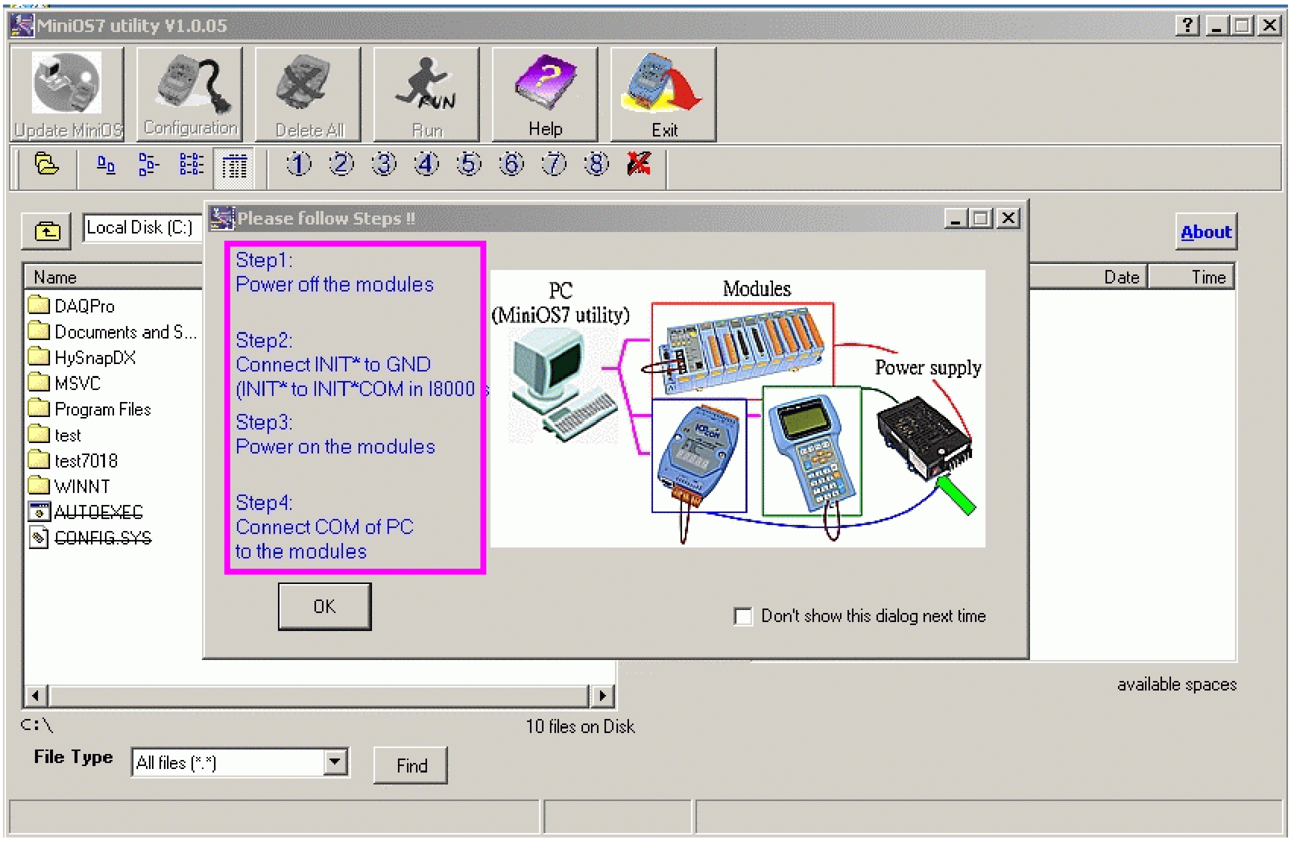
The MiniOS7 Utility is used to download files and update the OS image to the I-7188EF-016. It can also be used to configure the network and COM port settings. In contrast to the “Configure Wizard”, users must first have valid IP, Mask and Gateway information and must manually enter it into the text box provided.

Step 1: Refer to Sec. 1.4.2 for details the wire connection for the I-7188EF-016.

Step 2: Install the MiniOS7 Utility on the host PC by running: CD:\Napdos\MiniOS7\Utility\MiniOS7_Utility\MiniOS7_Utility.exe



Step 3: Follow each step of the instructions.



Please follow Steps !!

Step1:
Power off the modules

Step2:
Connect INIT* to GND
(INIT* to INIT*COM in I8000 s

Step3:
Power on the modules

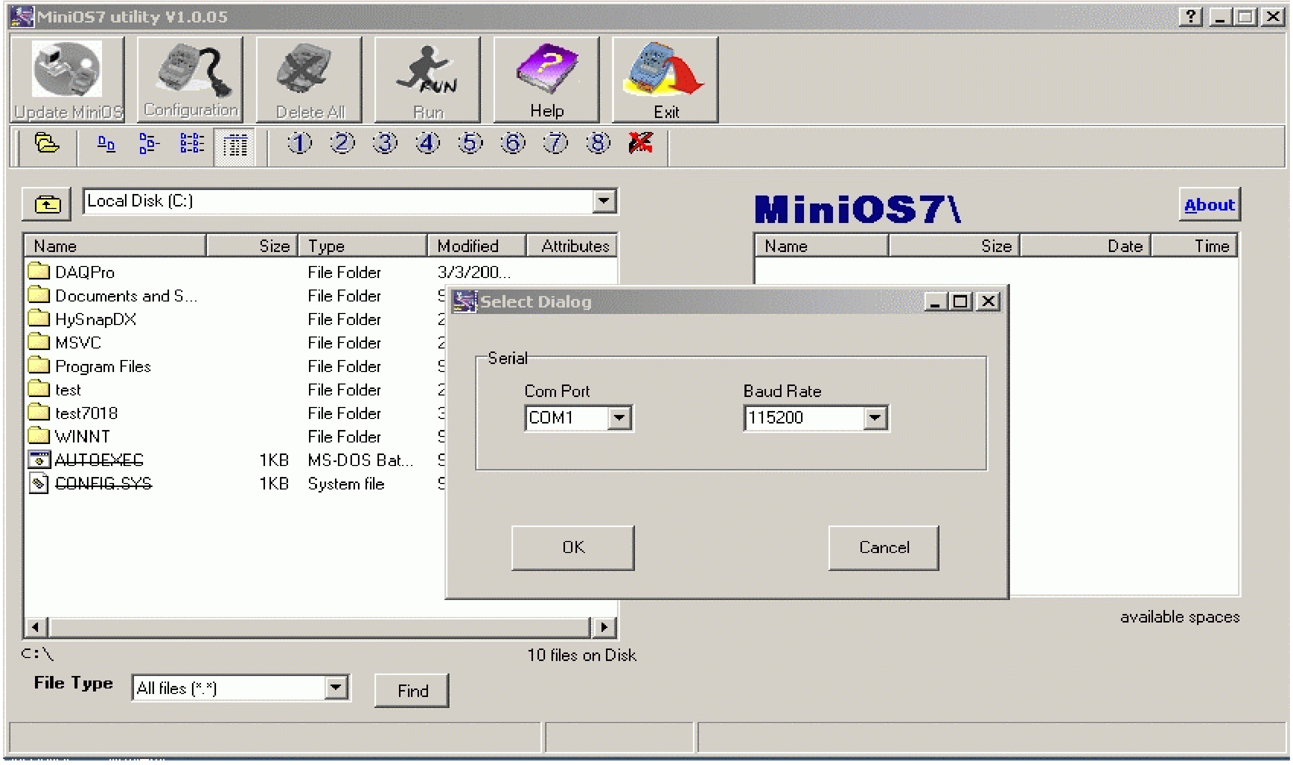
Step4:
Connect COM of PC
to the modules

□ Don't show this dialog next time

DAQPro
Documents and S...
HySnapDX
MSVC
Program Files
test
test7018
WINNT
AUTOEXEC
CONFIG.SYS

C:\
10 files on Disk

Step 4: Set Com port and Baudrate, and then click the "OK" button.



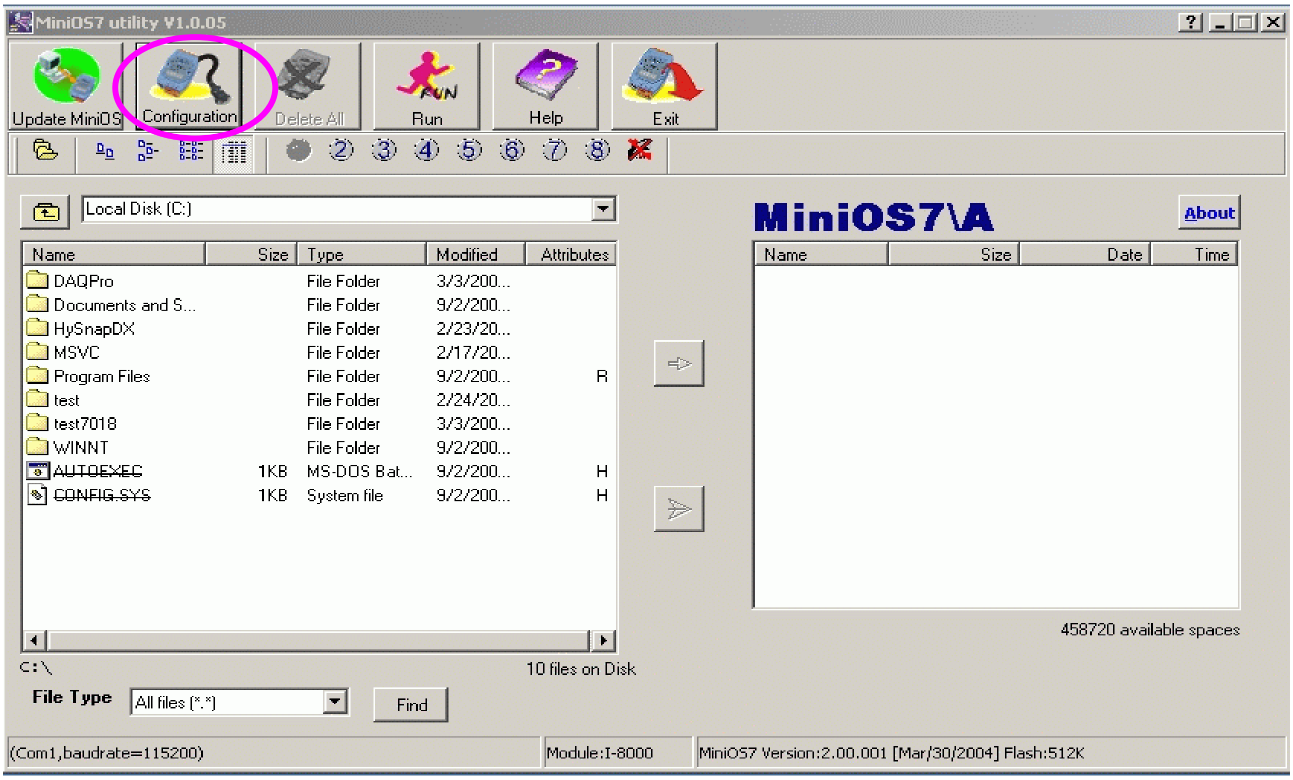
Name	Size	Type	Modified	Attributes
DAQPro		File Folder	3/3/200...	
Documents and S...		File Folder	9	
HySnapDX		File Folder	2	
MSVC		File Folder	2	
Program Files		File Folder	9	
test		File Folder	2	
test7018		File Folder	3	
WINNT		File Folder	9	
AUTOEXEC	1KB	MS-DOS Bat...	9	
CONFIG.SYS	1KB	System file	9	

C:\
10 files on Disk

Select Dialog

Serial
Com Port: COM1
Baud Rate: 115200

Step 5: Click the “Configuration” button to set IP address and the Setting of com port.



Local Disk (C:)

Name	Size	Type	Modified	Attributes
DAQPro		File Folder	3/3/200...	
Documents and S...		File Folder	9/2/200...	
HySnapDX		File Folder	2/23/20...	
MSVC		File Folder	2/17/20...	
Program Files		File Folder	9/2/200...	R
test		File Folder	2/24/20...	
test7018		File Folder	3/3/200...	
WINNT		File Folder	9/2/200...	
AUTOEXEC	1KB	MS-DOS Bat...	9/2/200...	H
CONFIG.SYS	1KB	System file	9/2/200...	H

Name	Size	Date	Time

C:\

10 files on Disk

458720 available spaces

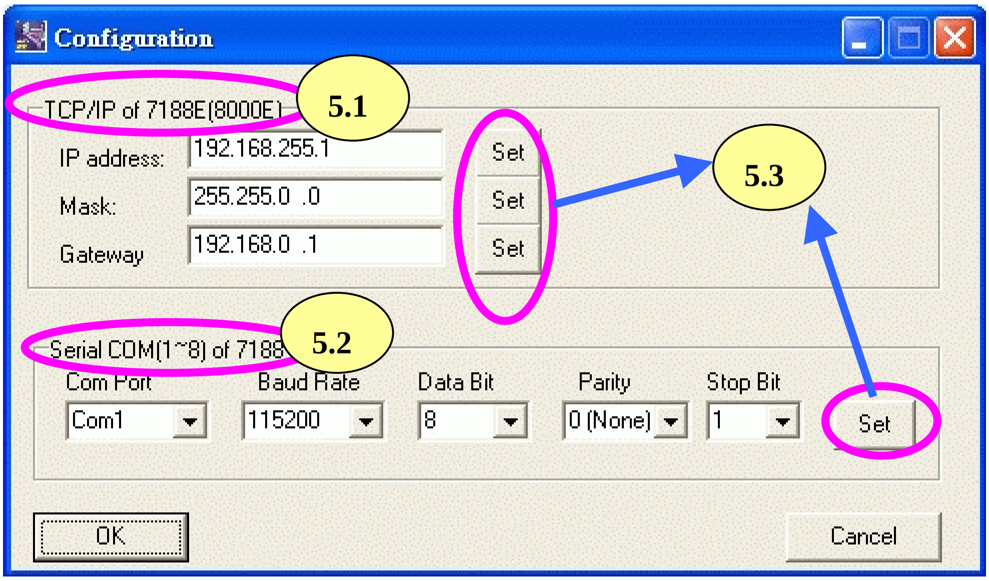
File Type: All files (*.*)

(Com1,baudrate=115200) | Module:I-8000 | MiniOS7 Version:2.00.001 [Mar/30/2004] Flash:512K

Step 5.1: Check that a valid IP, Mask and Gateway value has been Inserted into the “TCP/IP of 7188E [8000E]” fields.

Step 5.2: Check that a valid Com port, Baud Rate, Data bit, Parity and Stop Bit value has been Inserted into the “Serial COM [1~8] of 7188” fields.

Step 5.3: Modifying these values must click “Set” button to create these values, and then click the “OK” button.



TCP/IP of 7188E(8000E)

IP address: 192.168.255.1

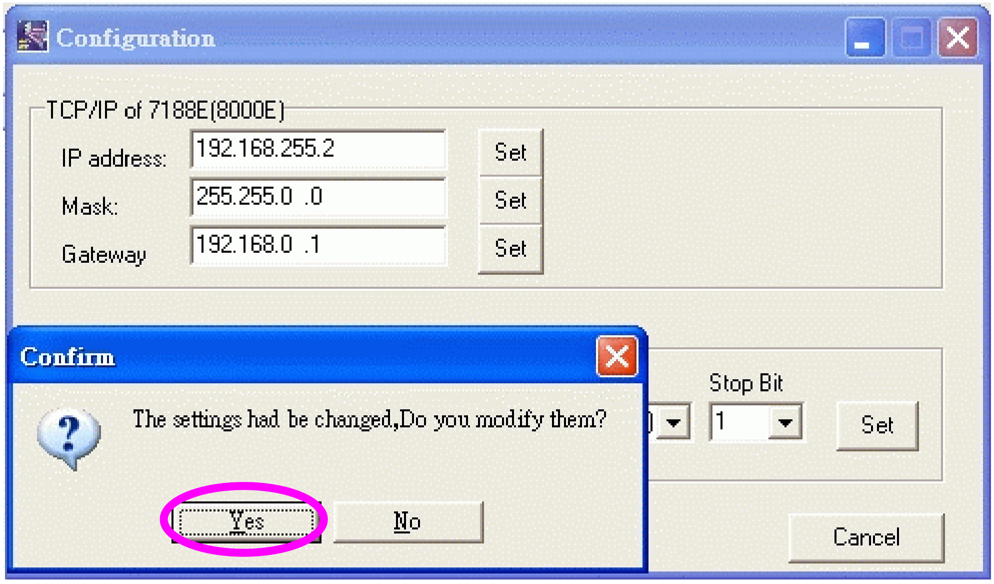
Mask: 255.255.0 .0

Gateway 192.168.0 .1

Serial COM(1~8) of 7188

Com Port	Baud Rate	Data Bit	Parity	Stop Bit
Com1	115200	8	0 (None)	1

Step 6: Click the "Yes" button to update new values.



TCP/IP of 7188E(8000E)

IP address: 192.168.255.2

Mask: 255.255.0 .0

Gateway 192.168.0 .1

Stop Bit 1

The settings had be changed,Do you modify them?

Step 7: Exit the MiniOS7 Utility and then restart the I-7188EF-016 for the new settings to take effect.

Note:

Please refer to Appendix C for more details regarding the steps of installation procedure for the MiniOS7 Utility.

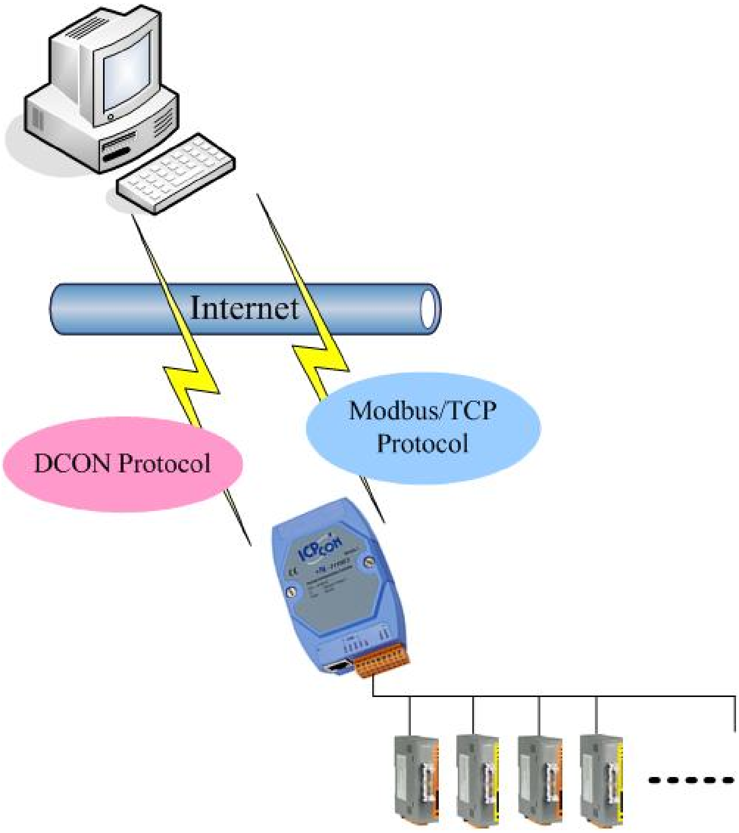
3. How to access distributed I/O of 7188EF-016?

I-7188EF series is designed as RS-232/RS-485 and FRnet to Ethernet converter. So it follows that they can be used to link these RS-232/RS-485 devices and link the FRnet devices to central computer.
With the FRnet interface, the I-7188EF-016 features the real I/O synchronization and fixed scan time with the FRnet distributed I/O module. So the distributed I/O data will be acquired by the I-7188EF-016 in the real time. It's similar to that the distributed I/O modules are attached on the I-7188EF-016.

3.1 Via an Ethernet Network

The Ethernet network is extremely popular and already existing for most applications. Either for using with local networks or for connecting to the Internet, the Host PC or the device in the LAN or WAN can connects to the I-7188EF-016 and control the FRnet I/O module or the devices attached on the COM1/COM2 of the I-7188EF-016.

The Host PC can access the FRnet I/O module using the Modbus/TCP or DCON protocol.



Modbus/TCP Protocol:

Modbus/TCP protocol is a variant of Modbus protocol. It was developed in 1999 to allow Internet community access Ethernet devices. Refer to Sec. 3.2 for more details.

DCON Protocol:

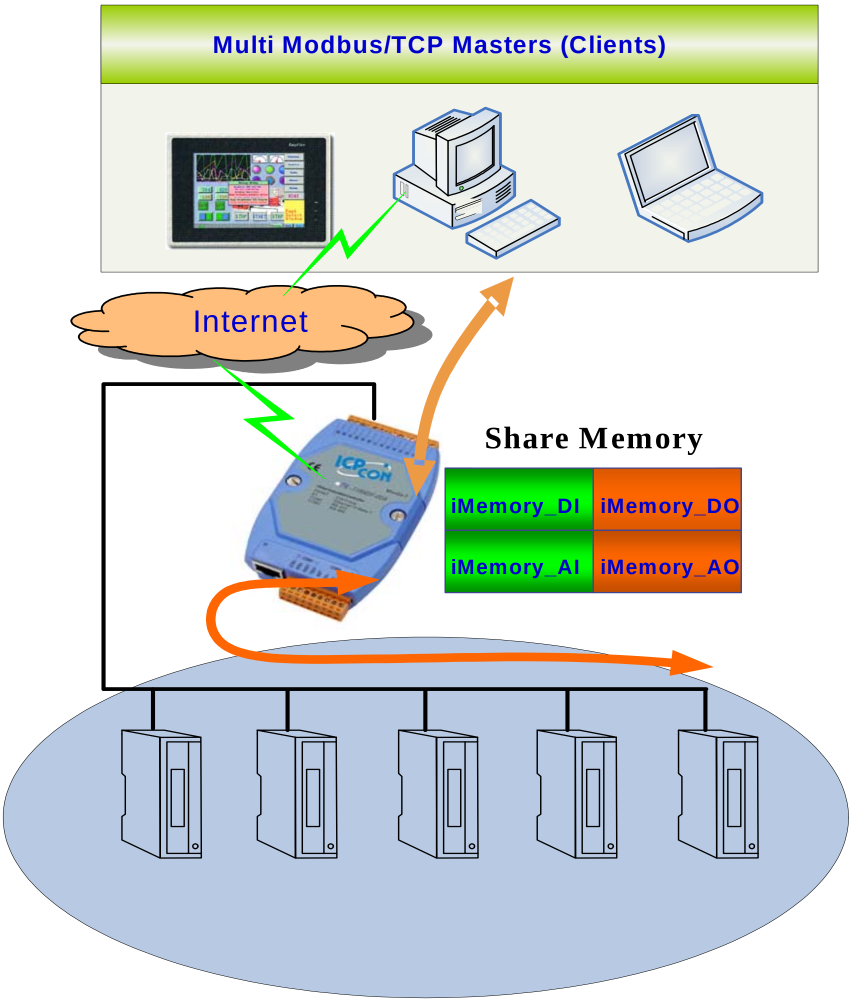
The DCON protocol is a request/reply communication protocol for the I-7000/8000/87K series I/O modules and I-7188EF-016. Refer to Sec. 3.3 for more details.

3.2 Using the Modbus protocol

3.2.1 Introduction

MODBUS is a master-slave bus system in which only one device (the master) actively starts a transaction (query). The passive device (the slave) then sends a response. Most SCADA Supervisor Control And Data Acuisition and HMI software can easily integrate serial devices via the Modbus protocol, such as Citect, ICONICS, iFIX, InduSoft, Intouch, Entivity Studio, Entivity Live, Entivity VLC, Trace Mode, Wizcon, Wonderware... etc.

I-7188EF-016 controller includes the Modbus/TCP protocol, which is a variation of Modbus protocol that was developed in 1999 to allow the Internet community to access Ethernet devices. Modbus address for Modbus/TCP client access.



Note:

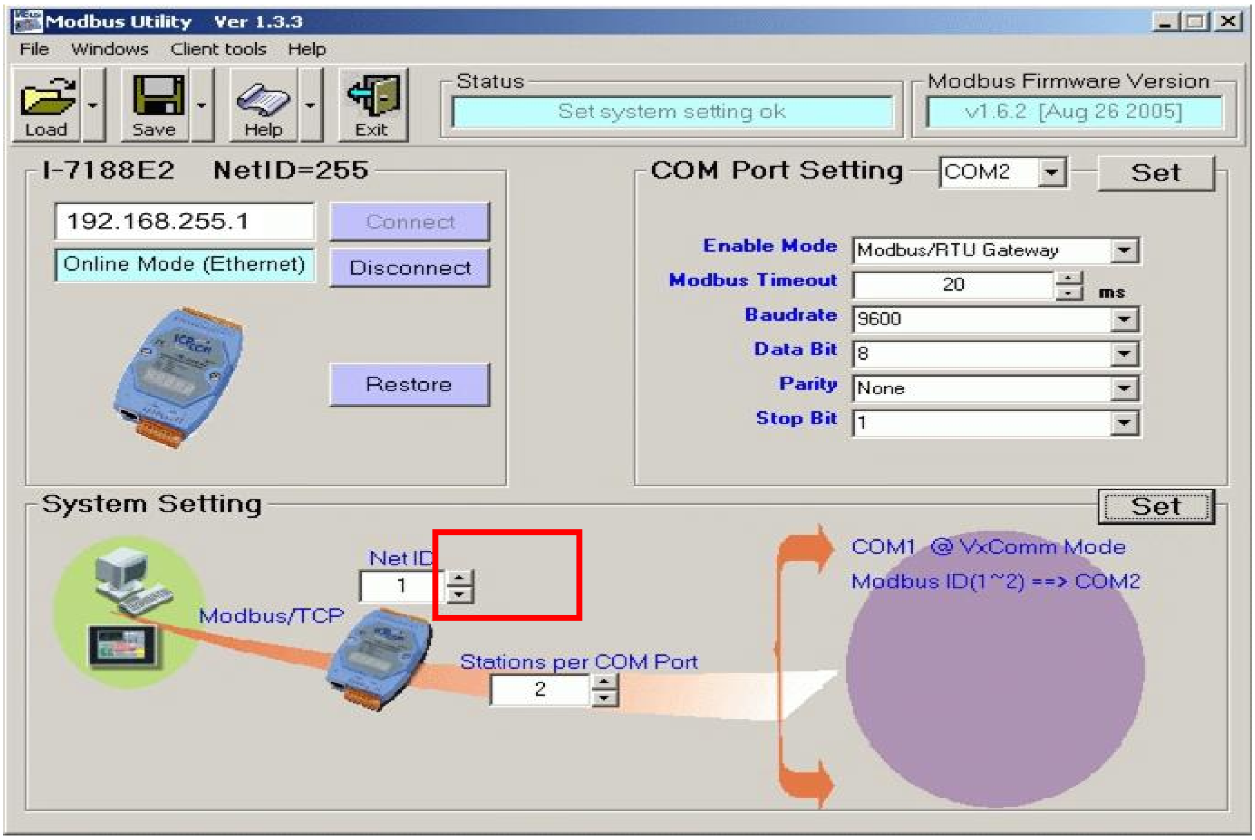
For more details regarding the Modbus address of the I-7188EF-016, please refer to Appendix D: Modbus protocol.

3.2.2 Modbus Applications for I-7188EF-016

Step 1: Connect the I-7188EF-016 controller (refer to Sec. 1.4.2) and configure its network settings (IP, Mask and Gateway - refer to Sec.2.1)

Step 2: Install the Modbus_Utility on the host PC by running CD:\Napdos\Modbus\ Modbus_Utility\Setup\Disk1\setup.exe.

Step 3: Connect to 7188EF-016 and set NetID.



Modbus Utility Ver 1.3.3

Status: Set system setting ok

Modbus Firmware Version: v1.6.2 [Aug 26 2005]

I-7188E2 NetID=255

192.168.255.1

Online Mode (Ethernet)

COM Port Setting: COM2

Enable Mode: Modbus/RTU Gateway

Modbus Timeout: 20 ms

Baudrate: 9600

Data Bit: 8

Parity: None

Stop Bit: 1

System Setting

Net ID: 1

Stations per COM Port: 2

COM1 @ VxComm Mode

Modbus ID(1~2) ==> COM2

3.2.3 Function Codes Supported

Modbus function codes are different for the analog/digital.

Modbus Command (Hex)	Protocol Description
01	Read multiple coils status for DO
02	Read multiple input discrete for DI
03	Read multiple registers for AO
04	Read multiple input registers for AI
05	Write single coil for DO
06	Write single register for AO
0F	Force multiple coils for DO
10	Write multiple registers for AO

3.2.4 Modbus Register address table

I-7188EF-016: DO module (0xxxx)

Start Coil Address DEC(HEX)	Stop Coil Address DEC(HEX)	Register Description 0xxxx "Coil" (Bit)Output Control (FRnet DO module channel value)	Range
Modbus function codes 01, 02 (read), 05, 15(write)			
0 (0x0)	15(0xF)	Group 0: Channel1~Channel16	0: off 1: on
16 (0x10)	31(0x1F)	Group 1: Channel1~Channel16	0: off 1: on
32(0x20)	47(0x2F)	Group 2: Channel1~Channel16	0: off 1: on
48(0x30)	63(0x3F)	Group 3 : Channel1~Channel16	0: off 1: on
64(0x40)	79(0x4F)	Group 4: Channel1~Channel16	0: off 1: on
80(0x50)	95(0x5F)	Group 5: Channel1~Channel16	0: off 1: on
96(0x60)	111(0x6F)	Group 6: Channel1~Channel16	0: off 1: on
112(0x70)	127(0x7F)	Group 7: Channel1~Channel16	0: off 1: on

Note:

For more detailed information regarding the FR-2053 module, please refer to CD\napdos\frnet\IO_Module\fr-2053\fr-2053.pdf

I-7188EF-016: DI module (1xxxx)

Start Coil/Record Address DEC(HEX)	Stop Coil/Record Address DEC(HEX)	Register Description 1xxxx "Discrete Input" (Bit)Input value (FRnet DI module channel value)	Range
Modbus fuction codes 01, 02 (read)			
0 (0x0)	15(0xF)	Group 0:Channel1~Channel16	0:off 1:on
16 (0x10)	31(0x1F)	Group 1: Channel1~Channel16	0:off 1:on
32(0x20)	47(0x2F)	Group 2: Channel1~Channel16	0:off 1:on
48(0x30)	63(0x3F)	Group 3 : Channel1~Channel16	0:off 1:on
64(0x40)	79(0x4F)	Group 4: Channel1~Channel16	0:off 1:on
80(0x50)	95(0x5F)	Group 5: Channel1~Channel16	0:off 1:on
96(0x60)	111(0x6F)	Group 6: Channel1~Channel16	0:off 1:on
112(0x70)	127(0x7F)	Group 7: Channel1~Channel16	0:off 1:on

DI module status:

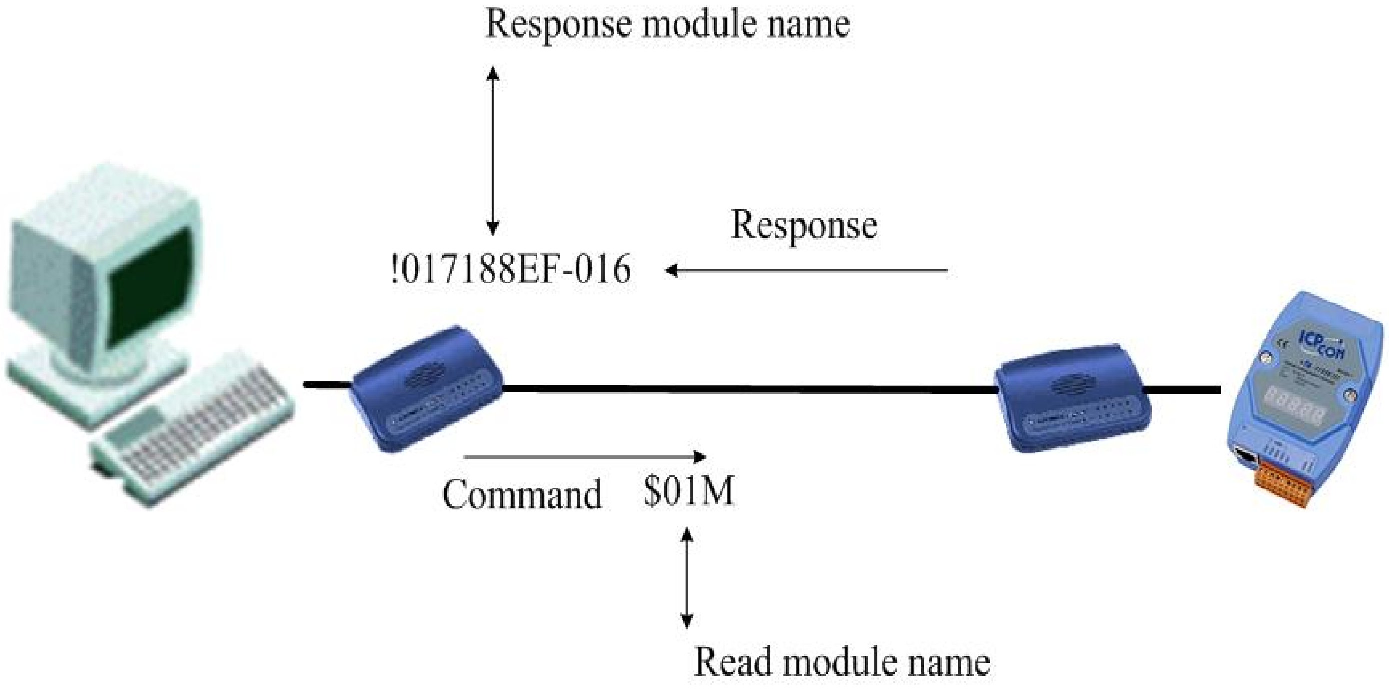
Start Coil/Record Address DEC(HEX)	Stop Coil/Record Address DEC(HEX)	Register Description 1xxxx "Discrete Input" (Bit)Input value (FRnet DI module status)	Range
Modbus fuction codes 01, 02 (read)			
200 (0xC8)	207 (0xCF)	Group0~Group7	0:offline 1:online

Note:

For more detailed information regarding the FR-2057 module, please refer to cd\napdos\frnet\IO_Module\fr-2057\fr-2057.pdf

3.3 Using the DCON Protocol

The default firmware provided with the I-7188EF-016 uses ASCII command to communicate, meaning that it is easy to use and most applications can be developed using toolkits supported by ICPDAS, such as DLL, ActiveX or OPC Server, thereby shortening development time.



For more details regarding the DCON Protocol, please refer to Appendix E: DCON protocol.

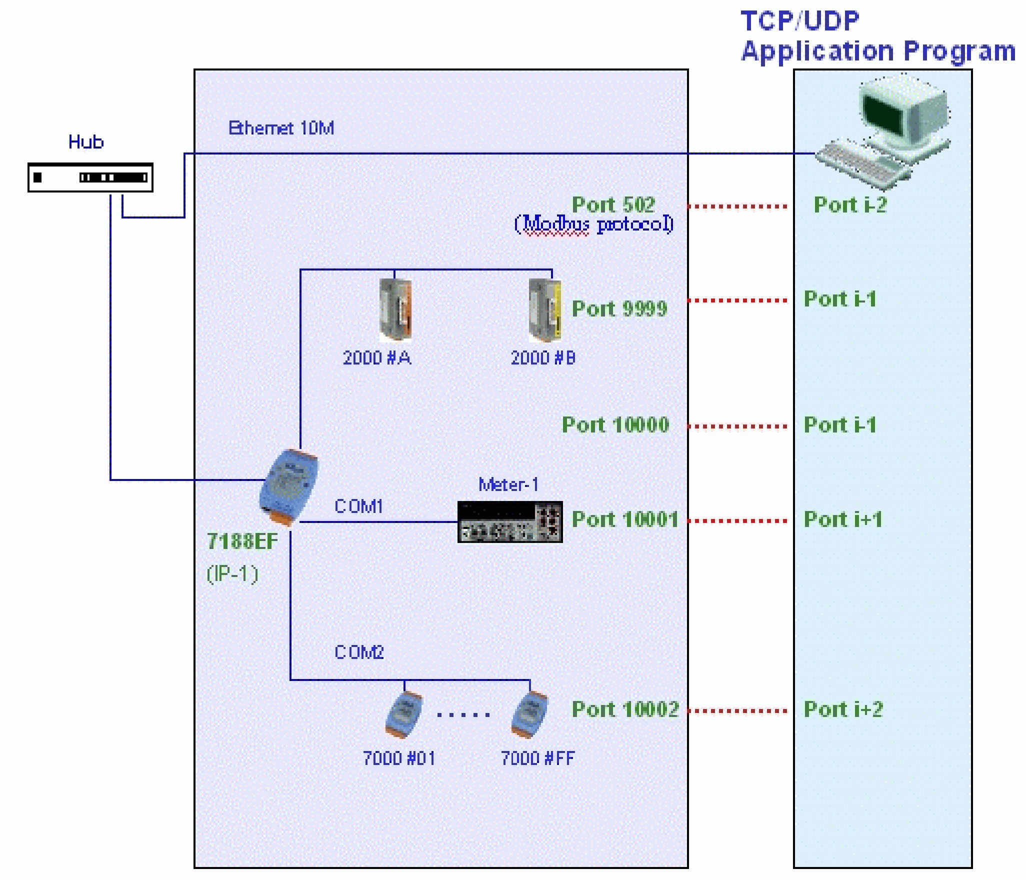
3.3.1 Software communication interface

The application on Host PC can use the DCON protocol to communicate with the I-7188EF-016 through two communication interface.

1. Using standard TCP/IP protocol

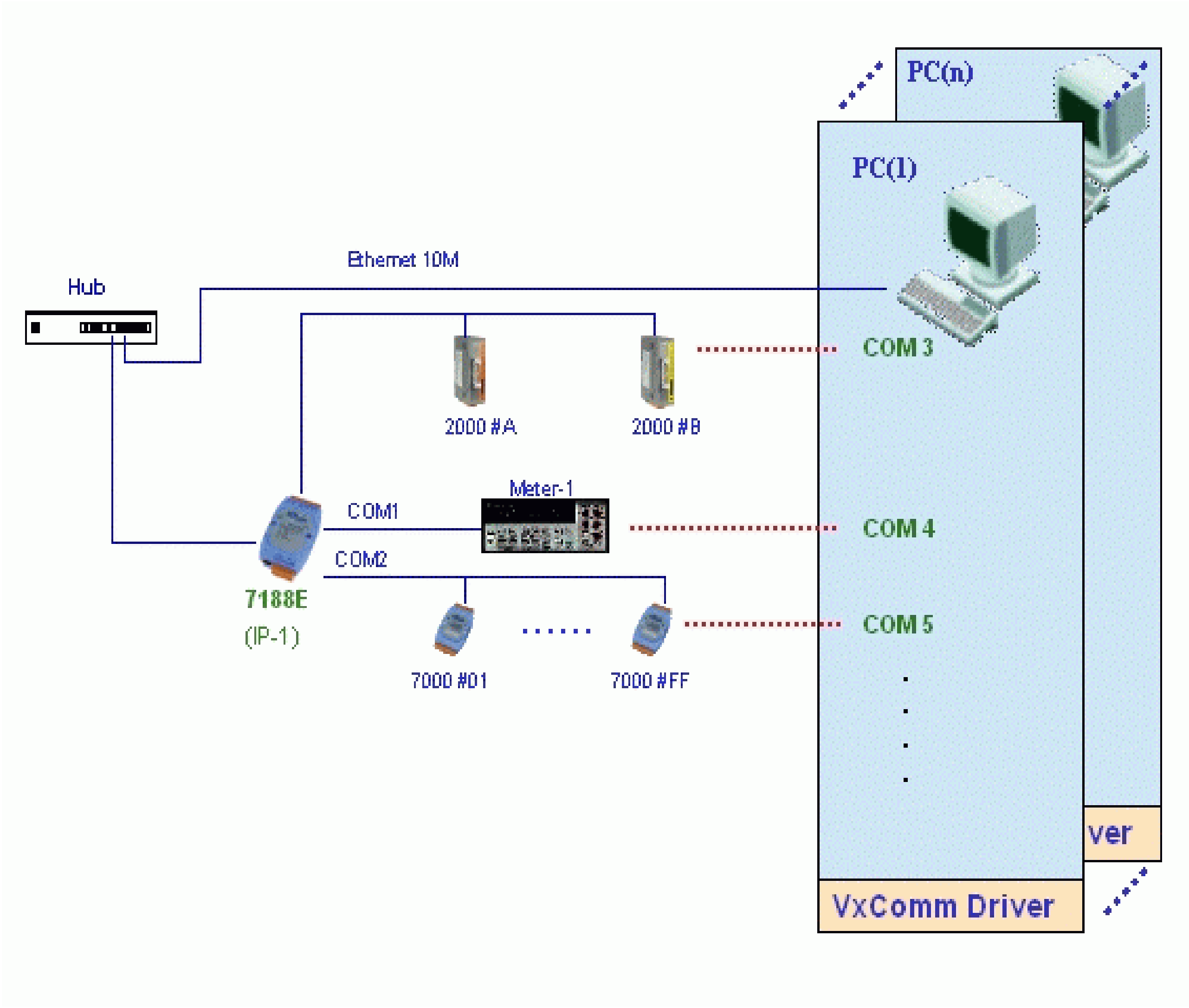
I-7188EF016 acts as a server that provides data translation between serial and Ethernet formats and data access of FRnet DIO.
The applications with TCP/IP protocol on the Host PC establish the connection with I-7188EF-016 and get data from FRnet network.

The well-known port 9999 is used for the communication using the DCON protocol.



2. Virtual COM Technology

With the help of VxComm utility, the built-in COM port of 7188EF can be virtualized to standard COM port of host-PC, the FRnet port also can be mapped as a virtual port on Host PC. The architecture shows as follow:



Note:

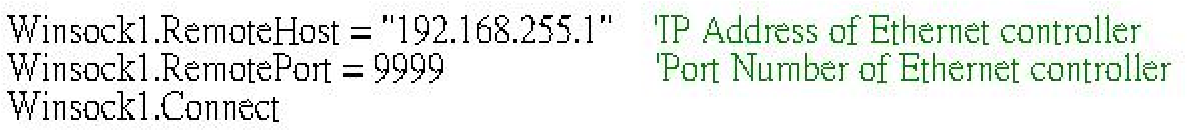
Please refer to Appendix F: “VxComm Technology” for more details.

3.3.2 Using TCP/IP protocol to connect the 7188EF-016

Support for the DCON communication protocol is available via the Ethernet port. A TCP program can be used to develop Ethernet Applications to communicate with TCP port 9999 of the I-7188EF-016.

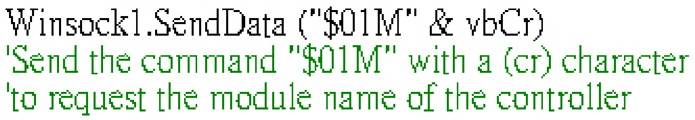
The following procedure illustrates how to use the VB Winsock component.

Step 1: Connect to the Ethernet controller



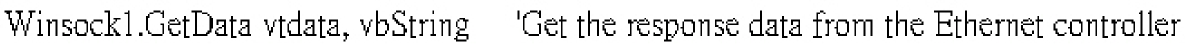
```
Winsock1.RemoteHost = "192.168.255.1"    'IP Address of Ethernet controller
Winsock1.RemotePort = 9999               'Port Number of Ethernet controller
Winsock1.Connect
```

Step 2: Send a command with "cr"



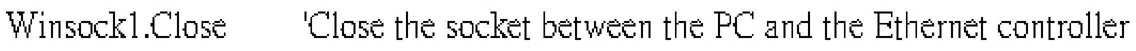
```
Winsock1.SendData ("$01M" & vbCr)
'Send the command "$01M" with a (cr) character
'to request the module name of the controller
```

Step 3: Receive the data from the Ethernet controller



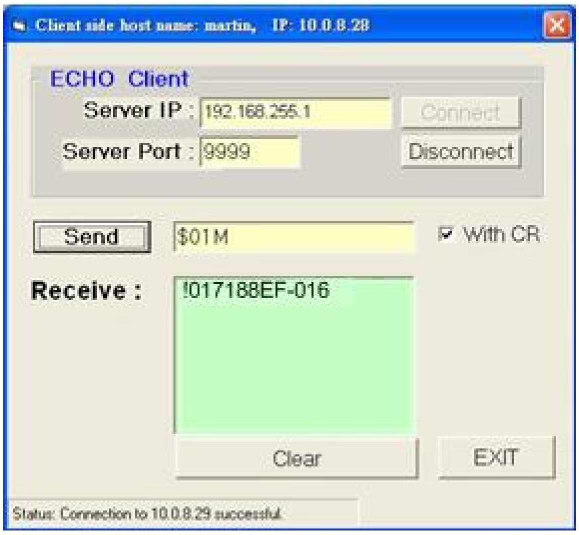
```
Winsock1.GetData vtdata, vbString    'Get the response data from the Ethernet controller
```

Step 4: Close the connection.



```
Winsock1.Close        'Close the socket between the PC and the Ethernet controller
```

The result will be as follows:



Client side host name: martin, IP: 10.0.8.28

ECHO Client

Server IP : 192.168.255.1

Server Port : 9999

$01M

☑ With CR

Receive : !017188EF-016

Status: Connection to 10.0.8.29 successful.

This TCP application uses the DCON Protocol to communicate with Ethernet port 9999 of the I-7188EF-016 Ethernet I/O controller.

The demo program can be found at:
CD:\Napdos\8000\843x883x\TCP\Xserver\Client\Common\VB5\Client4
or on the Internet at:
ftp://ftp.icpdas.com/pub/cd/8000cd/napdos/8000/843x883x/tcp/xserver/client/common/vb5/client4/

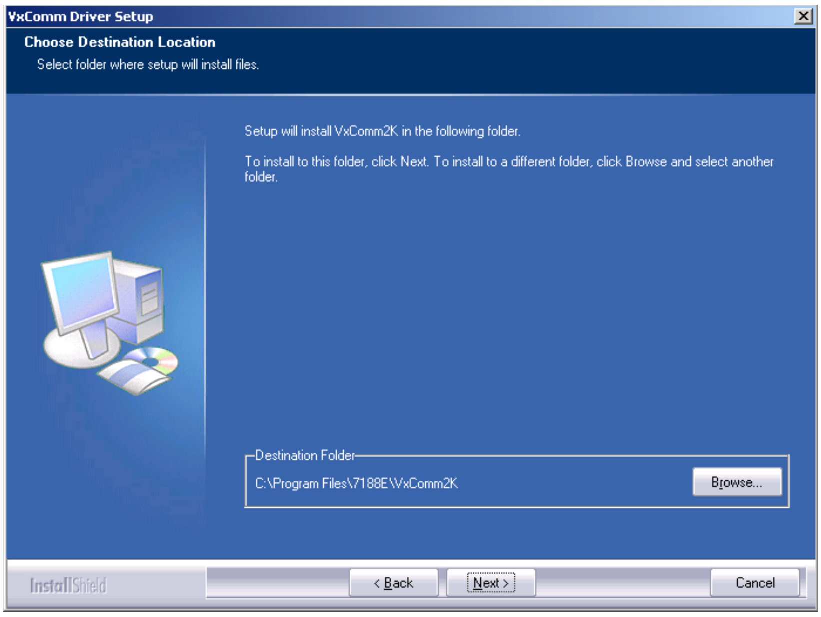
3.3.3 Using Vxcomm technology to connect the 7188EF-016

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.

The VxComm Utility using the Vxcomm technology can be used to create a virtual COM port to map the COM port on I-7188EF-016. The DCON utility can then be used to configure additional settings, or other DCON applications can be used.

Please refer to following of steps to install the VxComm Utility.
For more details regarding the VxComm Technology, please refer to Appendix F: “VxComm Technology”.

Installation and use VxComm Utility:
Step 1: Connect the I-7188EF-016 controller (refer to Sec. 1.4.2) and configure its network settings (refer to Sec. 2.1)
Step 2: Install the VxComm driver appropriate for your PC (95/98/NT/2000/XP) CD:\Napdos\7188e\tcp\VxComm\Driver(PC)\



VxComm Driver Setup

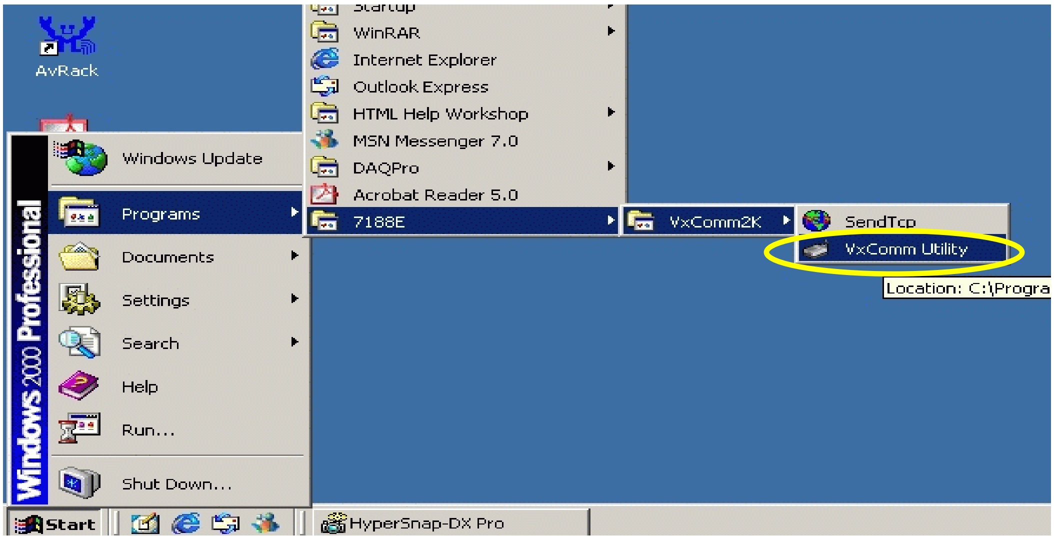
Choose Destination Location
Select folder where setup will install files.

Setup will install VxComm2K in the following folder.

To install to this folder, click Next. To install to a different folder, click Browse and select another folder.

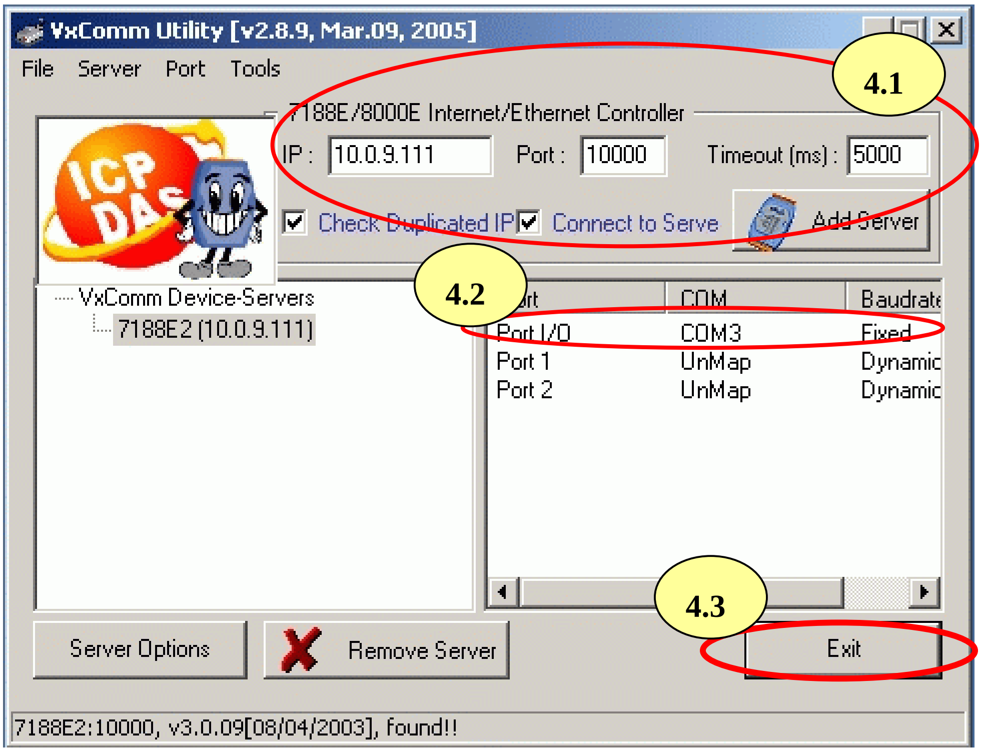
Destination Folder
C:\Program Files\7188E\VxComm2K

Step 3: Run the VxComm Utility and connect to the I-7188EF-016



Step 4: Map the “Port I/O” to a virtual COM port.

4.1: Set IP address, and then click the “Add Server” button.



7188E/8000E Internet/Ethernet Controller

IP : 10.0.9.111 Port : 10000 Timeout (ms) : 5000

☑ Check Duplicated IP ☑ Connect to Serve

VxComm Device-Servers
- 7188E2 (10.0.9.111)

rt	COM	Baudrate
Port I/O	COM3	Fixed
Port 1	UnMap	Dynamic
Port 2	UnMap	Dynamic

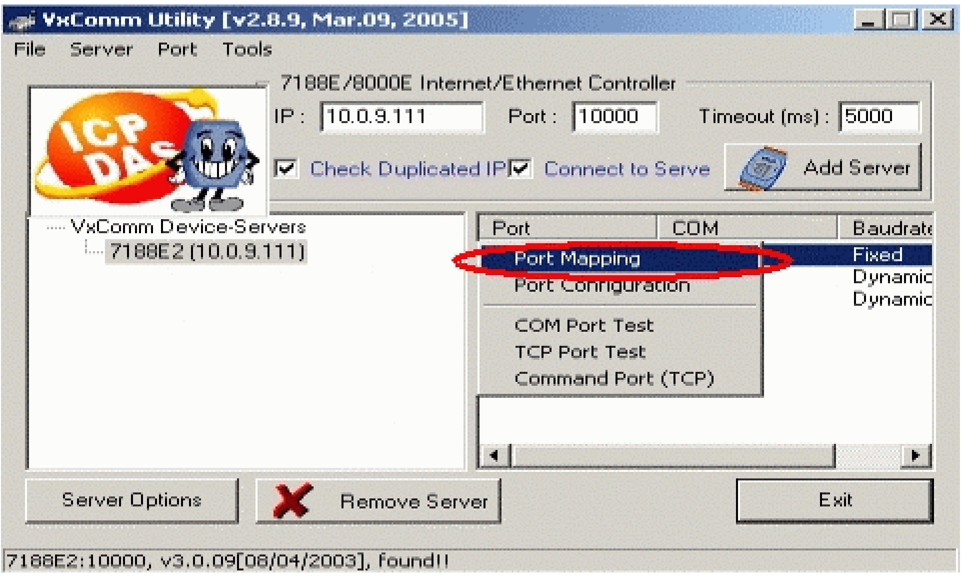
7188E2:10000, v3.0.09[08/04/2003], found!!

Note:

The “Port I/O” stands for FRnet port.

4.2: Set virtual Com port.

4.2.1: Double Click “Port I/O”, and then select port mapping.



VxComm Utility [v2.8.9, Mar.09, 2005]

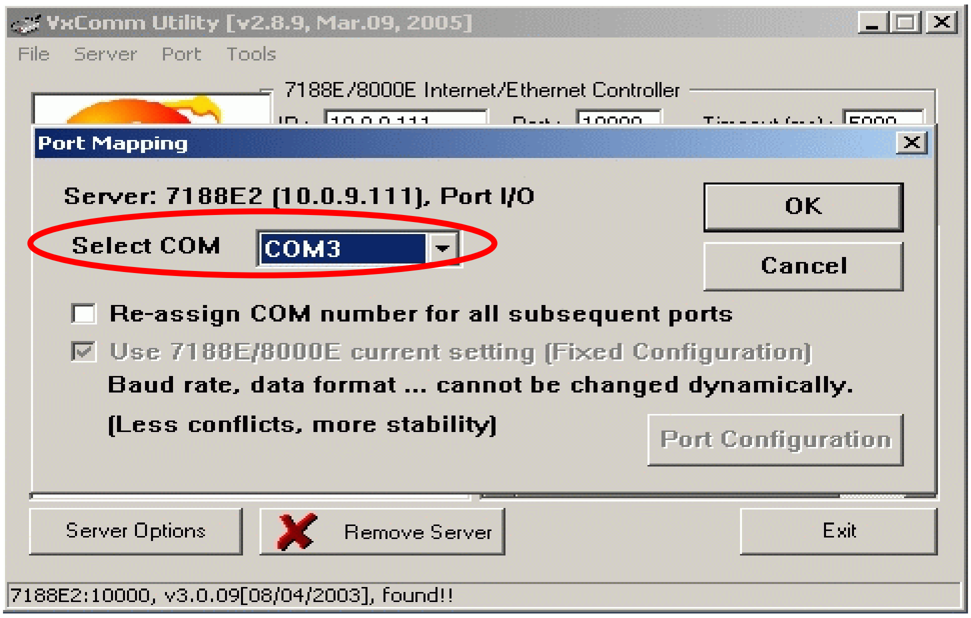
7188E/8000E Internet/Ethernet Controller

IP : 10.0.9.111 Port : 10000 Timeout (ms) : 5000

☑ Check Duplicated IP ☑ Connect to Serve

7188E2:10000, v3.0.09[08/04/2003], found!!

4.2.2: Select virtual Com port.



Port Mapping

Server: 7188E2 (10.0.9.111), Port I/O

Select COM: COM3

□ Re-assign COM number for all subsequent ports

☑ Use 7188E/8000E current setting (Fixed Configuration)

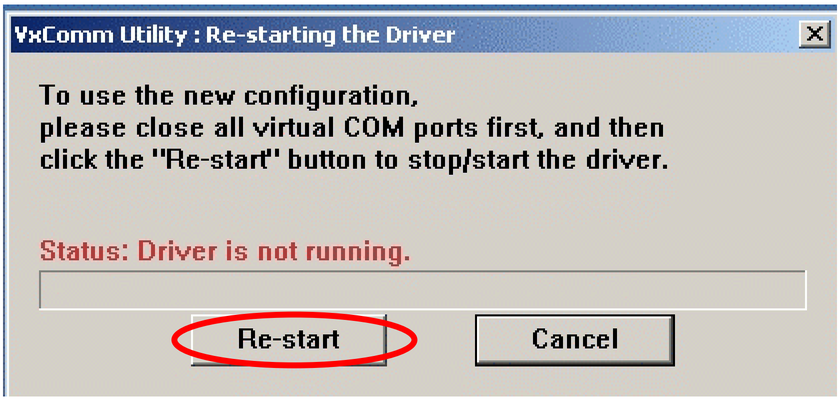
Baud rate, data format ... cannot be changed dynamically.

(Less conflicts, more stability)

VxComm Utility [v2.8.9, Mar.09, 2005]
File
Server
Port
Tools
7188E/8000E Internet/Ethernet Controller
OK
Cancel
Port Configuration
Server Options
Remove Server
Exit

7188E2:10000, v3.0.09[08/04/2003], found!!

Step 4.3: Exit the VxComm Utility



VxComm Utility : Re-starting the Driver

To use the new configuration,
please close all virtual COM ports first, and then
click the "Re-start" button to stop/start the driver.

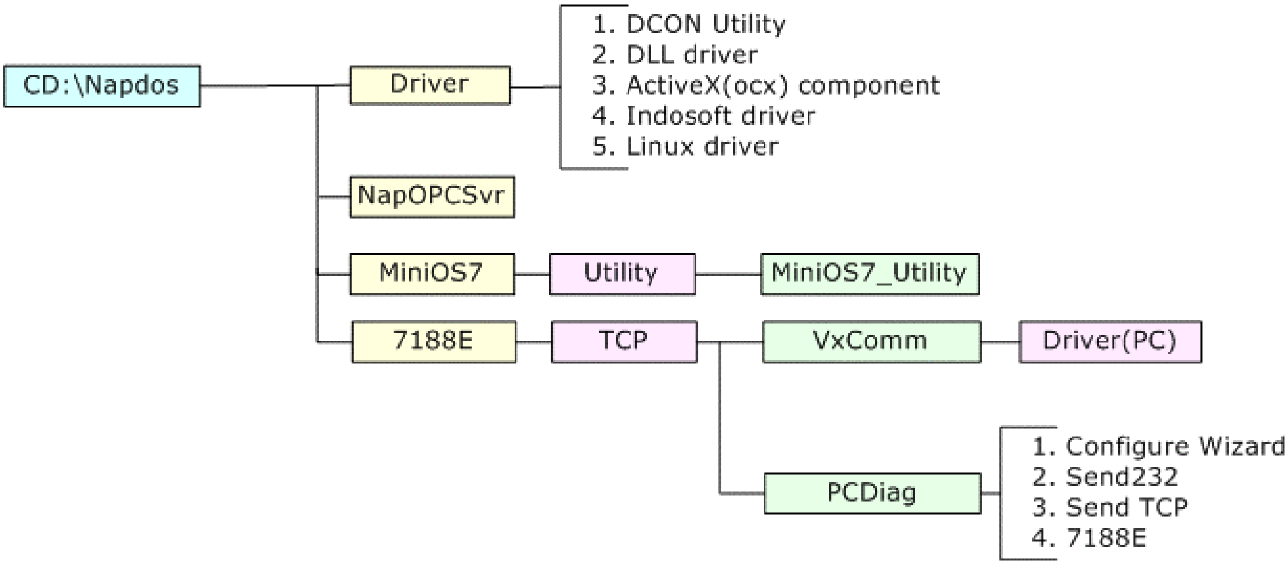
Status: Driver is not running.

Note:
Please refer to the 7188E user manual for more details regarding the installation and usage of the VxComm Utility.

4. Software Development ToolKit(DCON protocol)

4.1 Location of documents and software

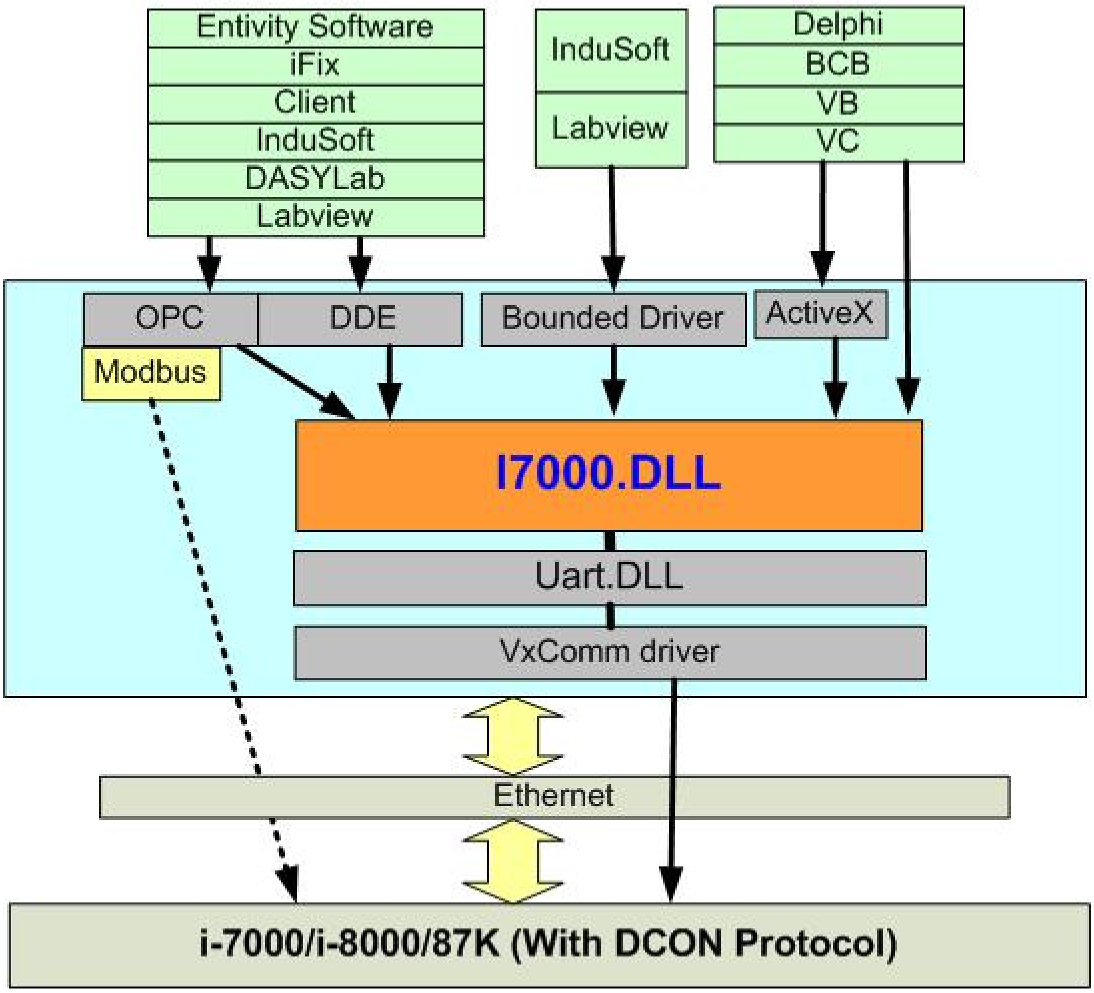
The location of all documents and software related to the DCON application are shown in the following directory tree. The relevant file can quickly be located by referring to the tree.



Various SDKs provided for the DCON protocol, such as DLL, ActiveX, Labview driver, Indusoft driver, Linux driver, OPC server, etc are availably used on Host PC. The SDKs can be used for the user to develop their application on the Host PC and they contain a number of helpful free demo programs and documents, which can be found on the CD included in the package, or can be downloaded from the ICP DAS web site or FTP site.

When planning the development of a system, appropriate software solutions should be chosen to suit different situations. Following chart shows the relation between the software solution and the SDK provided. Refer to the chart to find a solution to meet your requirements.

The diagram below shows the architecture of the SDK.

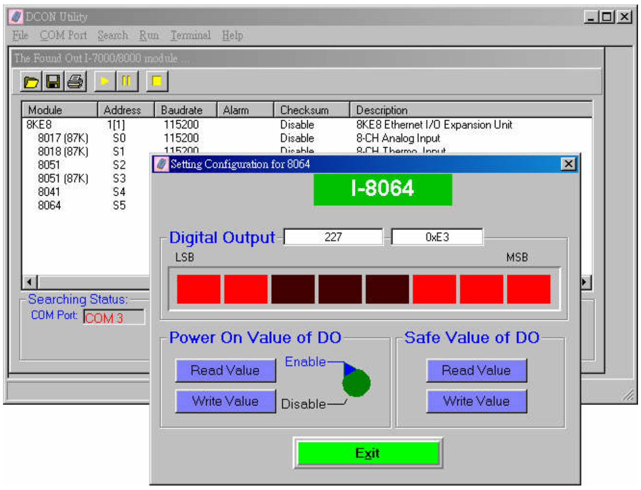


Note: **All the above SDKs are based on VxComm technology when using an Ethernet interface.**

4.2 DCON Uitility

The DCON Utility is used to configure the I-7188EF-016, I-7000, I-8000 and I-87K series I/O modules, and communicates with I/O modules via the COM port. For the I-7188EF-016, using the VxComm technique allows the let DCON Utility to access the FRnet distributed I/O modules via the Ethernet.

4.2.1 How to use the DCON Utility?



Module	Address	Baudrate	Alarm	Checksum	Description
8KE8	1[1]	115200		Disable	8KE8 Ethernet I/O Expansion Unit
8017 (87K)	S0	115200		Disable	8-CH Analog Input
8018 (87K)	S1	115200		Disable	8-CH Thermo Input
8051	S2				
8051 (87K)	S3				
8041	S4				
8064	S5				

Digital Output: 227 0xE3

COM Port: COM 3

DCON Utility

Main functions

- Module configuration
  - Baudrate
  - Address
  - Checksum
  - Power-on value
  - Safe value… etc.
  - Testing I/O actions

Modules supported:

I-7188EF-016/i-7000/i-8000/i-87K series
(with DCON protocol)

OS supported:

Windows 98/NT/2000/XP

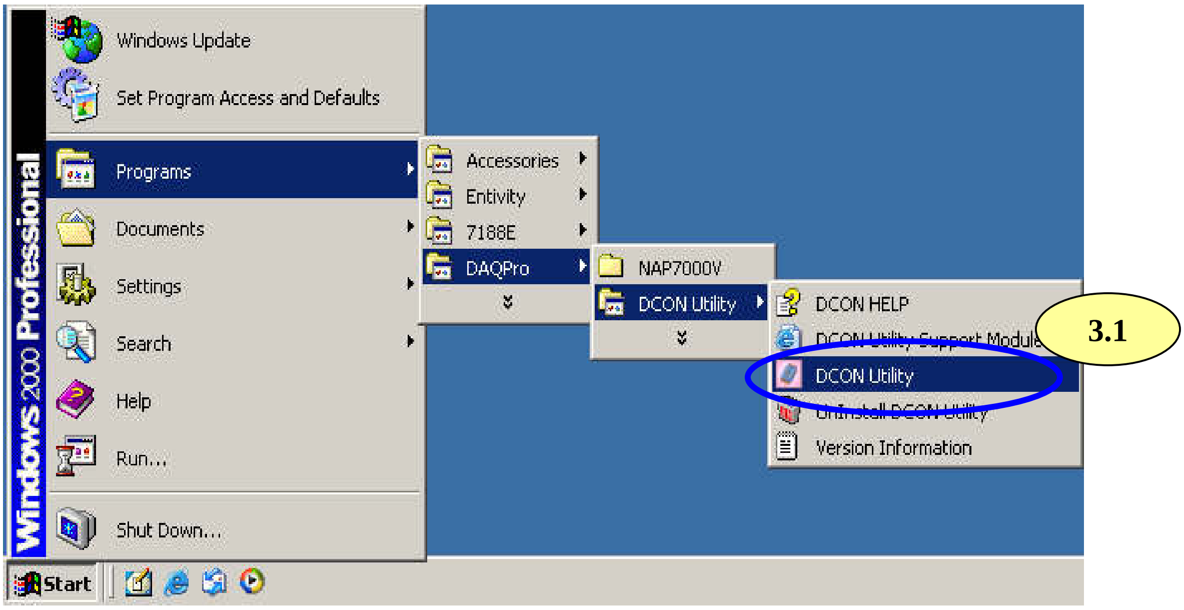
File location:

CD:\Napdos\Driver\DCON_Utility

Step 1: Connect the I-7188EF-016 controller (refer to Sec. 1.4.2) and configure its network settings (IP, Mask and Gateway - refer to Sec. 2.1)

Step 2: Create a virtual COM port (for example: COM3) to map the I/O modules

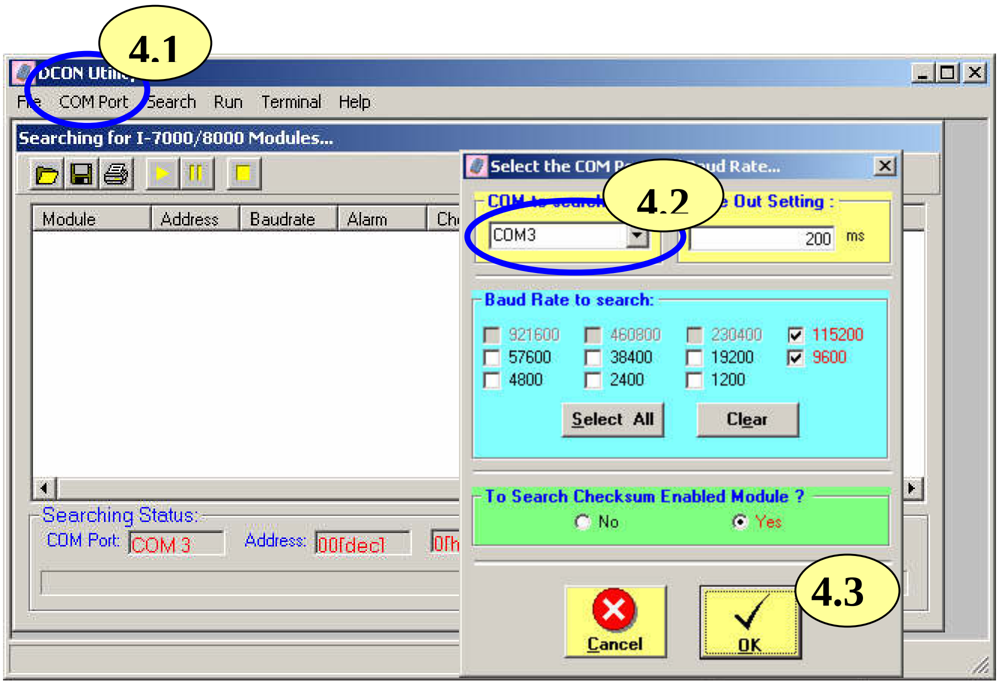
Step 3: Install the DCON Utililty on the host PC by running CD:\Napdos\Driver\DCON_Utility\Setup\setup.exe.



Step 4: Change the COM port to the virtual COM port.

Note:

For the I-I-7188EF-016, the Baud Rate is unimportant. Any Baud Rate setting can be used.



Searching for I-7000/8000 Modules...

Module	Address	Baudrate	Alarm	Ch

Searching Status:
COM Port: COM 3 Address: 00[dec] 0[h

Select the COM Port and Baud Rate...

COM to search: COM3

Time Out Setting : 200 ms

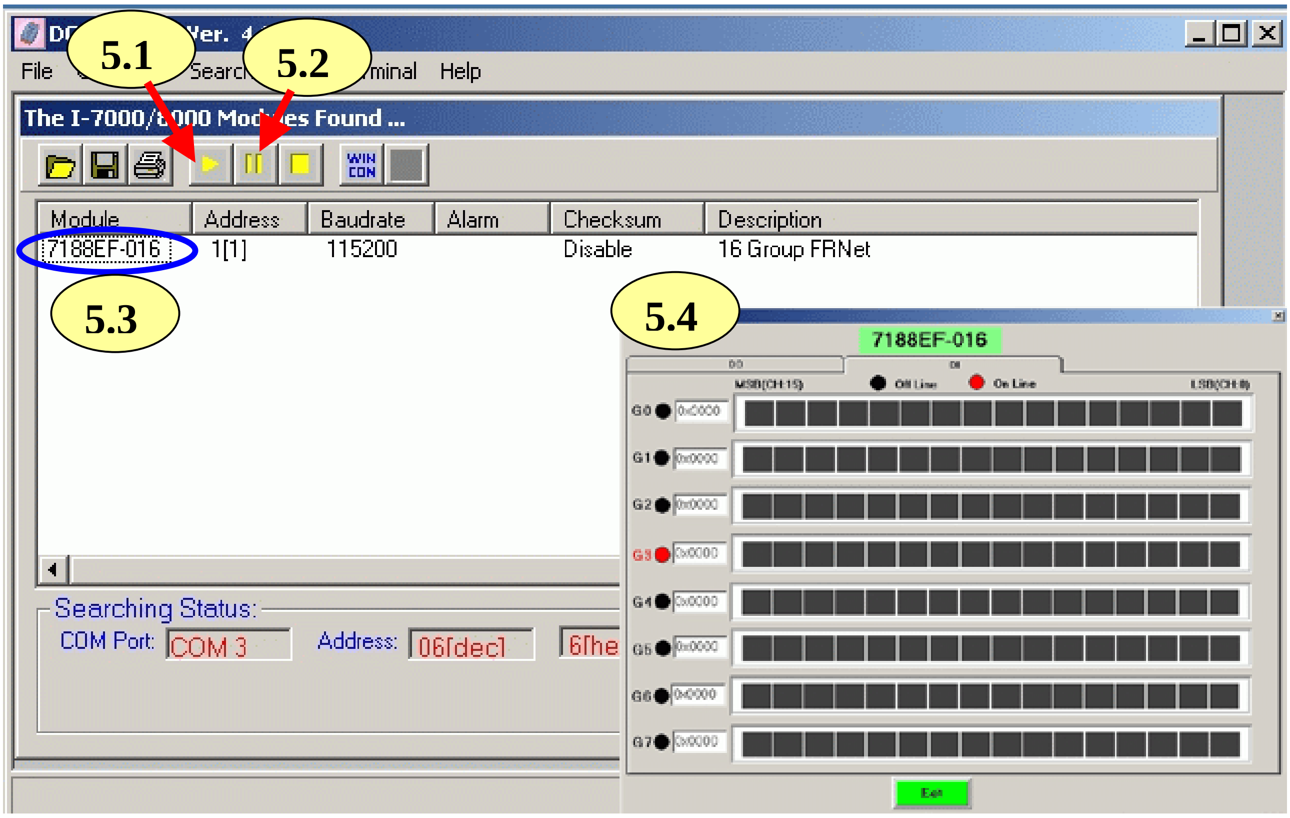
Baud Rate to search:

□ 921600	□ 460800	□ 230400	☑ 115200
□ 57600	□ 38400	□ 19200	☑ 9600
□ 4800	□ 2400	□ 1200	

Select All Clear

To Search Checksum Enabled Module ?
○ No ● Yes

Step 5: Search for the I/O modules on the I-7188EF-016. After the modules are found, individually click on them to configure them.



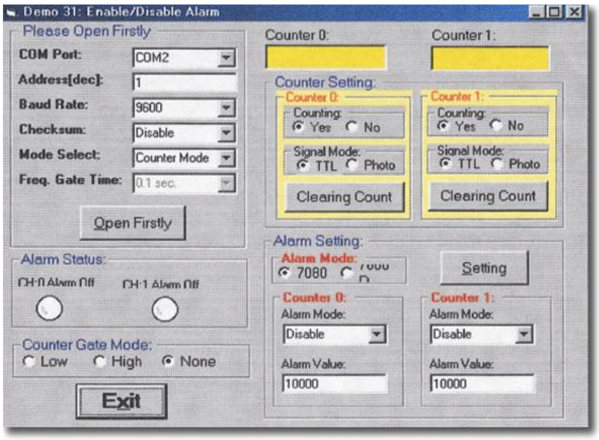
The I-7000/8000 Modules Found ...

Module	Address	Baudrate	Alarm	Checksum	Description
7188EF-016	1[1]	115200		Disable	16 Group FRNet

Searching Status:
COM Port: COM 3 Address: 06[dec] 6[he

G0	0x0000
G1	0x0000
G2	0x0000
G3	0x0000
G4	0x0000
G5	0x0000
G6	0x0000
G7	0x0000

4.3 DCON DLL



Demo 31: Enable/Disable Alarm

Please Open Firstly

COM Port: COM2

Address[dec]: 1

Baud Rate: 9600

Checksum: Disable

Mode Select: Counter Mode

Freq. Gate Time: 0.1 sec.

Alarm Status:

CH:0 Alarm Off CH:1 Alarm Off

Counter Gate Mode: ○ Low ○ High ● None

Counter 0: Counter 1:

Counter Setting:

Counter 0: Counting: ● Yes ○ No Signal Mode: ● TTL ○ Photo

Counter 1: Counting: ● Yes ○ No Signal Mode: ● TTL ○ Photo

Alarm Setting:

Alarm Mode: ● 7080 ○ 7080D

Counter 0: Alarm Mode: Disable Alarm Value: 10000

Counter 1: Alarm Mode: Disable Alarm Value: 10000

DCON DLL

DLL library

Supported modules:

i-7000/8000/87K/i7188EF series

(with DCON protocol)

Supported demos:

VB/VC/BCB/Delphi

Supported OS:

Windows 98/NT/2K/XP

File location:

CD:\Napdos\Driver\DCON_DLL

4.3.1 Procedure for using the DLL

Step 1: Read the basic and important documents

Readme.txt: contains most basic and important information, including:

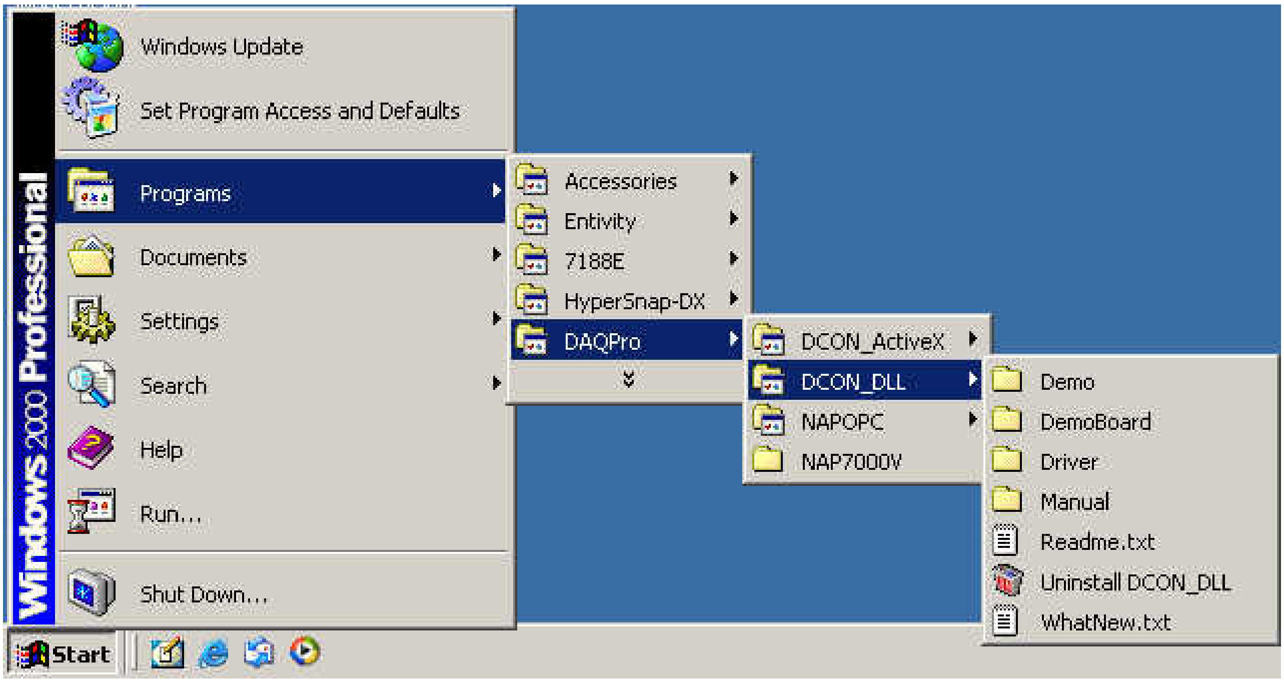
- What is DCON DLL
- What files are installed on the PC
- The directory tree installed on the PC
- Demo list

WhatsNew.txt: contains the version/reversion history information, including

- Bugs fixed
- Demos added or modified
- Updated DLL details

Step 2: Install the DCON DLL by executing:
CD:\Napdos\Driver\DCON_DLL\Setup\setup.exe

After installation, all related information can be found below



Step3: Read manuals for how to start

QuickStartManual.pdf:

Explain how to develop your first program using the DLL.

DCON_DLL.pdf explains the following details

- How to include the DLL in VB/VC/Delphi/BCB
- How to develop a program in VB/VC/Delphi/BCB
- Demo list
- Function descriptions and usage

FAQ.pdf:

Give solutions to frequently asked questions.

Step 4: Run the demo programs to test the I/O module and learn the functions

4.3.2 VB Example (Reading an digital output value)

The following is an example of reading Digital input/output from an I-7188EF-016.

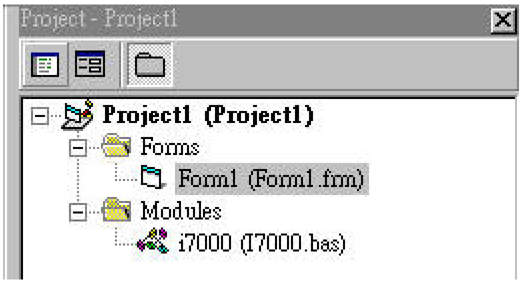
Step 1: Wire the I-7188EF-016 and configure its network settings (IP, Mask and Gateway)

Step 2: Run the VxComm Utility to create a virtual COM port (e.g. COM3) to map the I-7188EF-016

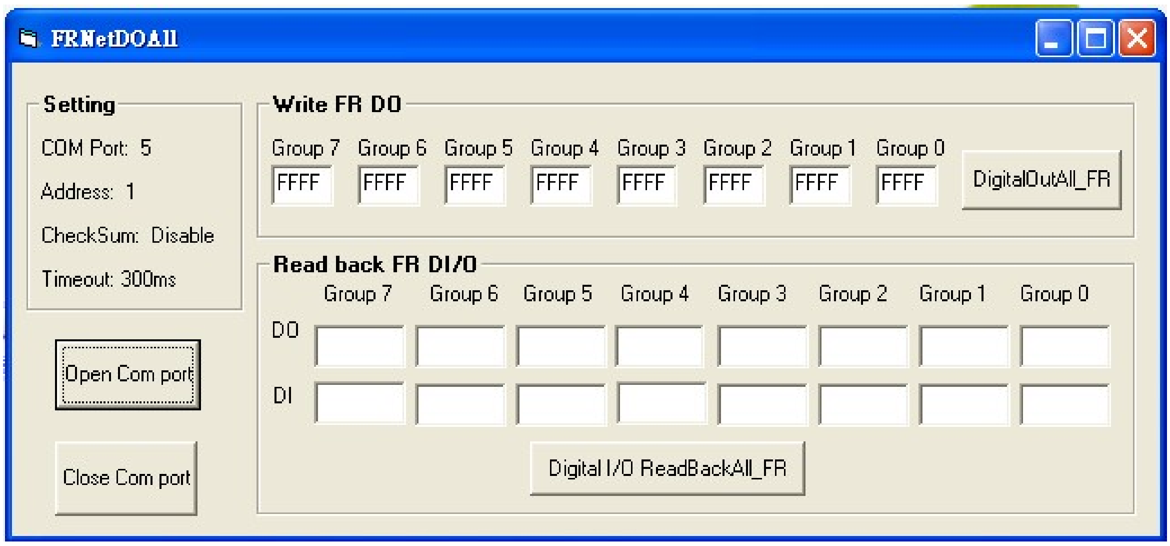
Step 3: Run the DCON Utility to configure the I/O modules

Step 4: Run VB and create a new project (.exe project)

Step 5: Add I7000.bas to the project



Step 6: Arrange all the components on the form



COM Port: 5

Address: 1

CheckSum: Disable

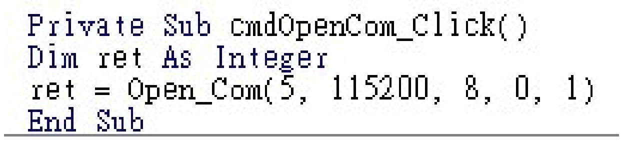
Timeout: 300ms

Group 7	Group 6	Group 5	Group 4	Group 3	Group 2	Group 1	Group 0
FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF	FFFF

	Group 7	Group 6	Group 5	Group 4	Group 3	Group 2	Group 1	Group 0
DO								
DI								

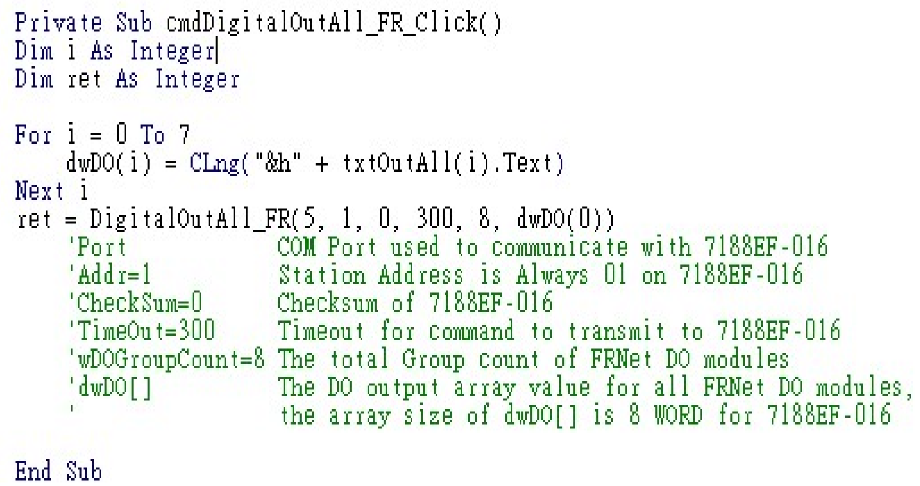
Step 7: Write the program code

Step 1



```
Private Sub cmdOpenCom_Click()
Dim ret As Integer
ret = Open_Com(5, 115200, 8, 0, 1)
End Sub
```

Step 2

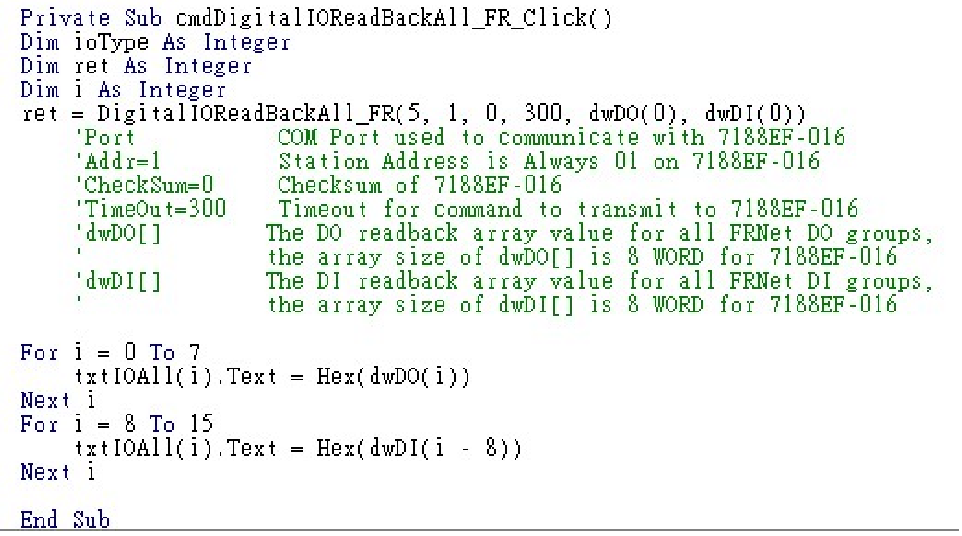


```
Private Sub cmdDigitalOutAll_FR_Click()
Dim i As Integer
Dim ret As Integer

For i = 0 To 7
    dwDO(i) = CLng("&h" + txtOutAll(i).Text)
Next i
ret = DigitalOutAll_FR(5, 1, 0, 300, 8, dwDO(0))
    'Port            COM Port used to communicate with 7188EF-016
    'Addr=1          Station Address is Always 01 on 7188EF-016
    'CheckSum=0      Checksum of 7188EF-016
    'TimeOut=300     Timeout for command to transmit to 7188EF-016
    'wDOGroupCount=8 The total Group count of FRNet DO modules
    'dwDO[]          The DO output array value for all FRNet DO modules,
    '                the array size of dwDO[] is 8 WORD for 7188EF-016

End Sub
```

Step 3

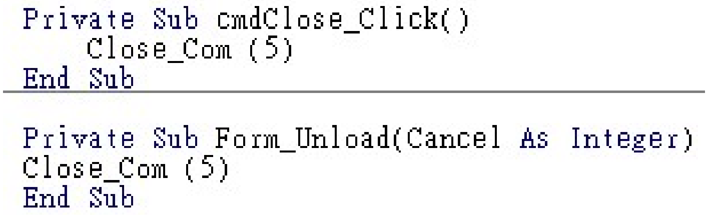


```
Private Sub cmdDigitalIOReadBackAll_FR_Click()
Dim ioType As Integer
Dim ret As Integer
Dim i As Integer
ret = DigitalIOReadBackAll_FR(5, 1, 0, 300, dwDO(0), dwDI(0))
    'Port           COM Port used to communicate with 7188EF-016
    'Addr=1         Station Address is Always 01 on 7188EF-016
    'CheckSum=0     Checksum of 7188EF-016
    'TimeOut=300    Timeout for command to transmit to 7188EF-016
    'dwDO[]        The DO readback array value for all FRNet DO groups,
    '              the array size of dwDO[] is 8 WORD for 7188EF-016
    'dwDI[]        The DI readback array value for all FRNet DI groups,
    '              the array size of dwDI[] is 8 WORD for 7188EF-016

For i = 0 To 7
    txtIOAll(i).Text = Hex(dwDO(i))
Next i
For i = 8 To 15
    txtIOAll(i).Text = Hex(dwDI(i - 8))
Next i

End Sub
```

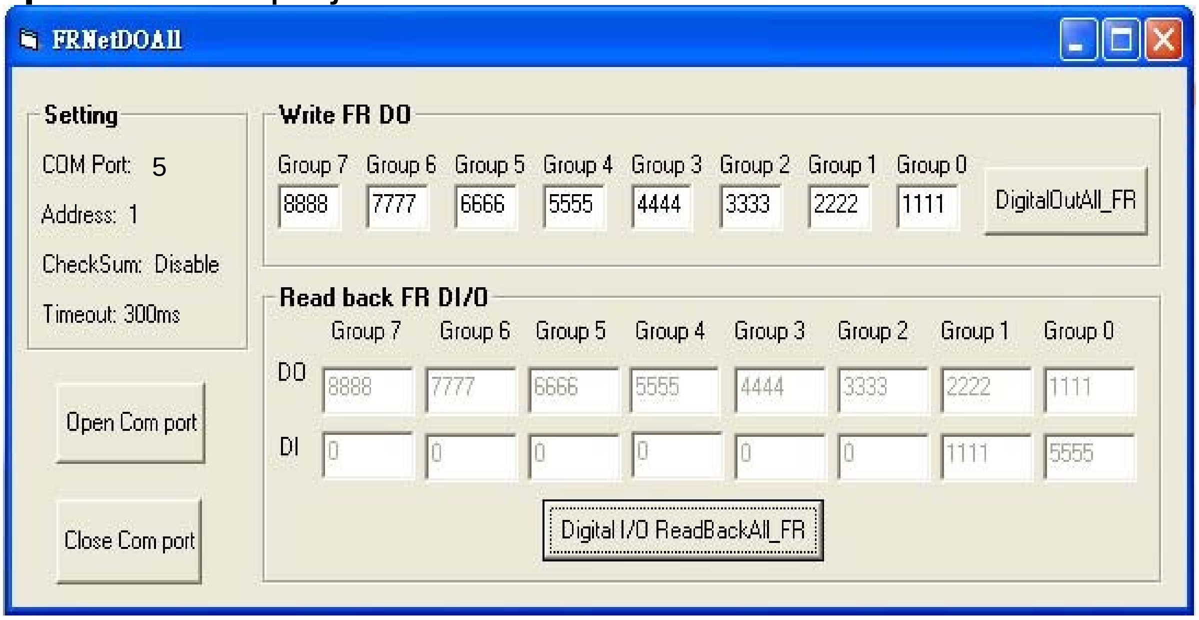
Step 4



```
Private Sub cmdClose_Click()
    Close_Com (5)
End Sub

Private Sub Form_Unload(Cancel As Integer)
Close_Com (5)
End Sub
```

Step 8: Run the project.



Setting

COM Port: 5

Address: 1

CheckSum: Disable

Timeout: 300ms

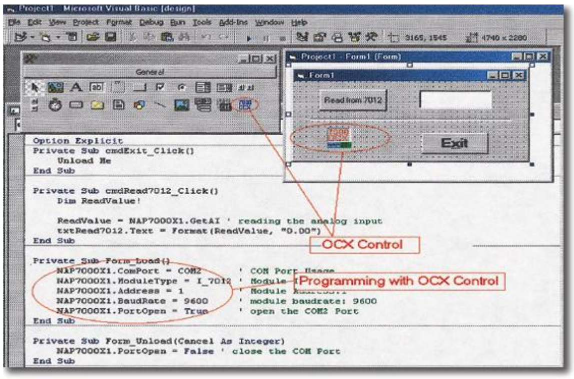
Write FR DO

Group 7	Group 6	Group 5	Group 4	Group 3	Group 2	Group 1	Group 0
8888	7777	6666	5555	4444	3333	2222	1111

Read back FR DI/O

	Group 7	Group 6	Group 5	Group 4	Group 3	Group 2	Group 1	Group 0
DO	8888	7777	6666	5555	4444	3333	2222	1111
DI	0	0	0	0	0	0	1111	5555

4.4 DCON ActiveX (Unfinished)


Project1 - Microsoft Visual Basic [design]
File Edit View Project Format Debug Run Tools Add-Ins Window Help
3165, 1545
4740 x 2280
General
Project1 - Form1 (Form)
Form1
Read from 7012
Exit
OCX Control
Programming with OCX Control

```
Option Explicit
Private Sub cmdExit_Click()
    Unload Me
End Sub

Private Sub cmdRead7012_Click()
    Dim ReadValue!

    ReadValue = NAP7000X1.GetAI ' reading the analog input
    txtRead7012.Text = Format(ReadValue, "0.00")
End Sub

Private Sub Form_Load()
    NAP7000X1.ComPort = COM2          ' COM Port Usage
    NAP7000X1.ModuleType = I_7012     ' Module
    NAP7000X1.Address = 1             ' Module Address:1
    NAP7000X1.BaudRate = 9600         ' module baudrate: 9600
    NAP7000X1.PortOpen = True         ' open the COM2 Port
End Sub

Private Sub Form_Unload(Cancel As Integer)
    NAP7000X1.PortOpen = False ' close the COM Port
End Sub
```

DCON ActiveX

ActiveX (ocx) component

Supported modules:

i-7000/8000/87K series
(with DCON protocol)

Supported demos:

VB/VC/BCB/Delphi

Supported OS:

Windows 98/NT/2K/XP

File location:

CD:\Napdos\Driver\DCON_ActiveX

4.4.1 Procedure for using the ActiveX

Step 1: Read most basic and important documents

Readme.txt: contains the basic and important information, including:

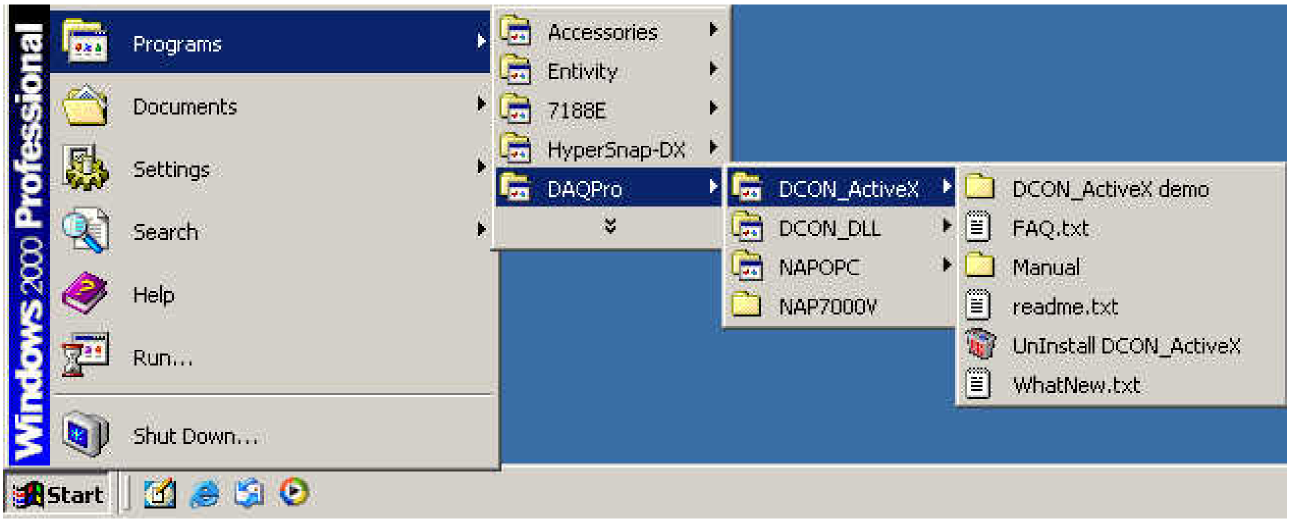
- What is DCON ActiveX
- What files are installed on the PC
- The directory tree installed on the PC
- Demo list

WhatsNew.txt: contains the version/reversion history information, including:

- Bugs fixed
- Demos added or modified
- Updated ActiveX (ocx) details

Step 2: Install the DCON ActiveX by executing:
CD:\Napdos\Driver\DCON_ActiveX\Setup\setup.exe

After installation, all related information can be found below



Step 3: Read the manuals describing how to start

InstallOCX.pdf:

Explains how to install/uninstall the ActiveX (ocx) component in
VB/VC/Delphi/BCB

DCON_ActiveX.pdf explains the following details:

- How to include the ActiveX (ocx) in VB/VC/Delphi/BCB
- How to develop a program in VB/VC/Delphi/BCB
- Demo list
- Function descriptions and usage

Step 4: Run the demo programs to test the I/O module and learn the functions

4.4.2 VB Example (Reading an analog input value)

The following is an example of reading analog values from an I-7188EF-016.

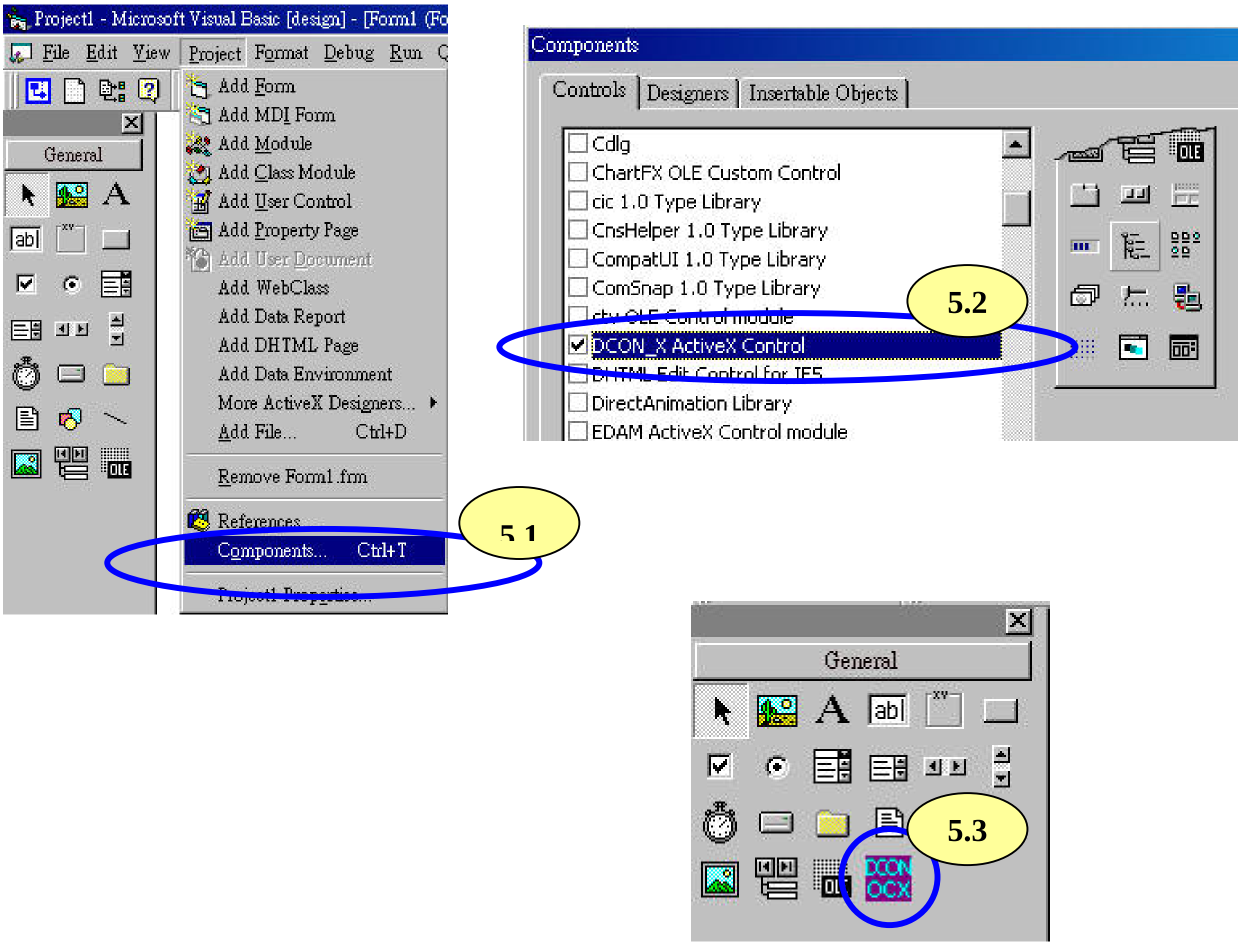
Step 1: Wire the I-7188EF-016 and configure its network settings (IP, Mask and Gateway)

Step 2: Run the VxComm Utility to create a virtual COM port (e.g. COM3) to map the I-7188EF-016

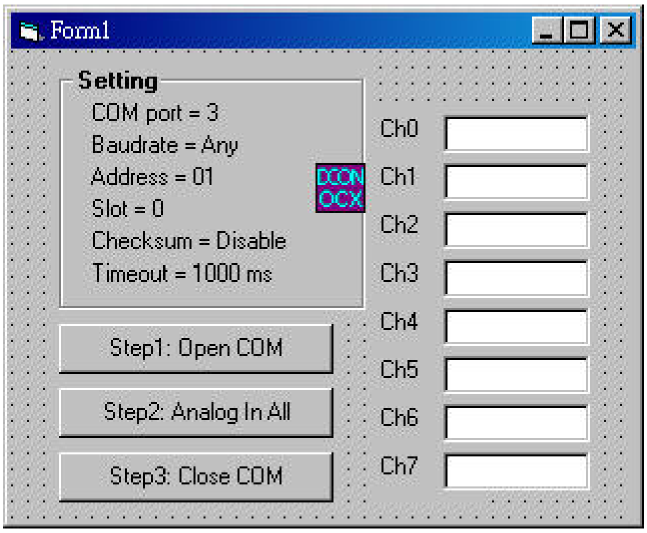
Step 3: Run the DCON Utility to configure the I/O module

Step 4: Run VB and create a new project (.exe project)

Step 5: Add the ActiveX (ocx) component to the project



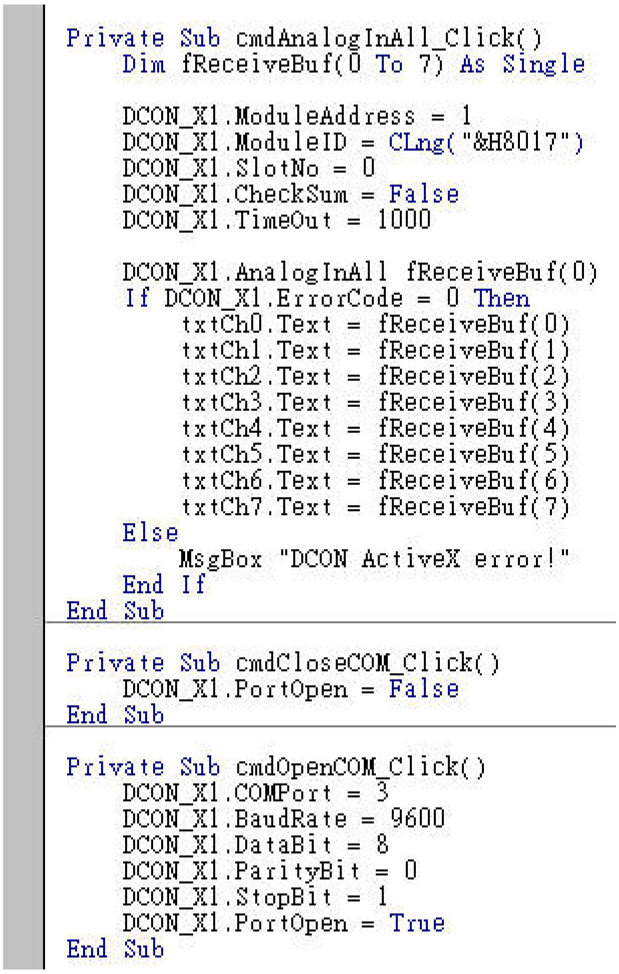
Step 6: Arrange all the components on the form



Setting

COM port = 3
Baudrate = Any
Address = 01
Slot = 0
Checksum = Disable
Timeout = 1000 ms

Step 7: Write the program code



VB Step 2

```
Private Sub cmdAnalogInAll_Click()
    Dim fReceiveBuf(0 To 7) As Single

    DCON_X1.ModuleAddress = 1
    DCON_X1.ModuleID = CLng("&H8017")
    DCON_X1.SlotNo = 0
    DCON_X1.CheckSum = False
    DCON_X1.TimeOut = 1000

    DCON_X1.AnalogInAll fReceiveBuf(0)
    If DCON_X1.ErrorCode = 0 Then
        txtCh0.Text = fReceiveBuf(0)
        txtCh1.Text = fReceiveBuf(1)
        txtCh2.Text = fReceiveBuf(2)
        txtCh3.Text = fReceiveBuf(3)
        txtCh4.Text = fReceiveBuf(4)
        txtCh5.Text = fReceiveBuf(5)
        txtCh6.Text = fReceiveBuf(6)
        txtCh7.Text = fReceiveBuf(7)
    Else
        MsgBox "DCON ActiveX error!"
    End If
End Sub
```

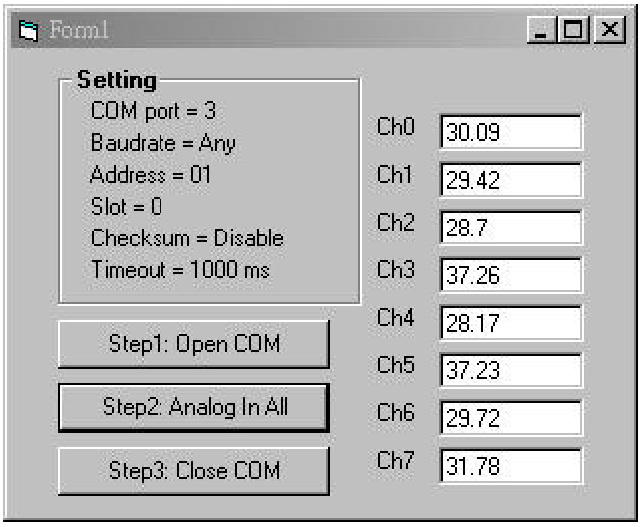
VB Step 3

```
Private Sub cmdCloseCOM_Click()
    DCON_X1.PortOpen = False
End Sub
```

VB Step 1

```
Private Sub cmdOpenCOM_Click()
    DCON_X1.COMPort = 3
    DCON_X1.BaudRate = 9600
    DCON_X1.DataBit = 8
    DCON_X1.ParityBit = 0
    DCON_X1.StopBit = 1
    DCON_X1.PortOpen = True
End Sub
```

Step 8: Run the project



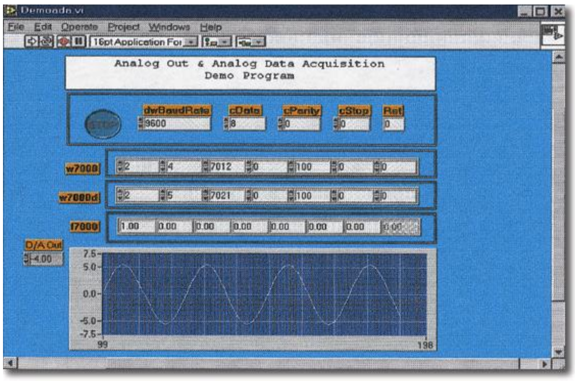
Form1

Setting

COM port = 3
Baudrate = Any
Address = 01
Slot = 0
Checksum = Disable
Timeout = 1000 ms

Ch0	30.09
Ch1	29.42
Ch2	28.7
Ch3	37.26
Ch4	28.17
Ch5	37.23
Ch6	29.72
Ch7	31.78

4.5 DCON LabView (Unfinished)



Demoada.vi

Analog Out & Analog Data Acquisition
Demo Program

dwBaudRate	cData	cParity	cStop	Ret
9600	8	0	0	0

w7000	2	4	7012	0	100	0	0	
w7000d	2	5	7021	0	100	0	0	
f7000	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

D/A Out: -4.00

DCON Labview

Bundled driver for Labview

Supported modules:

i-7000/8000/87K series

(with DCON protocol)

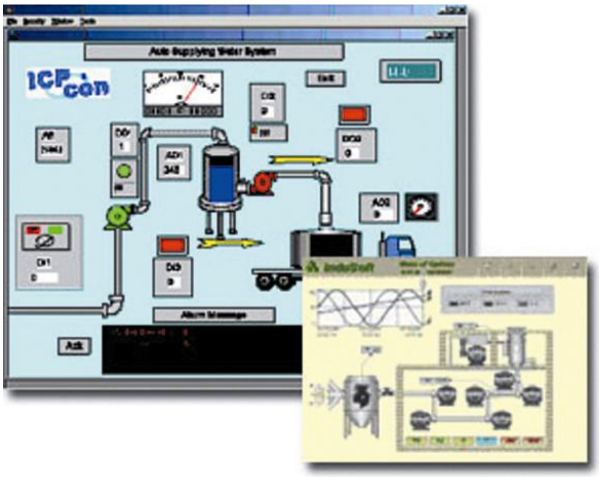
Supported OS:

Windows 98/NT/2K/XP

File location:

CD:\Napdos\Driver\DCON_Labview

4.6 DCON Indusoft (Unfinished)



DCON Indusoft

Bundled driver for Indusoft

Supported Module:

i-7000/8000/87K series
(with DCON protocol)

Supported OS:

Windows 98/NT/2K/XP/CE

File location:

CD:\Napdos\Driver\DCON_Indusoft

4.6.1 Procedure for using the Indusoft bundled driver

Step 1: Read the basic and important documents

Readme.txt: contains the basic and important information, including:

- Files on the shipped CD

Reversion.txt: contains the reversion information, including

- Bugs fixed
- New modules supported

Step 2: Install the Indusoft bundled driver by executing
CD:\Napdos\Driver\DCON_Indusoft\Setup\setup.exe

Step 3: Read the manuals describing how to start

The **DCON.pdf** user's manual describes how to use the Indusoft bundled driver

Step 4: Run the demo programs (ICPDriverTest.zip) to test I/O modules and learn the functions.

4.6.2 Indusoft Example (Reading an analog input value)

The following is an example of reading analog values from an I-7188EF-016

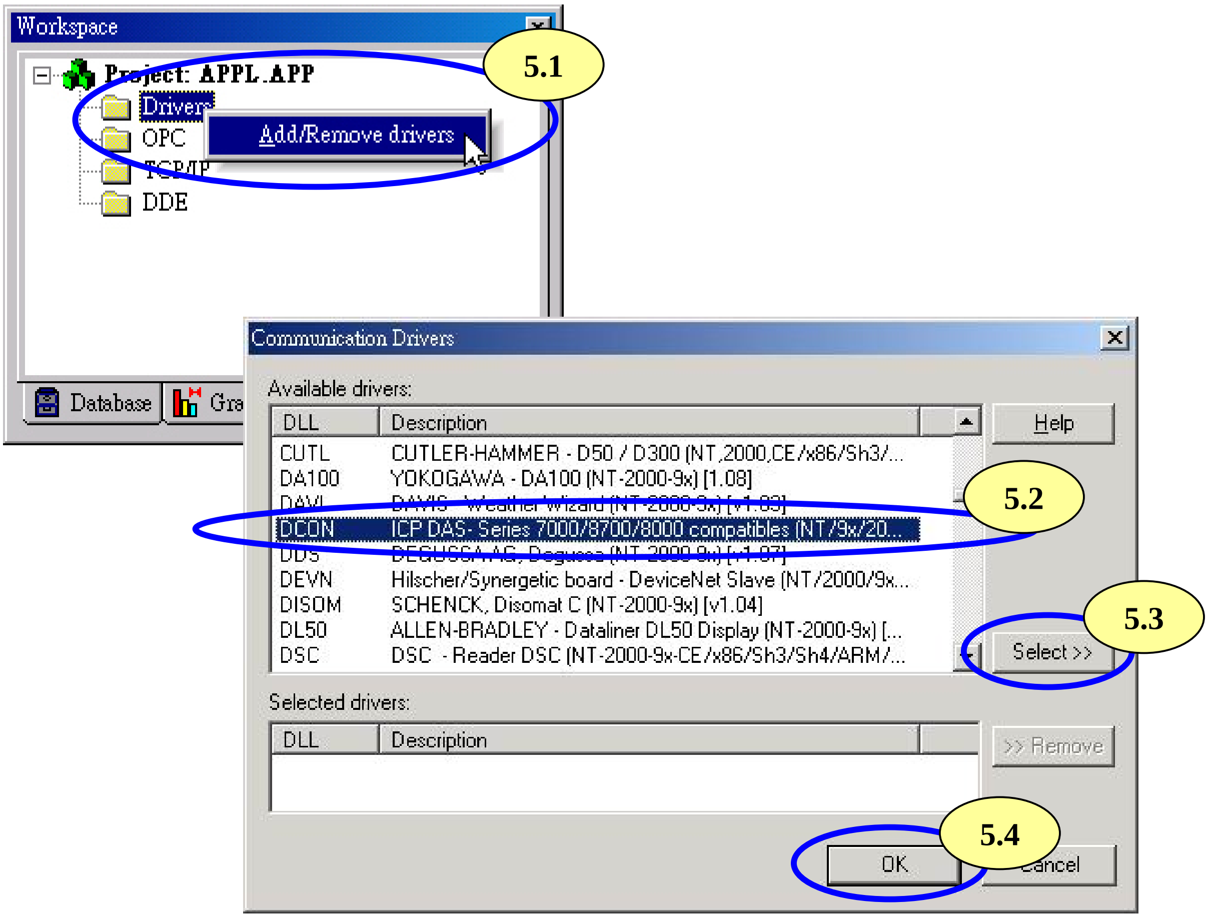
Step 1: Wire the I-7188EF-016 and configure its network settings (IP, Mask and Gateway)

Step 2: Run the VxComm Utility to create a virtual COM port (e.g. COM3) to map the I-7188EF-016

Step 3: Run the DCON Utility to configure the I/O modules

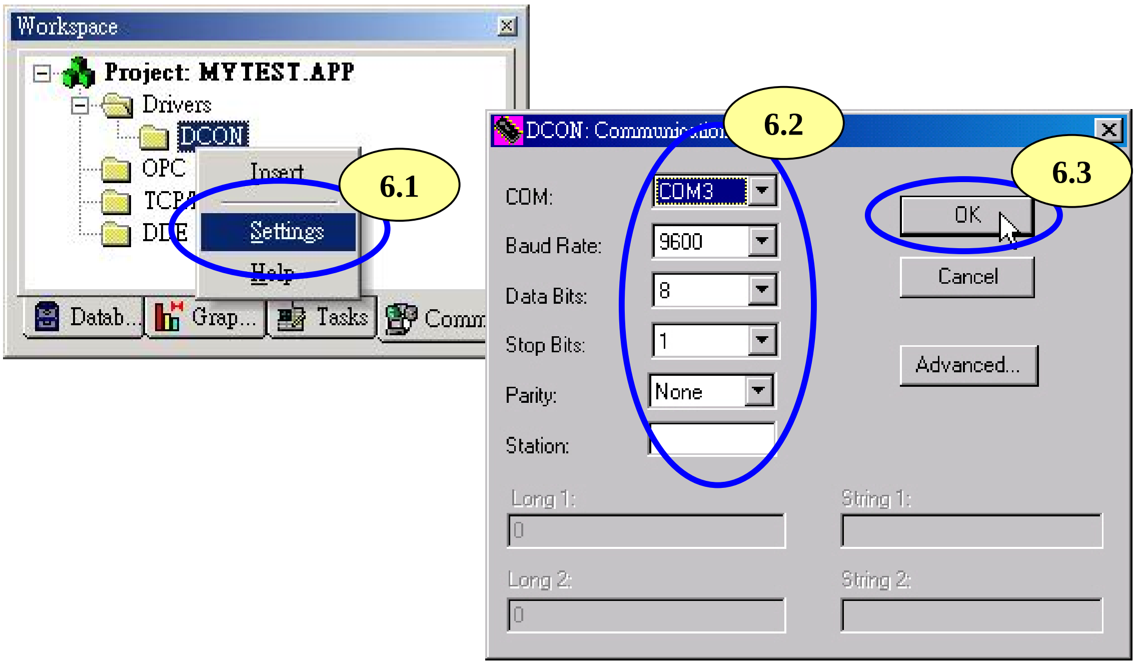
Step 4: Run Indusoft and create a new project

Step 5: Include the DCON driver



DLL	Description
CUTL	CUTLER-HAMMER - D50 / D300 (NT,2000,CE/x86/Sh3/...
DA100	YOKOGAWA - DA100 (NT-2000-9x) [1.08]
DAVI	DAVIS - Weather Wizard (NT-2000-9x) [v1.03]
DCON	ICP DAS- Series 7000/8700/8000 compatibles (NT/9x/20...
DDS	DEGUSSA AG, Degussa (NT-2000-9x) [v1.07]
DEVN	Hilscher/Synergetic board - DeviceNet Slave (NT/2000/9x...
DISOM	SCHENCK, Disomat C (NT-2000-9x) [v1.04]
DL50	ALLEN-BRADLEY - Dataliner DL50 Display (NT-2000-9x) [...
DSC	DSC - Reader DSC (NT-2000-9x-CE/x86/Sh3/Sh4/ARM/...

Step 6: Configure the DCON driver



DCON: Communication

COM: COM3

Baud Rate: 9600

Data Bits: 8

Stop Bits: 1

Parity: None

Station:

Long 1: 0

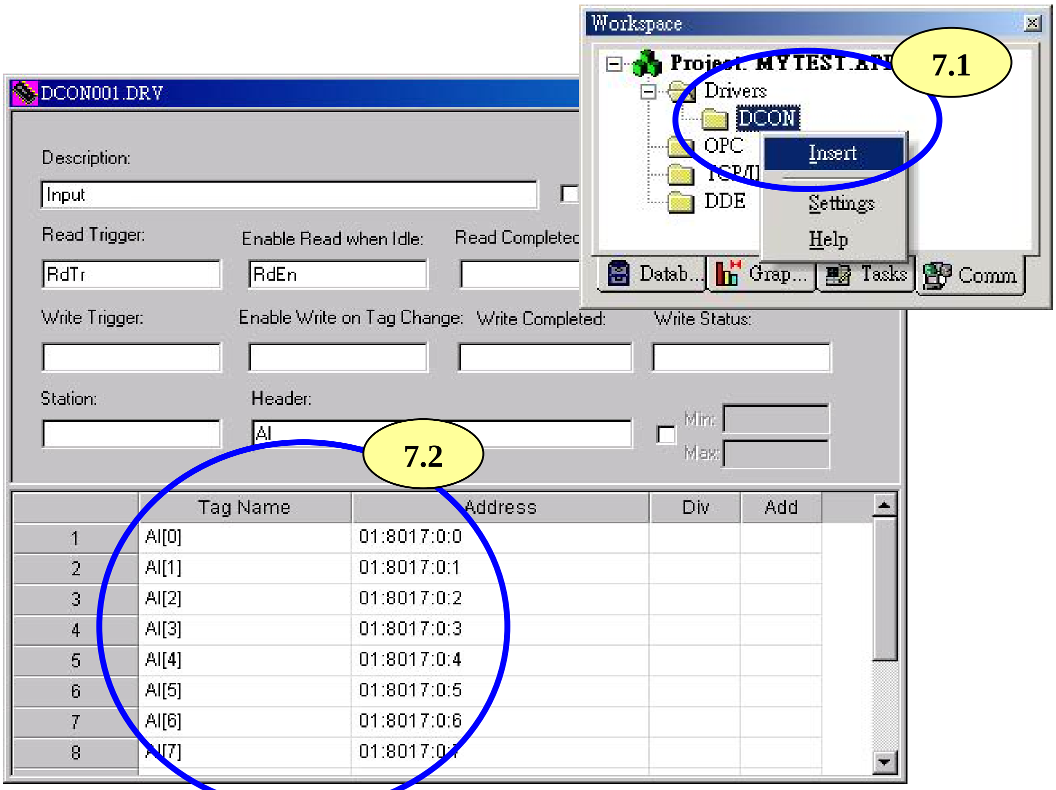
String 1:

Long 2: 0

String 2:

Step7: Insert tags to connect to I/O modules

The address format is [Address: ModuleID : Slot : Channel]



DCON001.DRV

Description: Input

Read Trigger: RdTr

Enable Read when Idle: RdEn

Read Completed:

Write Trigger:

Enable Write on Tag Change:

Write Completed:

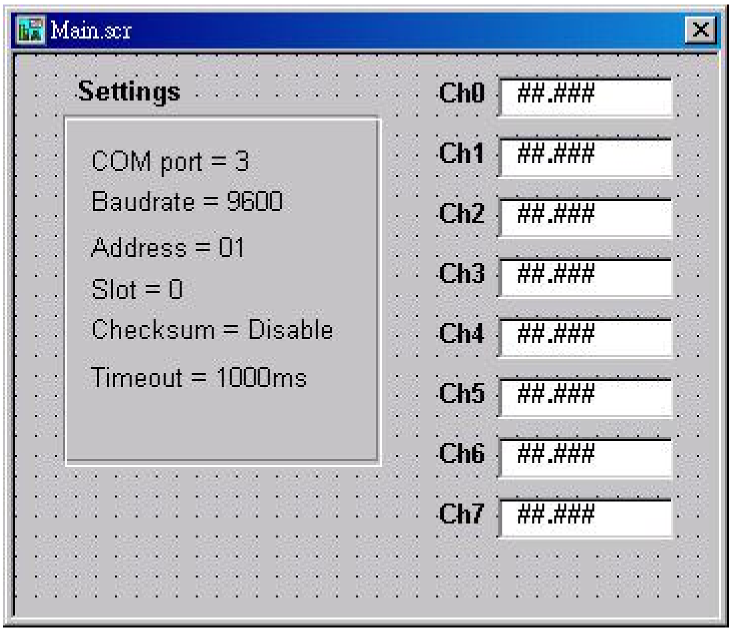
Write Status:

Station:

Header: AI

	Tag Name	Address	Div	Add
1	AI[0]	01:8017:0:0		
2	AI[1]	01:8017:0:1		
3	AI[2]	01:8017:0:2		
4	AI[3]	01:8017:0:3		
5	AI[4]	01:8017:0:4		
6	AI[5]	01:8017:0:5		
7	AI[6]	01:8017:0:6		
8	AI[7]	01:8017:0:7		

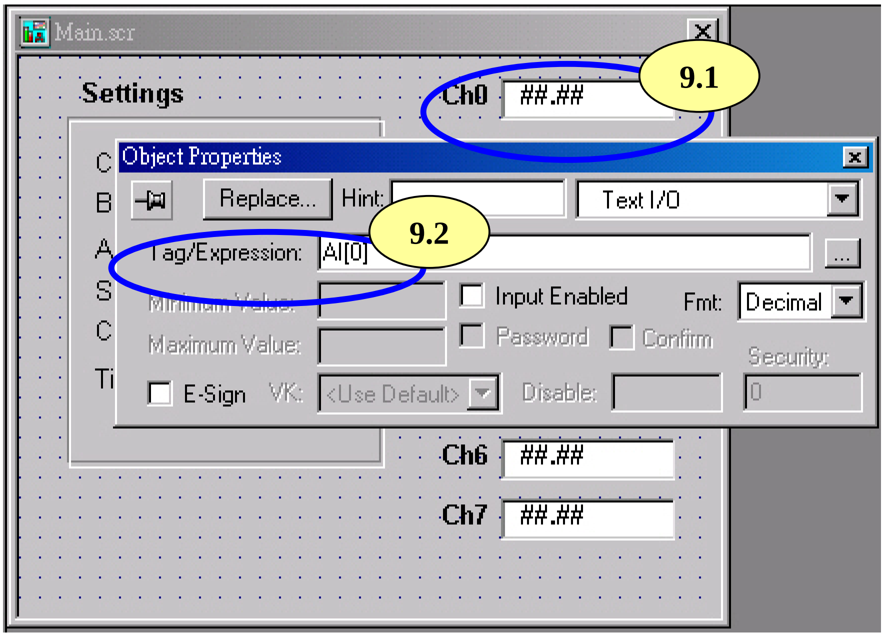
Step8: Arrange all the components on the form



Settings

COM port = 3
Baudrate = 9600
Address = 01
Slot = 0
Checksum = Disable
Timeout = 1000ms

Step9: Double click the text box to assign a tag to it



Object Properties

Hint:

Text I/O

Tag/Expression: AI[0]

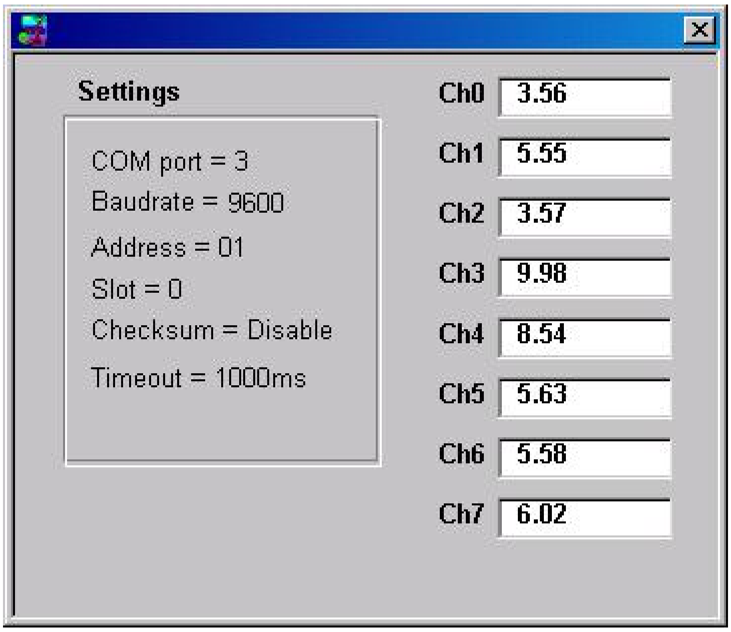
□ Input Enabled Fmt: Decimal

□ Password □ Confirm

□ E-Sign VK: <Use Default> Disable:

Security: 0

Step10: Run the project

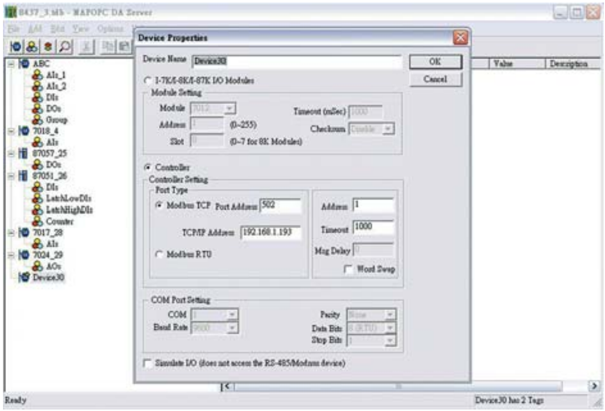


Settings

COM port = 3
Baudrate = 9600
Address = 01
Slot = 0
Checksum = Disable
Timeout = 1000ms

Ch0	3.56
Ch1	5.55
Ch2	3.57
Ch3	9.98
Ch4	8.54
Ch5	5.63
Ch6	5.58
Ch7	6.02

5. NAP OPC Server



Device Name: Device30

○ I-7K/I-8K/I-87K I/O Modules

Module Setting

Module: 7012 — Timeout (mSec): 1000

Address: 1 (0~255) — Checksum: Disable

Slot: 0 (0~7 for 8K Modules)

● Controller

Controller Setting

Port Type

● Modbus TCP — Port Address: 502 — Address: 1

TCP/IP Address: 192.168.1.193 — Timeout: 1000

○ Modbus RTU — Msg Delay: 0

□ Word Swap

COM Port Setting

COM: 1 — Parity: None

Baud Rate: 9600 — Data Bits: 8 (RTU)

Stop Bits: 1

□ Simulate I/O (does not access the RS-485/Modbus device)

Device30 has 2 Tags

NAP OPC server

OPC Server

Supported module:

i-7000/8000/87K/i7188EF series
(with DCON protocol)

Modbus embedded controller

ISaGRAF embedded controller

Supported OS:

Windows 98/NT/2K/XP/CE

File location:

CD:\Napdos\NapOPCSvr

5.1 Introduction

OPC (OLE for Process Control) is the first standard resulting from the collaboration of a number of leading worldwide automation suppliers working in cooperation with Microsoft. Originally based on Microsoft's OLE COM (component object model) and DCOM (distributed component object model) technologies, the specification defined a standard set of objects, interfaces and methods for use in process control and manufacturing automation applications to facilitate interoperability.

For accessing the various devices for any application, there are many different mechanisms provided by different vendors, but if vendors provide OPC server for their devices, other application can access the OPC server via “OPC” interface.

5.2 Procedure for using the OPC server

Step 1: Read the basic and important documents

Readme.txt: contains the basic and important information, including

- Files on the shipped CD

Reversion.txt: contains the reversion information, including

- Bugs fixed
- New modules supported

Step 2: Install the OPC server by executing
CD:\Napdos\NapOPCSvr\NapOPCServer.exe

Note: If there is an older version of Nap OPC Server installed on the PC, It must be uninstalled before installing the new version.

Step 3: Read the manuals describing how to start

The **NapOPCSvr.pdf** is the user's manual describing how to use the OPC server

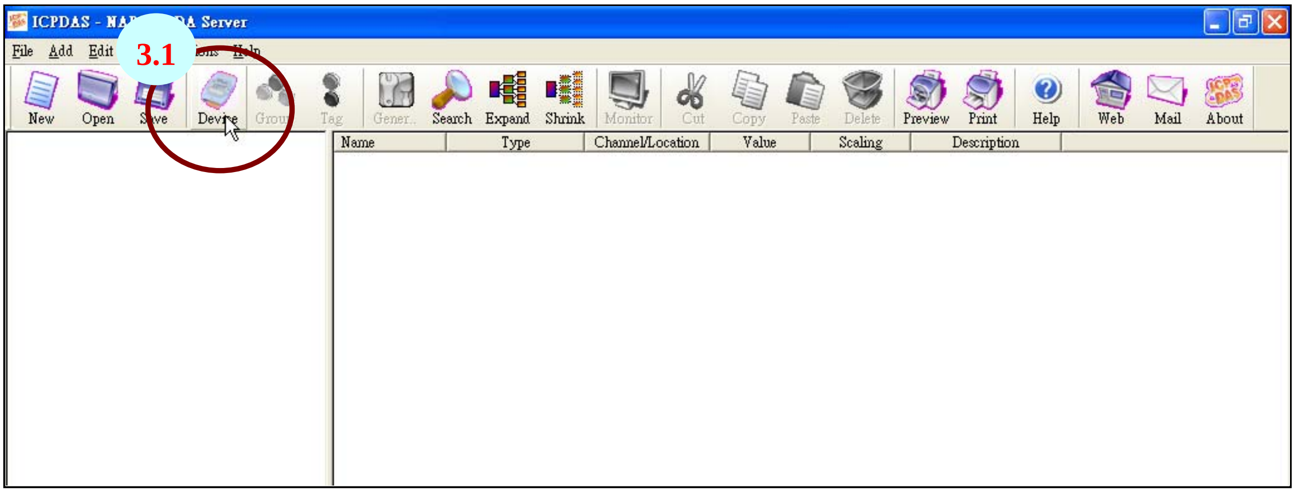
5.3 OPC Server Example using MODBUS protocol

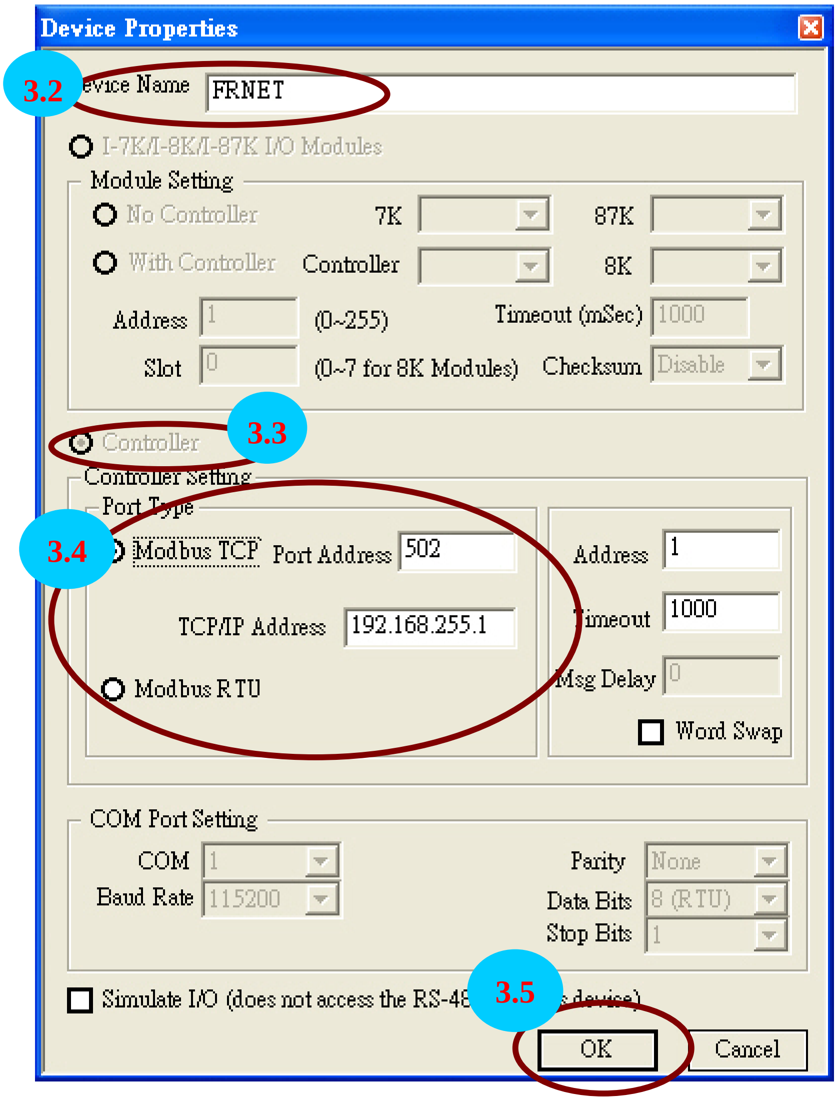
The following is an example of accessing Digital input and output values from an I-7188EF-016

Step 1: Connect the I-7188EF-016 controller (refer to Sec. 1.4.2) and configure its network settings (IP, Mask and Gateway - refer to Sec. 2.1)

Step 2: Run the OPC server

Step 3: New a device and to search for I/O modules using Modbus /TCP protocol





Device Properties

Device Name: FRNET

○ I-7K/I-8K/I-87K I/O Modules

Module Setting

○ No Controller 7K 87K

○ With Controller Controller 8K

Address: 1 (0~255) Timeout (mSec): 1000

Slot: 0 (0~7 for 8K Modules) Checksum: Disable

● Controller

Controller Setting

Port Type

● Modbus TCP Port Address: 502

TCP/IP Address: 192.168.255.1

○ Modbus RTU

Address: 1

Timeout: 1000

Msg Delay: 0

□ Word Swap

COM Port Setting

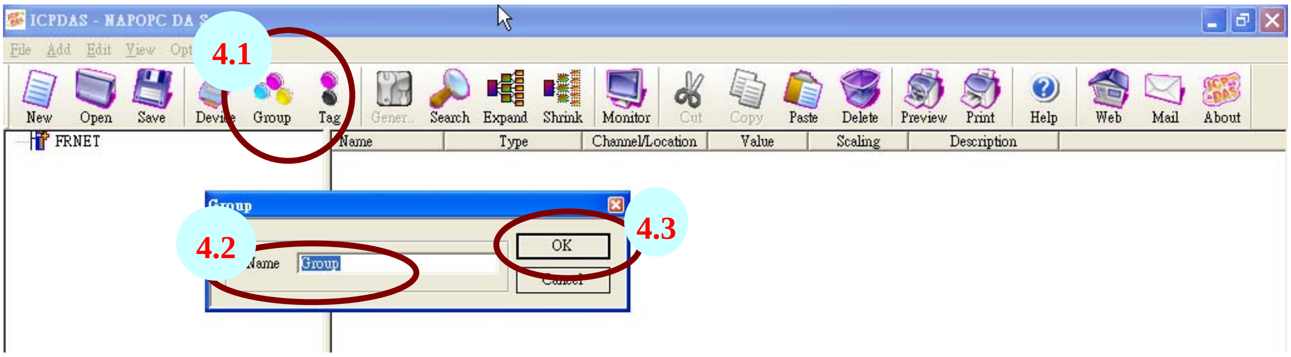
COM: 1 Parity: None

Baud Rate: 115200 Data Bits: 8 (RTU)

Stop Bits: 1

□ Simulate I/O (does not access the RS-485 device)

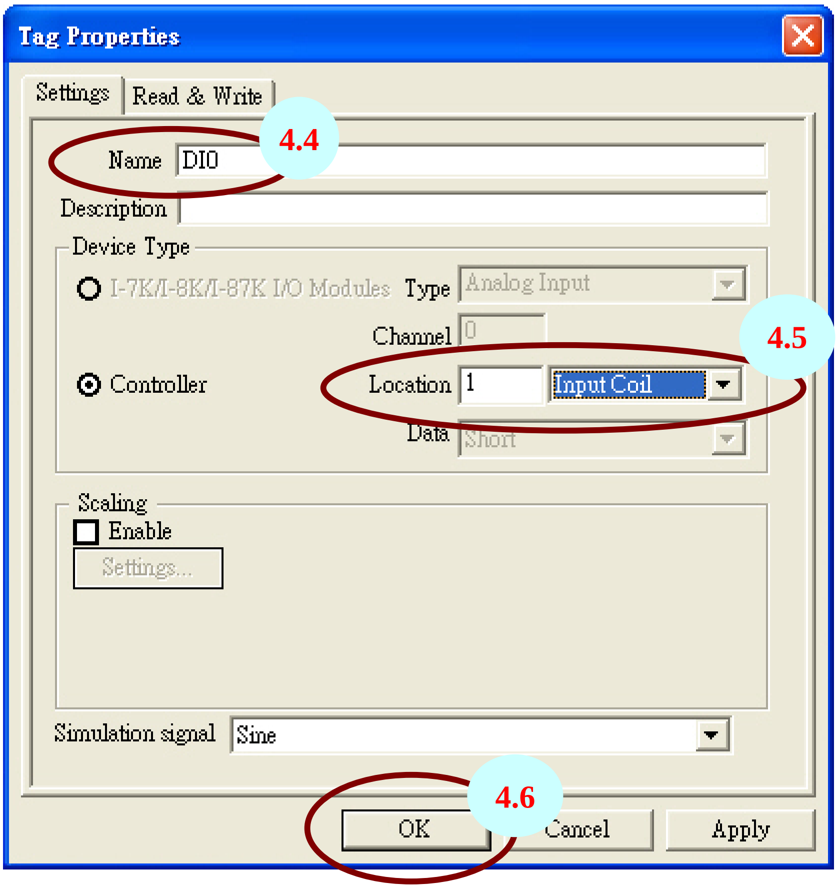
Step 4: New a Group and Tag



ICPDAS - NAPOPC DA S...

Name: Group

File Add Edit View Opt
New Open Save Device Group Tag Gener. Search Expand Shrink Monitor Cut Copy Paste Delete Preview Print Help Web Mail About
FRNET
Name Type Channel/Location Value Scaling Description
Group
OK
Cancel
4.1
4.2
4.3



Name: DIO

Description:

Device Type

○ I-7K/I-8K/I-87K I/O Modules Type: Analog Input

Channel: 0

● Controller Location: 1 Input Coil

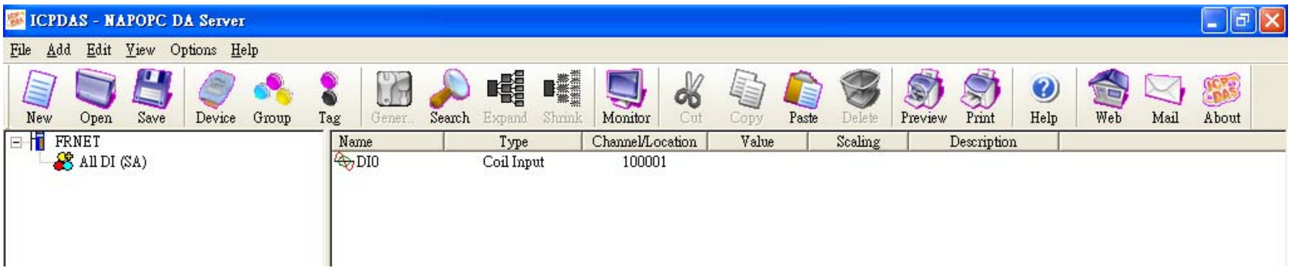
Data: Short

Scaling

□ Enable

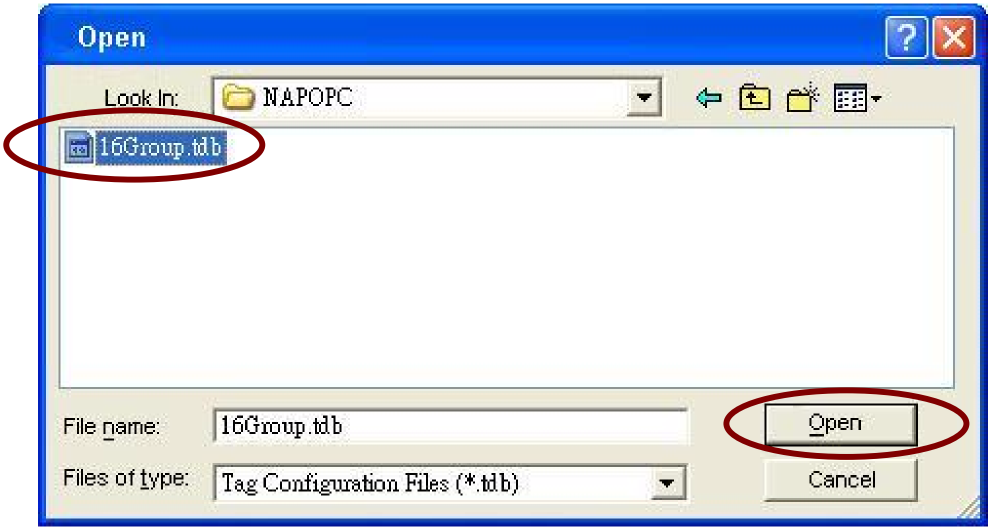
Settings...

Simulation signal: Sine


ICPDAS - NAPOPC DA Server
File Add Edit View Options Help
New Open Save Device Group Tag Gener.. Search Expand Shrink Monitor Cut Copy Paste Delete Preview Print Help Web Mail About
FRNET
All DI (SA)

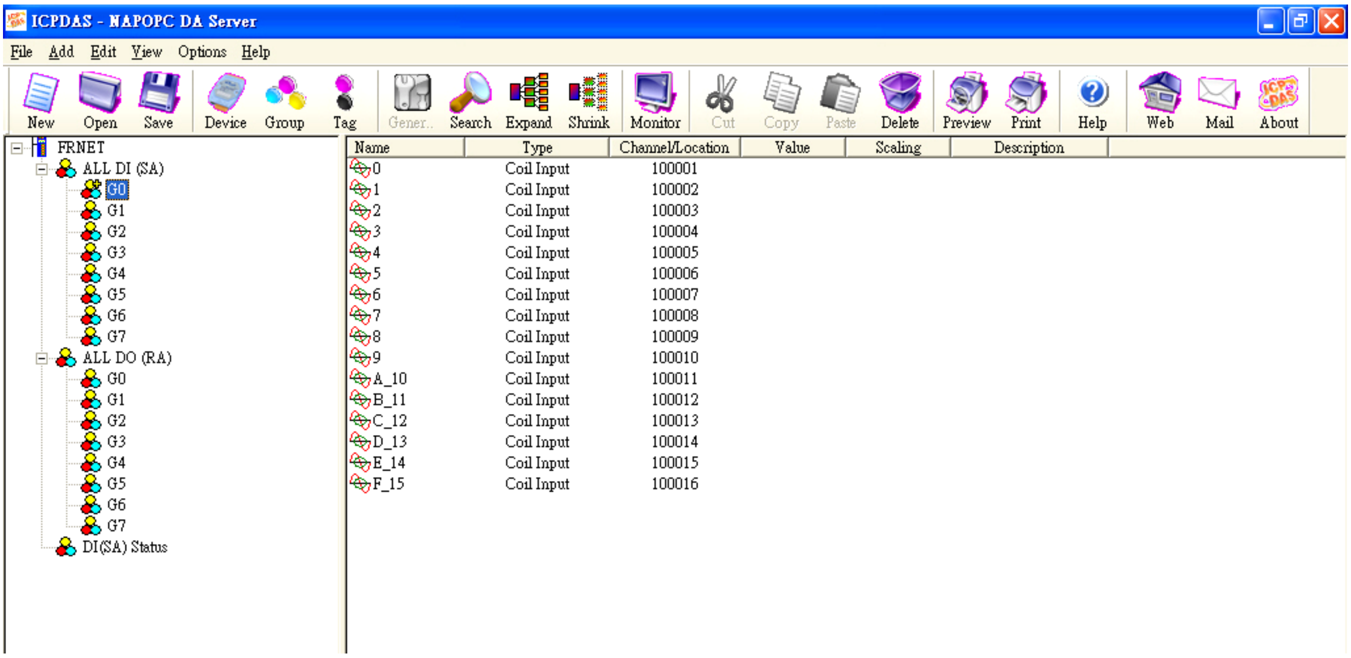
Name	Type	Channel/Location	Value	Scaling	Description
DIO	Coil Input	100001			

Step 6: Load the finished OPC project file for I-7188EF-016



File name: 16Group.tdb

Files of type: Tag Configuration Files (*.tdb)



- FRNET
  - ALL DI (SA)
    - G0
    - G1
    - G2
    - G3
    - G4
    - G5
    - G6
    - G7
  - ALL DO (RA)
    - G0
    - G1
    - G2
    - G3
    - G4
    - G5
    - G6
    - G7
  - DI(SA) Status

Name	Type	Channel/Location	Value	Scaling	Description
0	Coil Input	100001			
1	Coil Input	100002			
2	Coil Input	100003			
3	Coil Input	100004			
4	Coil Input	100005			
5	Coil Input	100006			
6	Coil Input	100007			
7	Coil Input	100008			
8	Coil Input	100009			
9	Coil Input	100010			
A_10	Coil Input	100011			
B_11	Coil Input	100012			
C_12	Coil Input	100013			
D_13	Coil Input	100014			
E_14	Coil Input	100015			
F_15	Coil Input	100016			

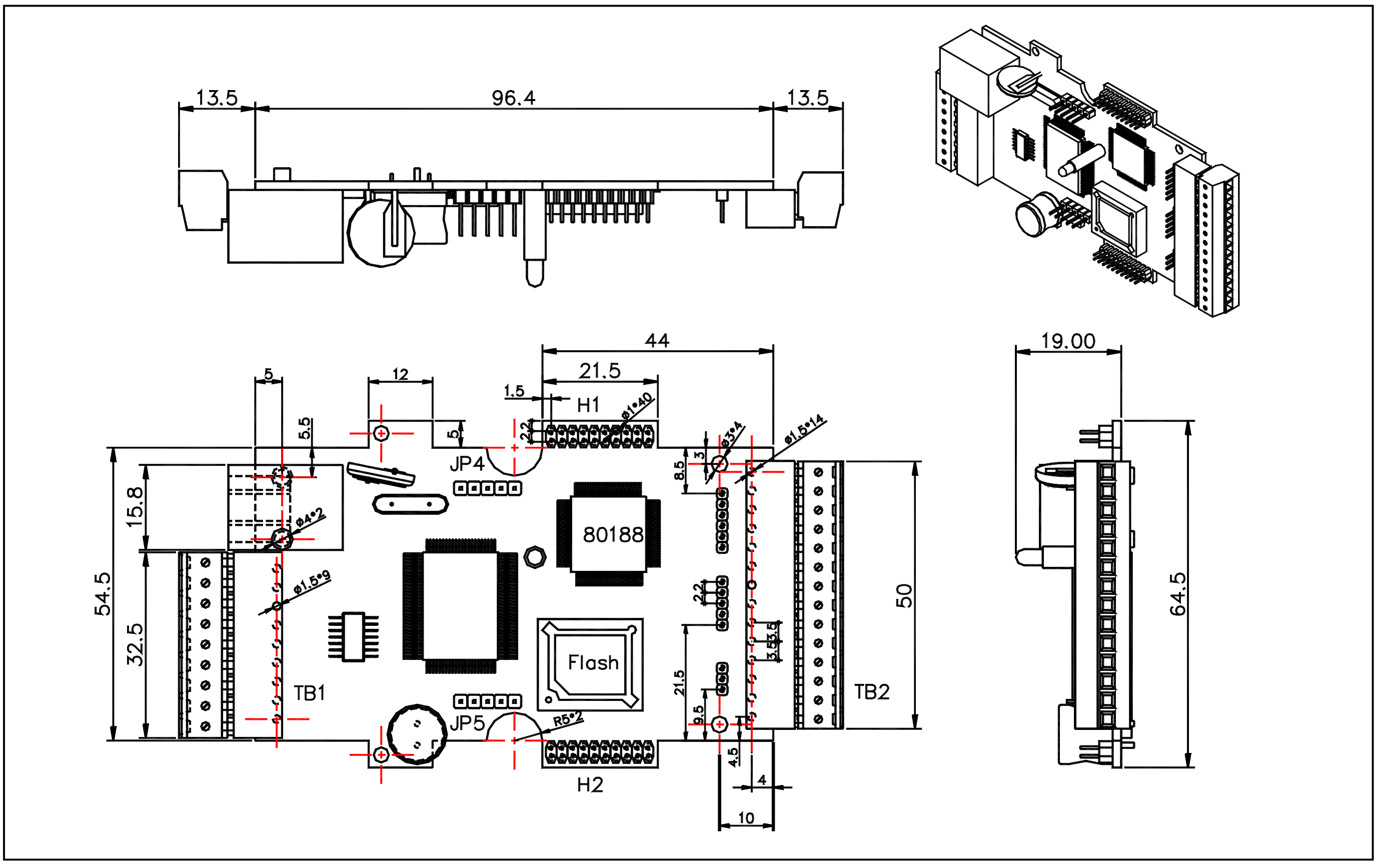
Note:

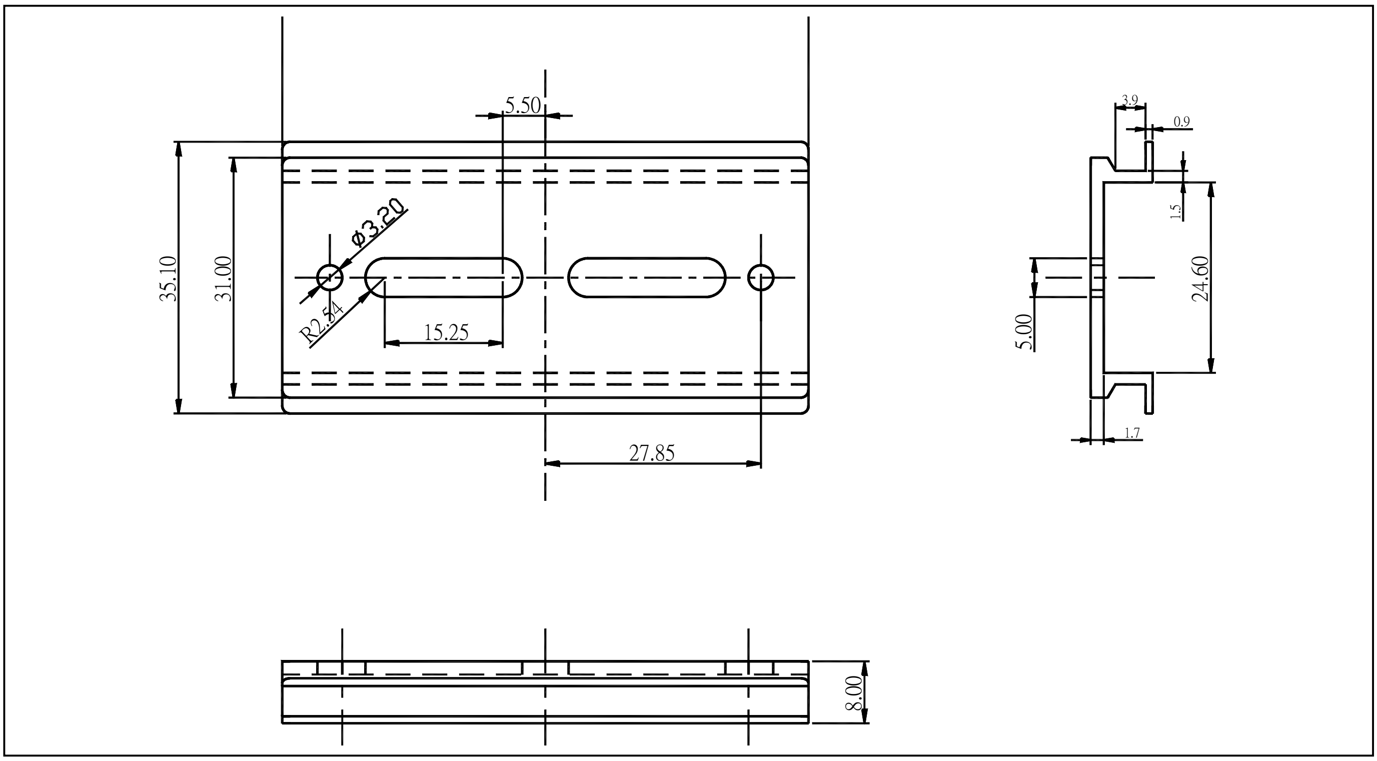
The 16Group.tdb is located on CD:\8000\NAPDOS\FR_Net\7188EF\Document

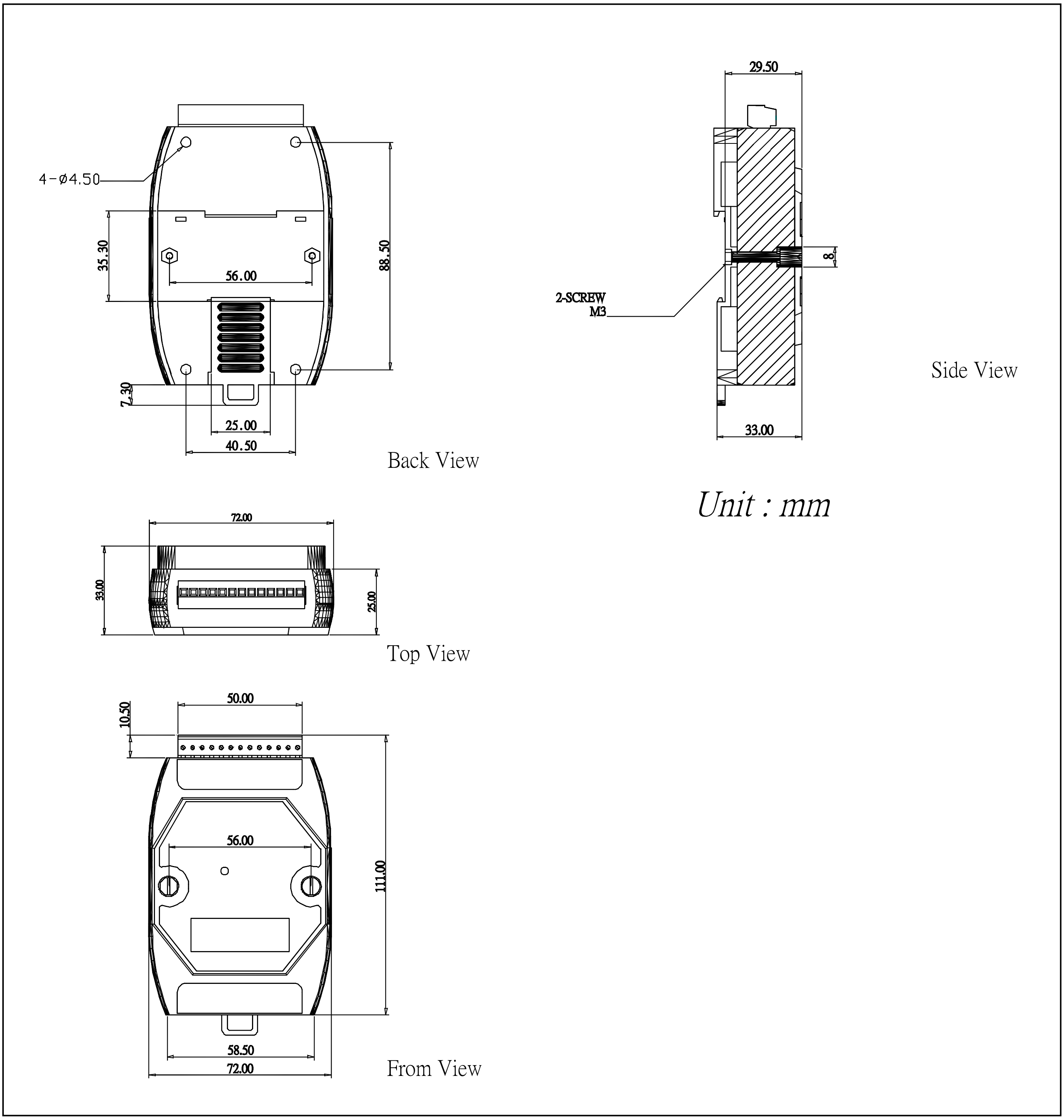
The OPC Server user's manual lists the procedures for the following SCADA software:

- **Labview**
- **National**
- **WIZCON**
- **iFix**
- **Indusoft**
- **Citect**

Appendix A: Dimension and Mounting

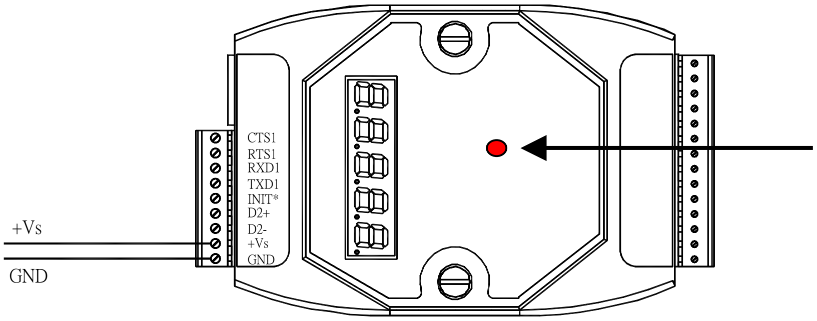





4-Ø4.50
35.30
56.00
88.50
7.30
25.00
40.50
Back View
29.50
8
2-SCREW
M3
33.00
Side View
Unit : mm
72.00
33.00
25.00
Top View
50.00
10.50
56.00
111.00
58.50
72.00
From View

Appendix B: LED Definitions

Apply Power to 7188EF-016



Indicator LED
FR-NET Program running:
flashing

Step 1: Apply power (+Vs, GND) to 7188E, +Vs can be anywhere from +30V to +10V.

Step 2: Checking the 5-digit 7-SEG LED will show as below.

Note:

Only the display-version modules have 5-digit 7-SEG LED.

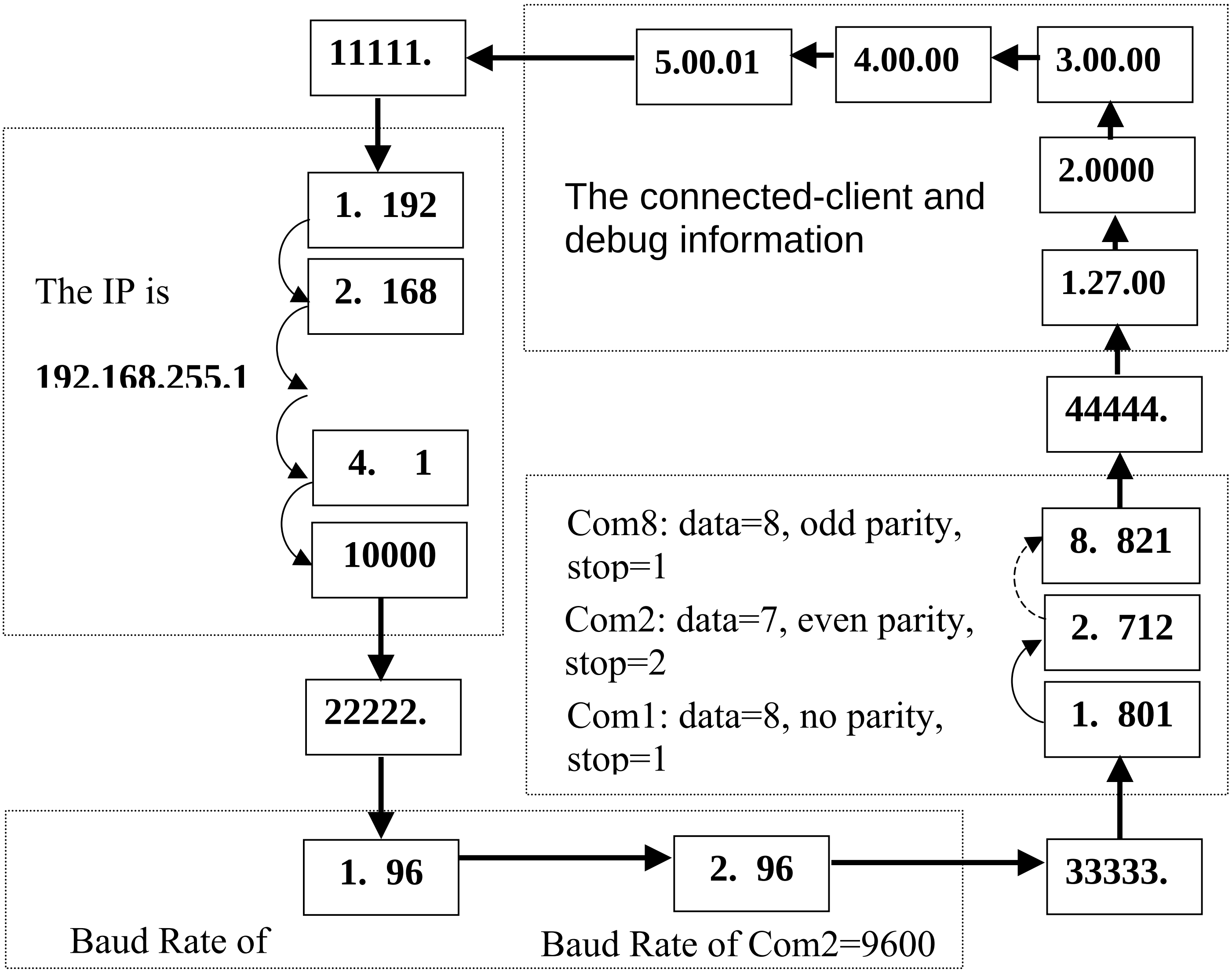
Important information related to the 7188E series can be classified as follows:

- 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 the Group-ID, and then show the IP address as indicated in the diagram below. 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 diagram below.



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 port configuration is 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)
- When LED-1 is 3, the information indicates that Ethernet packets are currently entering the 7188E.
- When LED-1 is 4, the information indicates the status of the internal Flag used to allow the Ethernet packets to be sent is 0 or 1.
- When LED-1 is 5, the information indicates the reset number of the Ethernet chip, 8019s.

When the 7188E is first powered-up or has just been reset, the reset state=1. If a client connects to the 7188E, the reset-state will be changed to 0, free-sockets will be decreased and used-sockets will be increased. If the number of the free-sockets is reduced to 0, then no extra clients can link to the 7188E. **The default number of free-sockets for the 7188E is 27. Therefore, the server allows up to 27 clients to link to a single 7188E.**

If the 5-digit LED does not display as above, the following steps should be taken:

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

Step 3: The function of the red LED indicator on the 7188E is as follows:

- The program is running: **On/Off**

In default conditions, the red indicator-LED on the 7188E will be periodically ON for 0.5 second, and then OFF for 0.5 seconds.

If the LED is always ON, the following steps should be taken:

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

Step 4: Power off.

Appendix C: MiniOS7 utility

On occasions, ICPDAS will offer an update to the I-7188EF-016 firmware or MiniOS7. The MiniOS7 utility can help you easily to update to the latest version. The **MiniOS7 Utility** is used for essential configuration and for downloading programs into the I-7188EF-016 controller embedded in the ICPDAS MiniOS7.

The **MiniOS7 Utility** program provides 3 main functions:

- Update the MiniOS7 image
- Download firmware to Flash memory
- Configure Ethernet and COM port settings

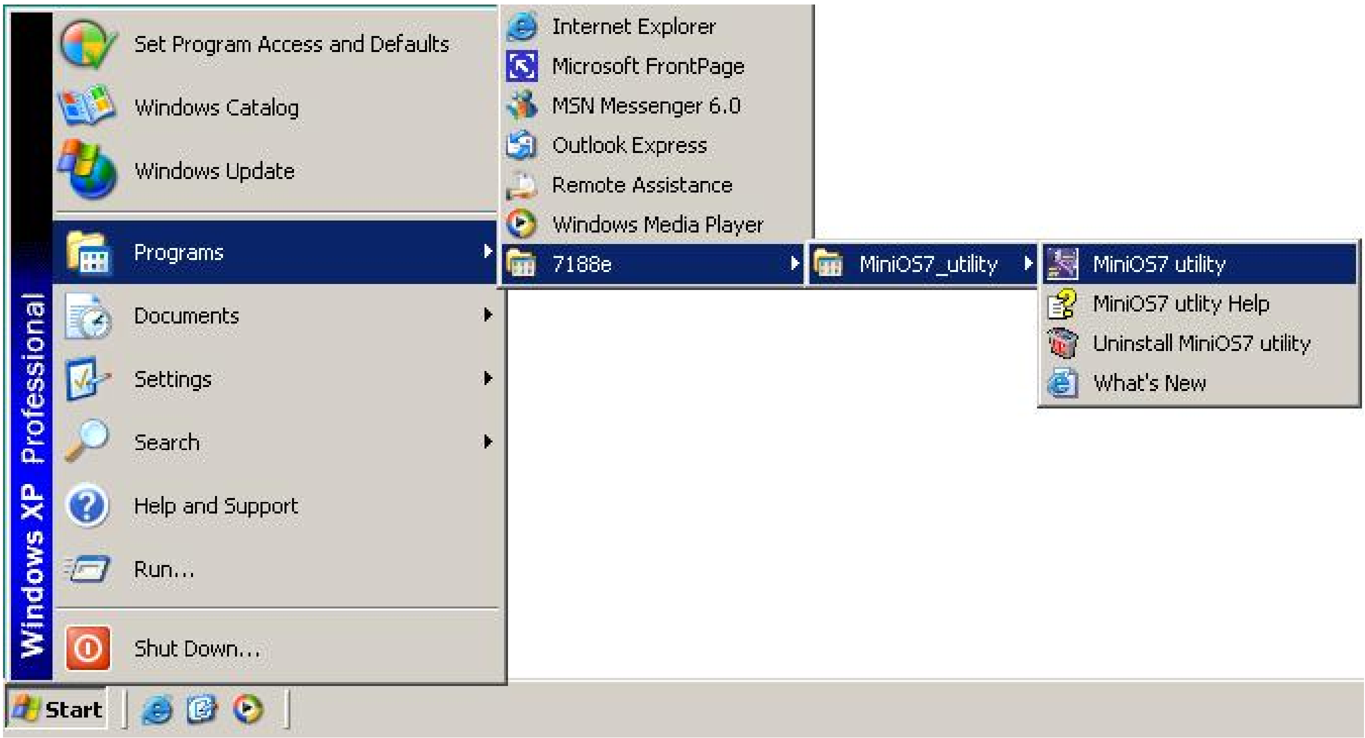
MiniOS7 utility location

The MiniOS7 utility is located in the
CD: \NAPDOS\MINIOS7\UTILITY \MiniOS7_utility folder or
ftp://ftp.icpdas.com/pub/cd/8000cd/napdos/minios7/utility/minios7_utility/

Installation procedure

Step 1: Locate and run MiniOS7utility.exe from the CD: \Napdos\MiniOS7\utility\MiniOS7_utility directory.

Step 2: After completing the installation, a new “7188E” folder will be added to the “programs” section of the start menu. The MiniOS7_utility files can be accessed by clicking on this folder and then the **'MiniOS7 utility' folder. See the diagram below for details.**



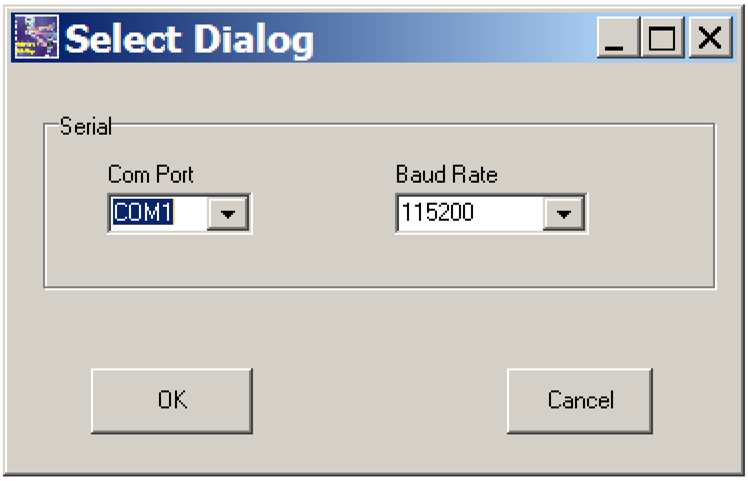
Downloading files to the I-7188EF-016 controller

Before using this utility, ensure that the cable from the PC is connected to the 7188E and that the INIT and GND pins on the 7188E are connected. Refer to page 29 of the I-7188E Series user’s manual for details.

4The download procedure is as follows:

Step 1: From the Windows START menu, go to programs/7188E/MiniOS7_utility and locate the **MiniOS7 utility'** program.

Step 2: Select COM1 from the Com Port menu and 115200 from the baud Rate menu.

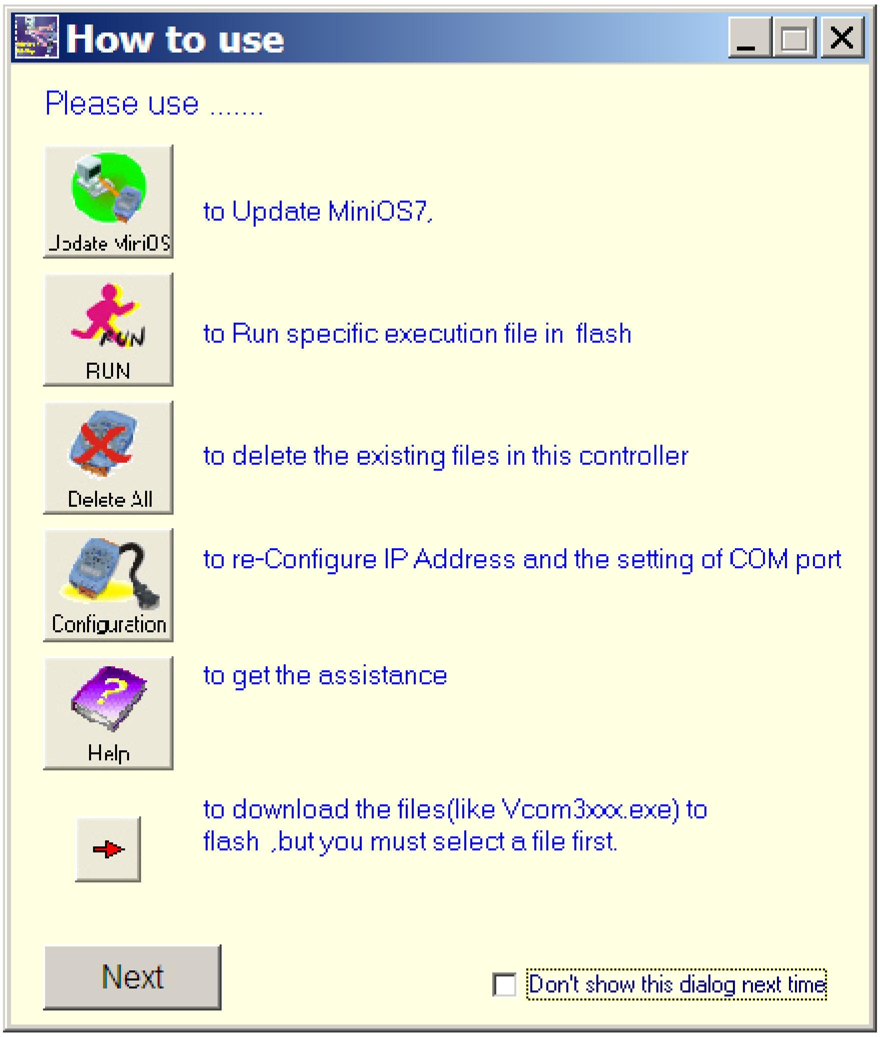


Serial

Com Port: COM1

Baud Rate: 115200

Step 3: After clicking the **'OK' button**, the ‘How to use’ dialog will be displayed. Please read this information and then click 'Next'.



Please use ....

to Update MiniOS7.

to Run specific execution file in flash

to delete the existing files in this controller

to re-Configure IP Address and the setting of COM port

to get the assistance

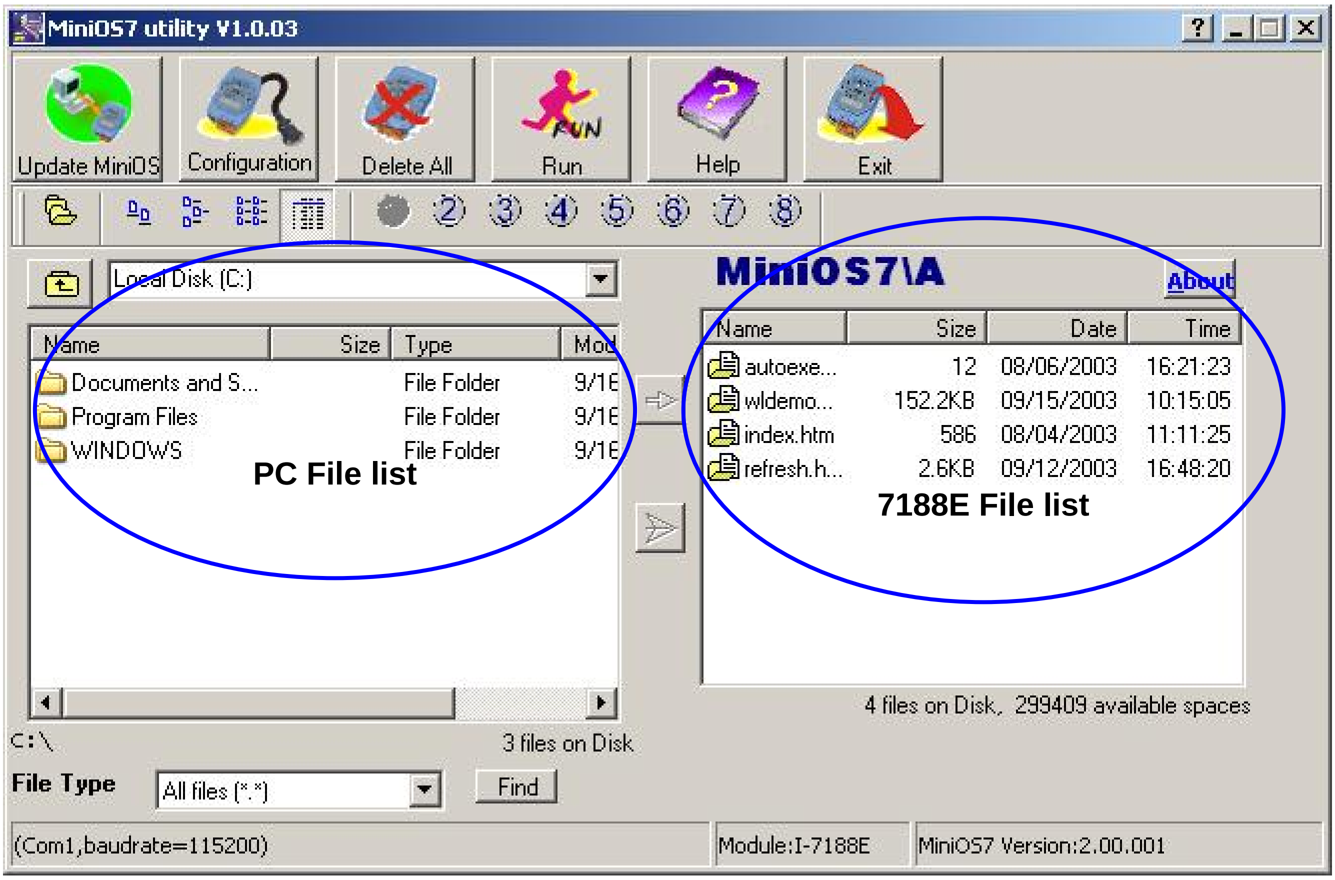
to download the files(like Vcom3xxx.exe) to flash ,but you must select a file first.

□ Don't show this dialog next time

Note:

The above screen will be displayed each time you start the program. If you wish to disable this function, please click the 'Don't show this dialog next time' check box.

Step 4: Once the screen shown below is displayed, it means that has been successfully established a connection between the 7188E and the PC.



Local Disk (C:)

Name	Size	Type	Mod
Documents and S...		File Folder	9/16
Program Files		File Folder	9/16
WINDOWS		File Folder	9/16

C:\ 3 files on Disk

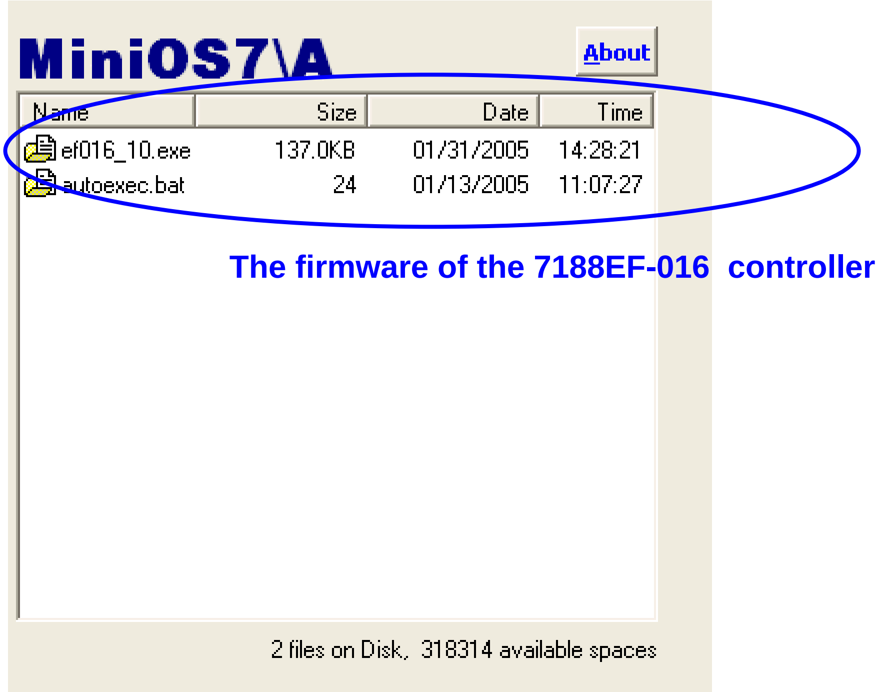
File Type: All files (*.*)

Name	Size	Date	Time
autoexe...	12	08/06/2003	16:21:23
wldemo...	152.2KB	09/15/2003	10:15:05
index.htm	586	08/04/2003	11:11:25
refresh.h...	2.6KB	09/12/2003	16:48:20

4 files on Disk, 299409 available spaces

(Com1,baudrate=115200) Module:I-7188E MiniOS7 Version:2.00.001

Step 5: Locate the required file (The CLI firmware is a file named CLInnnn.exe, where 'nnnn' is the version number) in the left hand window, then click → to download the file to 7188E. The figure below shows that the CLI firmware and autoexec.bat has been downloaded to the I-7188EF-016 controller.



MiniOS7\A

About

Name	Size	Date	Time
ef016_10.exe	137.0KB	01/31/2005	14:28:21
autoexec.bat	24	01/13/2005	11:07:27

2 files on Disk, 318314 available spaces

The firmware of the 7188EF-016 controller

Notes:

- To select multiple files, hold the CTRL or SHIFT keys while making the selection and click ➤ to simultaneously download the files to 7188E.

- After completing the download, turn off the power to the 7188E and then turn it back ON. This will cause the program to begin running the autoexec.bat (The content of the autoexec.bat indicates which file in the 7188E will run after reboot). Alternatively, click the Run button to execute it.

  Please refer to the MiniOS7 utility help file (MiniOS7.chm) for more details regarding the use of MiniOS7 utility. The MiniOS7.chm file is located in the 7188E MiniOS7_utility group in the 'Start' menu or can be accessed by clicking on the Help icon at the top of the MiniOS7 utility toolbar

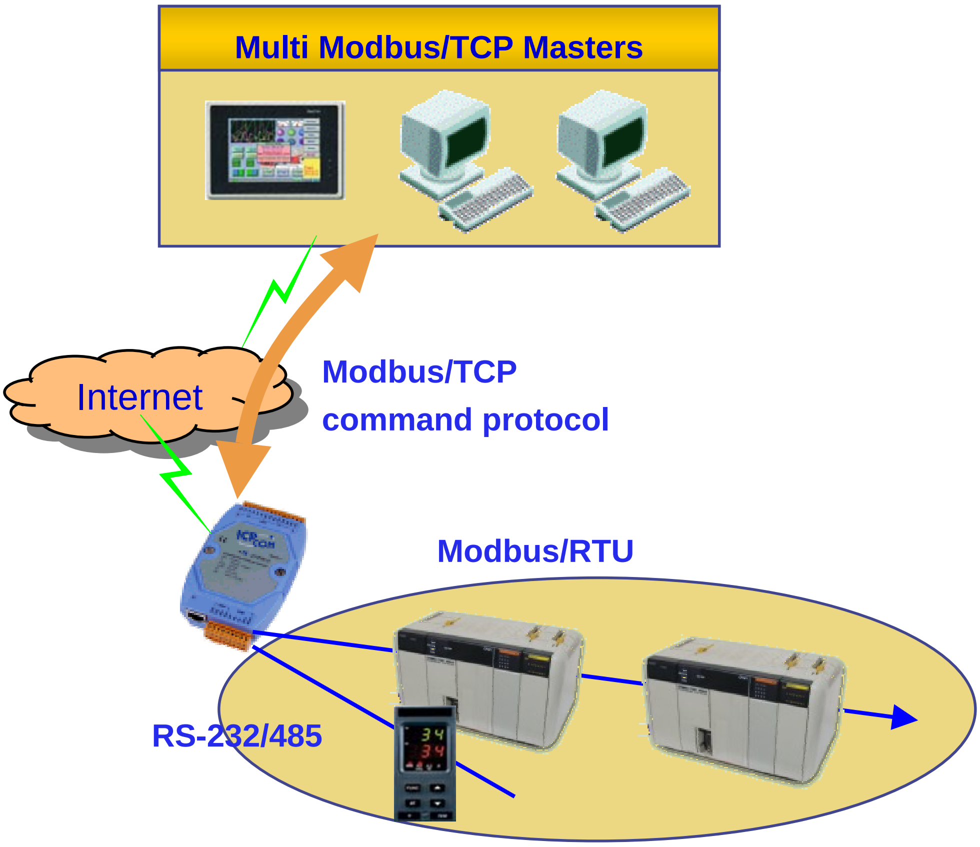
.

Appendix D: Modbus Protocol

Modbus Protocol provides client/server communication between devices connected on different types of buses or networks. Modbus is capable to run full-duplex RS232 lines, half-duplex RS485 and Ethernet & TCP/IP solutions. The Internet community can access MODBUS at a reserved system port 502 on the TCP/IP stack.

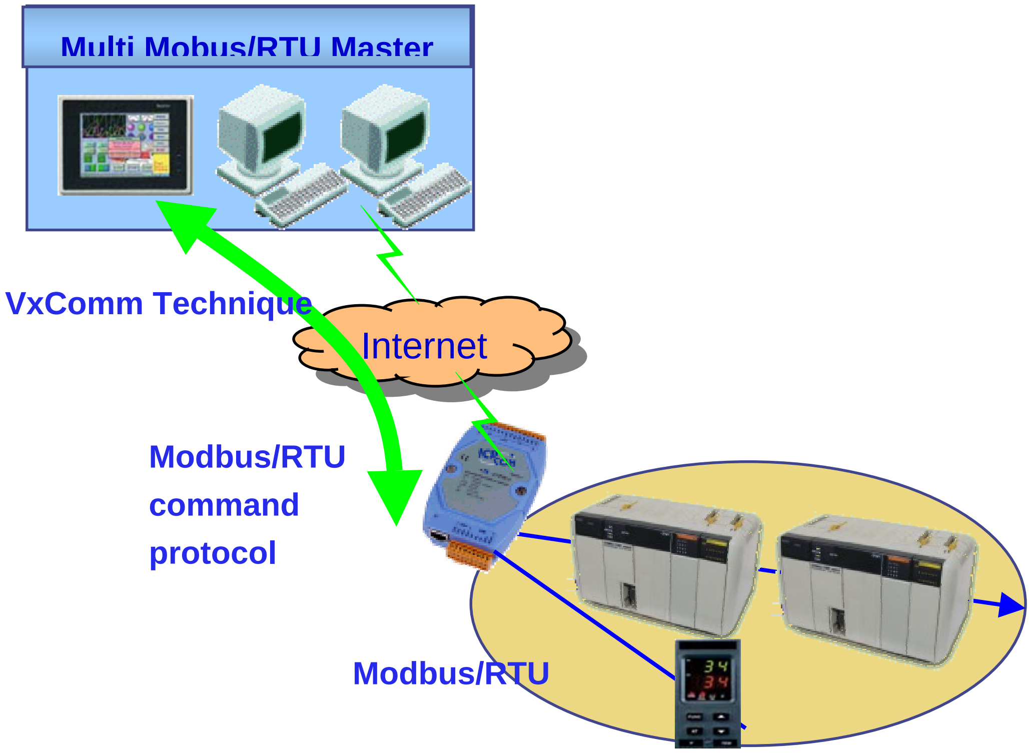
◆ Modbus/TCP to Modbus/RTU protocol converter

The I-7188EF-016 controller can be used as a single Modbus/TCP to multi-Modbus/RTU converter simply by configuring the device and then setting connection between SCADA, HMI software and the I-7188EF-016 using the Modbus utility.



◆ Modbus/RTU protocol using the VxComm technique

In combination with the Vxcomm technique, the I-7188EF-016 controller is also able to link to serial devices supported by the Modbus/RTU without changing the original Modbus/RTU program on the host PC.

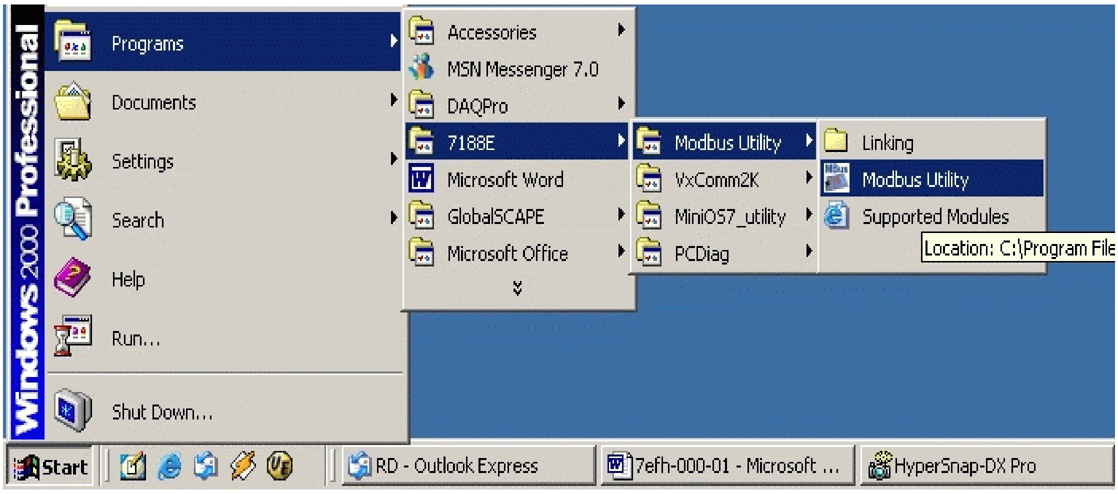


◆ Modbus utility

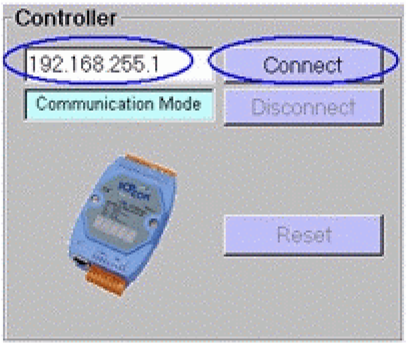
In this topic, the ICPDAS solution with I-7188EF-016 via the Modbus/TCP protocol will be presented step by step.

The Modbus utility is located in the CD:\modbus\modbus_utility\setup\disk1\ or ftp://ftp.icpdas.com.tw/pub/cd/8000cd/napdos/modbus/modbus_utility/setup/disk1/

Step 1: Install the Modbus Utililty on the host PC by running

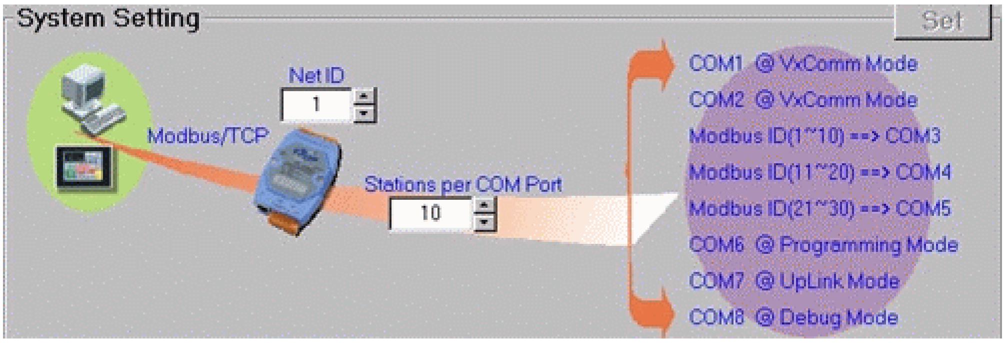


Step 2: Replace the default IP address with the IP address that you used, then click [Connect]. After connecting to the I-7188EF-016, the Modbus Utility will give detailed information regarding system settings, COM port settings, etc.



192.168.255.1

Step 3: Adjust system settings.



Net ID 1

Stations per COM Port 10

COM1 @ VxComm Mode
COM2 @ VxComm Mode
Modbus ID(1~10) ==> COM3
Modbus ID(11~20) ==> COM4
Modbus ID(21~30) ==> COM5
COM6 @ Programming Mode
COM7 @ UpLink Mode
COM8 @ Debug Mode

The Modbus station number is a very important parameter for I-7188EF-016. It is used to recognize different Modbus stations. But the I-7188EF-016 does not have any hardware design such as dip-switch or jump allowing you to set the Modbus station number (or called NetID). You must use the Modbus Utility to set some parameters regarding to Modbus station number. System settings include follows:

Net ID (Default = 1):
if the Modbus station number in a Modbus/TCP request (from PC or HMI) matches the Net ID, the request is passed to the Modbus kernel. Then Modbus kernel program will then respond and send the internal registers to the Modbus/TCP client (PC or HMI).

The content of all other registers is zero.

Stations per COM port (Default = 10):
This value is used to decide how many Modbus/RTU stations can one I-7188EF-016 COM port control. That also means the value can decide which COM the Modbus/TCP request will be passed to. The formula is as follows:

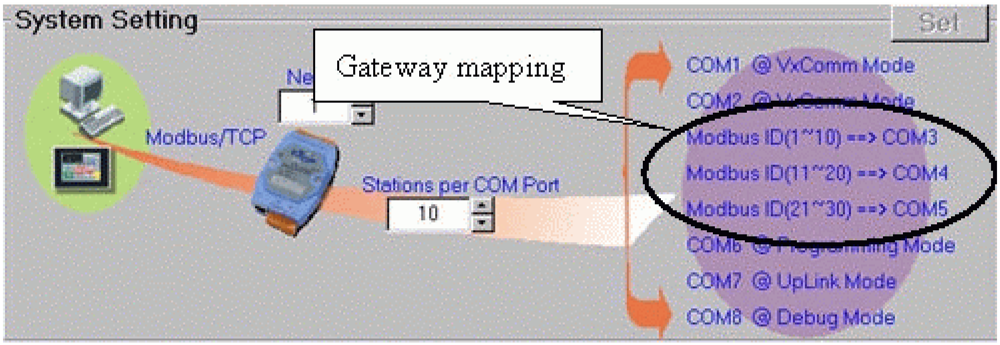
COM = station number in Modbus/TCP request / Stations per COM port

Example 1:
Stations per COM port = 10
Modbus/TCP requests for station 35

The requests will be passed to COM 3 (35/10 = 3.5)

Example 2:
Stations per COM port = 20
Modbus/TCP requests for station 35

The request will be passed to COM 1 (35/20 = 1.75)



Step 4: Adjust the COM port settings

Enable Mode (Default = Modbus/RTU):
I-7188EF-016 COM ports can be configured as follows:

1. VxComm (Virtual COM):

   Enable VxComm. Remote application program can use Virtual COM (need to install the VxComm Driver) or connect to TCP/IP port 10000 + n to access the COM port via Ethernet. At VxComm mode, the COM port can link to any serial device.

2. Modbus/RTU:

   Enable protocol converter function to convert Modbus/TCP to Modbus/RTU. At Modbus/RTU mode, the COM port can only link to Modbus/RTU slave devices.

3. Programming:

   Disable communication of the COM port. Users must use C language under Xserver structure to develop a program for the 7188E to access the COM port. At programming mode, the COM port can link to any serial device.

4. UpLink:

   Enable the COM port to be a Modbus/RTU slave port.

5. Debug port:

   The Modbus kernel prints out some messages, while communicating with Modbus clients or masters.
   The messages includes

   (0) Receives Modbus request response to Modbus clients or master

   (1) By passes Modbus request to COM port
   (2) Send Modbus request to COM port
   (3) Check Modbus response from COM port
   (4) Send Modbus response to Modbus client or masters

Data format of Modbus/RTU

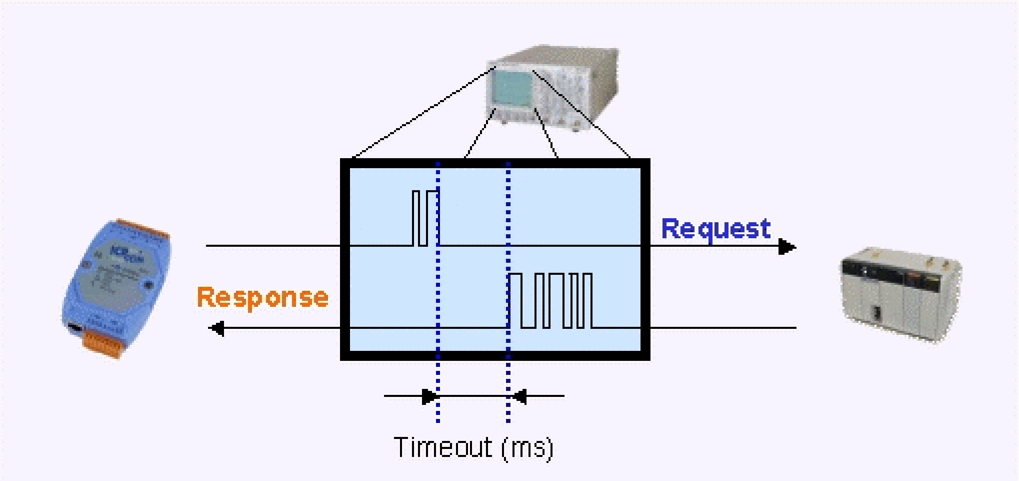
There are several kinds of data format used in the Modbus/RTU protocol, you must change it to suit the Modbus/RTU devices that connect to the COM port.
8 data bits, none parity, 1 stop bits
8 data bits, none parity, 2 stop bits

8 data bits, odd parity, 1stop bits
8 data bits, even parity, 1stop bits (Default)

Note: When an I-7188E -MTCP receives a Modbus/TCP request that not to its internal registers, it first decides which COM port to send the request. Modbus/RTU must be enabled for this COM port, otherwise the request will be discarded.

Timeout (Default = 200 ms)

After finishing data transmission, the system begins to count time, if timeout expires, the system stop receiving responses.



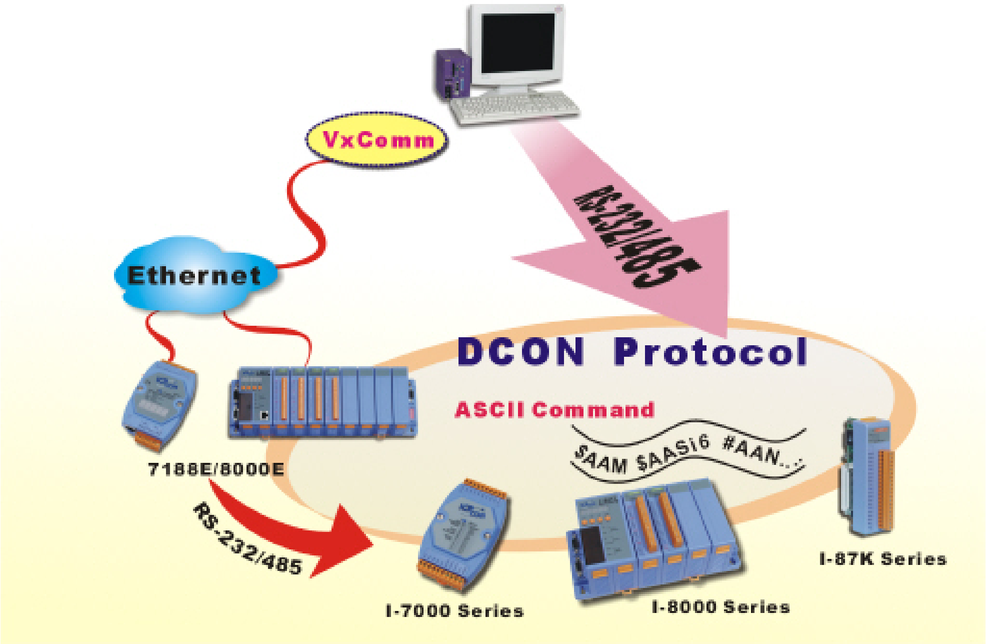
Step 5: Save all settings

After clicking [Save], the Modbus Utility generates one record file (default file is called Modbus_7E.ini). You can run the Modbus Utility to load the record file to review all settings of specific I-7188EF-016. If you forget to sotre these settings, you can still obtain the information for the I-7188EF-016 via Ethernet.

Note:

Please refer to CD\Napdos\Modbus\Modbus_Utility and CD\Napdos\Modbus\7188E\Document\MBUtility_MBTCP_7E_Eng.chm for more detailed Modbus information

Appendix E: DCON protocol



The DCON protocol is a request/reply communication protocol for the I-7000/8000/87K series I/O modules and I-7188EF-016, and uses a simple ASCII format such as $AAN, $AASi6, #AAN, #AASiCj, etc. The protocol format is defined as follows:

Basic Command Format

Command Format:

Leading Character	Module Address	Command	[CHKSUM]	CR

Response Format:

Leading Character	[Module Address]	[Data]	[CHKSUM]	CR

The Leading Character can include '@', '#', '$', '%', '~', '!'

Address 0x00 ~ 0xFF (AA is Always 01 on 7188EF-016)

Checksum A 2-character checksum and is present when the checksum option is enabled.

CR Carriage Return (0x0D) Command Set

◆ Command sets

The DCON protocol command sets for I-7188EF-016 can be found in. Please refer to CD:\Napdos\FR_Net\7188EF\Document ftp://ftp.icpdas.com/pub/cd/8000cd/napdos/fr_net/7188ef/document/

Command table reference:

Command	Description
%AANNCCFF	Set Module Configuration
$AA2	Read the configuration status from I-7188EF-016
$AAM	Read module Name
$AAF	Read Firmware Version
$AAGCN	Inquire the total channel number
$AAGD(Type)	Inquire the channel description (unavailable)
$AAGSt	Get the FRnet module online/offline status by Group
#AASCcccv	One channel digital output
#AASGggvvvv	One group digital output
@AA	Read Digital input and Digital output read back
@AA(Data)	Write to all DO channels
@AAGGtgg	Read a group value of DI and DO read back
@AAGCtccc	Read single channel value of DI and DO read back

$AA2

<table>
<tr><td><b>Command</b></td><td>$AA2</td></tr>
<tr><td><b>Description</b></td><td>Read the configuration status from I-7188EF-016</td></tr>
<tr><td><b>Syntax</b></td><td>$AA2[CHK](cr)
$ a delimiter character
AA AA is Always 01 on 7188EF-016
2 Command for read configuration status.
[CHK] 2-characters of Checksum
(cr) Character Return(0x0D) for denote the end of command</td></tr>
<tr><td><b>Response</b></td><td>Valid Command !AACCFF[chk](cr)
Invalid Command ?AA[CHK](cr)
Syntax error or communication error may get no response.
! delimiter for valid command
? delimiter for invalid command
AA 2-characters HEX module address (AA is Always 01 on 7188EF-016)
CC Baudrate code Baudrate
<table>
<tr><td>Code</td><td>Baudrate</td><td>Code</td><td>Baudrate</td></tr>
<tr><td>03</td><td>1200</td><td>07</td><td>19200</td></tr>
<tr><td>04</td><td>2400</td><td>08</td><td>38400</td></tr>
<tr><td>05</td><td>4800</td><td>09</td><td>57600</td></tr>
<tr><td>06</td><td>9600</td><td>0A</td><td>115200</td></tr>
</table>
FF Data format code Format (00 CheckSum Disable, 40 Checksum enable)
[CHK] 2-characters of Checksum
(cr) Character Return(0x0D) for denote the end of response</td></tr>
<tr><td><b>Example</b></td><td>Command <i>$012</i>
Response <i>!010A00(cr)</i></td></tr>
</table>

	Description	The example reads the configuration from the I-7188EF-016 system at address 01h. Baudrate = > 0A, 115.2K bps Check sum => enabled

%AANNCCFF

<table>
<tr><td><b>Command</b></td><td>%AANNCCFF</td></tr>
<tr><td><b>Description</b></td><td>This command set the specified I-7188EF-016 baud rate and checksum status.
If set the address to 0.It will set the system configuration into initial state. In this state the baud rate is 9600 and check sum is disable.</td></tr>
<tr><td><b>Syntax</b></td><td>%AANNCCFF[CHK](cr)
% a delimiter character
AA AA is Always 01 on 7188EF-016
NN It is reserved for future application. It should be 00h.
CC Baudrate code Baudrate,
<table>
<tr><td>Code</td><td>Baudrate</td><td>Code</td><td>Baudrate</td></tr>
<tr><td>03</td><td>1200</td><td>07</td><td>19200</td></tr>
<tr><td>04</td><td>2400</td><td>08</td><td>38400</td></tr>
<tr><td>05</td><td>4800</td><td>09</td><td>57600</td></tr>
<tr><td>06</td><td>9600</td><td>0A</td><td>115200</td></tr>
</table>
FF Data format code Format (00 CheckSum Disable, 40 Checksum enable)
[CHK] 2-characters of Checksum
(cr) Character Return(0x0D) for denote the end of command</td></tr>
<tr><td><b>Response</b></td><td>Valid Command !AA[chk](cr)
Invalid Command ?AA[CHK](cr)
Syntax error or communication error may get no response.
! delimiter for valid command
? delimiter for invalid command
AA 2-characters HEX module address(AA is Always 01 on 7188EF-016)
[CHK] 2-characters of Checksum
(cr) Character Return(0x0D) for denote the end of response</td></tr>
<tr><td><b>Example</b></td><td>Command <i>%01000A40</i>
Response <i>!01(cr)</i></td></tr>
</table>

	Description	The example to configure the I-7188EF016 at address 01h. Baudrate = > 115.2K bps Check sum => enabled The response indicates the command is valid.

$AAM

Command	$AAM
Description	Read module name
Syntax	$AAM(cr) $ a delimiter character AA AA is Always 01 on I-7188EF-016 M command for reading module name (cr) Character Return(0x0D) for denote the end of command
Response	Valid Command !AA(Name)(cr) Invalid Command ?AA(cr) Syntax error or communication error may get no response. ! delimiter for valid command ? delimiter for invalid command. AA AA is Always 01 on I-7188EF-016 (Name) module name (cr) Character Return(0x0D) for denote the end of response
Example	Command *$01M* Response !01I-7188EF-016 Description Read address module name, response module name is "I-7188EF-016".
Reference	

$AAF

Command	$AAF
Description	Read Firmware Version
Syntax	$AAF(cr) $ a delimiter character AA AA is Always 01 on I-7188EF-016 F Command for read firmware version (cr) Character Return(0x0D) for denote the end of command
Response	Valid Command !AA(Data)(cr) Invalid Command ?AA(cr) Syntax error or communication error may get no response. ! delimiter for valid command ? delimiter for invalid command. AA AA is Always 01 on I-7188EF-016 (Data) Firmware version of module (cr) Character Return(0x0D) for denote the end of response
Example	Command *$01F* Response !011001 Description Read module firmware version, return version 1.0.01
Reference	

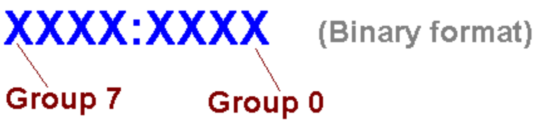
$AAGCN

Command	$AAGCN
Description	Get the total channel number
Syntax	$AAGCN(cr) $ a delimiter character AA AA is Always 01 on I-7188EF-016 GCN command for reading the total channel number (cr) Character Return(0x0D) for denote the end of command
Response	Valid Command >(Type A)(channel A)(Type B)(channel B)...(Type Z)(channel Z)(cr) Invalid Command ?AA(cr) Syntax error or communication error may get no response. (Type)= (3 bytes characters) "AIN" for AI channel (unused) "AON" for AO channel (unused) "DIN" for DI channel "DON" for DO channel "DIC" for DI counter channel (unused) "DIL" for DI latch channel (unused) "DOL" for DO latch channel (unused) "CNT" for Counter channel (unused) ... etc. (channel)= "001" ~ "FFF" (3 bytes in hex format)
Example	Command *$01GCN* Response *>DIN010DON004* Description Read total channel number of I-7188EF-016, response 16(0x10) DI channels and 4(0x04) DO channels
Reference	

$AAGD(Type) (unavailable)

Command	$AAGD(Type)
Description	Get the channel description
Syntax	$AAGD(Type)(cr) $ a delimiter character AA AA is Always 01 on I-7188EF-016 GD command for reading the channel description (Type) (Type)= (3 bytes characters) "AIN" for AI channel (unused) "AON" for AO channel (unused) "DIN" for DI channel "DON" for DO channel "DIC" for DI counter channel (unused) "DIL" for DI latch channel (unused) "DOL" for DO latch channel (unused) "CNT" for Counter channel (unused) ... etc. (cr) Character Return(0x0D) for denote the end of command
Response	Valid Command >(Description of ch0):(Description of ch1)…(Description of chj)(cr) Invalid Command ?AA(cr) Syntax error or communication error may get no response. ! delimiter for valid command ? delimiter for invalid command. Description The description of one channel occupied 16 bytes character and separates with the next description by‘:’symbol. The description cannot include cr and ‘:’ symbol. One command can get the description of all channel. (cr) Character Return(0x0D) for denote the end of response
Example	Command $01GDDON Response *>Isolation:Isolation:Isolation:…* Description Read the description of all DO channel, the all type are Isolation Digital output
Reference	

$AAGSt

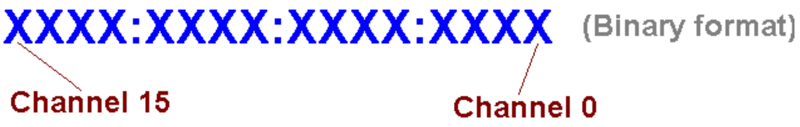
Command	$AAGSt
Description	Get the FRnet module online/offline status by Group
Syntax	$AAGSt(cr) $ a delimiter character AA AA is Always 01 on I-7188EF-016 GS command for reading the module online/offline status t Type 0:DO, 1:DI (cr) Character Return(0x0D) for denote the end of command
Response	Valid Command >VV(cr) Invalid Command ?AA(cr) Syntax error or communication error may get no response. > delimiter for valid command ? delimiter for invalid command. VV Module status in HEX format >VV(cr) (8 groups) > VVVVVVVVVVVVVVVV(cr) (64 groups) 00~FF (8 groups)  0000000000000000~FFFFFFFFFFFFFFFF (64 groups) (1: online status, 0:offline status) AA AA is Always 01 on I-7188EF-016 (cr) Character Return(0x0D) for denote the end of response
Example	Command *$01GS0* Response *>F0* Description Get the status of FRnet DI module, response is Group0~Group3 are offline Group4~Group7 are online

Reference	

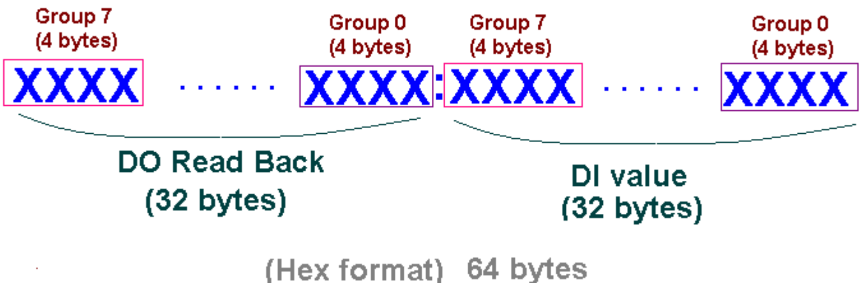
#AASCcccv

Command	#AASCcccv
Description	One channel digital output
Syntax	#AASCcccv (cr) # a delimiter character AA address of reading module (00 to FF) SC command for writing digital output for one channel ccc channel number 000~07F in HEX format(16 Groups) 000~39F in HEX format (128 Groups) v Output value 1:ON, 0:OFF (cr) Character Return(0x0D) for denote the end of command
Response	Valid Command >(cr) Invalid Command ?AA(cr) Syntax error or communication error may get no response. > delimiter for valid command ? delimiter for invalid command. If the channel is not available or not enabled, the module will response as invalid command. AA AA is Always 01 on I-7188EF-016 (cr) Character Return(0x0D) for denote the end of response
Example	Command *#01SC0011* Response > Description Set the channel 1 of FRnet to 1, response success.
Reference	

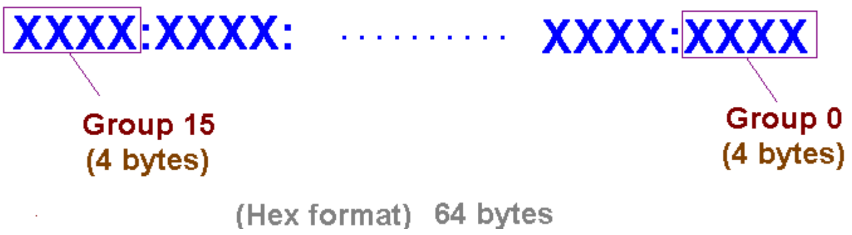
#AASGggvvvv

Command	#AASGggvvvv
Description	One group digital output
Syntax	#AASGggvvvv(cr) # a delimiter character AA AA is Always 01 on I-7188EF-016 SG command for writing digital output for one group gg Group number 00~07 in HEX format (16 Groups) 00~63 in HEX format (128 Groups) vvvv output value 0000~FFFF in HEX format  XXXX:XXXX:XXXX:XXXX (Binary format) Channel 15 Channel 0 (cr) Character Return(0x0D) for denote the end of command
Response	Valid Command >(cr) Invalid Command ?AA(cr) Syntax error or communication error may get no response. > delimiter for valid command ? delimiter for invalid command. If the channel is not available or not enabled, the module will response as invalid command. AA AA is Always 01 on I-7188EF-016 (cr) Character Return(0x0D) for denote the end of response
Example	Command *#01SG00FFFF* Response > Description Set the group 0 of FRnet to FFFF, response success.
Reference	

@AA

Command	@AA
Description	Read Digital input and Digital output readback
Syntax	@AA(cr) @ a delimiter character AA AA is Always 01 on I-7188EF-016 (cr) Character Return(0x0D) for denote the end of command
Response	Valid Command >AAA...ABBB...B(cr) Invalid Command ?AA(cr) Syntax error or communication error may get no response. > delimiter for valid command ? delimiter for invalid command. AAA...ABBB...B >AAAA..............AABBB.....B(cr) (32 characters for 16 Groups) AAA..A: DO readback (32 characters) BBB..B: DI values (32 characters) >AAAA................AABBB........B(cr) (512 characters for 128 Groups) AAA..A: DO readback (256 characters) BBB..B: DI values (256 characters) (cr) Character Return(0x0D) for denote the end of response
Example	Command *@01* Response *>1111111111111111FFFFFFFFFFFFFFFF00000000000000000000000000000000*  Group 7 (4 bytes) XXXX Group 0 (4 bytes) XXXX Group 7 (4 bytes) XXXX Group 0 (4 bytes) XXXX DO Read Back (32 bytes) DI value (32 bytes) (Hex format) 64 bytes Description Read all digital input/output, DO readback is *1111111111111111FFFFFFFFFFFFFFFF (Group0~ Group3 are 1, Group4~Group7 are FFFF) and DI value is 00000000000000000000000000000000 (all DI channels are 0)*
Reference	

@AA(Data)

Command	@AA(Data)
Description	Write to all DO channels
Syntax	@AA(Data)(cr) @ a delimiter character AA AA is Always 01 on I-7188EF-016 (Data) DO values 32 characters for 16 Groups 000...0~FFF...F (32 characters) 256 characters for 128 Groups 000...0~FFF...F (256 characters) (cr) Character Return(0x0D) for denote the end of command
Response	Valid Command >(cr) Invalid Command ?AA(cr) Syntax error or communication error may get no response. > delimiter for valid command ? delimiter for invalid command. AA AA is Always 01 on I-7188EF-016 (cr) Character Return(0x0D) for denote the end of response
Example	Command *@011111111111111111FFFFFFFFFFFFFFFF00000000000000000000000000000000*  XXXX:XXXX: .... XXXX:XXXX Group 15 (4 bytes) Group 0 (4 bytes) (Hex format) 64 bytes Response > Description Set digital output to*1111111111111111FFFFFFFFFFFFFFFF00000000000000000000000000000000* , response success.
Reference	

@AAGGtgg

Command	@AAGGtgg
Description	Read a group value of DI and DO ReadBack
Syntax	@AAGGtgg(cr) # A delimiter character AA AA is Always 01 on I-7188EF-016 t Type 0: DO readback (FRnet RA) , 1: DI (FRnet SA) gg Group number 00~07 in HEX format (16 Groups) 00~63 in HEX format (128 Groups) (cr) Character Return(0x0D) for denote the end of command
Response	Valid Command >vvvv(cr) Invalid Command ?AA(cr) Syntax error or communication error may get no response. > delimiter for valid command ? delimiter for invalid command. vvvv 16 channels value of DI or DO (4 characters) 0000~FFFF (HEX) (1:online status, 0:offline status) AA AA is Always 01 on I-7188EF-016 (cr) Character Return(0x0D) for denote the end of response
Example	Command *@01GG001* Response *>F0F0* Description Get the first group DI value of FRnet, DI response is F0F0
Reference	

@AAGCtccc

Command	@AAGCtccc
Description	Read single channel value of DI and DO Read Back
Syntax	@AAGCtccc(cr) @ A delimiter character AA AA is Always 01 on I-7188EF-016 GC Command for reading single channel value t Type 0: DO readback (FRnet RA) , 1: DI (FRnet SA) ccc channel number 000~07F in HEX format(16 Groups) 000~39F in HEX format (128 Groups) (cr) Character Return(0x0D) for denote the end of command
Response	Valid Command >v (cr) Invalid Command ?AA(cr) Syntax error or communication error may get no response. > delimiter for valid command ? delimiter for invalid command. v The value of DI or DO (1 character) (1:on, 0:off) AA AA is Always 01 on I-7188EF-016 (cr) Character Return(0x0D) for denote the end of response
Example	Command *@01GC1001* Response *>1* Description Get the channel 1 value of Group 1 of DI, the value is on.
Reference	

Appendix F: VxComm Technology

VxComm ("Virtual Communication Port") is a technique that allows access to remote I/O slots or RS-232 ports. There are two types of software interfaces that can be used to access remote I/O modules and the COM ports of the 7188E/8000E series the first is serial port interface and the second is the TCP/IP interface. For the serial port interface, we provide a VxComm driver for Windows OS. It is used to create virtual COM ports to map to I/O modules and COM ports of the 7188E and 8000E. After creating virtual COM ports, you can easily upgrade serial devices to with Ethernet communication ability and the original software only need to link to a virtual COM port. It doesn't need any source code modification.

Comparison of using **Virtual COM Port** and **TCP Port** to develop Ethernet application.

	Use Virtual **COM Port i**nterface	Use **TCP Port** interface
Extra Driver	Need to install VxComm driver on PC	No
Platform	Windows 98 /NT /2000 /XP	All platforms
SDK provided	DLL, ActiveX, LabView bundle driver, InduSoft bundle driver, OPC driver	No. Program has to use DCON Protocol directly to communicate with I/O modules

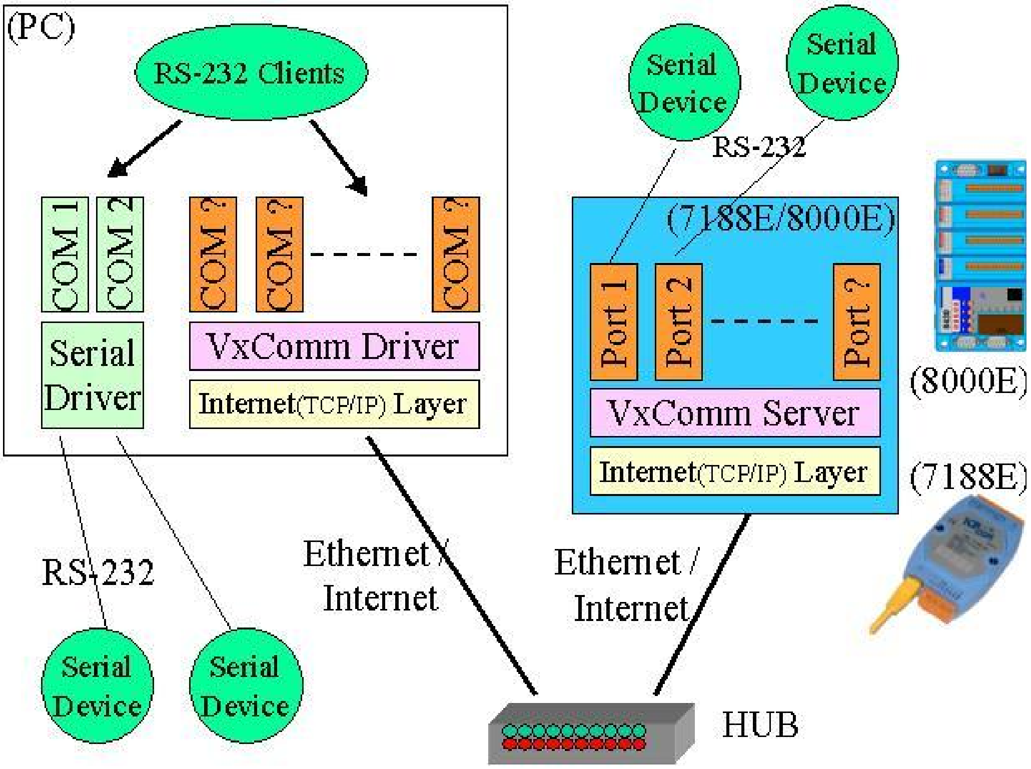
There are many RS-232 devices in the factory. Linking all these RS-232 devices to a central computer is important in industry automation. There are many different approaches to link these devices together. Some important approaches are given as follows:

- 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)

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 is given as follows:



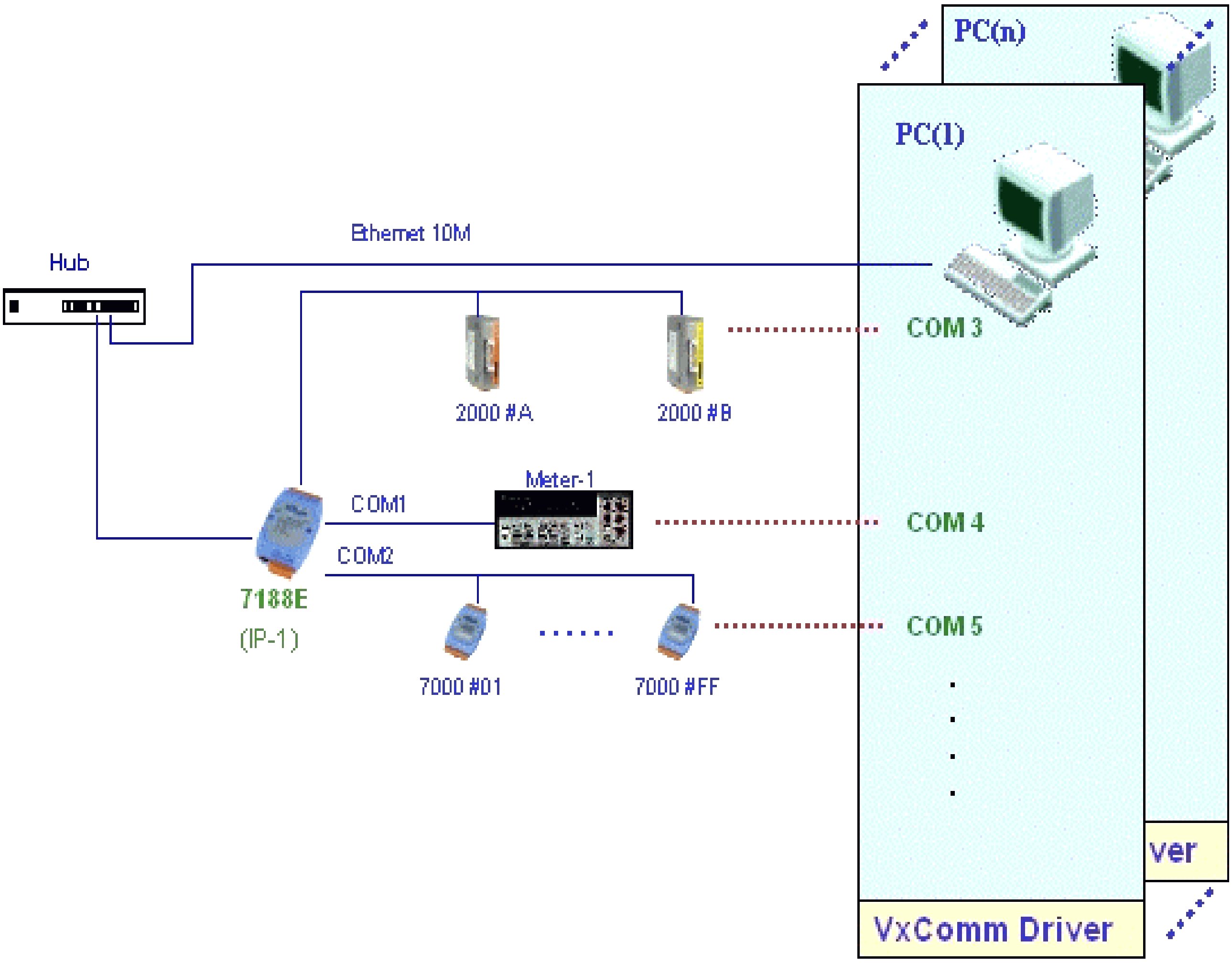
The VxComm technology can be used to virtualize COM ports of the 7188E/8000E to become a COM port of PC. With the help of VxComm driver, users can access the remote COM port of the 7188E/8000E just as them would access the PC's COM 1/2.

Note:
Refer to "7188E Series Software User's Manual" for more information.

The two application architectures are shown as below:

1. Using Virtual COM Technology

The 7188EF is designed for linking RS-232/485/422 device to Ethernet network. With the help of VxComm utility, the built-in COM port of 7188EF 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. Using standard TCP/IP protocol

On the Internet or other network, a computer that provided the shared network resources for another computer (called a client) accessing is called a server. I-7188EF016 acts as a server that provides data translation between serial and Ethernet formats and data access of FRnet DIO. I-7188EF016 allows the SCADA, data collection system or the other applications with TCP/IP protocol on the Host PC to establish a connection with and get data from the serial device or access the FRnet DIO.

The following describes TCP port assignments for well-known ports.

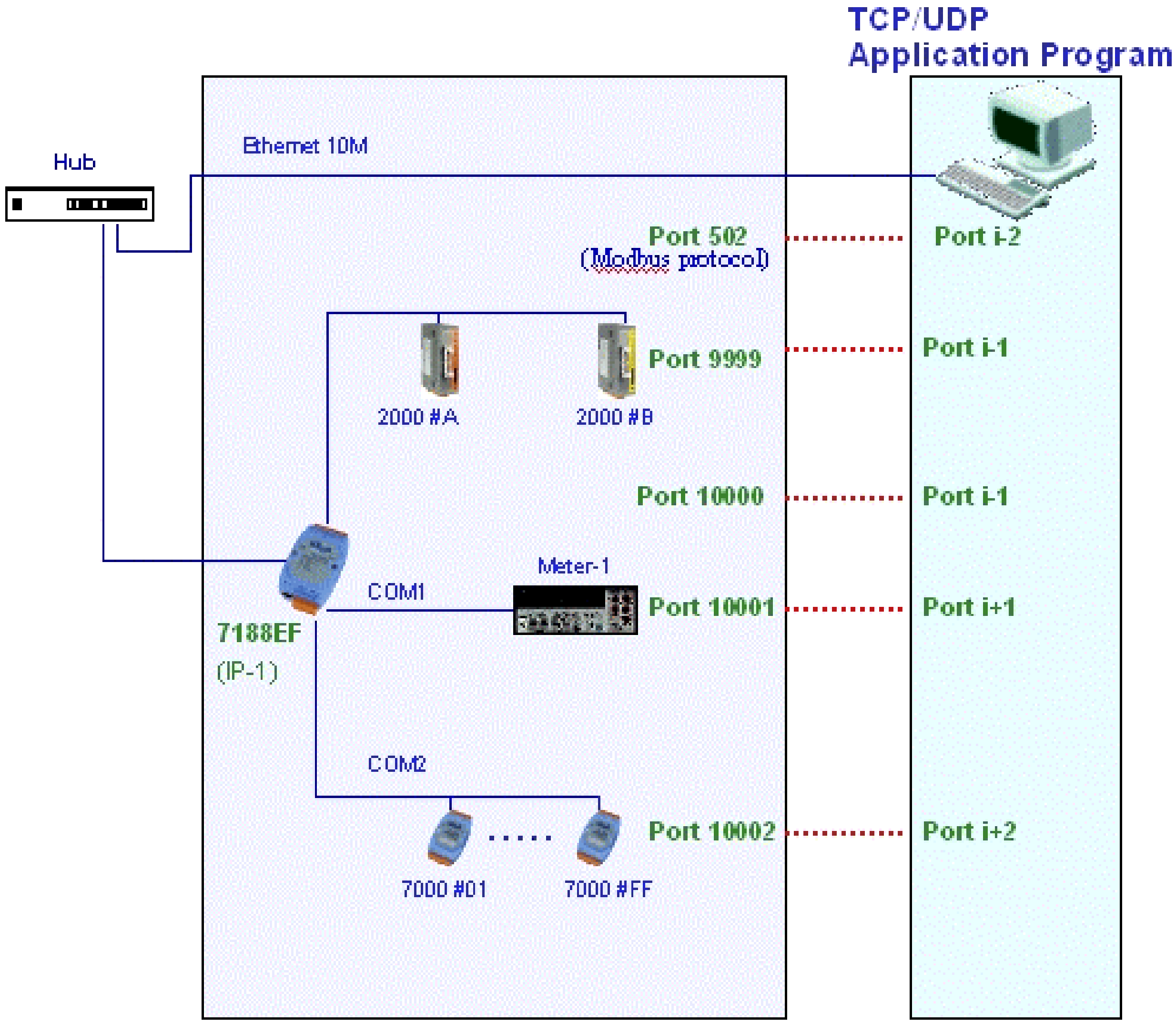
- Port-502: Read/write to devices using Modbus protocol.
- Port-9999: Read/write the FRnet I/O of I-7188EF series.
- Port-10000: Get/Set the configuration of I-7188EF016
- Port-10001: Read/write to COM1 of I-7188EF series.
- Port-10002: Read/write to COM2 of I-7188EF series.

When one client program on PC sends a TCP/IP packet to I-7188EF, if port=502, 9999 or 10000, the I-7188EF will recognize the packet is a command to control and re-configure the relative devices or COM ports. If port=10001, the I-7188EF will pass the data to COM1 and send the response from COM1 back to the client program on PC. This procedure is given as follows:

Step 1: Client program on PC sends TCP/IP packets to the I-7188EF.

Step 2: If port = (10000 + N), the I-7188EF sends this command to COM-port N of the 7188EF.
If port =502, 999, 10000, the I-7188EF will control and re-configure the relative devices or COM ports.

Step 3: If port = (10000 + N), the I-7188EF sends the responses of COM ports back to the client program in PC.
If port =502, 9999 or 10000, the I-7188EF sends the return-code back to the client program in PC.


TCP/UDP
Application Program
Hub
Ethernet 10M
Port 502
(Modbus protocol)
Port i-2
2000 #A
2000 #B
Port 9999
Port i-1
Port 10000
Port i-1
Meter-1
COM1
Port 10001
Port i+1
7188EF
(IP-1)
COM2
Port 10002
Port i+2
7000 #01
7000 #FF