µPAC-7186E Series User Manual

Service and usage information for

µPAC-7186EX

µPAC-7186PEX

µPAC-7186EX-FD

µPAC-7186EX-SM

µPAC-7186EXD

µPAC-7186PEXD

µPAC-7186EXD-FD

µPAC-7186EXD-SM

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Edited by Anna Huang

Warranty

All products manufactured by ICP DAS are under warranty regarding defective materials for a period of one year, beginning from the date of delivery to the original purchaser.

Warning

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Email: service@icpdas.com

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1. Introduction

The µPAC-7186E is a palm-size programmable automation controller that with Ethernet, RS-232, RS-485 communication. ICP DAS provides easy-to-use software development tool kits (Xserver, VxComm, Modbus libraries). Users can use them to easily integrate serial devices to have Ethernet/Internet communication ability and through the standard Modbus protocol to communicate with SCADA software (Indusoft, ISaGARF, DasyLab, Trace Mode, Citect, iFix, etc.).
For the hardware, it also supports an I/O expansion bus. The I/O expansion bus can be used to implement various I/O functions such as D/I, D/O, A/D, D/A, Timer/Counter, UART, flash memory, battery backup SRAM, ASIC key & other I/O functions. Nearly all kinds of I/O functions can be implemented by this bus but the bus can support only one board. There are more than 50 boards available for µPAC-7186E, you can choose one of them to expand hardware features.

Tips & Warnings

In the descriptions in this manual, “µPAC-7186E” means “µPAC-7186E” and “µPAC-7186PEX” series product. The only difference between the two series product is that the µPAC-7186PEX can receive power from an Ethernet cable when added to a PoE enabled network; the µPAC-7186E can receive power from power input terminal only.

The features of µPAC-7186PEX differ from µPAC-7186E

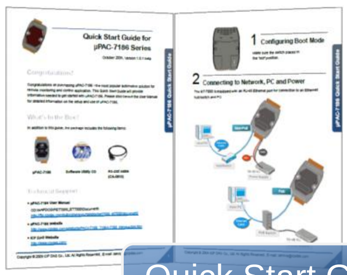
Compared to µPAC-7186E, µPAC-7186PEX equips with an integrated IEEE 802.3af Power-over-Ethernet (PoE) that allows power and data to be carried over a single Ethernet cable, so a device can operate solely from the power it receives through the data cable. This innovation allows greater flexibility in office design, higher efficiency in systems design, and faster turnaround time in set-up and implementation.

The features of µPAC-7186EX-FD differ from µPAC-7186E

Compared to µPAC-7186E, uPAC-718EX-FD equips with an extra 64MB flash memory. By using the built-in MFS (MiniOS7 File System) library, you can freely read/write files from/to the 64MB flash memory.
Simply with the uPAC-786EX-FD, many kinds of data-logging applications become a piece of cake! For example, log analog signals with timeline, or log RS-232/485 data for further analysis.

Package List

One µPAC-7186E module


Quick Start Guide

Software Utility CD

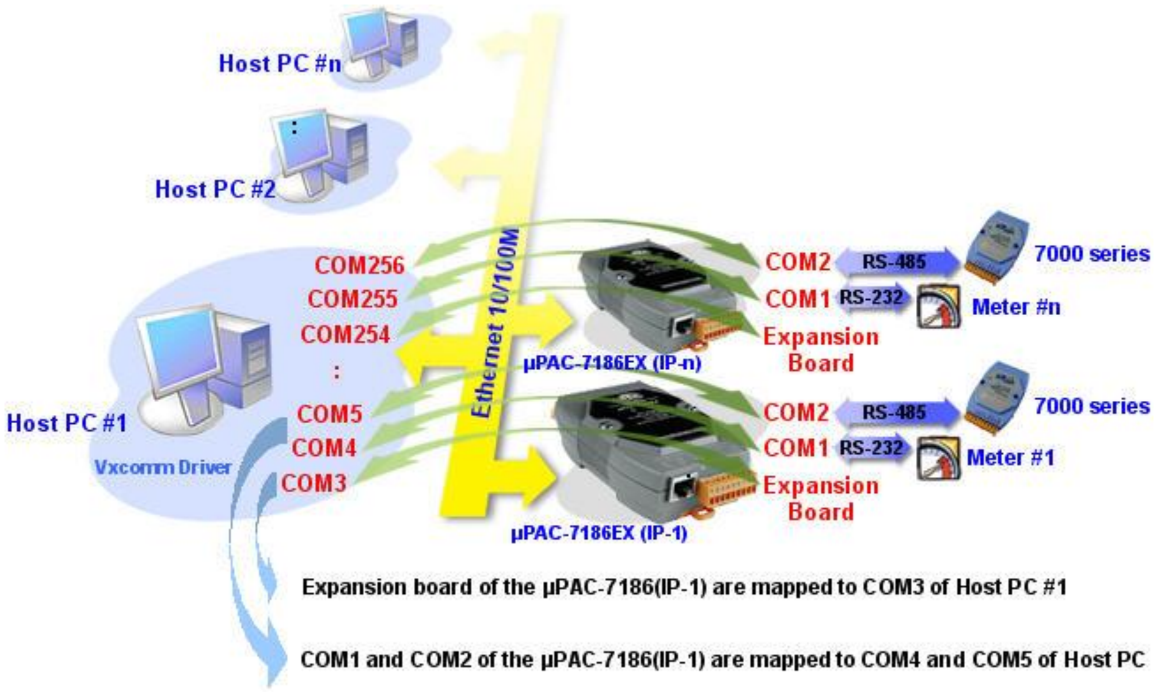
RS-232 Cable

1.1. Features

➤ **Support for Virtual COM technology**

Using the VxComm technology, PC can create virtual COM ports to map the RS-232, RS-485 of the µPAC-7186E. The software running on the PC can operate the virtual COM ports like a standard COM port to access the serial devices connect to the µPAC-7186E. That is to say, the original software developed for the serial devices can access the serial devices via the Ethernet/Internet without any modification.

Each PC can control up to 256 COM ports (including real COM ports). Using the I/O expansion board, each µPAC-7186E can have up to 8 COM ports.



➤ **Support Modbus Protocol**

Using the Modbus firmware, µPAC-7186E offers following Modbus features:

* Modbus/TCP/RTU/ASCII slave

* Modbus/TCP/RTU/ASCII master

* Gateway for Modbus/TCP to Modbus/RTU

➤ **Easy-to-use software development tool kits (using C language)**

If the default firmware does not totally fulfill the user's application needs, custom firmware can be easily developed with using the SDK (Xserver, Modbus library) provided by ICP DAS.

➤ **Ethernet protocols**

TCP, UDP, IP, ICMP, ARP

➤ **Support web configuration**

µPAC-7186E has a built-in web server for configuration. You can use standard web browsers (such as IE, Netscape, Firefox,., .etc) to configure its Ethernet and COM ports configurations.

➤ **Remote configuration/maintenance**

µPAC-7186E can be operated via the Ethernet (TCP/IP or UDP) or RS-232, to allow tasks such as downloading programs, configuration, updating the MiniOS7, etc.

➤ **Built-in watchdog timer (WDT)**

µPAC-7186E include an internal watchdog timer (WDT). The watchdog timer will trigger a system reset if the main program fails or neglects to regularly service the watchdog. The intention is to bring the system back from the hung state into normal operation.

➤ **I/O expansion bus interface**

The µPAC-7186E supports the use of an I/O expansion bus to add a single I/O Expansion Board. ICP DAS provides all function libraries for I/O Expansion Boards to enable easy use of the I/O Expansion Board functions.

➤ Support PoE (for µPAC-7186PEX series only)

The µPAC-7186PEX feature true IEEE 802.3af-compliant (classification, Class 1) Power over Ethernet (PoE) using both Ethernet pairs (Category 5 Ethernet cable). µPAC-7186PEX can receive power from an auxiliary power sources like AC adapters and battery in addition to the PoE enabled network. This is a desirable feature when the total system power requirements exceed the PSE's load capacity. Furthermore, with the auxiliary power option, the µPAC-7186PEX can be used in a standard Ethernet (non-PoE) system.

➤ MiniOS7 file system (MFS) (for µPAC-7186EX-FD series only)

Can dynamically read/write/append data to files continuously

The 64MB flash memory is divided to 2 disks, each disk can store 456 files max. You can create files and then write/append data to it. Then read data in the file and forward to PC for posted analysis when the data is complete collected.

Provides C language API

Following functions are similar to the functions that turbo C and Borland C provide. This helps users to be familiar to MFS with a short learning curve.

mfs_OpenFile, mfs_CloseFile, mfs_ReadFile, mfs_WriteFile, mfs_Gets, mfs_Puts, mfs_Getc, mfs_Putc, mfs_EOF, mfs_Seek, mfs_Tell, mfs_DeleteFile, mfs_DeleteAllFiles, mfs_GetFileInfoByName, mfs_GetFileInfoByNo, … etc.

Writing Verification

Data written to flash memory are read back to verify its correction.
The function can be disabled to increase writing speed. But for data safety, we recommend users to enable the function.

Automate file system recovery in the event of unexpected reset or power losses

When an unexpected reset or power loss occurs, closed files, and files opened for reading are never at risk. Only writing data has risk to be lost.

MFS writes data to the flash memory just after executing writing functions (such as mfs_WriteFile, mfs_Puts, mfs_Putc, etc.). And meanwhile, MFS stores important information (such as file name, pointer, flash location, etc) to NVRAM (non-volatile random access memory).

When an unexpected reset or power loss occurs, only data written since the last writing operation (such as mfs_WriteFile, mfs_Puts, mfs_Putc, etc.) could be lost. After the MFS reboots, it refers the information stored in the NVRAM to restores the file system. The un-closed writing file will be automatically closed and all its data written before the last writing operation will be safe.

1.2. Specifications

1.2.1. µPAC-7186EX/µPAC-7186EXD

CPU	
CPU	80186 or compatible (16-bit and 80 MHz)
SRAM	512 KB
Flash	512 KB, erase unit is one sector (64K bytes); 100,000 erase/write cycles.
EEPROM	16 KB, data retention: 40 years; 1,000,000 erase/write cycles.
NVRAM	31 Bytes (Battery backup, data valid up to 10 years)
RTC (Real Time Clock)	RTC Provide seconds, minutes, hours, date of week/month; month and year, valid from 1980 to 2079
64-bit Hardware Serial Number	Yes
Built-in Watchdog Timer	Yes (0.8 second)

Communication Interface	
COM1	RS-232 (TxD, RxD, CTS, RTS and GND); Non-isolated
COM2	RS-485 (D2+, D2-; self-tuner ASIC inside); Non-isolated
Ethernet Port	10/100Base-TX Ethernet Controller (Auto-negotiating, Auto_MDIX, LED indicator)

COM Port Formats	
Data bit	7, 8
Parity	Even, Odd, None
Stop bit	1

LED Display	
5-Digit 7 Segment LED Display	Yes (for µPAC-7186EXD only)
System LED Indicator	Yes

Hardware Expansion	
I/O Expansion Bus	Yes
User Defined I/O Pins	14 Pins

Dimensions	
W x H x D	72 mm x 123 mm x 35 mm

Operating Environment	
Operating Temperature	-25°C ~ +75°C
Storage Temperature	-40°C ~ +80°C
Relative Humidity	5 ~ 90% RH, non-condensing

Power	
Protection	Power reverse polarity protection
Frame Ground for ESD Protection	Yes
Required Supply Voltage	+10 ~ +30 V_{DC} (non-regulated)
Power consumption	1.5 W for µPAC-7186EX 2.5 W for µPAC-7186EXD

1.2.2. µPAC-7186PEX/µPAC-7186PEXD

CPU	
CPU	80186 or compatible (16-bit and 80 MHz)
SRAM	512 KB
Flash	512 KB, erase unit is one sector (64K bytes); 100,000 erase/write cycles.
EEPROM	16 KB, data retention: 40 years; 1,000,000 erase/write cycles.
NVRAM	31 Bytes (Battery backup, data valid up to 10 years)
RTC (Real Time Clock)	RTC Provide seconds, minutes, hours, date of week/month; month and year, valid from 1980 to 2079
64-bit Hardware Serial Number	Yes
Built-in Watchdog Timer	Yes (0.8 second)

Communication Interface	
COM1	RS-232 (TxD, RxD, CTS, RTS and GND); Non-isolated
COM2	RS-485 (D2+, D2-; self-tuner ASIC inside); Non-isolated
Ethernet Port	10/100Base-TX Ethernet Controller (Auto-negotiating, Auto_MDIX, LED indicator)

COM Port Formats	
Data bit	7, 8
Parity	Even, Odd, None
Stop bit	1

LED Display	
5-Digit 7 Segment LED Display	Yes (for µPAC-7186PEXD only)
System/PoE LED Indicator	Yes (Red/Green)

Hardware Expansion	
I/O Expansion Bus	Yes
User Defined I/O Pins	14 Pins

Dimensions	
W x H x D	72 mm x 123 mm x 35 mm

Operating Environment	
Operating Temperature	-25°C ~ +75°C
Storage Temperature	-40°C ~ +80°C
Relative Humidity	5 ~ 90% RH, non-condensing

Power	
IEEE 802.3af	Class 1
Protection	Power reverse polarity protection
Required Supply Voltage	Powered by Power-Over-Ethernet (PoE) or auxiliary power +12 ~ 48 V_{DC} (non-regulated)
Power consumption	1.5 W for µPAC-7186PEX 2.5 W for µPAC-7186PEXD

1.2.3. µPAC-7186EX-SM/µPAC-7186EXD-SM

CPU	
CPU	80186 or compatible (16-bit and 80 MHz)
SRAM	640 KB
Flash	512 KB, erase unit is one sector (64K bytes); 100,000 erase/write cycles.
EEPROM	16 KB, data retention: 40 years; 1,000,000 erase/write cycles.
NVRAM	31 Bytes (Battery backup, data valid up to 10 years)
RTC (Real Time Clock)	RTC Provide seconds, minutes, hours, date of week/month; month and year, valid from 1980 to 2079
64-bit Hardware Serial Number	Yes
Built-in Watchdog Timer	Yes (0.8 second)

Communication Interface	
COM1	RS-232 (TxD, RxD, CTS, RTS and GND); Non-isolated
COM2	RS-485 (D2+, D2-; self-tuner ASIC inside); Non-isolated
Ethernet Port	10/100Base-TX Ethernet Controller (Auto-negotiating, Auto_MDIX, LED indicator)

COM Port Formats	
Data bit	7, 8
Parity	Even, Odd, None
Stop bit	1

LED Display	
5-Digit 7 Segment LED Display	Yes (for µPAC-7186EXD-SM only)
System LED Indicator	Yes

Hardware Expansion	
I/O Expansion Bus	Yes
User Defined I/O Pins	14 Pins

Dimensions	
W x H x D	72 mm x 123 mm x 35 mm

Operating Environment	
Operating Temperature	-25°C ~ +75°C
Storage Temperature	-40°C ~ +80°C
Relative Humidity	5 ~ 90% RH, non-condensing

Power	
Protection	Power reverse polarity protection
Frame Ground for ESD Protection	Yes
Required Supply Voltage	+10 ~ +30 V_{DC} (non-regulated)
Power consumption	µPAC-7186EX-SM: 2W µPAC-7186EXD-SM: 3W

1.2.4. µPAC-7186EX-FD/µPAC-7186EXD-FD

CPU	
CPU	80186 or compatible (16-bit and 80 MHz)
SRAM	512 KB
Flash	512 KB, erase unit is one sector (64K bytes); 100,000 erase/write cycles.
Flash Disk	64M x 8 Bit, data retention: 10 years; 100,000 erase/write cycles.
EEPROM	16 KB, data retention: 40 years; 1,000,000 erase/write cycles.
NVRAM	31 Bytes (Battery backup, data valid up to 10 years)
RTC (Real Time Clock)	RTC Provide seconds, minutes, hours, date of week/month; month and year, valid from 1980 to 2079
64-bit Hardware Serial Number	Yes
Built-in Watchdog Timer	Yes (0.8 second)

Communication Interface	
COM1	RS-232 (TxD, RxD, CTS, RTS and GND); Non-isolated
COM2	RS-485 (D2+, D2-; self-tuner ASIC inside); Non-isolated
Ethernet Port	10/100Base-TX Ethernet Controller (Auto-negotiating, Auto_MDIX, LED indicator)

COM Port Formats	
Data bit	7, 8
Parity	Even, Odd, None
Stop bit	1

LED Display	
5-Digit 7 Segment LED Display	Yes (for µPAC-7186EXD-FD only)
System LED Indicator	Yes

Hardware Expansion	
I/O Expansion Bus	Yes
User Defined I/O Pins	14 Pins

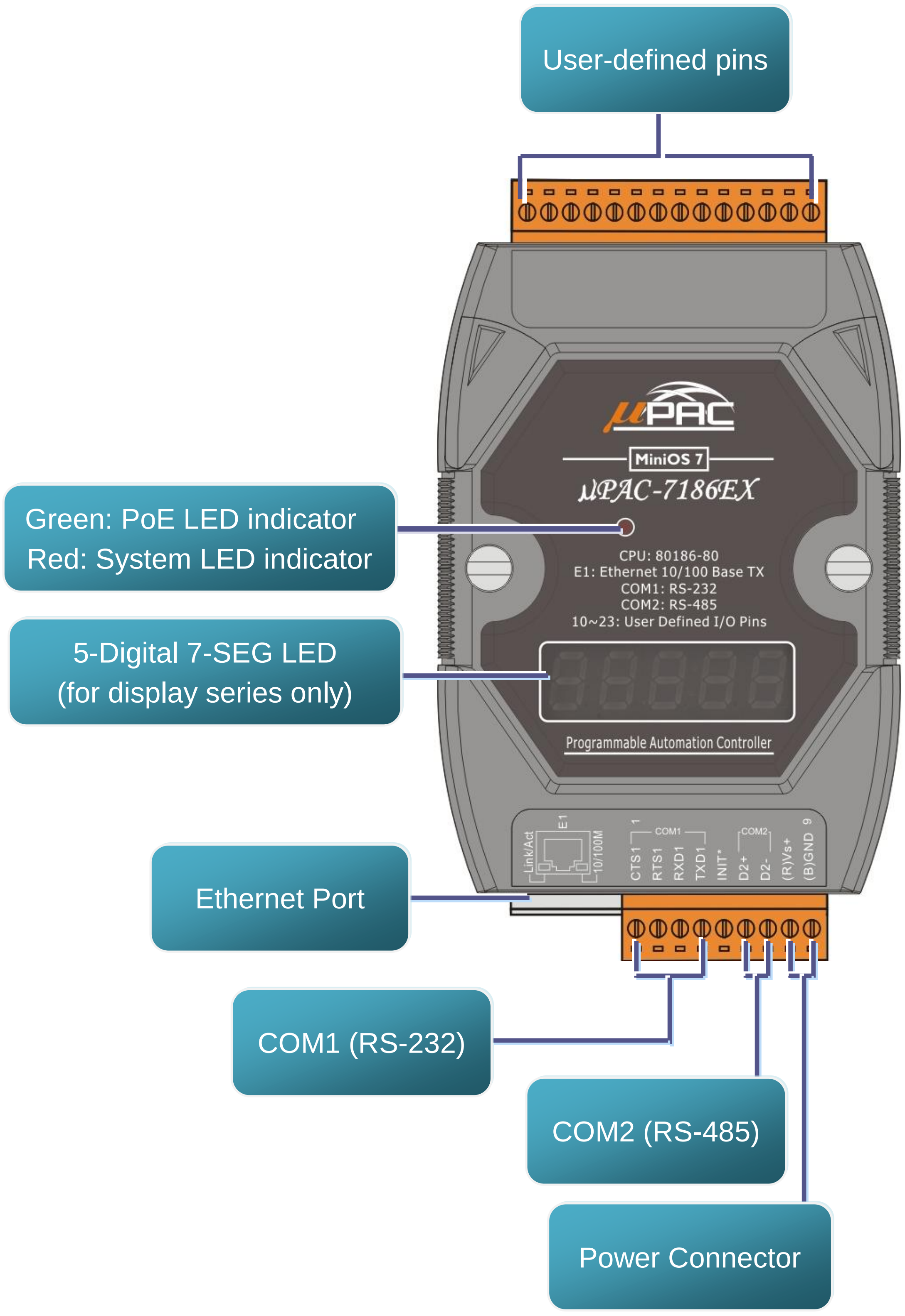
Dimensions	
W x H x D	72 mm x 123 mm x 35 mm

Operating Environment	
Operating Temperature	-25°C ~ +75°C
Storage Temperature	-40°C ~ +80°C
Relative Humidity	5 ~ 90% RH, non-condensing

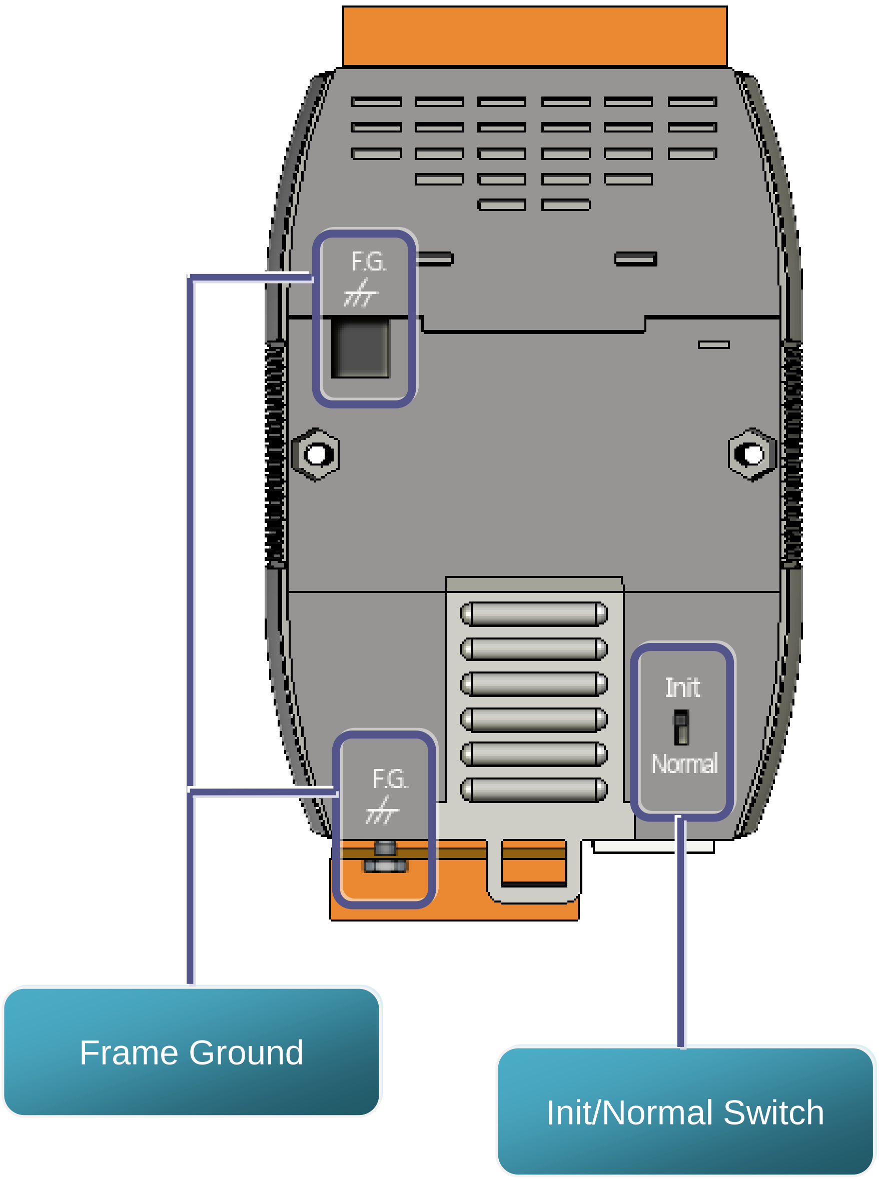
Power	
Protection	Power reverse polarity protection
Frame Ground for ESD Protection	Yes
Required Supply Voltage	+10 ~ +30 V_{DC} (non-regulated)
Power consumption	µPAC-7186EX-FD: 2W µPAC-7186EXD-FD: 3W

1.3. Overview

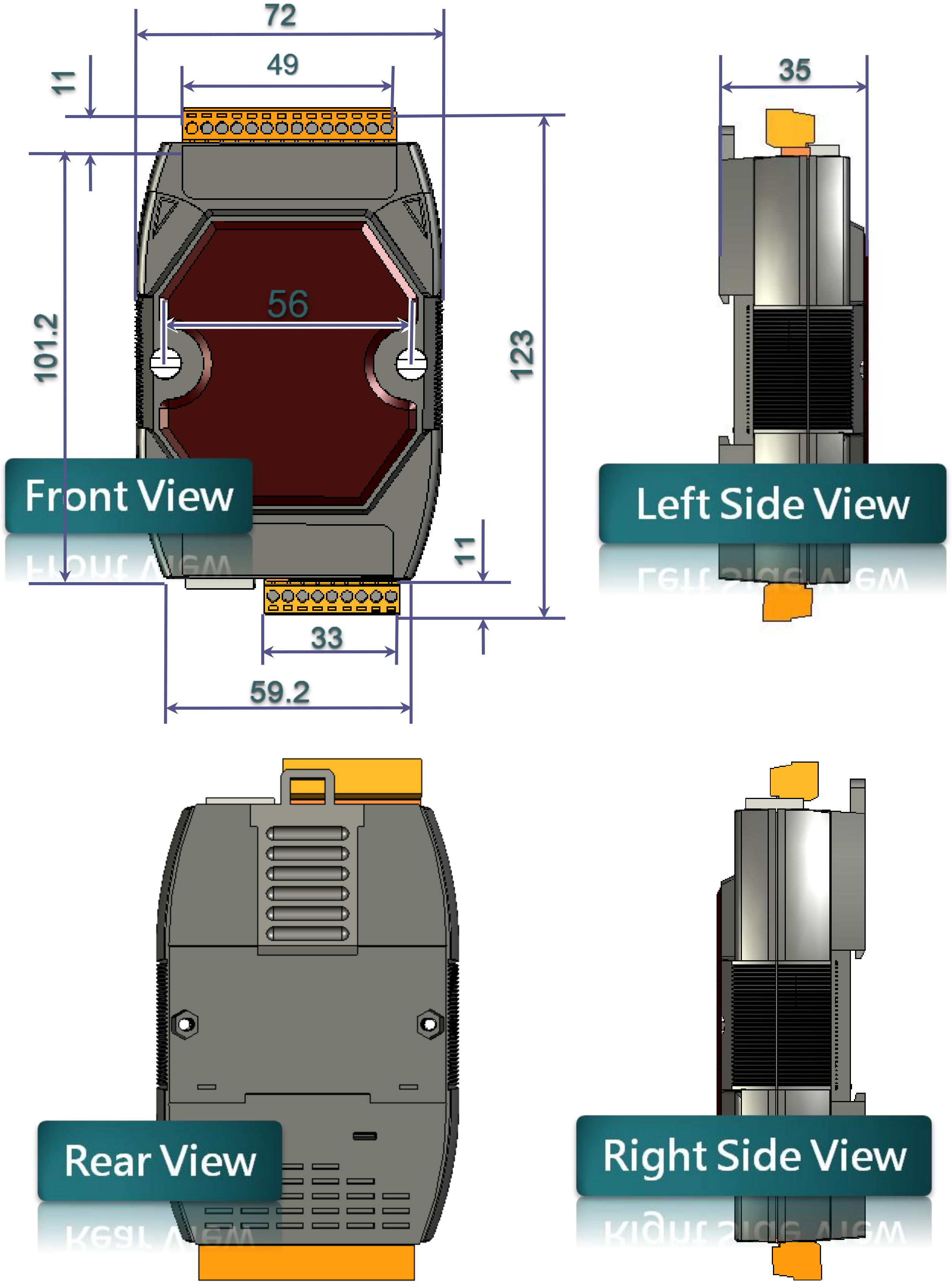
The µPAC-7186E front panel contains the Ethernet port, connectors and LEDs.



The µPAC-7186E back panel contains the frame ground and Init/Normal Switch

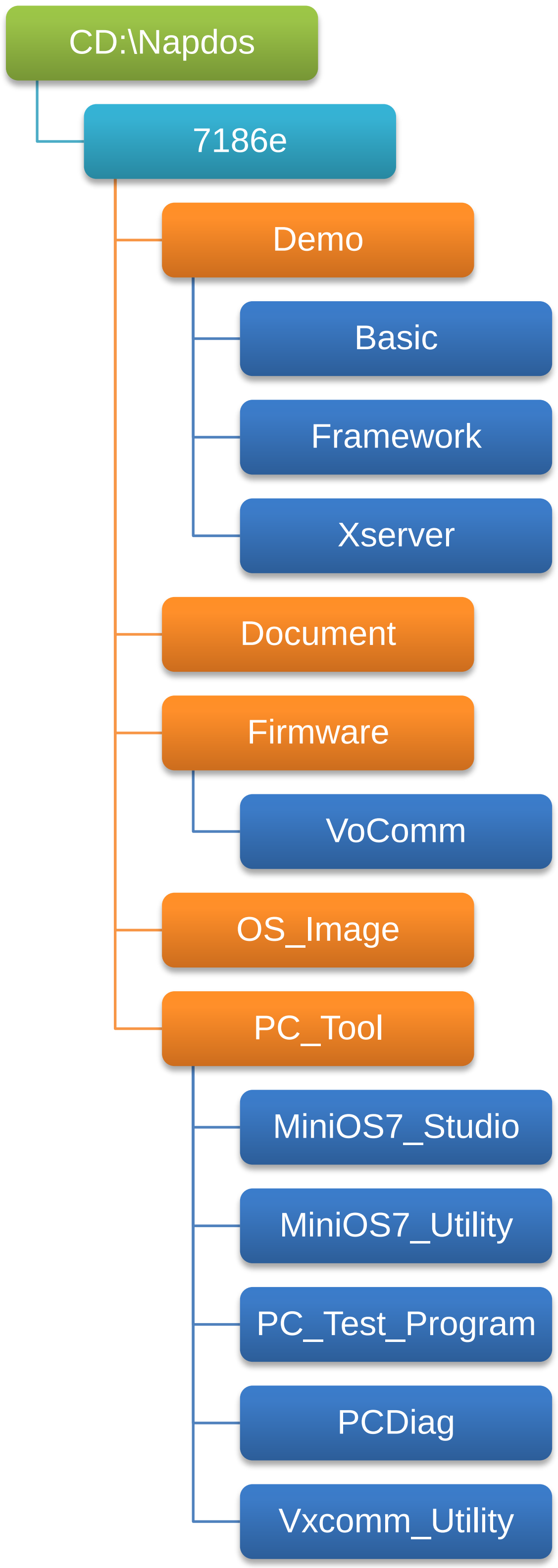


1.4. Dimensions



1.5. Companion CD

This package comes with a CD that provides drivers, software utility, all of the required documentations…, etc. All of them are listed below.



2. Getting Started

If you are a new user, begin with this chapter, it includes a guided tour that provides a basic overview of installing, configuring and using the µPAC-7186E.

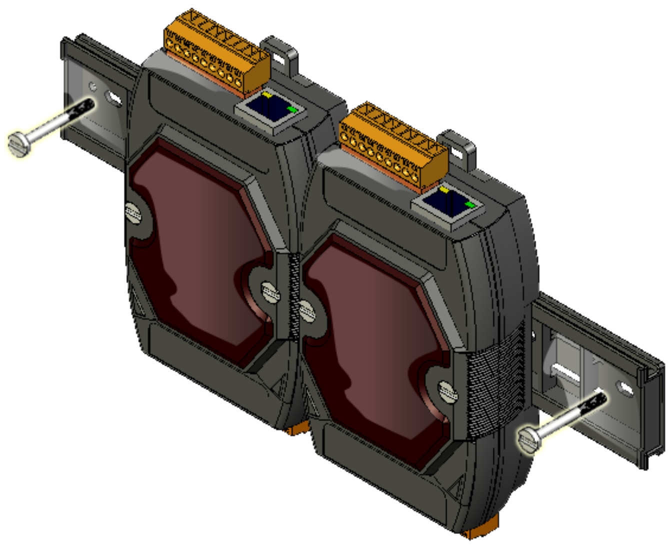
2.1. Hardware Installation

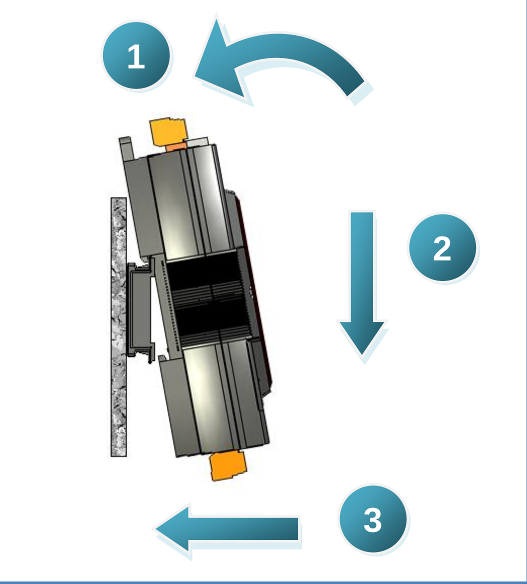
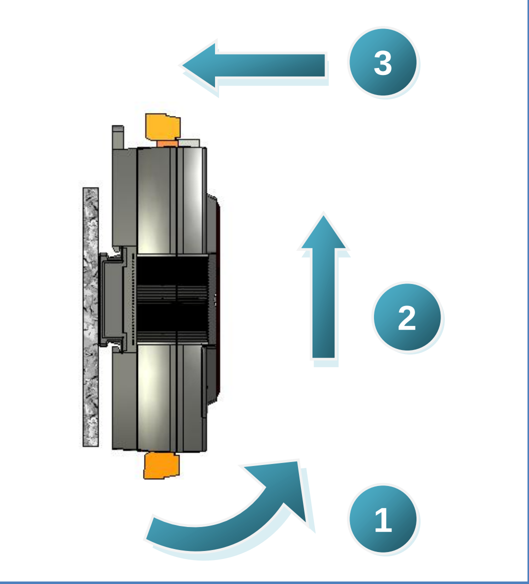
2.1.1. Mounting the Hardware

The µPAC-7186E can be mounted with the bottom of the chassis on the DIN rail, the wall or piggyback.

DIN Rail mounting

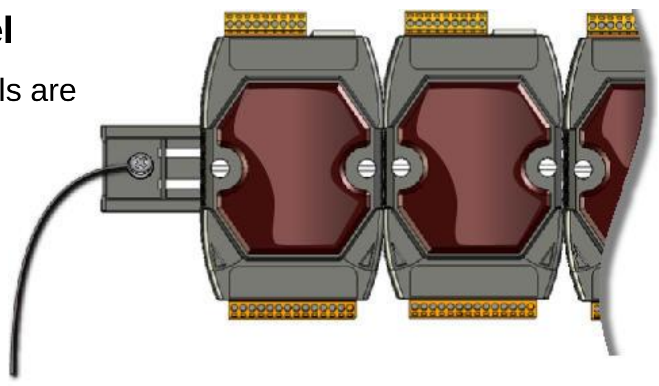
The µPAC-7186E has simple rail clips for mounting reliably on a standard 35 mm DIN rail.



Mounting on DIN Rail	Remounting from DIN Rail
	

Din Rail Mountable Model

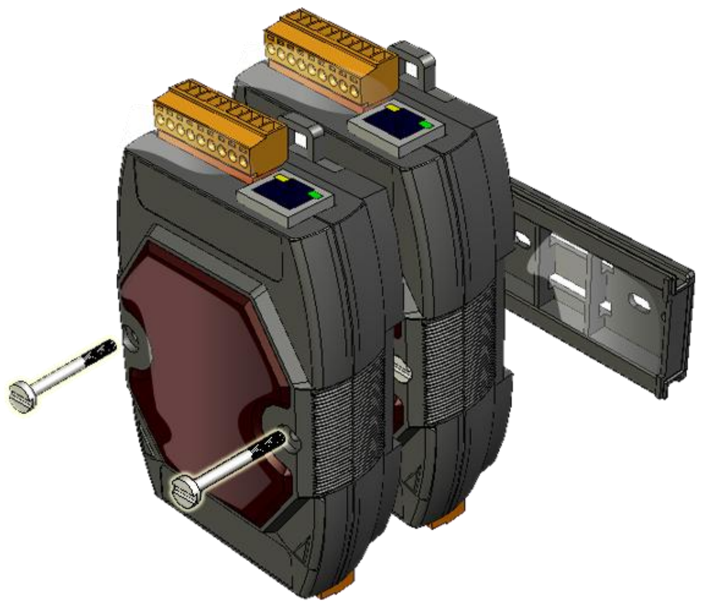
Three Din rail mountable models are available to mount a variety of ICP DAS devices. Each is made of stainless steel and has a ground wire at the end.



Part number	Maximum number of modules	Dimensions
DRS-125	2	125 mm x 35 mm
DRS-240	3	240 mm x 35 mm
DRS-360	5	360 mm x 35 mm

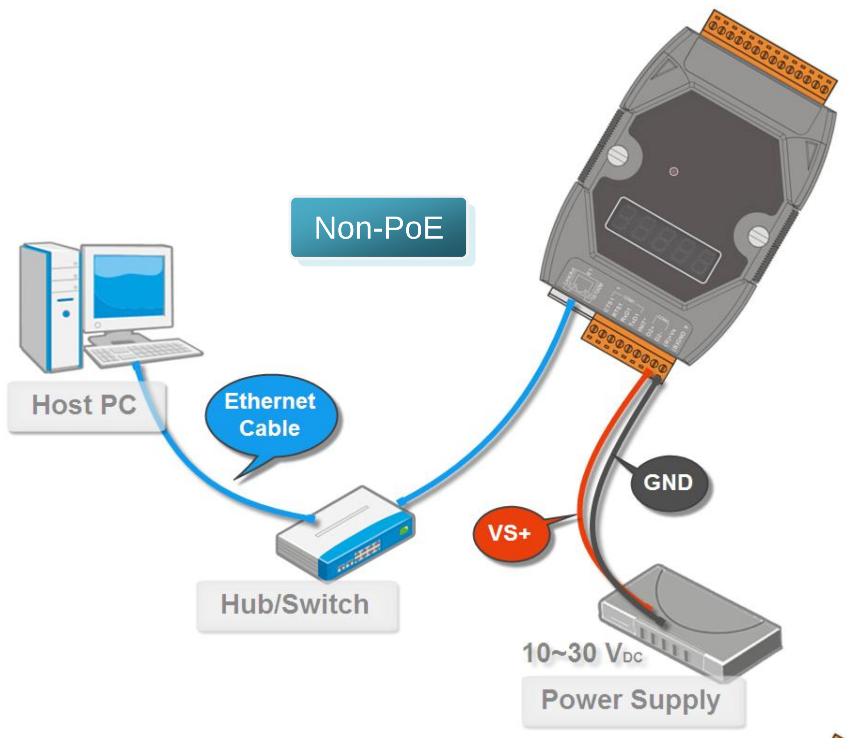
Piggyback Mounting

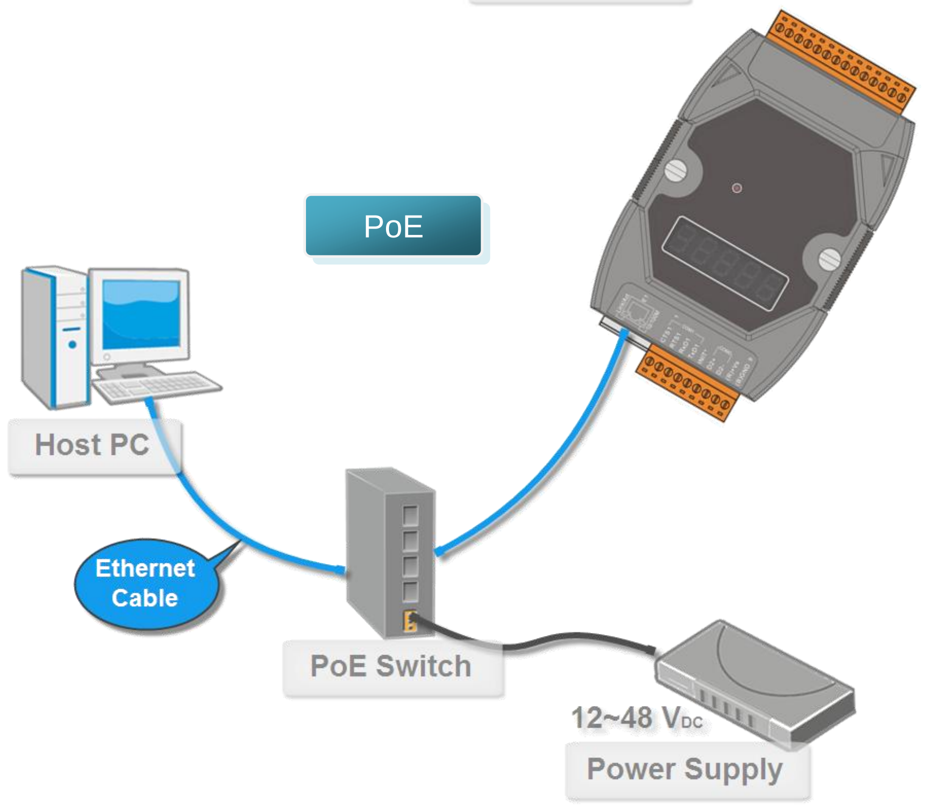
The µPAC-7186E has two holes on both sides for piggyback mounting



2.1.2. Setting up the Power Supply and Networking to PC

The μPAC-7186E is equipped with an RJ-45 Ethernet port for connection to an Ethernet hub/switch and PC



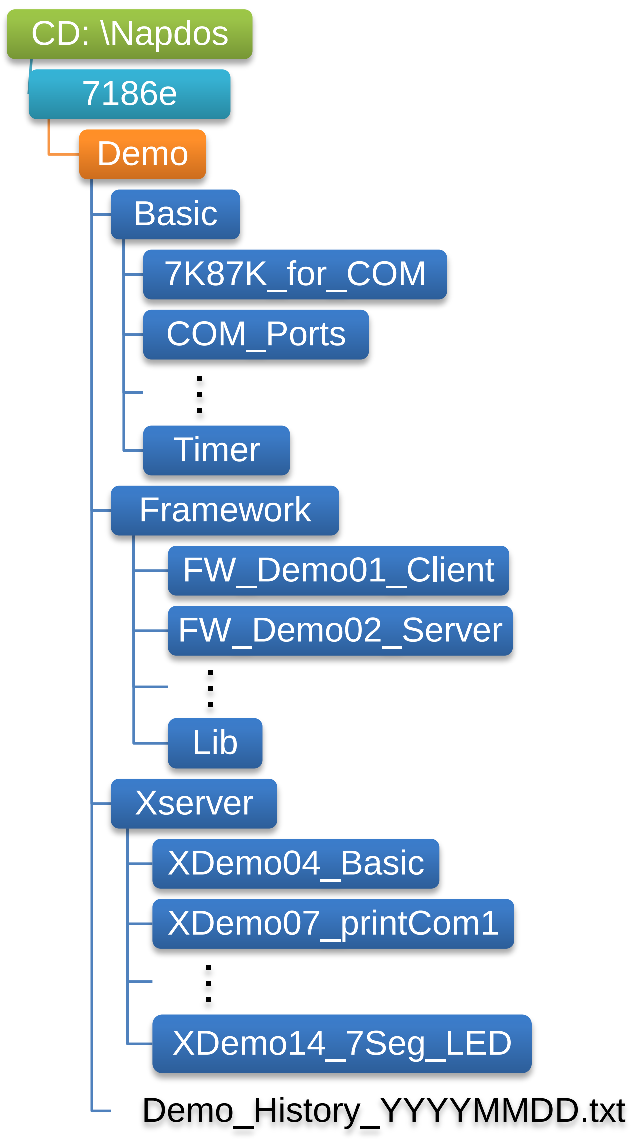


2.2. Software Installation

All software resources are included on the companion CD. The following steps will help you to install the resources and software from the companion CD.

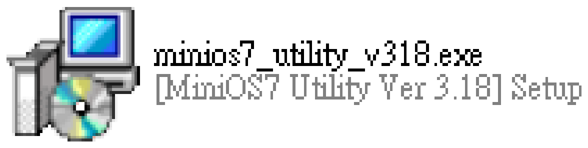
Step 1: Copy the “Demo” folder from the companion CD to PC

The folder is an essential resource for users developing custom programs which contains libraries, header files, demo programs and more information as shown below.



Step 2: Install the MiniOS7 Utility

The MiniOS7 Utility is a useful tool that provides a quick and easy way to update OS image or firmware, configure Ethernet settings, and download files to µPAC-7186E from PC.



minios7_utility_v318.exe
[MiniOS7 Utility Ver 3.18] Setup

The MiniOS7 Utility can be obtained from companion CD or our FTP site:

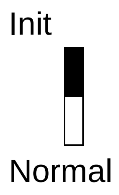
CD:\Napdos\minios7\utility\minios7_utility\
ftp://ftp.icpdas.com/pub/cd/8000cd/napdos/minios7/utility/minios7_utility/

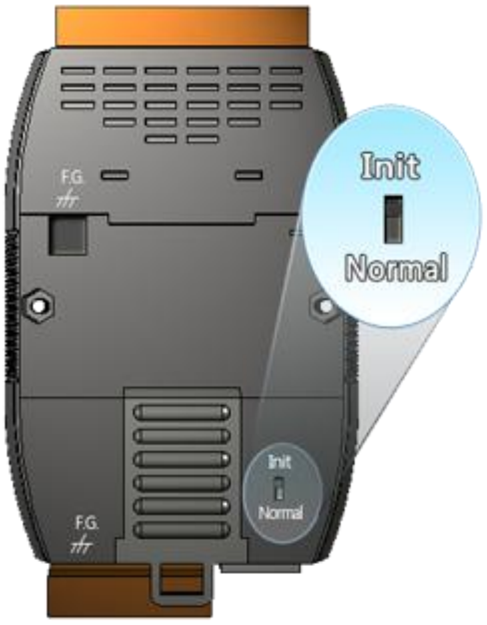
2.3. Configuring the Boot Mode

The μPAC-7186E has two operating modes that can be determined by the switch mechanism on the chassis.

Init Mode

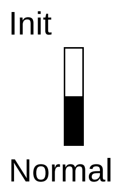
Init mode is a way to use MiniOS7 configuration mode





Normal Mode

Normal mode: Firmware running mode



Normal mode is the default mode of operation and the one you will use most of the time. Use this mode for more tasks and configurations. Programs also are executed in this mode.

Move the switch to the Normal position after the update is complete

2.4. Using MiniOS7 Utility to download programs

Before you begin using the MiniOS7 Utility to download programs, ensure that the controller is connected to the Host PC.

The download process has the following main steps:

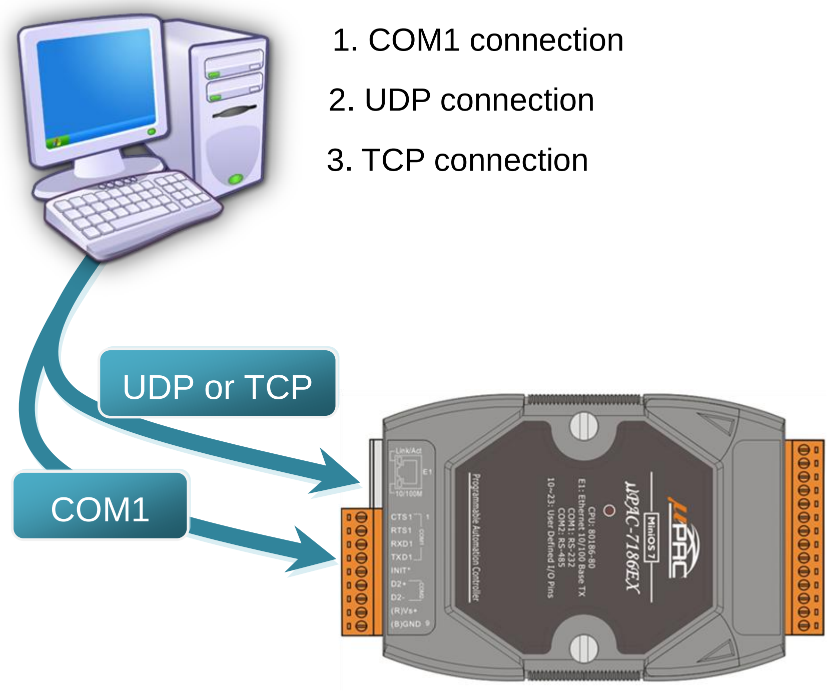
1. Establishing a connection
2. Download and executing programs on the controller
3. Making programs start automatically

All of these main steps will be described in detail later.

2.4.1. Establishing a connection between the PC and the µPAC-7186E

There are three ways to establish a connection between the PC and the µPAC-7186E

1. COM1 connection
2. UDP connection
3. TCP connection

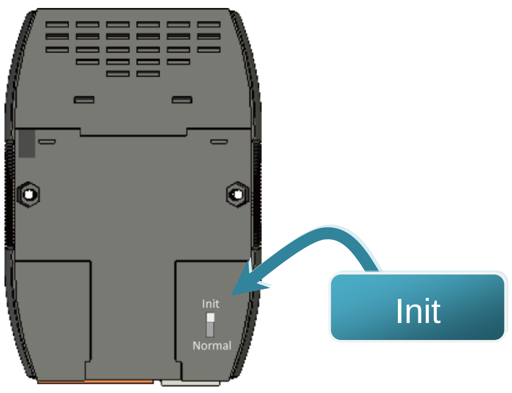


Each of the connection types will be described in detail later.

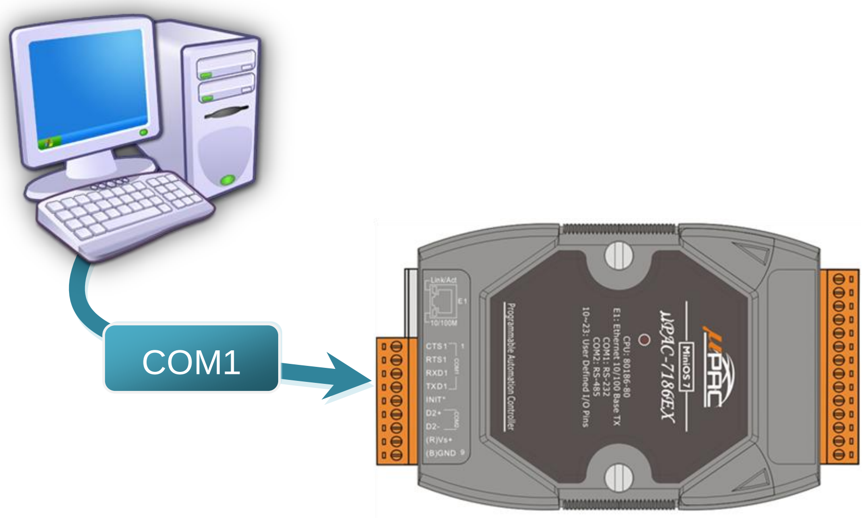
2.4.1.1. Steps to use a COM1 connection

To connect to the PC using a COM1 connection, please follow the instructions below.

Step 1: Turn the switch to "Init" position

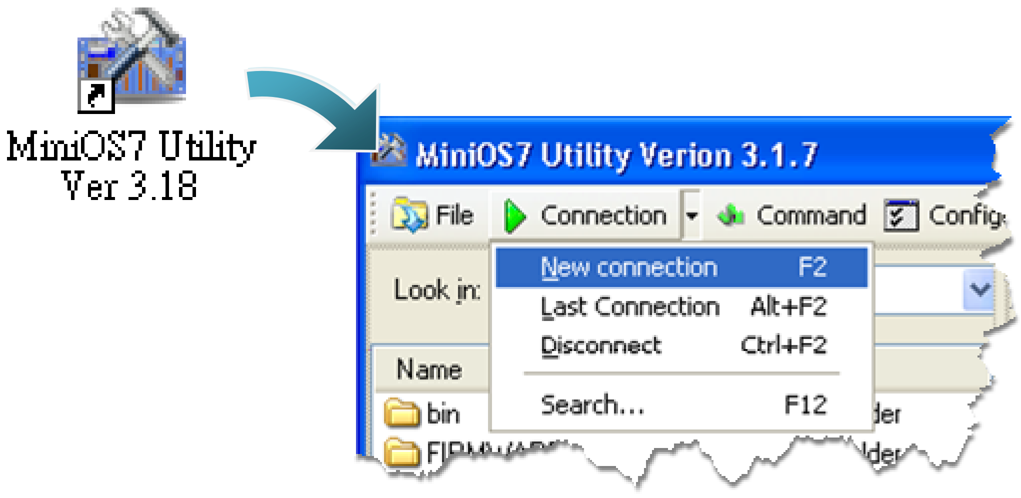


Step 2: Use RS-232 Cable (CA-0910) to connect to PC

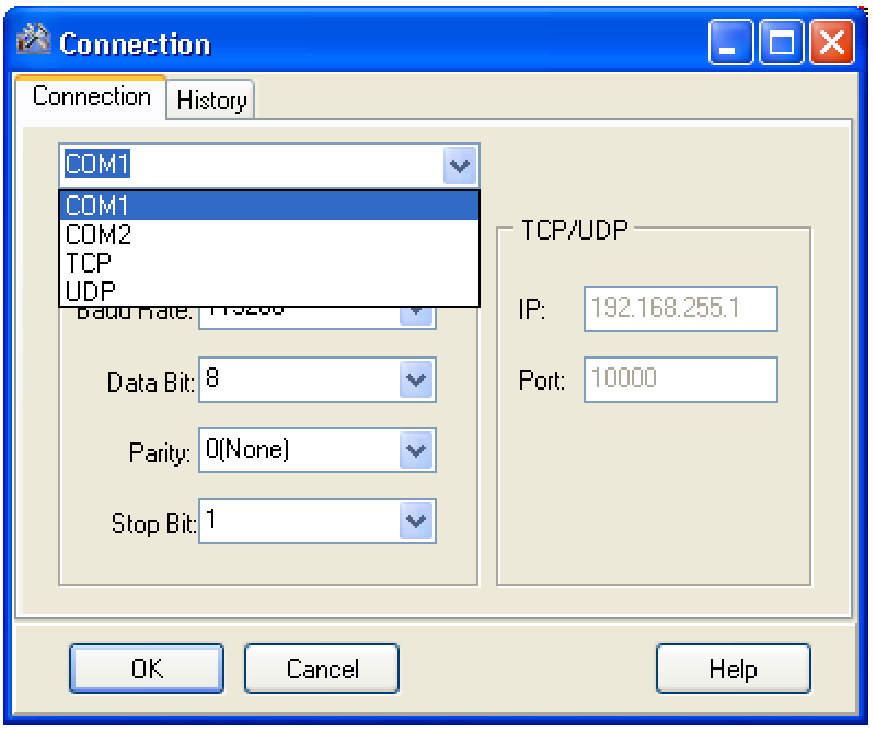


Step 3: Run the MiniOS7 Utility

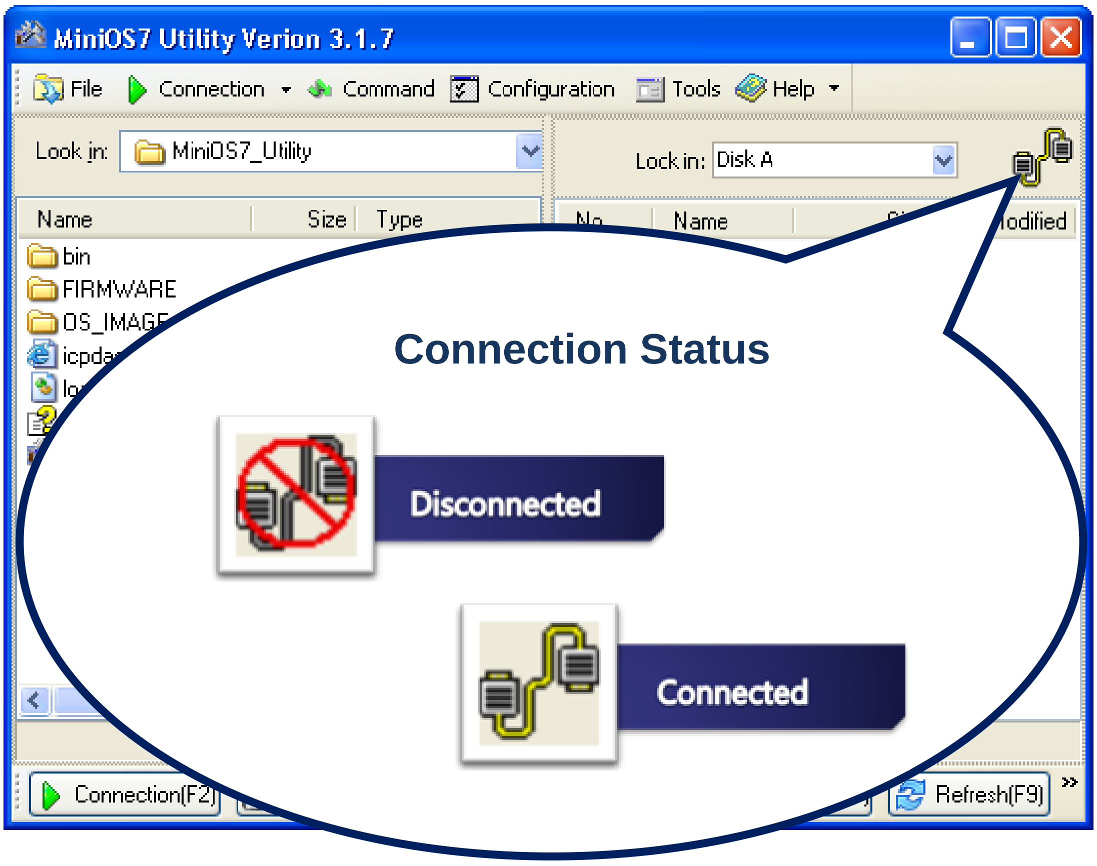
Step 4: Click the "New connection" function from the "Connection" menu



Step 5: On the "Connection" tab of the "Connection" dialog box, select "COM1" from the drop down list, and then click "OK"



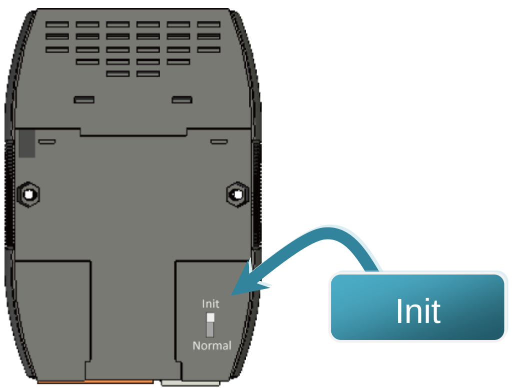
Step 6: The connection has already established



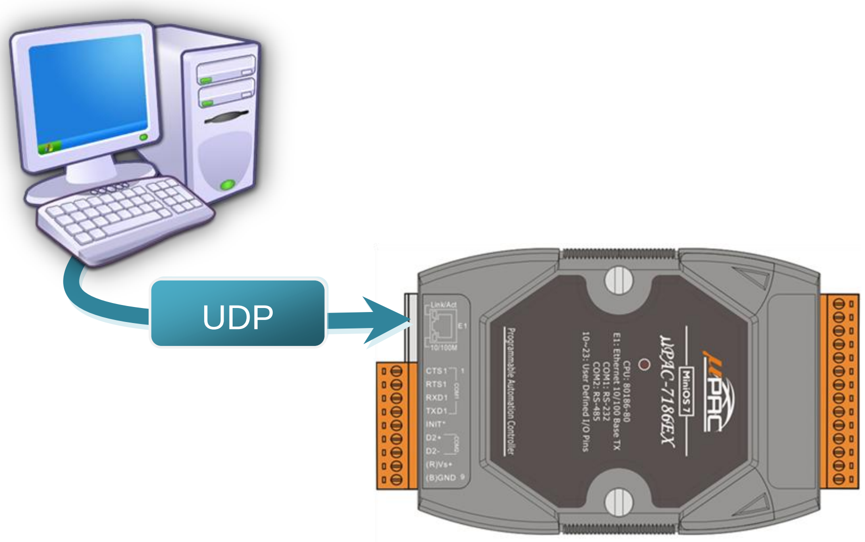
2.4.1.2. Steps to use a UDP connection

To connect to the PC using a UDP connection, please follow the instructions below.

Step 1: Turn the switch to "Init" position

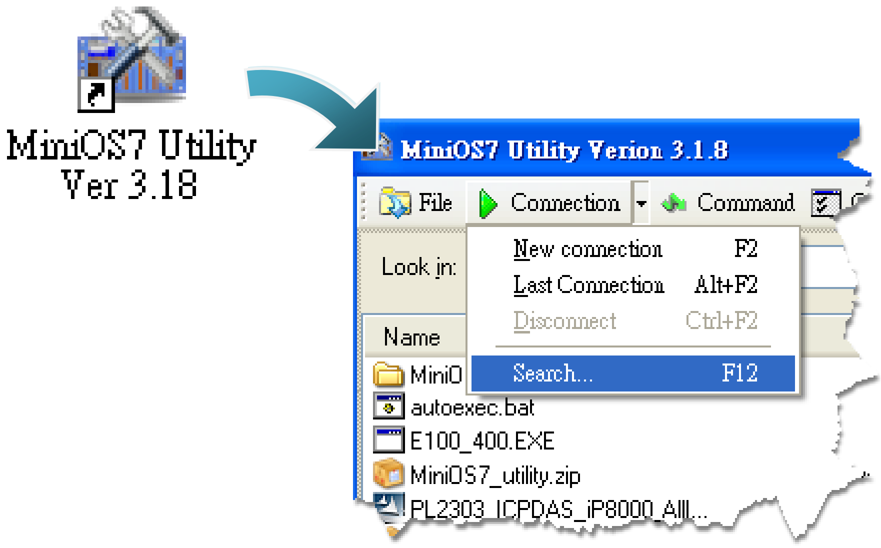


Step 2: Use an Ethernet cable to connect to PC

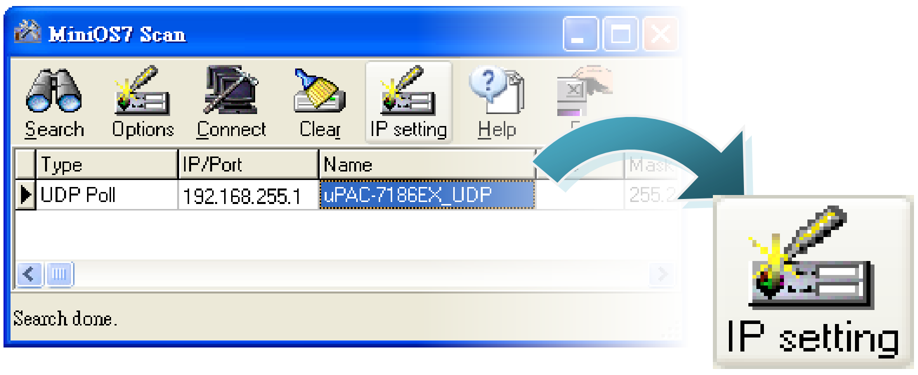


Step 3: Run the MiniOS7 Utility

Step 4: Click the "Search" function from the "Connection" menu



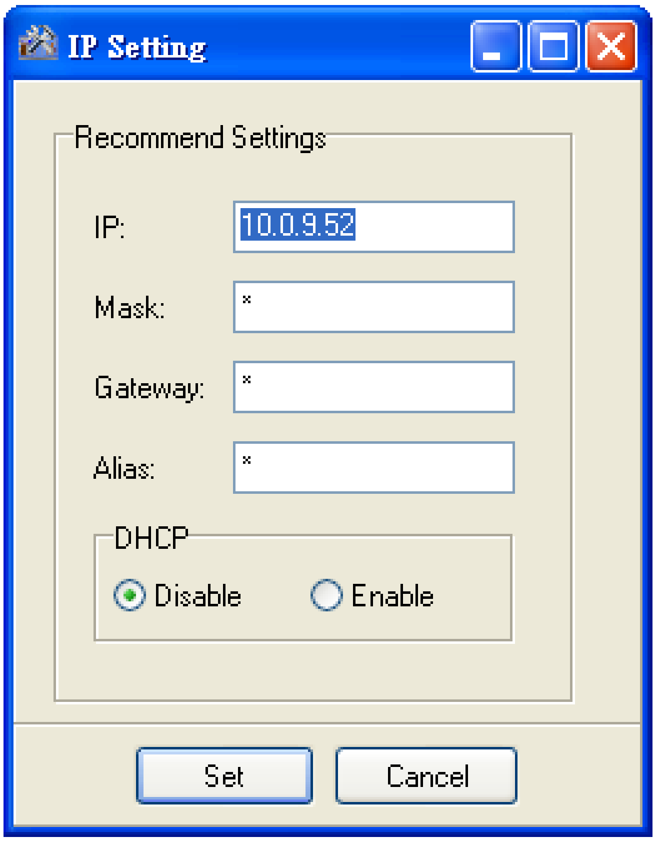
Step 5: On the "MiniOS7 Scan" dialog box, choose the module name from the list and then choose "IP setting" from the toolbar



Type	IP/Port	Name	Mask
UDP Poll	192.168.255.1	uPAC-7186EX_UDP	255.2

Search done.

Step 6: On the "IP Setting" dialog, configure the "IP" settings and then click the "Set" button



IP Setting

Recommend Settings

IP: 10.0.9.52

Mask: *

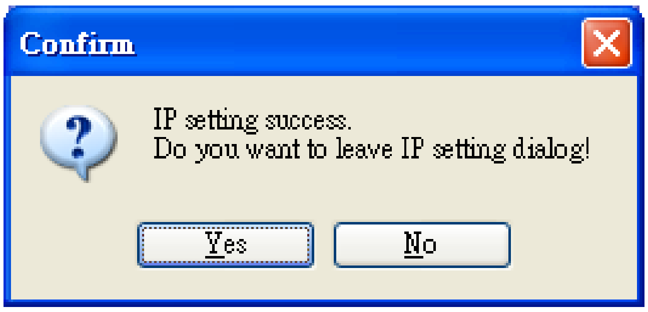
Gateway: *

Alias: *

DHCP

[✓ Disable] Enable

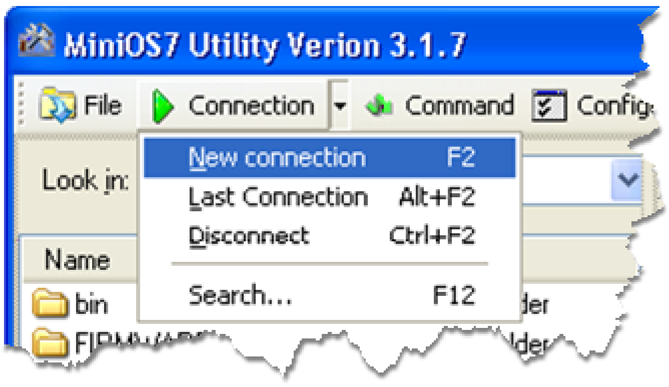
Step 7: On the "Confirm" dialog box, click "Yes"



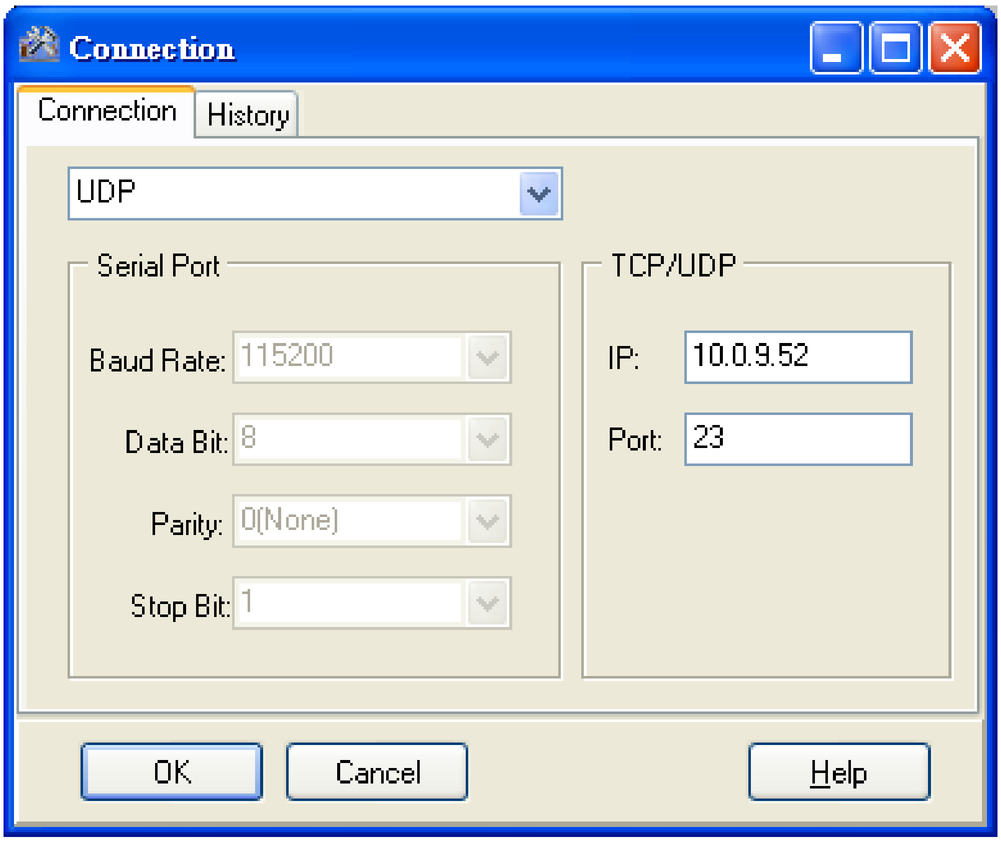
Confirm

IP setting success.
Do you want to leave IP setting dialog!

Step 8: Click the “New connection” function from the “Connection” menu



Step 9: On the “Connection” tab of the “Connection” dialog box, select “UDP” from the drop down list, type the IP address which you are assigned, and then click “OK”



UDP

Baud Rate: 115200

Data Bit: 8

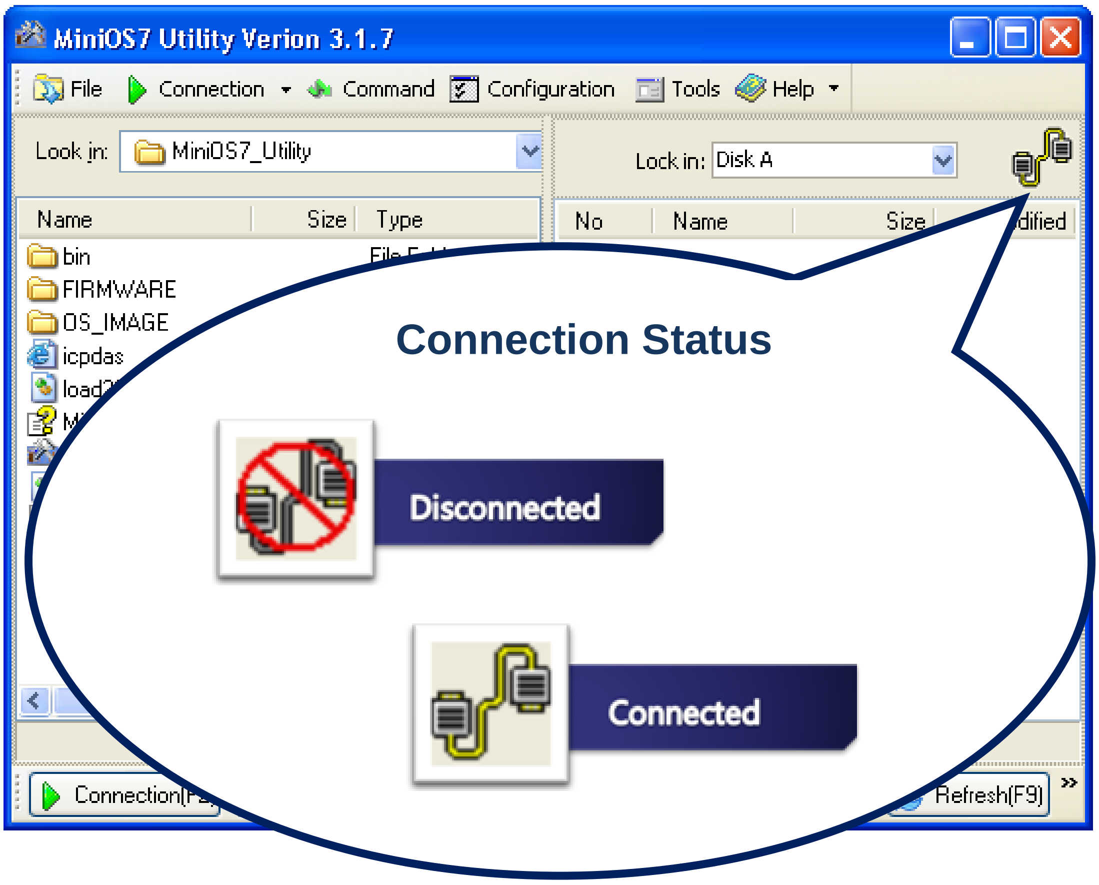
Parity: 0(None)

Stop Bit: 1

IP: 10.0.9.52

Port: 23

Step 10: The connection has already established

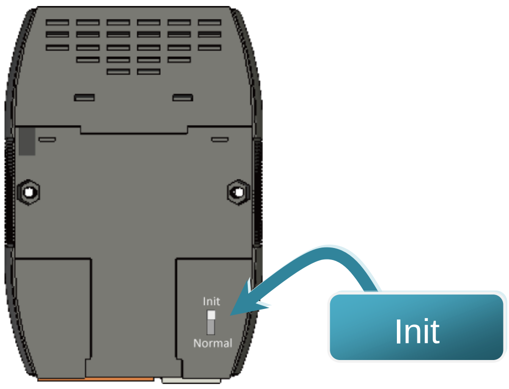


2.4.1.3. Steps to use a TCP connection

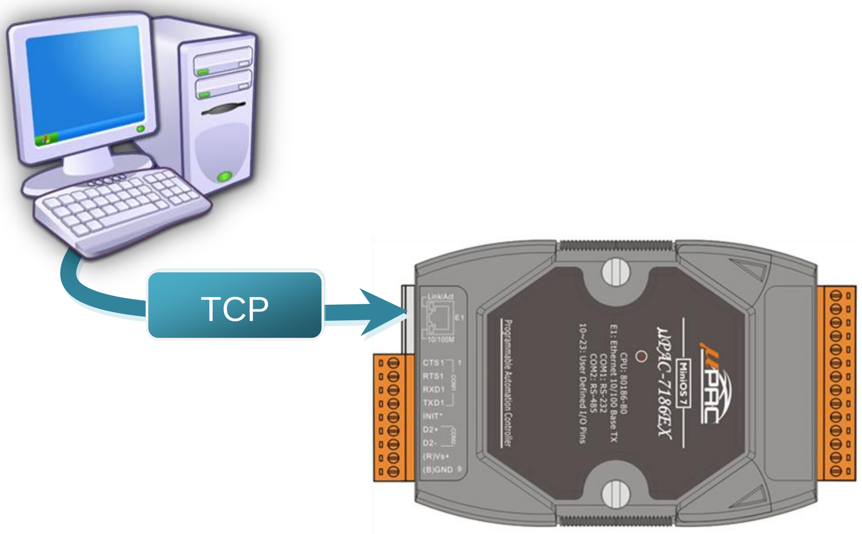
TCP/IP connection only can be created when the module runs VxComm driver, the steps to upload firmware and execute are illustrated in section "2.4.2. Uploading and executing programs on µPAC-7186E"

To connect to the PC using a TCP connection, please follow the instructions below.

Step 1: Turn the switch to "Init" position



Step 2: Use an Ethernet cable to connect to PC



Step 3: Run the VxComm driver

vc6_3231.exe

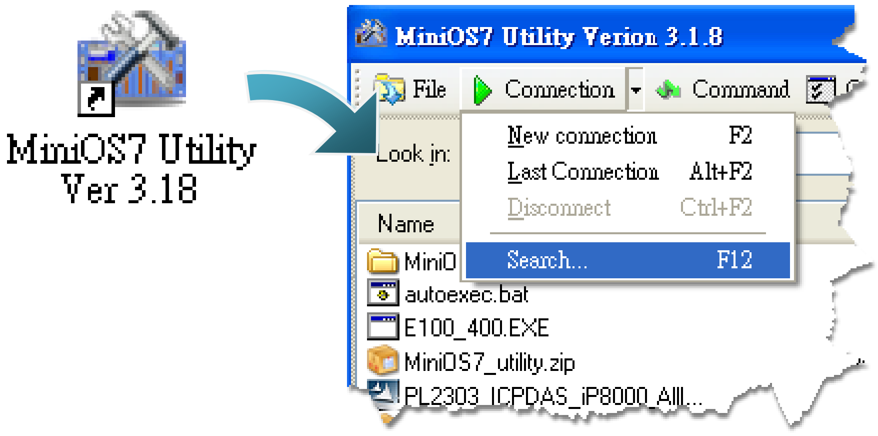
The VxComm driver is located at:

CD:\NAPDOS\7186e\Firmware\VxComm\Server(7186e)\7186EX\

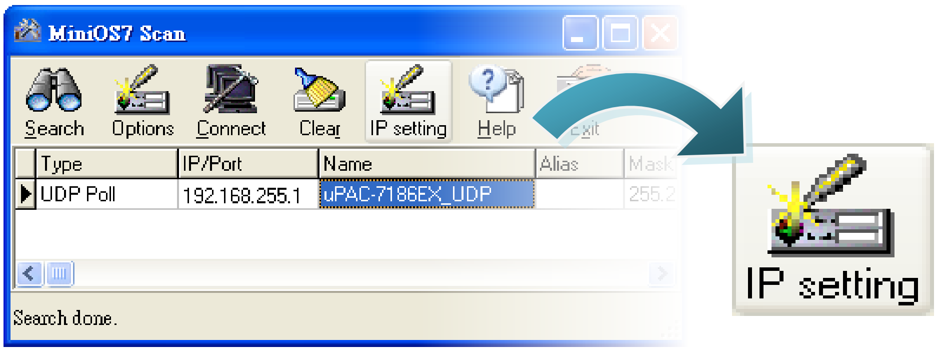
ftp://ftp.icpdas.com/pub/cd/8000cd/napdos/7186e/firmware/vxcomm/server(7186e)/7186ex/

Step 4: Run the MiniOS7 Utility

Step 5: Click the "Search" function from the "Connection" menu



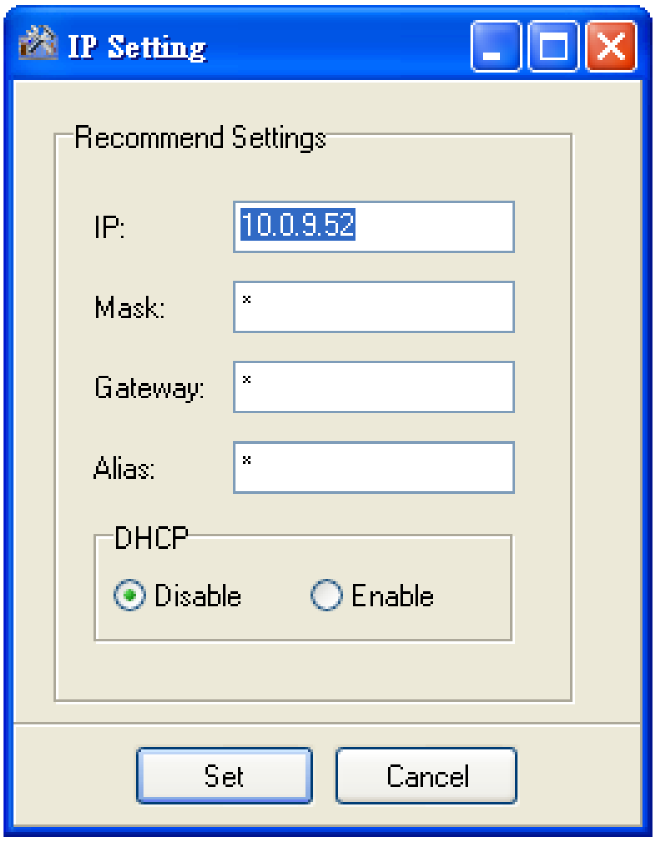
Step 6: On the "MiniOS7 Scan" dialog box, choose the module name from the list and then choose "IP setting" from the toolbar



Type	IP/Port	Name	Alias	Mask
UDP Poll	192.168.255.1	uPAC-7186EX_UDP		255.2

Search done.

Step 7: On the "IP Setting" dialog, configure the "IP" settings and then click the "Set" button


IP Setting

Recommend Settings

IP: 10.0.9.52

Mask: *

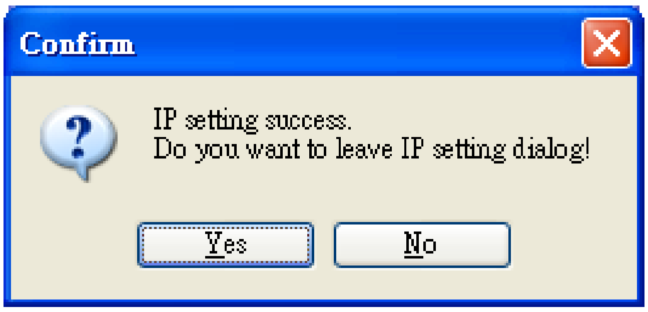
Gateway: *

Alias: *

DHCP

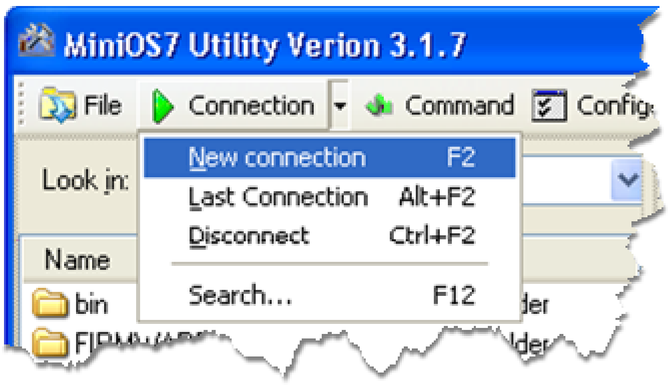
(●) Disable ( ) Enable

Step 8: On the "Confirm" dialog box, click "Yes"

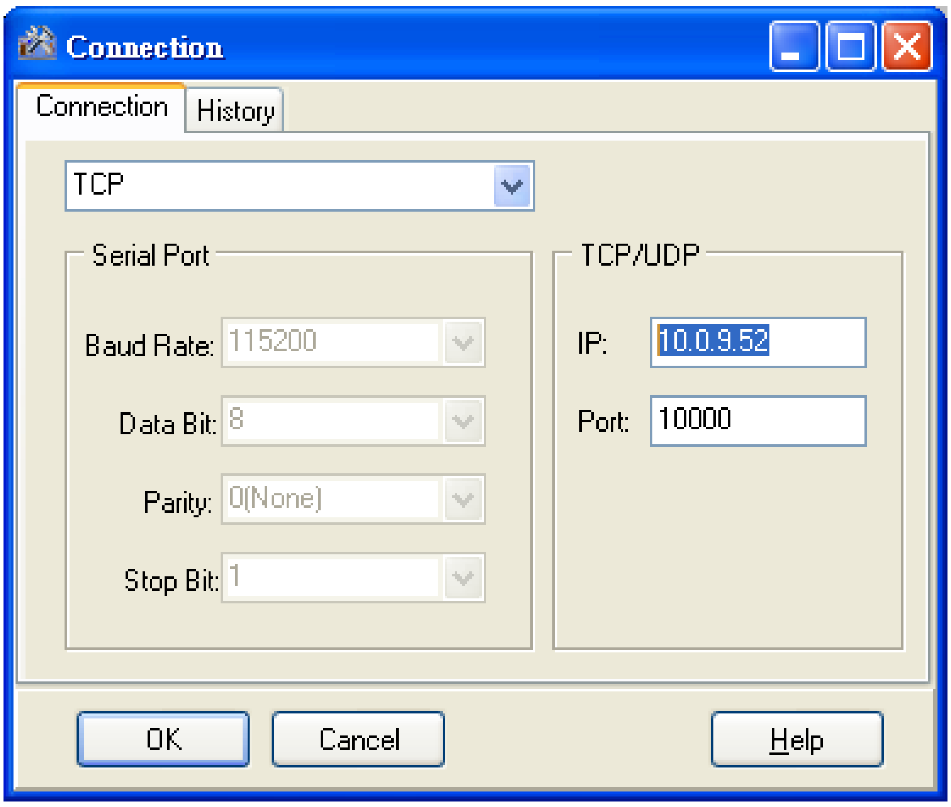

Confirm

IP setting success.
Do you want to leave IP setting dialog!

Step 9: Click the “New connection” function from the “Connection” menu



Step 10: On the “Connection” tab of the “Connection” dialog box, select “TCP” from the drop down list, type the IP address which you are assigned, and then click “OK”



TCP

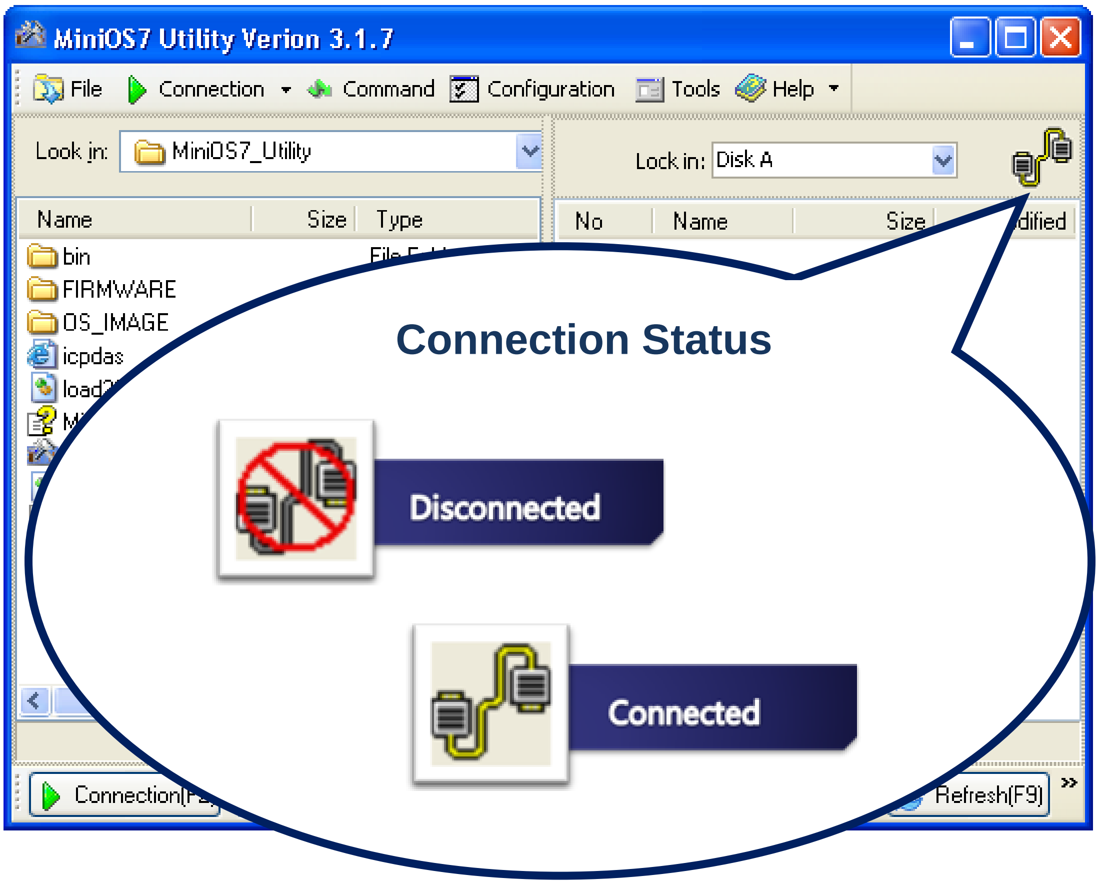
Serial Port

Baud Rate: 115200
Data Bit: 8
Parity: 0(None)
Stop Bit: 1

TCP/UDP

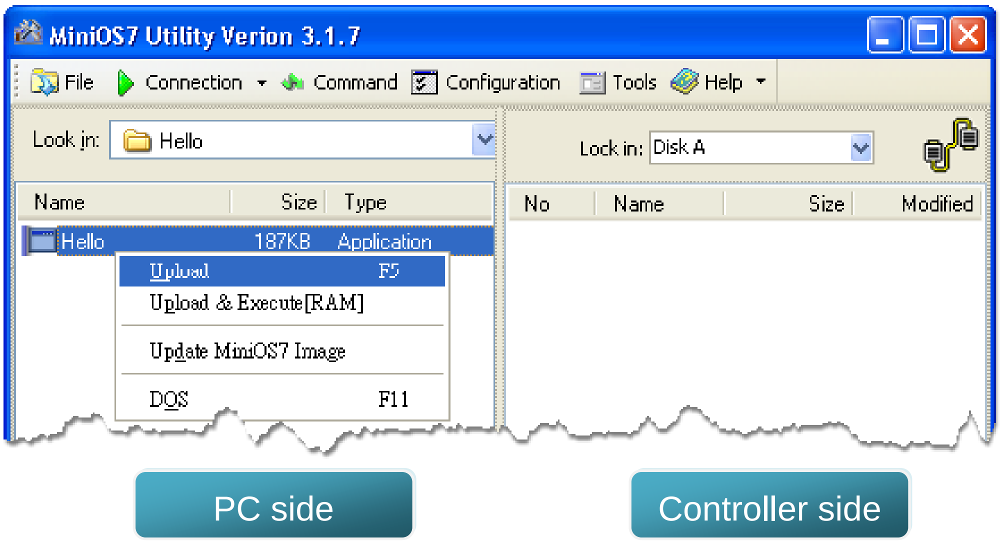
IP: 10.0.9.52
Port: 10000

Step 11: The connection has already established

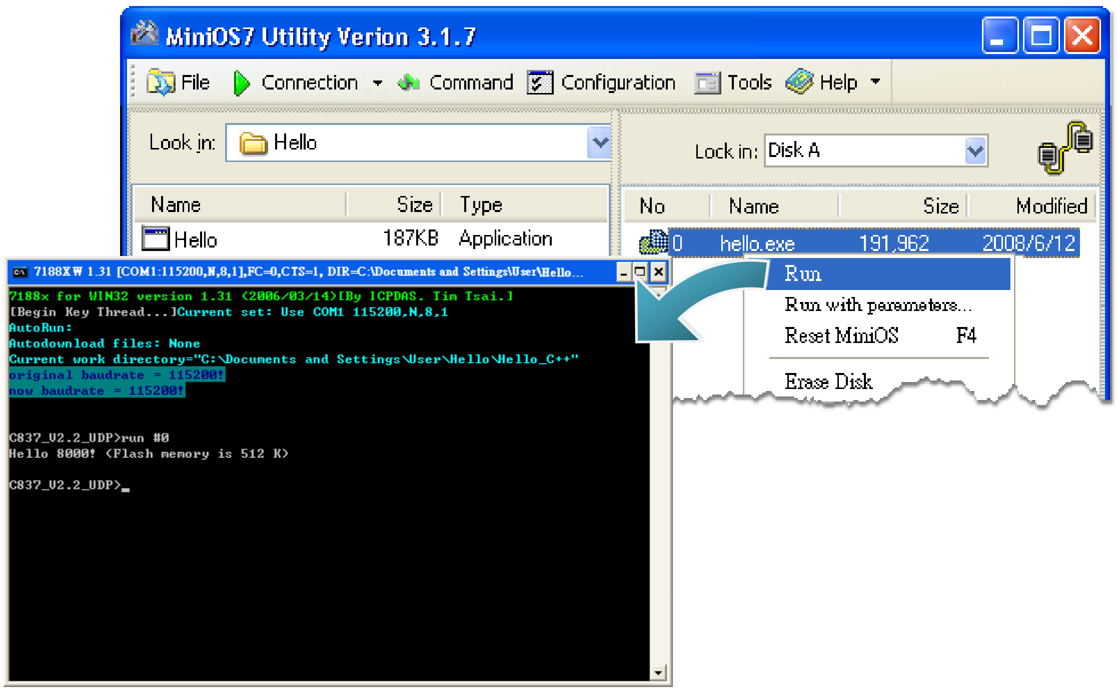


2.4.2. Uploading and executing programs on µPAC-7186E

Step 1: On the PC side, right click the file name that you wish to download and then select the "Upload"



Step 2: On the controller side, right click the file name that you wish to execute and then select the "Run"

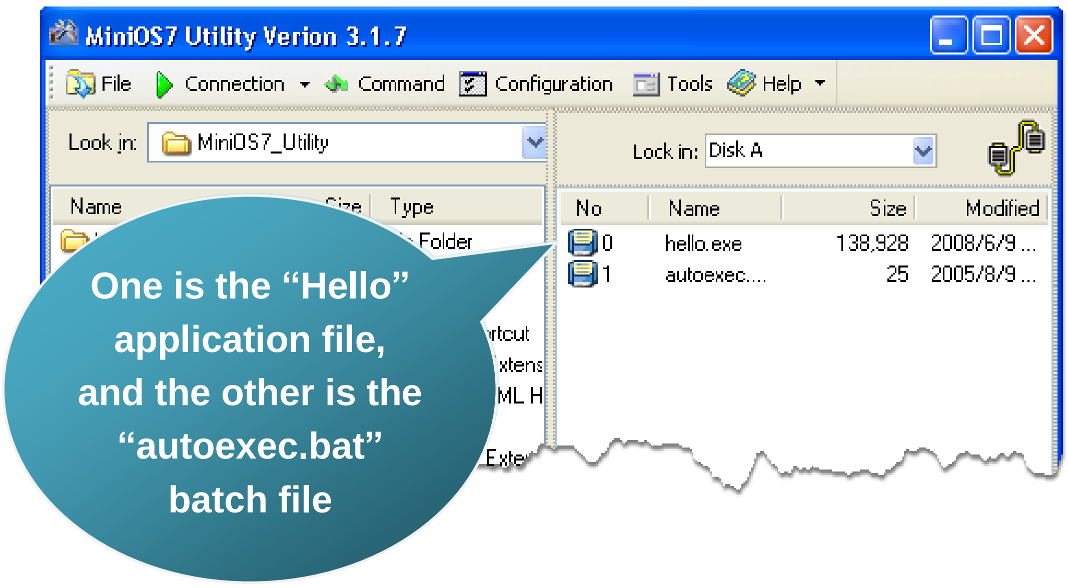


```
7188XW 1.31 [COM1:115200,N,8,1],FC=0,CTS=1, DIR=C:\Documents and Settings\User\Hello...
7188x for WIN32 version 1.31 (2006/03/14)[By ICPDAS. Tim Tsai.]
[Begin Key Thread...]Current set: Use COM1 115200,N,8,1
AutoRun:
Autodownload files: None
Current work directory="C:\Documents and Settings\User\Hello\Hello_C++"
original baudrate = 115200!
now baudrate = 115200!


C837_V2.2_UDP>run #0
Hello 8000! (Flash memory is 512 K)

C837_V2.2_UDP>_
```

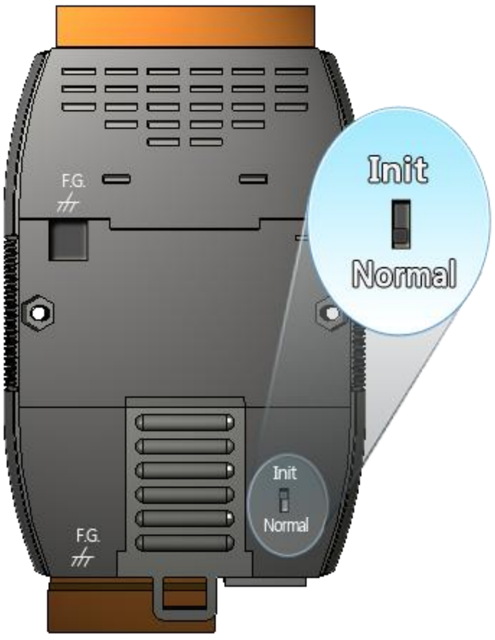
2.4.3. Making programs start automatically

After download programs on the µPAC-7186E, if you need programs to start automatically after the µPAC-7186E start-up, it is easy to achieve it, to create a batch file called autoexec.bat and then upload it on the µPAC-7186E, the program will start automatically in the next start-up.

For example, to make the program "hello" run on start-up.


MiniOS7 Utility Verion 3.1.7
File
Connection
Command
Configuration
Tools
Help
Look in: MiniOS7_Utility
Look in: Disk A
One is the "Hello" application file, and the other is the "autoexec.bat" batch file

No	Name	Size	Modified
0	hello.exe	138,928	2008/6/9 ...
1	autoexec....	25	2005/8/9 ...



Tips & Warnings

Before restaring the module for settings to take effect, you must first turn the switch to "Normal" position.

2.5. Using MiniOS7 Utility to update OS image

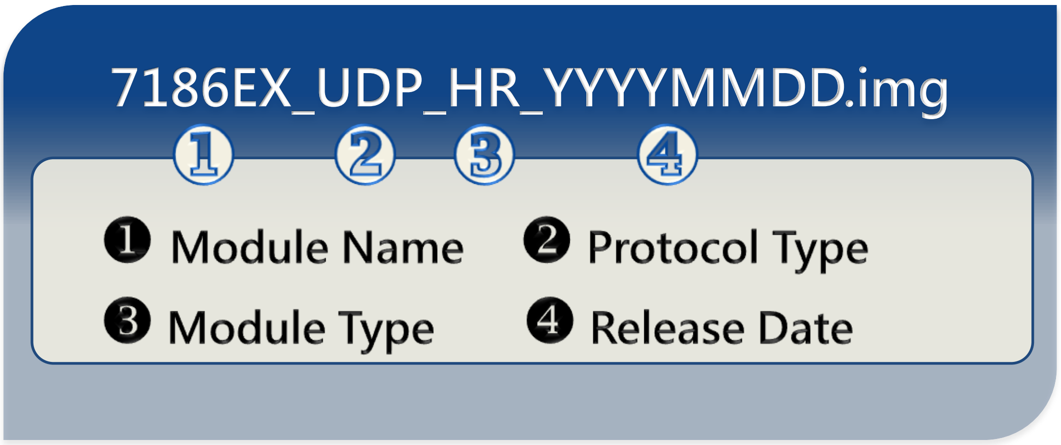
ICP DAS will continue to add additional features to MiniOS7 in the future, we advise you periodically check the ICP DAS web site for the latest update to MiniOS7.

Step 1: Get the latest version of the MiniOS7 OS image

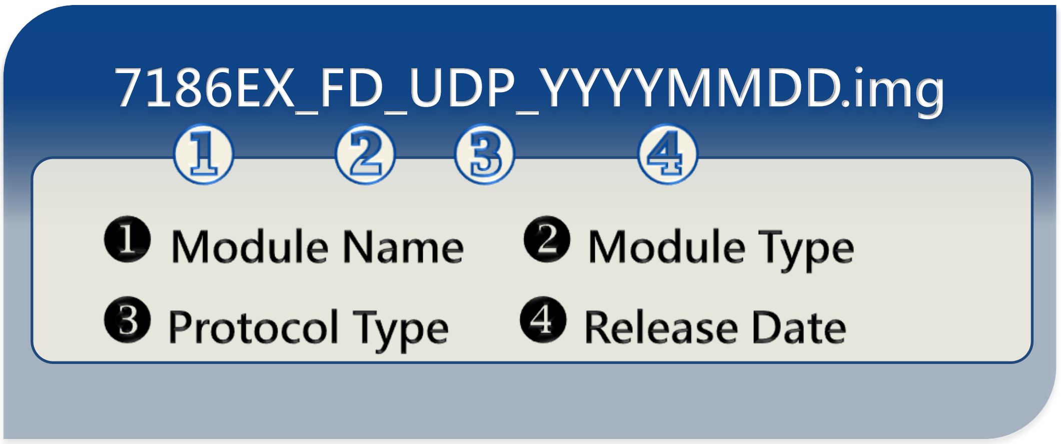
The latest version of the MiniOS7 OS image can be obtained from:

CD:\NAPDOS\7186e\OS_Image\
http://ftp.Icpdas.com/pub/cd/8000cd/napdos/7186e/os_image/

➤ **For 7186EX, 7186PEX and 7186EX-SM series**



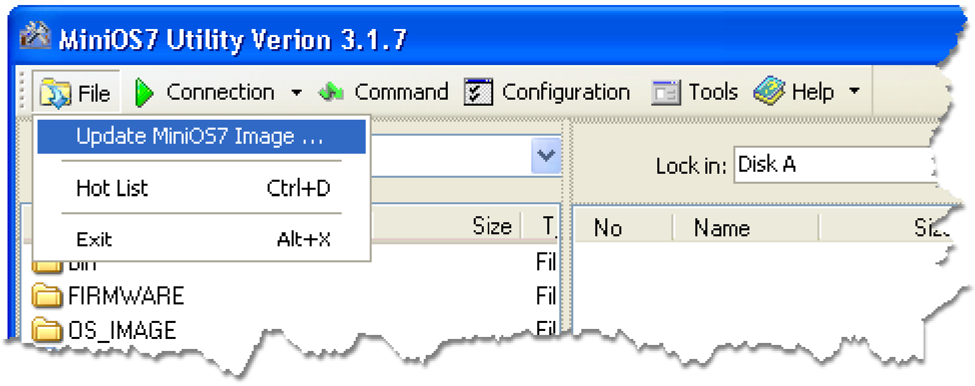
➤ **For 7186EX-FD series**



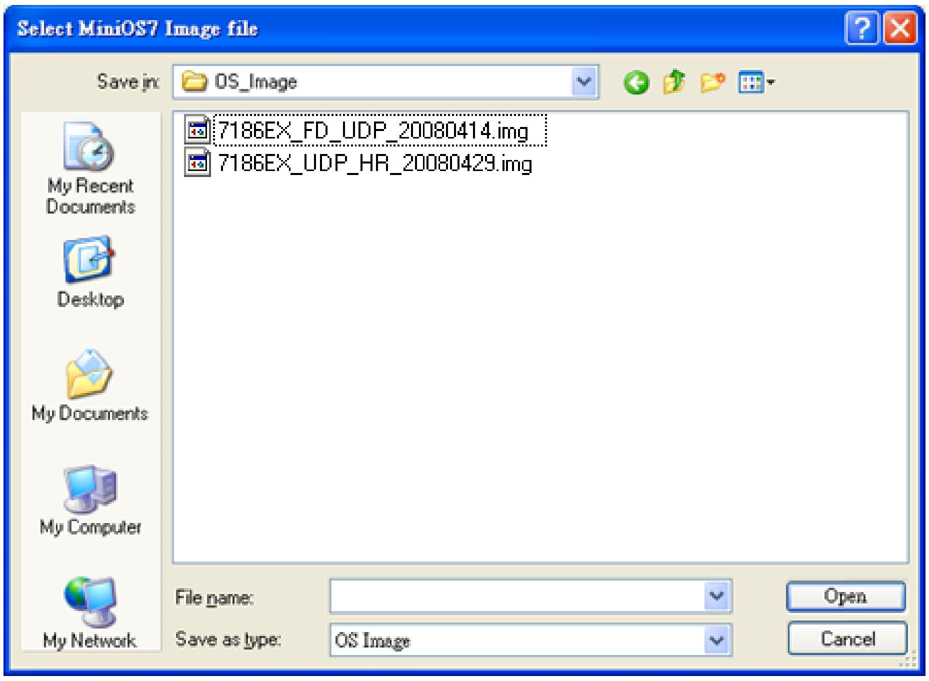
Step 2: Establish a connection

For more detailed information about this process, please refer to section "2.4.1. Establishing a connection"

Step 3: Click the "Update MiniOS7 Image …" from the "File" menu

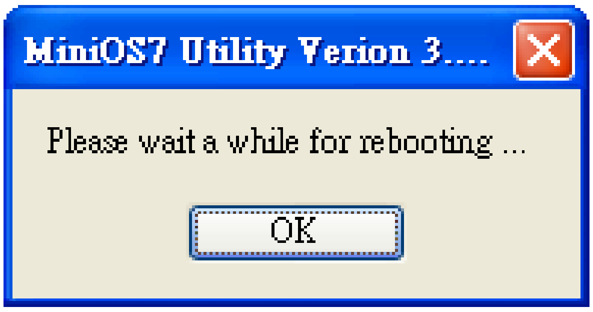


Step 4: Select the latest version of the MiniOS7 OS image



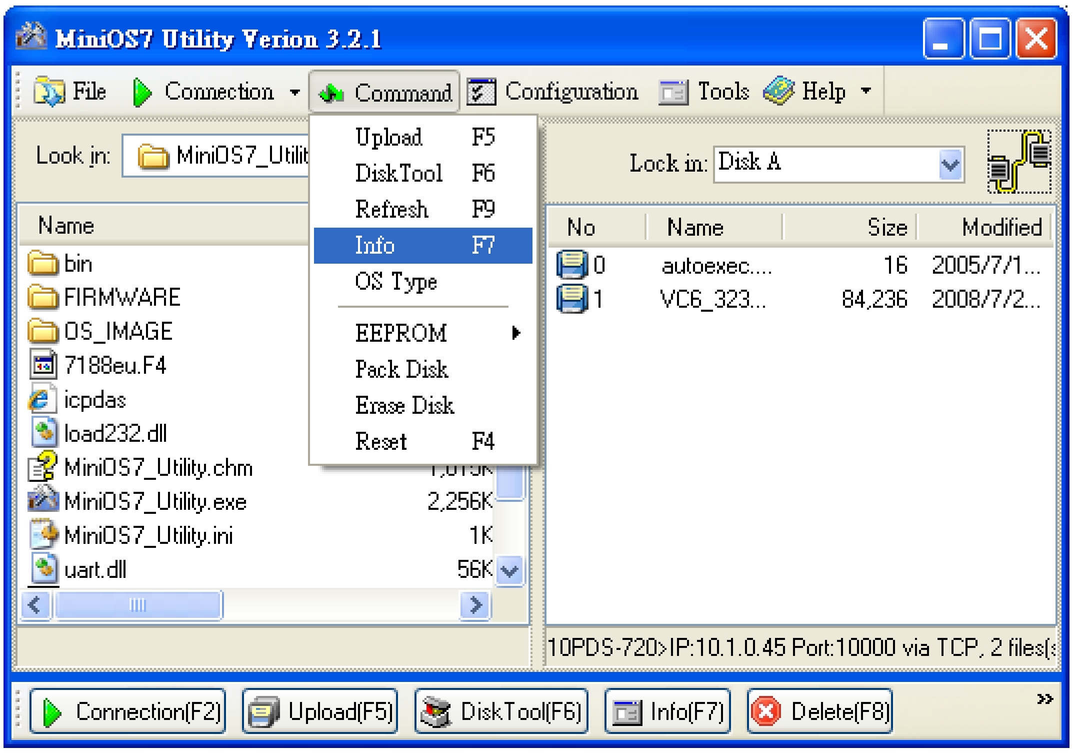
7186EX_FD_UDP_20080414.img
7186EX_UDP_HR_20080429.img

Step 5: Click the “OK”


MiniOS7 Utility Verion 3....

Please wait a while for rebooting ...

Step 6: Click the “Info” from the “Command” menu to check the version of the OS image


MiniOS7 Utility Verion 3.2.1

Name	
bin	
FIRMWARE	
OS_IMAGE	
7188eu.F4	
icpdas	
load232.dll	
MiniOS7_Utility.chm	1,015K
MiniOS7_Utility.exe	2,256K
MiniOS7_Utility.ini	1K
uart.dll	56K

No	Name	Size	Modified
0	autoexec....	16	2005/7/1...
1	VC6_323...	84,236	2008/7/2...

10PDS-720>IP:10.1.0.45 Port:10000 via TCP, 2 files(s

3. Your First Program on µPAC-7186E

Before writing your first program, ensure that you have the necessary C/C++ compiler and the corresponding functions library on your system.

3.1. Setting up the compiler

The following compilers are available for µPAC-7186E.

- Turbo C++ Version 1.01
- Turbo C Version 2.01
- Borland C++ Versions 3.1 - 5.2.x
- MSC
- MSVC ++

Tips & Warnings

ICP DAS suggests that the Borland C++ version compiler is used as the libraries provided on the companion CD have been created using this compiler.

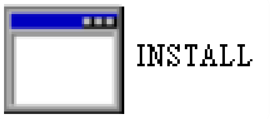
Special attention should be paid to the following items before using the compiler to develop custom applications:

- Generate a standard DOS executable program
- Set the CPU option to 80188/80186
- Set the floating point option to EMULATION if floating point computation is required. (Be sure not to choose 8087)
- Cancel the Debug Information function as this helps to reduce program size. (MiniOS7 supports this feature.).

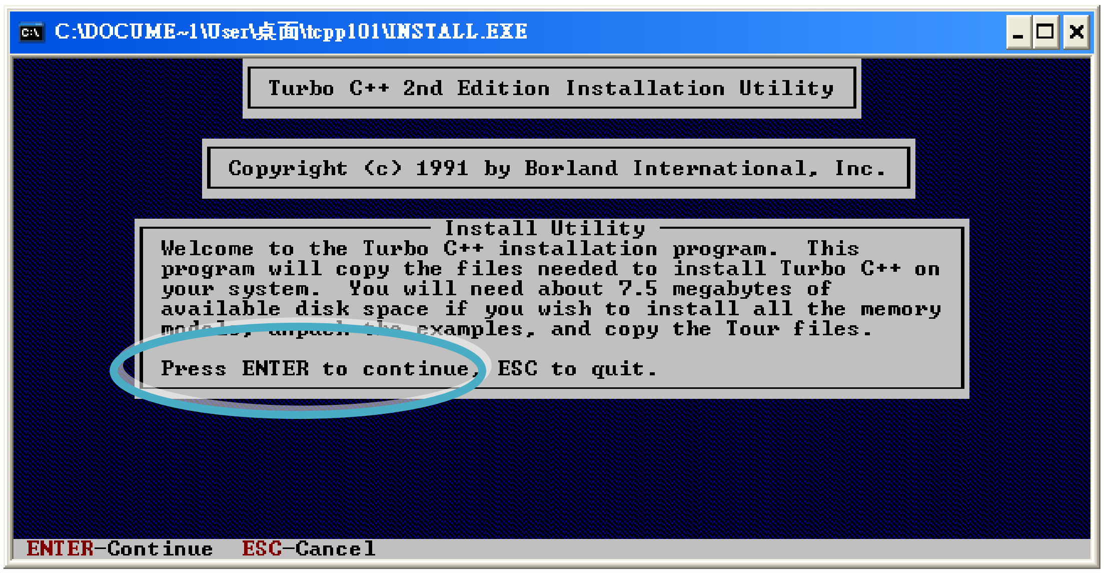
3.1.1. Installing the compiler

If there is no compiler currently installed on your system, installation of the compiler should be the first step. The following section guides you to install Turbo C++ Version 1.01 on your system.

Step 1: Double click the Turbo C++ executable file to start setup wizard

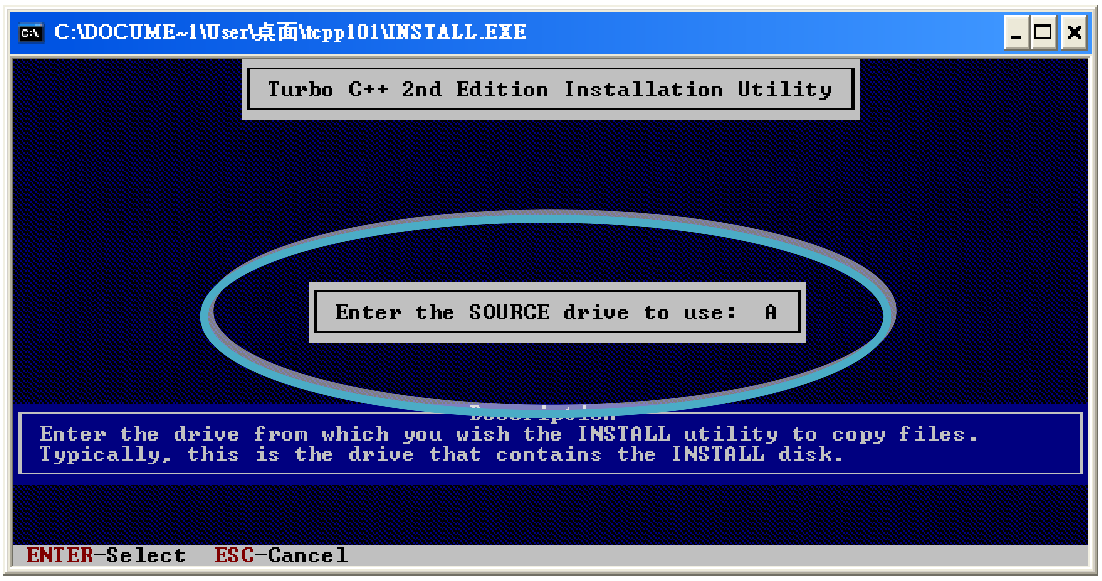


Step 2: Press "Enter" to continue



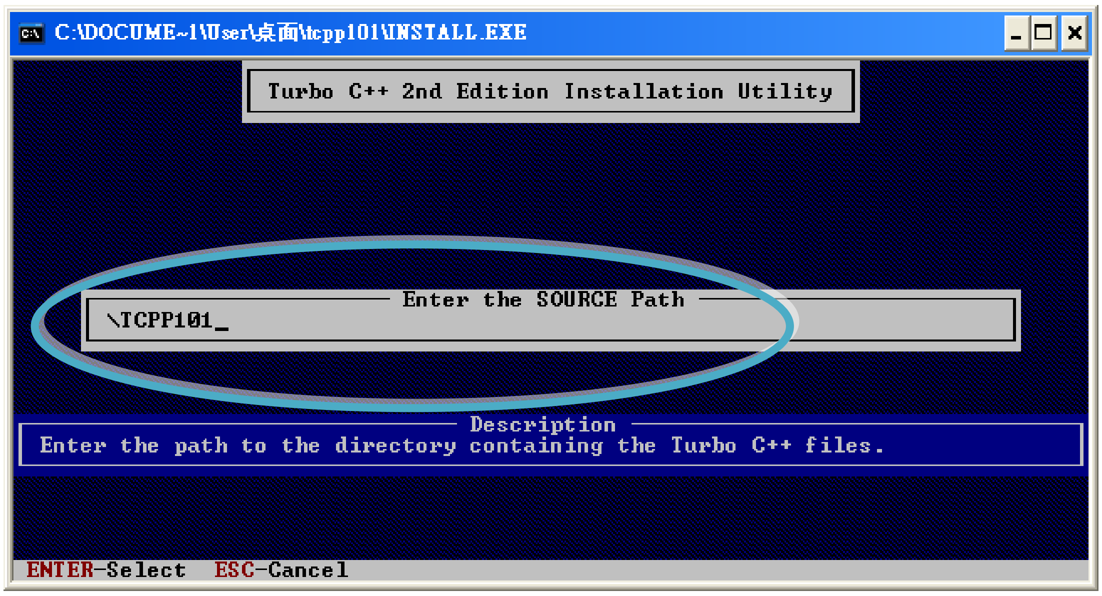
```
C:\DOCUME~1\User\桌面\tcpp101\INSTALL.EXE

Turbo C++ 2nd Edition Installation Utility

Copyright (c) 1991 by Borland International, Inc.

Install Utility
Welcome to the Turbo C++ installation program.  This
program will copy the files needed to install Turbo C++ on
your system.  You will need about 7.5 megabytes of
available disk space if you wish to install all the memory
models, unpack the examples, and copy the Tour files.

Press ENTER to continue, ESC to quit.

ENTER-Continue   ESC-Cancel
```

Step 3: Enter the letter of the hard drive you wish to install the software



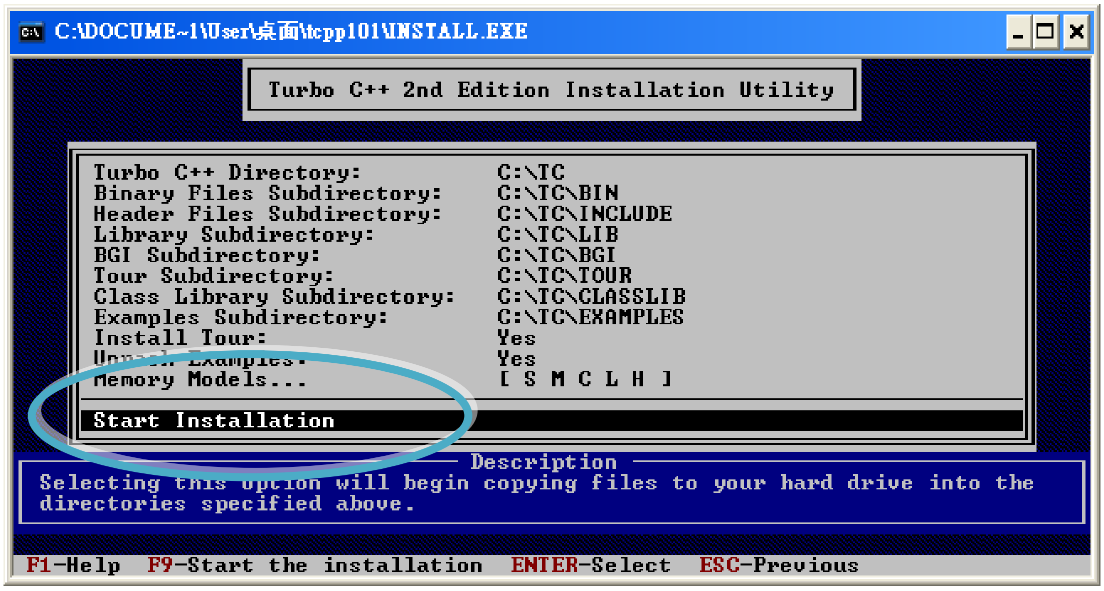
```
C:\DOCUME~1\User\桌面\tcpp101\INSTALL.EXE

Turbo C++ 2nd Edition Installation Utility

Enter the SOURCE drive to use:  A

Description
Enter the drive from which you wish the INSTALL utility to copy files.
Typically, this is the drive that contains the INSTALL disk.

ENTER-Select   ESC-Cancel
```

Step 4: Enter the path to the directory you wish to install files to



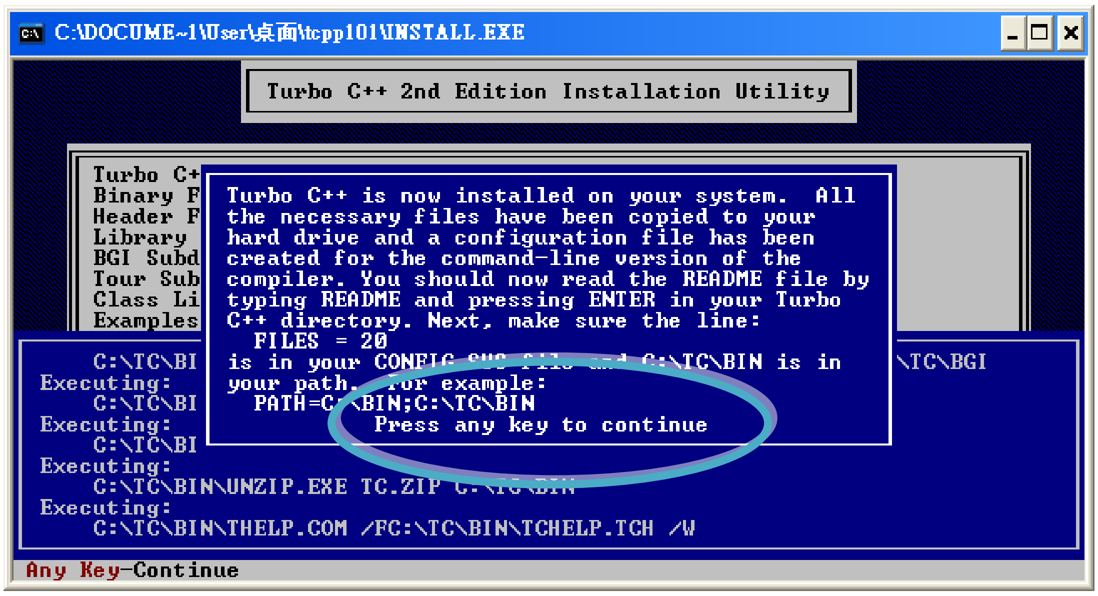
```
C:\DOCUME~1\User\桌面\tcpp101\INSTALL.EXE

Turbo C++ 2nd Edition Installation Utility

Enter the SOURCE Path
\TCPP101_

Description
Enter the path to the directory containing the Turbo C++ files.

ENTER-Select   ESC-Cancel
```

Step 5: Select “Start Installation” to begin the install process



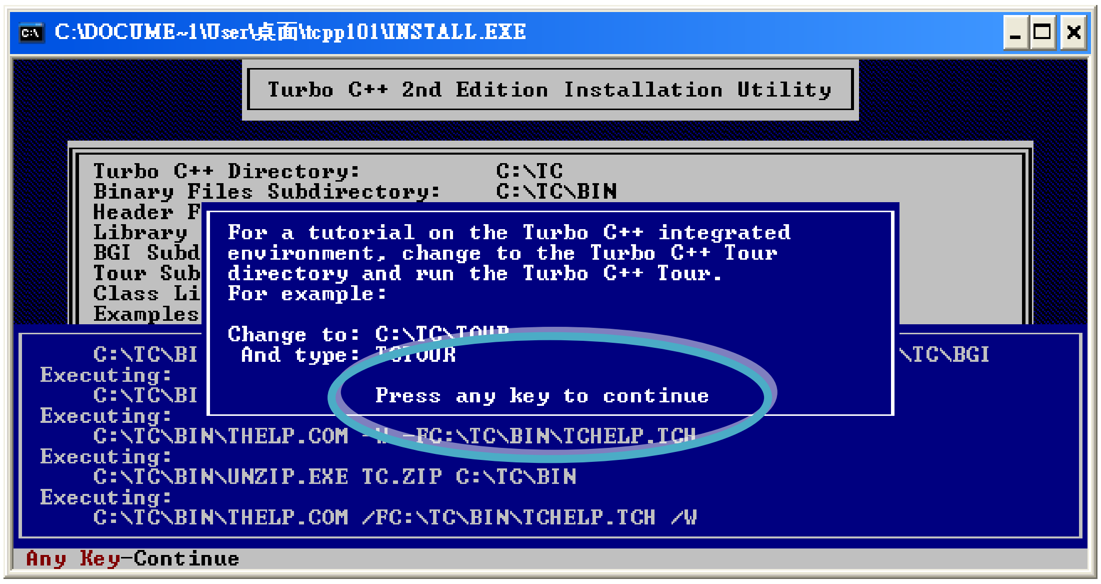
```
C:\DOCUME~1\User\桌面\tcpp101\INSTALL.EXE

        Turbo C++ 2nd Edition Installation Utility

  Turbo C++ Directory:              C:\TC
  Binary Files Subdirectory:        C:\TC\BIN
  Header Files Subdirectory:        C:\TC\INCLUDE
  Library Subdirectory:             C:\TC\LIB
  BGI Subdirectory:                 C:\TC\BGI
  Tour Subdirectory:                C:\TC\TOUR
  Class Library Subdirectory:       C:\TC\CLASSLIB
  Examples Subdirectory:            C:\TC\EXAMPLES
  Install Tour:                     Yes
  Unpack Examples:                  Yes
  Memory Models...                  [ S M C L H ]

  Start Installation
                          Description
 Selecting this option will begin copying files to your hard drive into the
 directories specified above.

F1-Help  F9-Start the installation  ENTER-Select  ESC-Previous
```

Step 6: Press any key to continue



```
C:\DOCUME~1\User\桌面\tcpp101\INSTALL.EXE

        Turbo C++ 2nd Edition Installation Utility

  Turbo C+  Turbo C++ is now installed on your system.  All
  Binary F  the necessary files have been copied to your
  Header F  hard drive and a configuration file has been
  Library   created for the command-line version of the
  BGI Subd  compiler. You should now read the README file by
  Tour Sub  typing README and pressing ENTER in your Turbo
  Class Li  C++ directory. Next, make sure the line:
  Examples    FILES = 20
    C:\TC\BI  is in your CONFIG.SYS file and C:\TC\BIN is in   \TC\BGI
 Executing:   your path.  For example:
    C:\TC\BI    PATH=C:\BIN;C:\TC\BIN
 Executing:              Press any key to continue
    C:\TC\BI
 Executing:
    C:\TC\BIN\UNZIP.EXE TC.ZIP C:\TC\BIN
 Executing:
    C:\TC\BIN\THELP.COM /FC:\TC\BIN\TCHELP.TCH /W

Any Key-Continue
```

Step 7: Press any key to continue



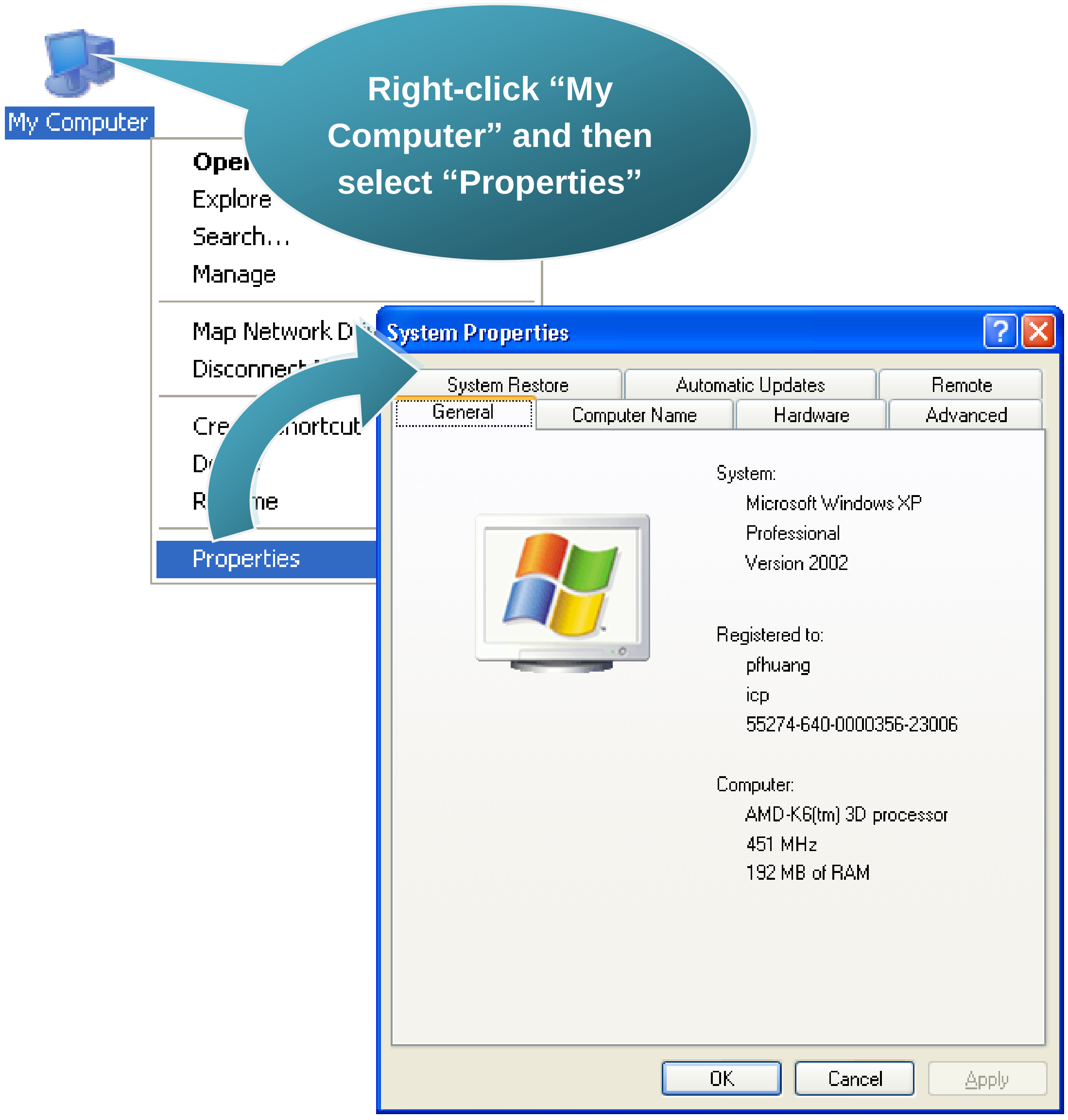
```
C:\DOCUME~1\User\桌面\tcpp101\INSTALL.EXE

Turbo C++ 2nd Edition Installation Utility

Turbo C++ Directory:          C:\TC
Binary Files Subdirectory:    C:\TC\BIN
Header F
Library
BGI Subd
Tour Sub
Class Li
Examples
    C:\TC\BI                                                   \TC\BGI
Executing:
    C:\TC\BI
Executing:
    C:\TC\BIN\THELP.COM -W -FC:\TC\BIN\TCHELP.TCH
Executing:
    C:\TC\BIN\UNZIP.EXE TC.ZIP C:\TC\BIN
Executing:
    C:\TC\BIN\THELP.COM /FC:\TC\BIN\TCHELP.TCH /W

For a tutorial on the Turbo C++ integrated
environment, change to the Turbo C++ Tour
directory and run the Turbo C++ Tour.
For example:

Change to: C:\TC\TOUR
 And type: TCTOUR

           Press any key to continue

Any Key-Continue
```

Step 8: Installation is complete

3.1.2. Setting up the environment variables

After installing the compiler, several compilers will be available from the Windows Command line. You can set the path environment variable so that you can execute this compiler on the command line by entering simple names, rather than by using their full path names.

Step 1: Right click on the "My Computer" icon on your desktop and select the "Properties" menu option



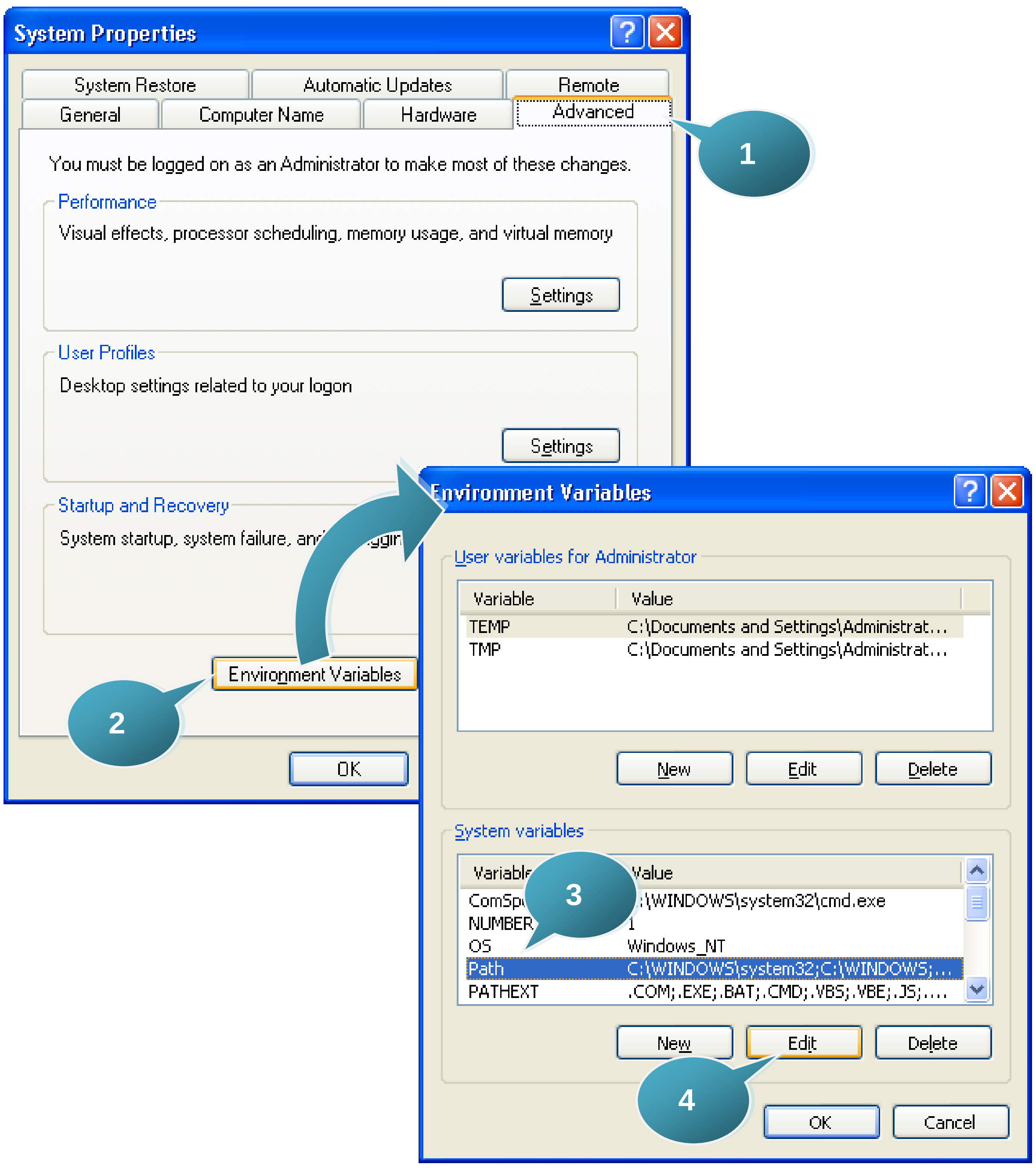
System:
Microsoft Windows XP
Professional
Version 2002

Registered to:
pfhuang
icp
55274-640-0000356-23006

Computer:
AMD-K6(tm) 3D processor
451 MHz
192 MB of RAM

Step 2: On the "System Properties" dialog box, click the "Environment Variables"button located under the "Advanced" sheet

Step 3: On the "Environment Variables" dialog box, click the "Edit" button located in the "System variables" option



You must be logged on as an Administrator to make most of these changes.

Visual effects, processor scheduling, memory usage, and virtual memory

Desktop settings related to your logon

System startup, system failure, and debugging information

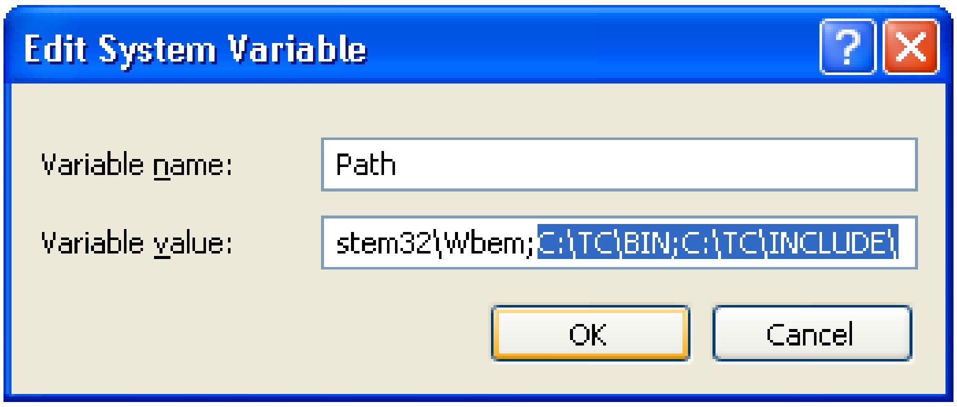
Variable	Value
TEMP	C:\Documents and Settings\Administrat...
TMP	C:\Documents and Settings\Administrat...

Variable	Value
ComSpec	C:\WINDOWS\system32\cmd.exe
NUMBER_OF_PROCESSORS	1
OS	Windows_NT
Path	C:\WINDOWS\system32;C:\WINDOWS;...
PATHEXT	.COM;.EXE;.BAT;.CMD;.VBS;.VBE;.JS;....

Step 4: Add the target directory to the end of the variable value field

A semi-colon is used as the separator between variable values.

For example, ”;c:\TC\BIN\;c:\TC\INCLUDE\”



Edit System Variable

Variable name: Path

Variable value: stem32\Wbem;C:\TC\BIN;C:\TC\INCLUDE\

Step 5: Restart the computer to allow your changes to take effect

3.2. API for µPAC-7186E

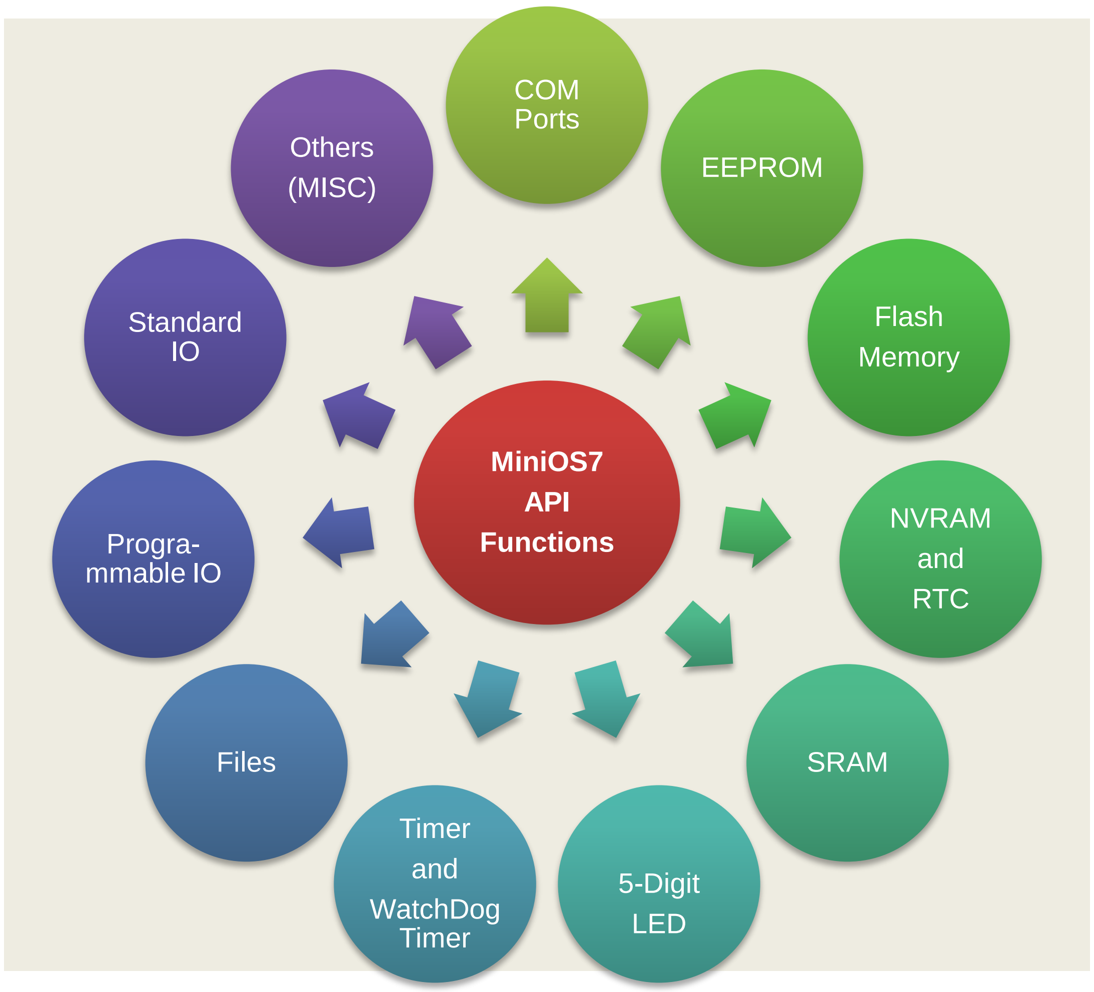
To develop a custom program, ensure that the files below are installed the PC. If they are not installed, refer to “section 2.2. Software Installation”.

➤ Functions Library — 7186e.lib

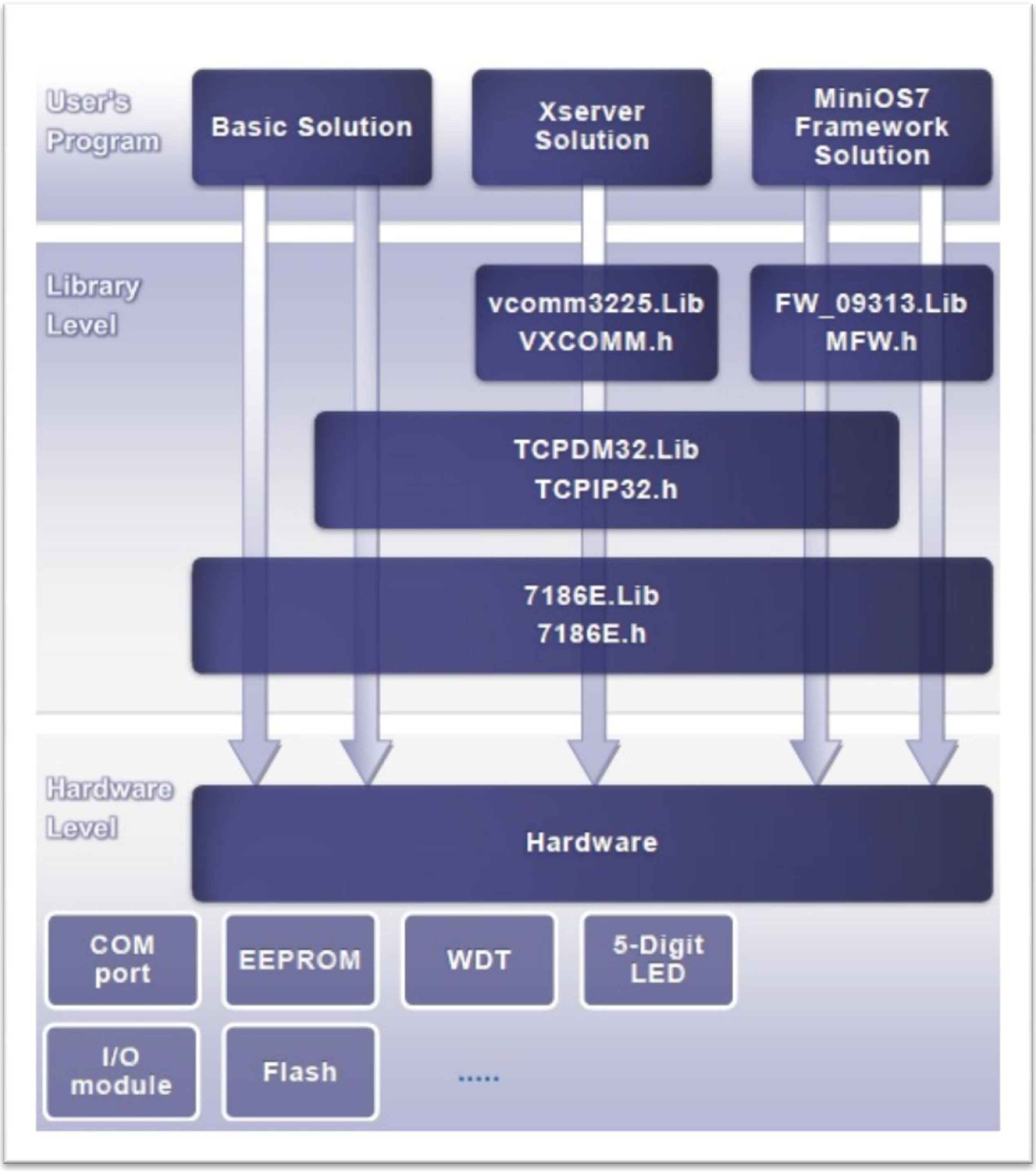
This file contains the MiniOS7 API (Application Programming Interface) and has hundreds of pre-defined functions related to µPAC-7186E

➤ Header File — 7186e.h

This file contains the forward declarations of subroutines, variables, and other identifiers used for the MiniOS7 API.



➤ *System Structure*



➤ Basic:

Demos developed from main()

➤ Xserver:

Demos developed based on Xserver library.

Xserver is a library for TCP/IP server applications.

With an addional modbus library, users can develop programs with

1. Modbus/TCP slave
2. Modbus/TCP client
3. Modbus/RTU slave
4. Modbus/RTU client
5. Modbus/ASCII slave
6. Modbus/ASCII client
7. Modbus/TCP to Modbus/RTU gateway

The Modbus library and demos can be obtained from:

CD:\Napdos\Modbus\7186EX\Demo\

➤ MiniOS7 Framework Solution:

Demos developed based on MiniOS7 framwork.

MiniOS7 framework is a library for general TCP/IP applications.

It is second generation library of Xserver and is much flexible and powerful than the Xserver.

Base on it, users can quickly and easily develop programs with

1. TCP Client
2. TCP Server
3. Web Server
4. UDP Client
5. UDP Server

With an additional Modbus library, users can develop programs with

1. Modbus/TCP slave
2. Modbus/TCP client
3. Modbus/RTU slave
4. Modbus/RTU client
5. Modbus/ASCII slave
6. Modbus/ASCII client
7. Modbus/TCP to Modbus/RTU gateway

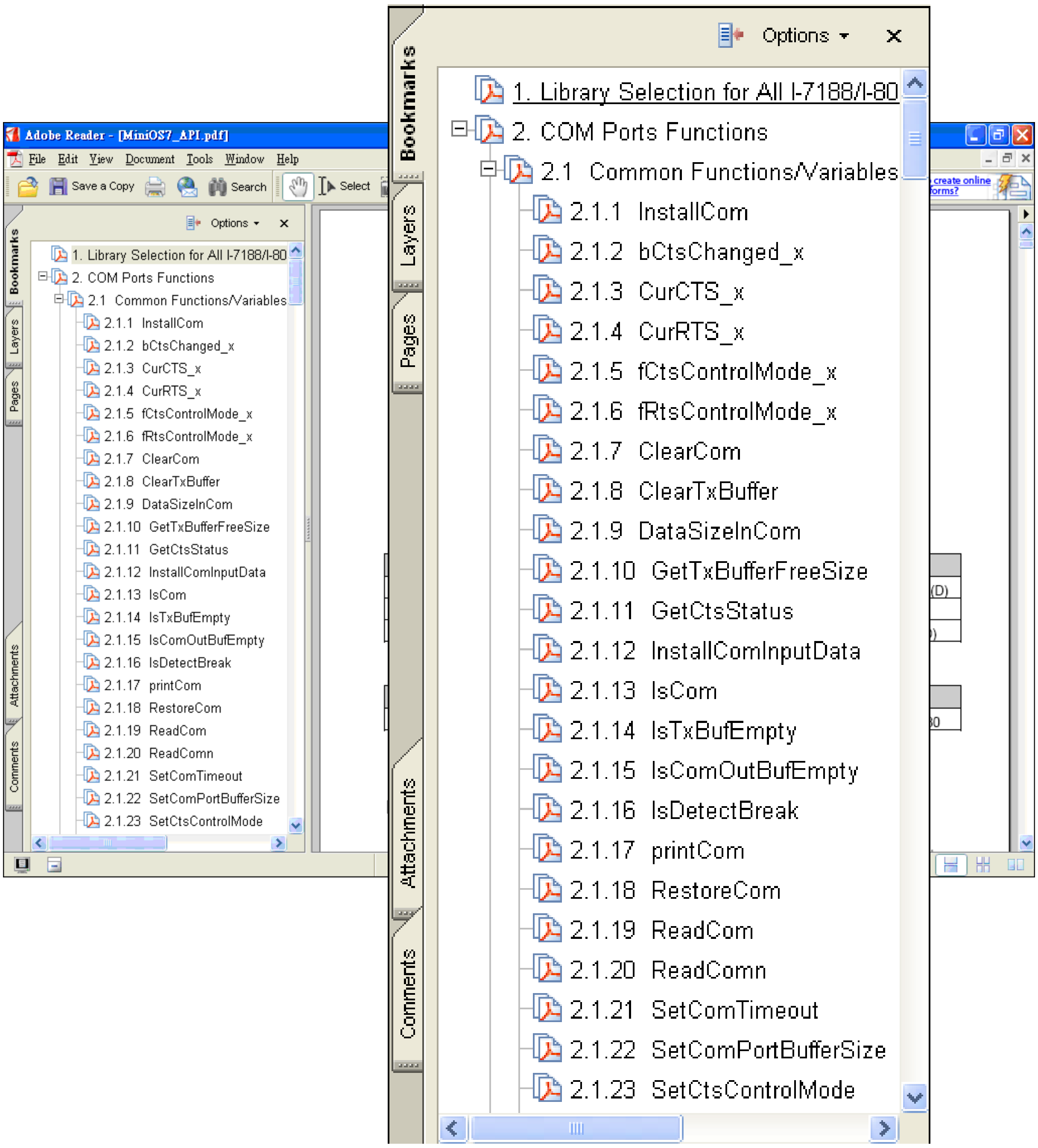
The Modbus library and demos can be obtained from:

CD:\Napdos\Modbus\7186EX\Demo\

For full usage information regarding the description, prototype and the arguments of the functions, please refer to the “MiniOS7 API Functions User Manual” located at:

CD:\Napdos\MiniOS7\Document

http://ftp.Icpdas.com/pub/cd/8000cd/napdos/minios7/document/



Adobe Reader - [MiniOS7_API.pdf]
File Edit View Document Tools Window Help
Save a Copy
Search
Select
Bookmarks
Layers
Pages
Attachments
Comments
Options

1. Library Selection for All I-7188/I-80
2. COM Ports Functions
2.1 Common Functions/Variables
2.1.1 InstallCom
2.1.2 bCtsChanged_x
2.1.3 CurCTS_x
2.1.4 CurRTS_x
2.1.5 fCtsControlMode_x
2.1.6 fRtsControlMode_x
2.1.7 ClearCom
2.1.8 ClearTxBuffer
2.1.9 DataSizeInCom
2.1.10 GetTxBufferFreeSize
2.1.11 GetCtsStatus
2.1.12 InstallComInputData
2.1.13 IsCom
2.1.14 IsTxBufEmpty
2.1.15 IsComOutBufEmpty
2.1.16 IsDetectBreak
2.1.17 printCom
2.1.18 RestoreCom
2.1.19 ReadCom
2.1.20 ReadComn
2.1.21 SetComTimeout
2.1.22 SetComPortBufferSize
2.1.23 SetCtsControlMode

3.3. Build and run your first program

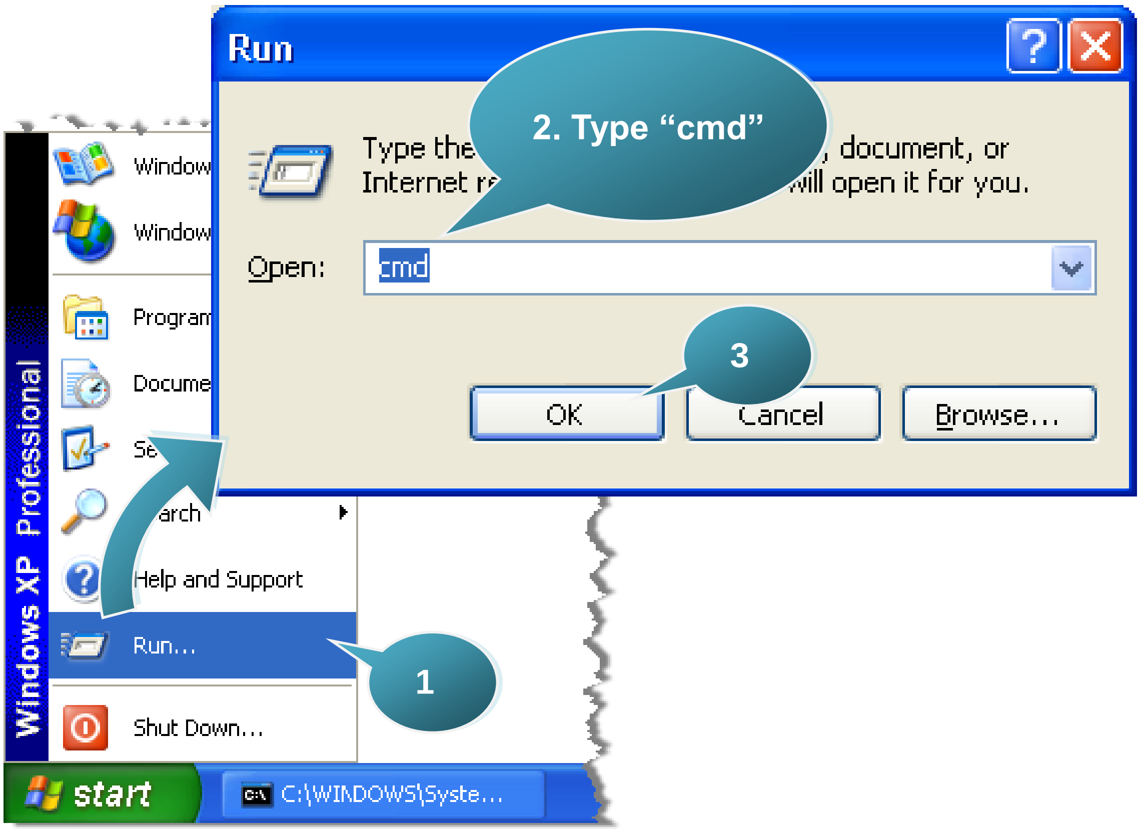
If you don't use the TC++ (Turbo C++) to write a program, please take the following steps.

Step 1: Open a MS-DOS command prompt

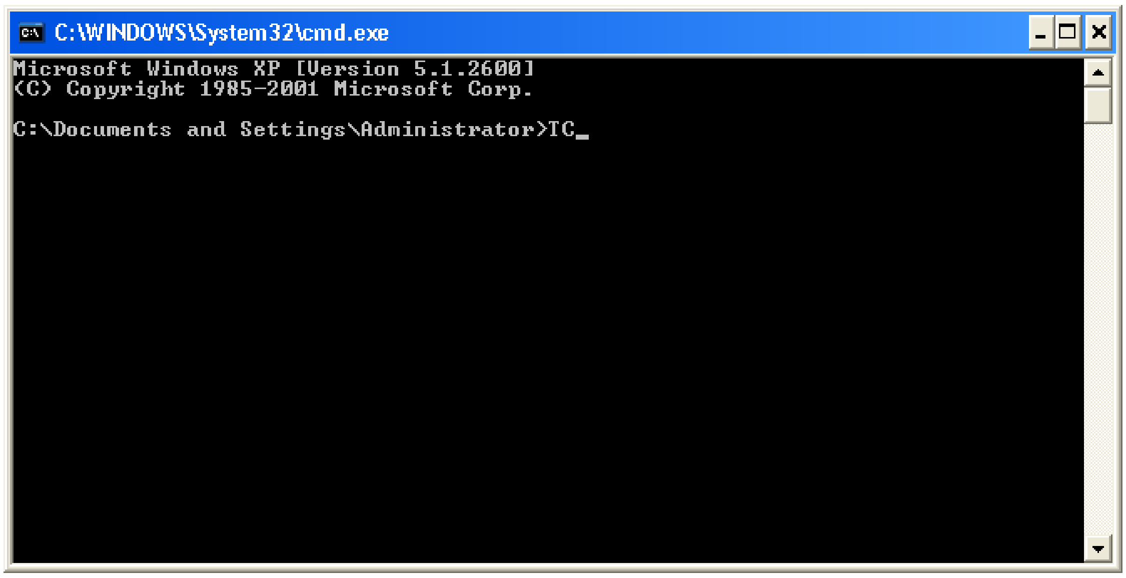
i. Select "Run" from the "Start" menu

ii. On the "Run" dialog box, type "cmd"

iii. Click the "OK" button

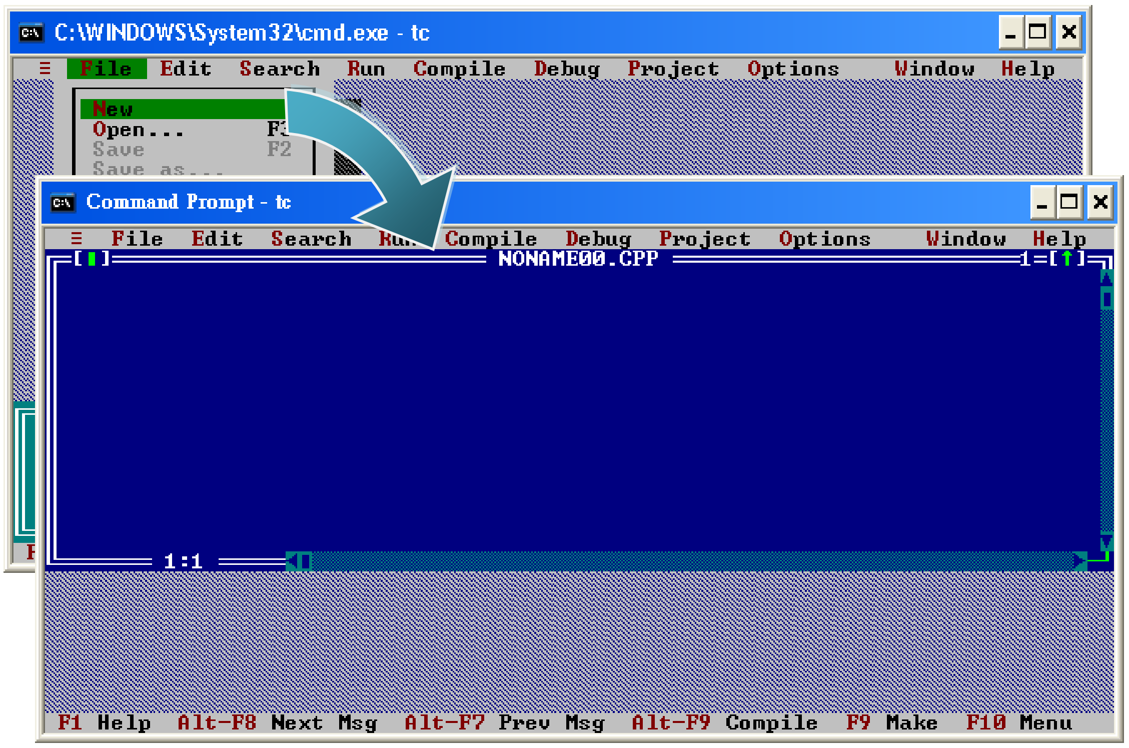


Step 2: At the command prompt, type "TC" and then press "Enter"



```
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.

C:\Documents and Settings\Administrator>TC_
```

Step 3: Select "New" from the "File" menu to create a new source file


C:\WINDOWS\System32\cmd.exe - tc
≡ File Edit Search Run Compile Debug Project Options Window Help
New
Open... F3
Save F2
Save as...
Command Prompt - tc
≡ File Edit Search Run Compile Debug Project Options Window Help
NONAME00.CPP
1
1:1
F1 Help Alt-F8 Next Msg Alt-F7 Prev Msg Alt-F9 Compile F9 Make F10 Menu

Step 4: Type the following code. Note that the code is case-sensitive

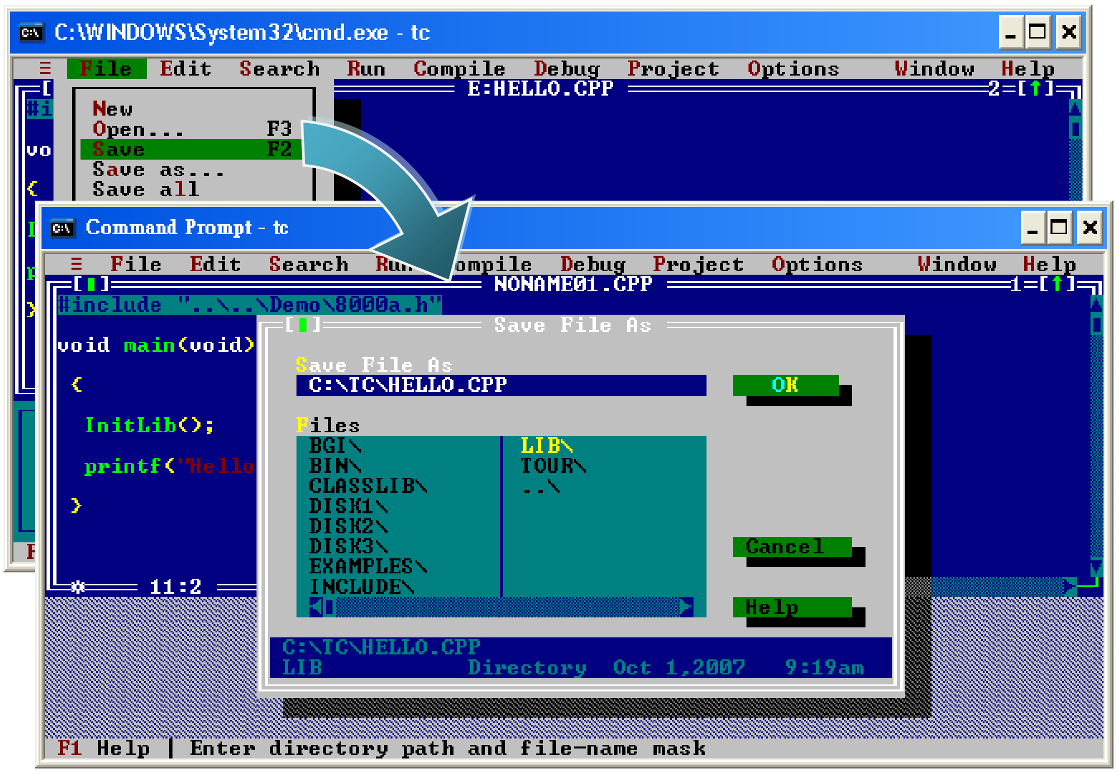
```
#include “7186e.h”
/* Include the header file that allows 8000e.lib functions to be used */

void main(void)
{
  InitLib();      /* Initiate the 7186e library */
  Print(“Hello world!\r\n”);      /* Print the message on the screen */
}
```

Step 5: Save the source file

i. Select “Save” from the “File” menu

ii. Type the file name “Hello”

iii. Select “OK”



```
C:\WINDOWS\System32\cmd.exe - tc
 ≡  File  Edit  Search  Run  Compile  Debug  Project  Options    Window  Help
                    E:HELLO.CPP                                  2=[↑]
   New
   Open...        F3
   Save           F2
   Save as...
   Save all

Command Prompt - tc
 ≡  File  Edit  Search  Run  Compile  Debug  Project  Options    Window  Help
 [■]                NONAME01.CPP                                 1=[↑]
#include "..\..\Demo\8000a.h"

void main(void)
 {
  InitLib();
  printf("Hello
 }
      11:2

            Save File As
  Save File As
  C:\TC\HELLO.CPP                                  OK

  Files
   BGI\            LIB\
   BIN\            TOUR\
   CLASSLIB\       ..\
   DISK1\
   DISK2\
   DISK3\                                          Cancel
   EXAMPLES\
   INCLUDE\
                                                   Help
  C:\TC\HELLO.CPP
  LIB            Directory   Oct 1,2007    9:19am

F1 Help | Enter directory path and file-name mask
```

Tips & Warnings

You can write the code as shown below with your familiar text editor or other tools; please note that

you must save the source code under a filename that terminates with the extension “C”.

Step 6: Create a project (*.prj)

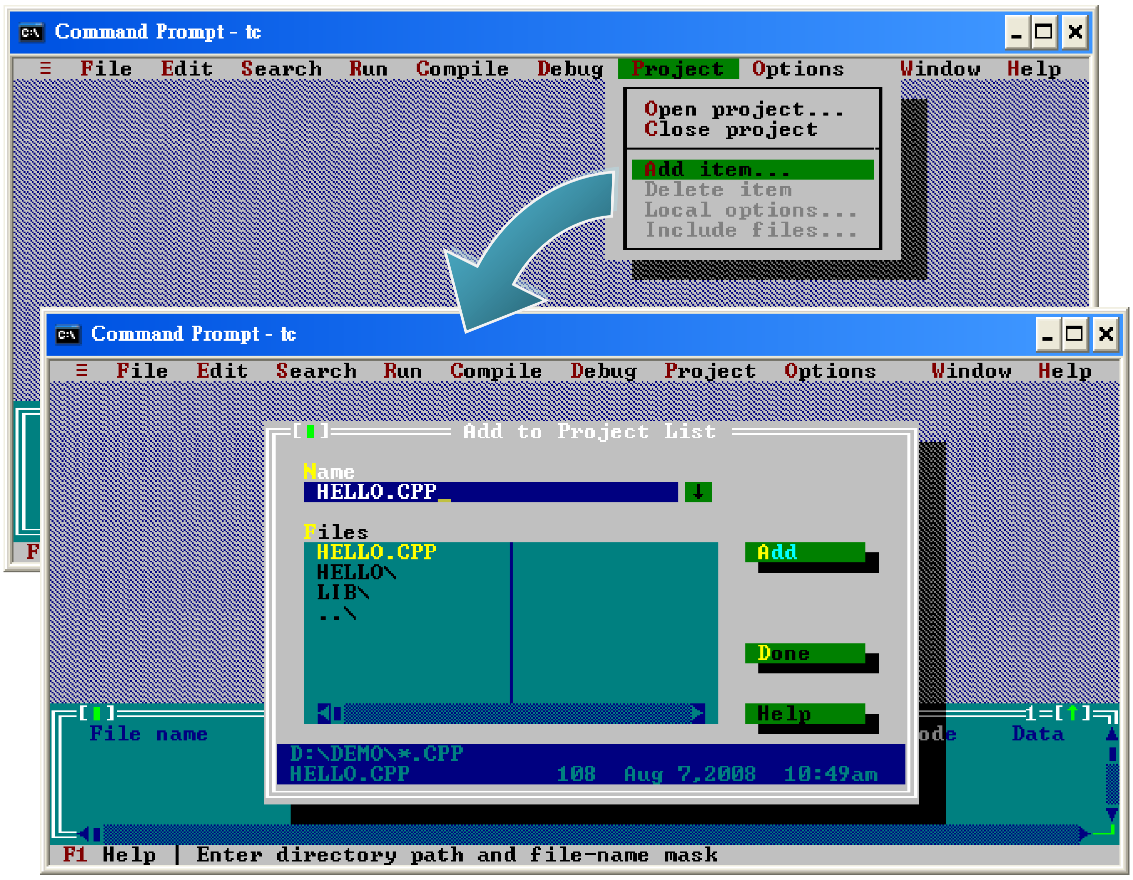
i. Select "Open project…" from the "Project" menu

ii. Type the project name "Hello"

iii. Select "OK"

iv. Select "Add"

v. Select "Done" to exit



```
HELLO.CPP_
HELLO.CPP
HELLO\
LIB\
..\
D:\DEMO\*.CPP
HELLO.CPP            108   Aug 7,2008   10:49am
F1 Help | Enter directory path and file-name mask
```

Step 8: Add the necessary function libraries to the project (*.lib)

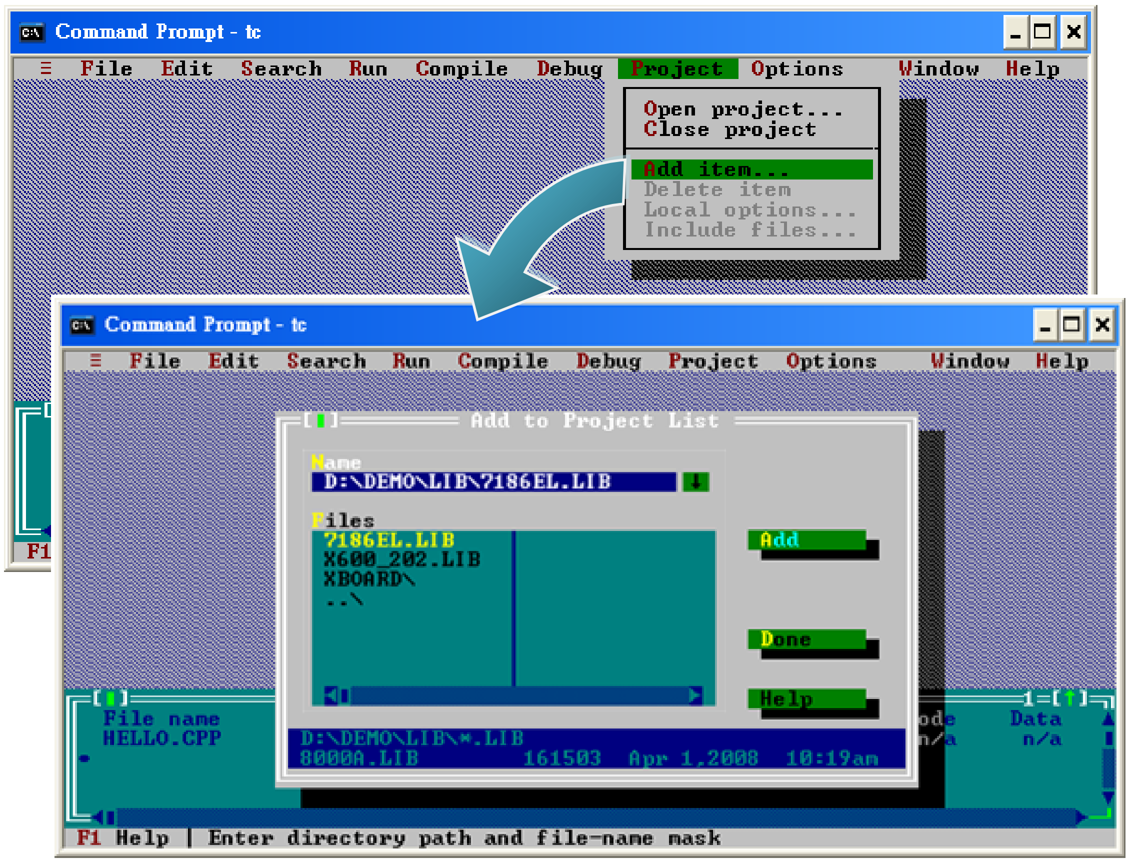
i. Select “Add item…” from the “Project” menu

ii. Type “ *.LIB ” to display a list of all available function libraries

iii. Choose the function libraries you require

iv. Select “Add”

v. Select “Done” to exit



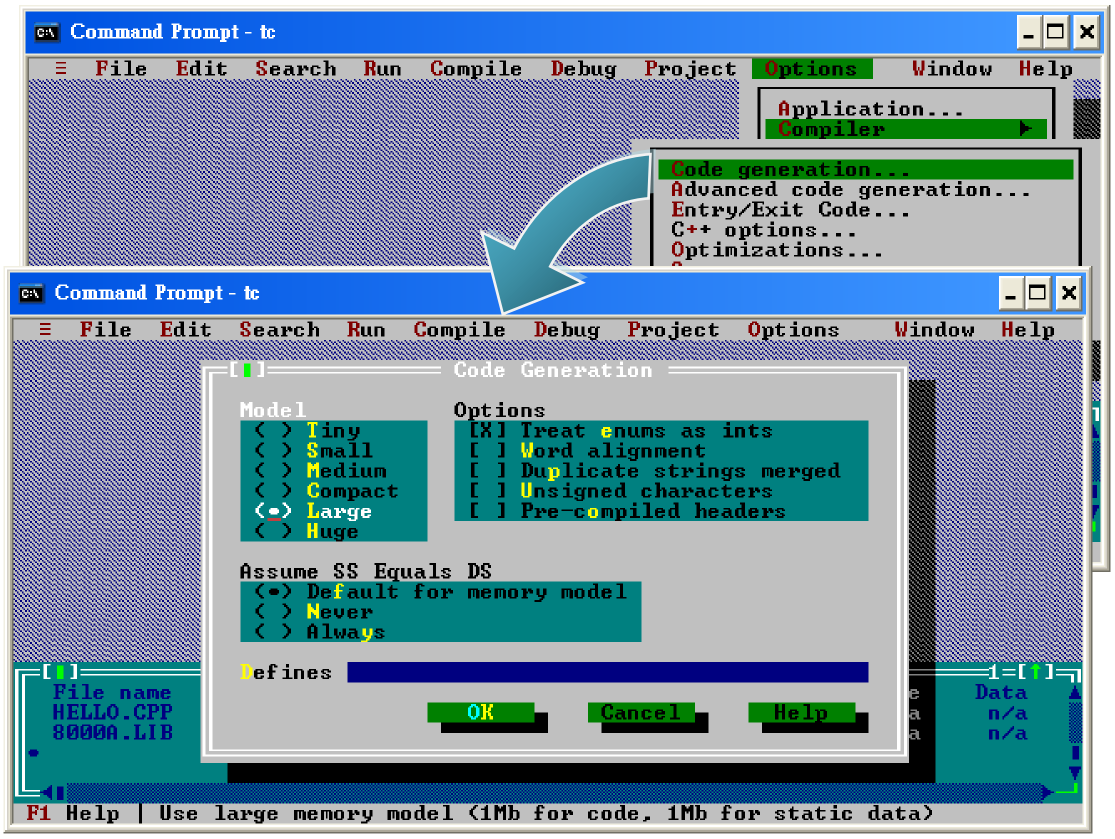
```
Name
D:\DEMO\LIB\7186EL.LIB
Files
7186EL.LIB
X600_202.LIB
XBOARD\
..\
D:\DEMO\LIB\*.LIB
8000A.LIB            161503  Apr 1,2008   10:19am
HELLO.CPP
F1 Help | Enter directory path and file-name mask
```

Step 9: Set the memory model to large

i. Select “Compiler” from the “Options” menu and then select “Code generation…”

ii. On “Model” option, select “Large”

iii. Select “OK”



```
Model               Options
( ) Tiny            [X] Treat enums as ints
( ) Small           [ ] Word alignment
( ) Medium          [ ] Duplicate strings merged
( ) Compact         [ ] Unsigned characters
(•) Large           [ ] Pre-compiled headers
( ) Huge

Assume SS Equals DS
(•) Default for memory model
( ) Never
( ) Always

Defines

F1 Help | Use large memory model (1Mb for code, 1Mb for static data)
```

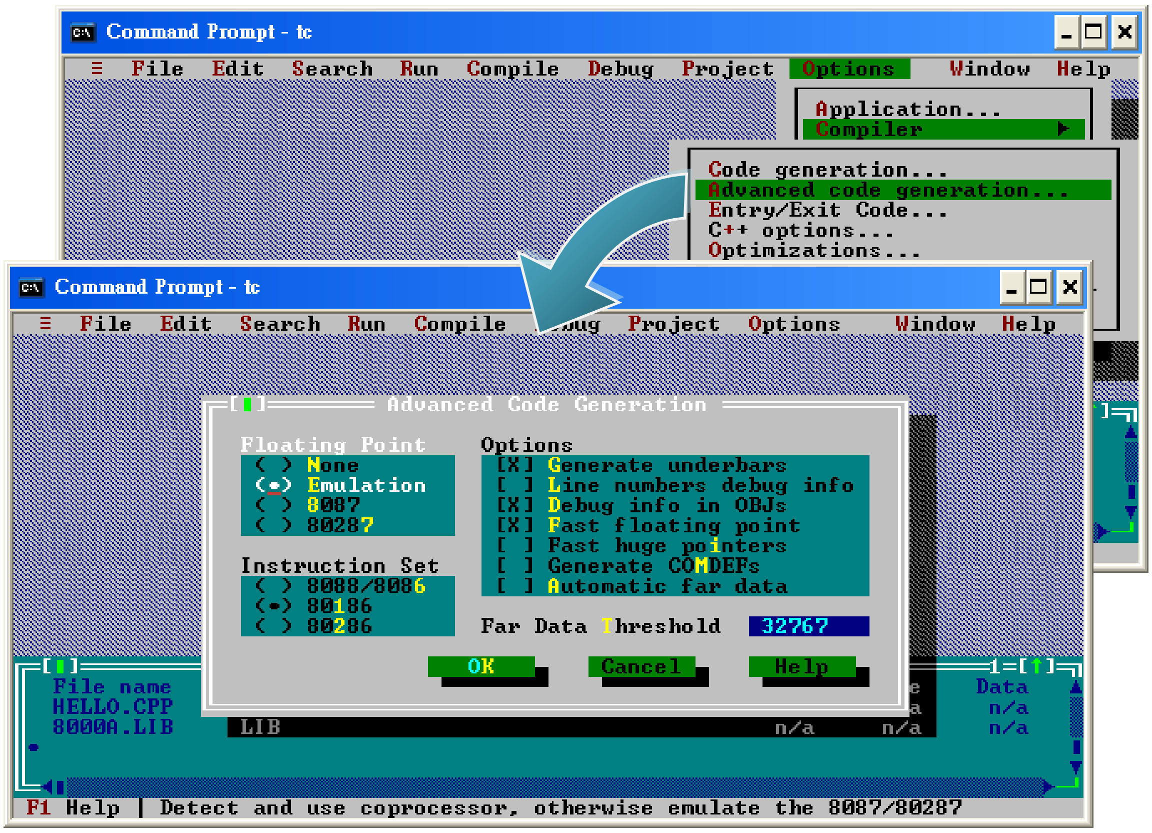
Step 10: Set the memory model to large

i. Select “Compiler” from the “Options” menu and then select “Advanced code generation…”

ii. On “Floating Point” option, select “Emulation”

iii. On “Instruction Set” option, select “80186”

iv. Select “OK”


Command Prompt - tc
≡ File Edit Search Run Compile Debug Project Options Window Help
Application...
Compiler
Code generation...
Advanced code generation...
Entry/Exit Code...
C++ options...
Optimizations...
Command Prompt - tc
≡ File Edit Search Run Compile Debug Project Options Window Help
OK
Cancel
Help

```
Advanced Code Generation

Floating Point              Options
( ) None                    [X] Generate underbars
(•) Emulation               [ ] Line numbers debug info
( ) 8087                    [X] Debug info in OBJs
( ) 80287                   [X] Fast floating point
                            [ ] Fast huge pointers
Instruction Set             [ ] Generate COMDEFs
( ) 8088/8086               [ ] Automatic far data
(•) 80186
( ) 80286                   Far Data Threshold  32767

File name                                   Data
HELLO.CPP                                   n/a
8000A.LIB     LIB                n/a   n/a  n/a

F1 Help | Detect and use coprocessor, otherwise emulate the 8087/80287
```

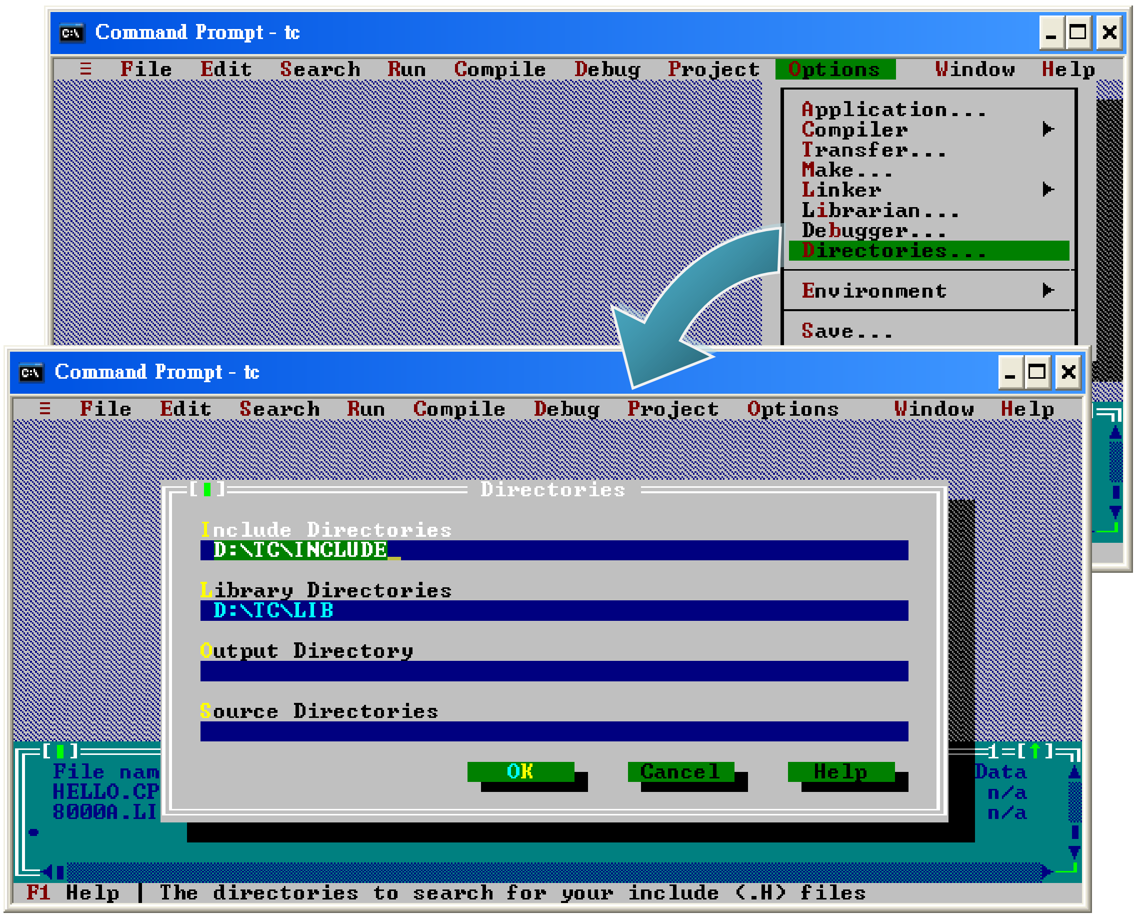
Step 11: Set the memory model to large

i. Select “Directories…” from the “Options” menu

ii. On “Include Directories” option, specify the header file

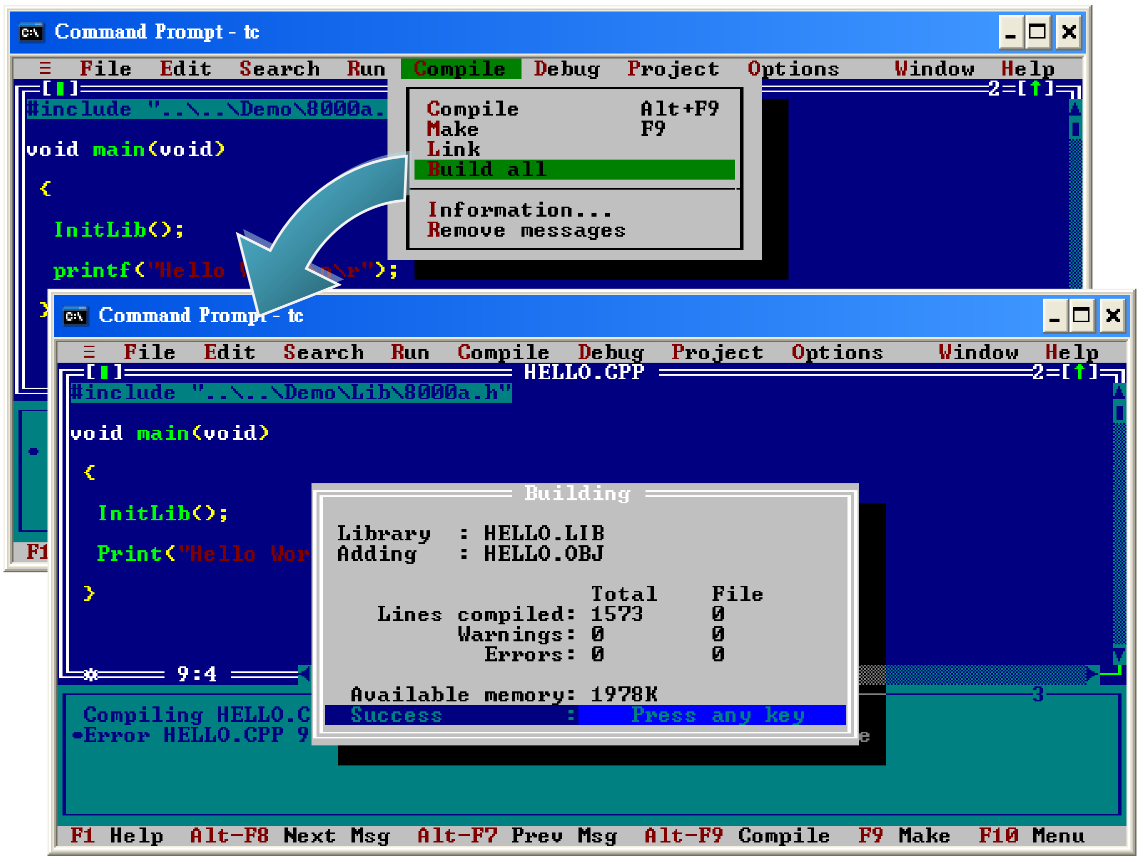
iii. On “Library Directories” option, specify the function library file

iv. Select “OK”



```
Include Directories
D:\TC\INCLUDE
Library Directories
D:\TC\LIB
Output Directory

Source Directories

F1 Help | The directories to search for your include (.H) files
```

Step 12: Select “Build all” from the “Compile” menu to build the project



```
 ≡  File  Edit  Search  Run  Compile  Debug  Project  Options   Window  Help
#include "..\..\Demo\8000a.
void main(void)
 {
  InitLib();
  printf("Hello ...\n\r");
 }
```

```
Compile            Alt+F9
Make               F9
Link
Build all

Information...
Remove messages
```

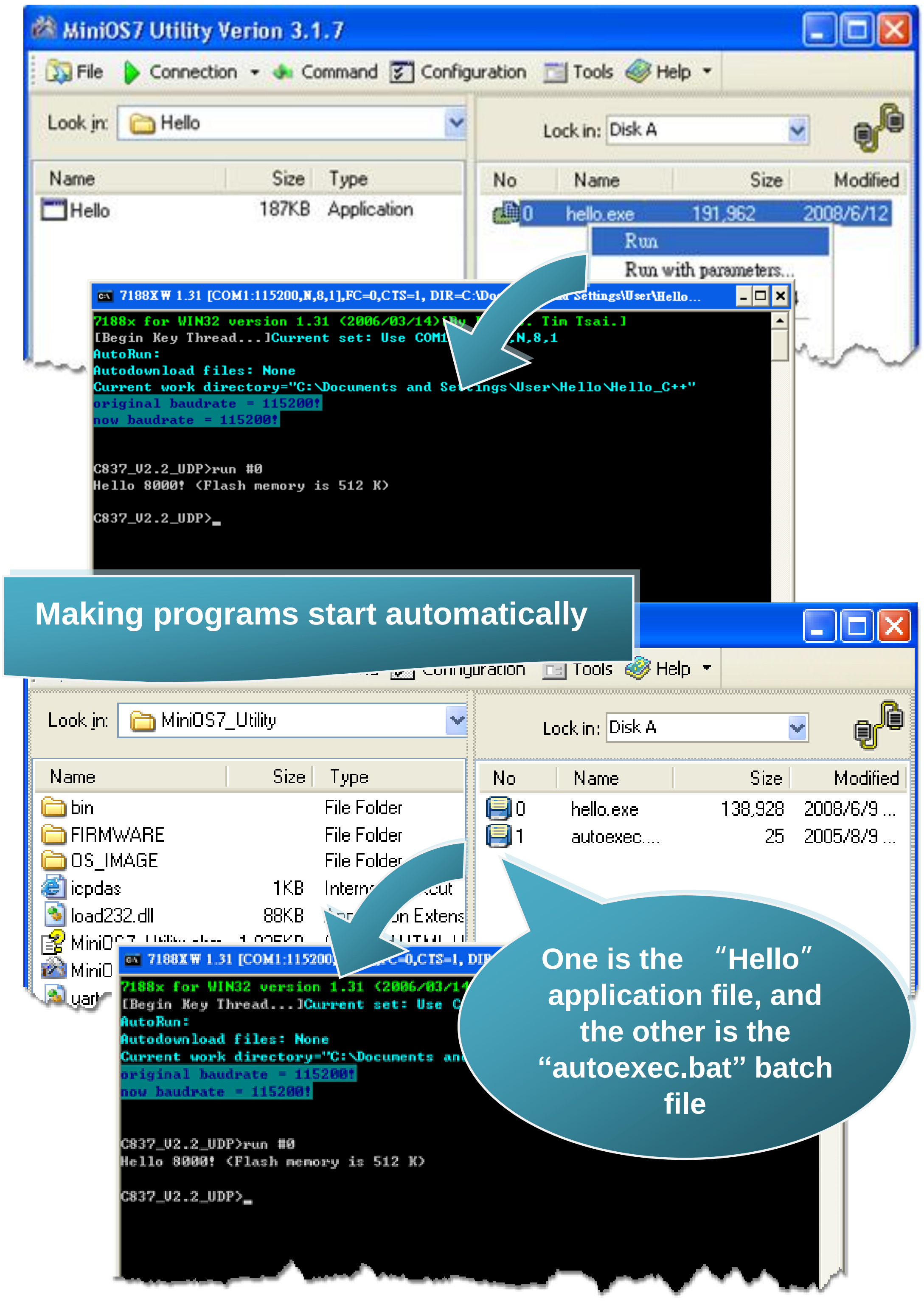
```
 ≡  File  Edit  Search  Run  Compile  Debug  Project  Options   Window  Help
                                          HELLO.CPP
#include "..\..\Demo\Lib\8000a.h"
void main(void)
 {
  InitLib();
  Print("Hello Wor
 }
     9:4
Compiling HELLO.C
•Error HELLO.CPP 9
```

```
                 Building
Library   : HELLO.LIB
Adding    : HELLO.OBJ

                   Total     File
   Lines compiled: 1573      0
         Warnings: 0         0
           Errors: 0         0

  Available memory: 1978K
  Success           :        Press any key
```

```
F1 Help  Alt-F8 Next Msg  Alt-F7 Prev Msg  Alt-F9 Compile  F9 Make  F10 Menu
```

Step 13: Use the MiniOS7 Utility to connect the µPAC-7186E

For more detailed information about this process, please refer to section "2.3.1. Establishing a connection"



```
7188XW 1.31 [COM1:115200,N,8,1],FC=0,CTS=1, DIR=C:\Do          Settings\User\Hello...
7188x for WIN32 version 1.31 (2006/03/14)[By         . Tim Tsai.]
[Begin Key Thread...]Current set: Use COM1       ,N,8,1
AutoRun:
Autodownload files: None
Current work directory="C:\Documents and Se  ings\User\Hello\Hello_C++"
original baudrate = 115200!
now baudrate = 115200!


C837_V2.2_UDP>run #0
Hello 8000! (Flash memory is 512 K)

C837_V2.2_UDP>_
```

4. API and Demo Reference

There are several demo programs that have been designed for µPAC-7186E. You can examine the demo source code, which includes numerous comments, to familiarize yourself with the MiniOS7 APIs and quickly develop your own applications quickly by modifying these demo programs.

➤ **Basic**

Folder	Demo	Explanation
File	Config_1_Basic	Reads information from a text file (basic).
	Config_2_Advanced	Reads a config file (text file) (advanced).
Hello	Hello_C	Reads the library version and flash memory size.
	Hello_C++	
Misc	Reset	Resets the software.
	Runprog	Illustrates how to select an item and run it.
	Serial	Illustrates how to retrieve 64-bit hardware unique serial number.
	Watchdog	Enables the WDT or bypasses the enable WatchDog function.
Memory	EEPROM	Shows how to write a value to the EEPROM.
Memory	Flash	Shows how to write and erase the Flash.
LED	Led	Shows how to control the red LED display.
	Seg7led	Shows how to control the red 7-segment display.
DateTime	DateTime	Shows how to read and write the date and time from the RTC.
7K87K_Module	7K87K_DI_for_Com	Shows how to connect and

Folder	Demo	Explanation
	7K87K_DO_for_Com	control the 7K or 87K series modules via COM2.
	7K87K_AI_for_Com	
	AO_22_26_for_Com	
	AO_024_for_Com	
Com port	C_Style_IO	(1) Shows how to write a function to input data. (2) Shows how to receive a string. (3) Shows how to use a C function: sscanf or just use Scanf()
	Receive	Receives data from COM port. Slv_COM.c is in non-blocked mode Receive.c is in blocked mode.
	Slv_COM	A slave COM Port demo for (request/reply) or (command/response) applications.
	ToCom_In_Out	Illustrates how to Read/Write byte data via COM Port.
7186FD (for 64MB flash memory on µPAC-7186EX-FD)	Utiliy	Utility for the MiniOS7 File System. Operations Include Dir, Read, Write, etc.
	MFS_QA	Quality assurance program for the MiniOS7 File System. Including function test, read/write performance test.
	Puts	How to write a string to a file in the 64MB flash memory
	Gets	How to get a string from a file in the 64MB flash memory

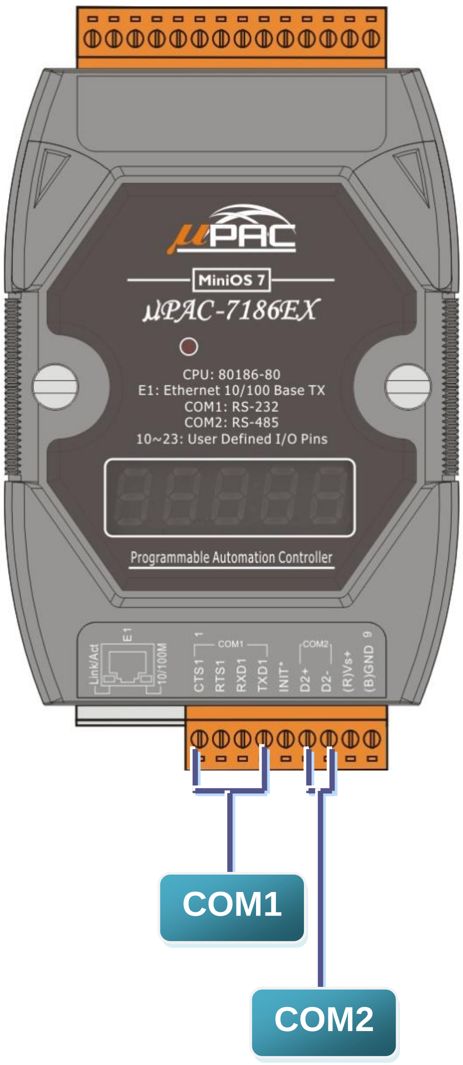
For more information about these demo programs, please refer to:

CD:\NAPDOS\7186e\Demo\Basic\bc_tc\
http://ftp.Icpdas.com/pub/cd/8000cd/napdos/7186e/demo/basic/bc_tc/

4.1. API for COM Port

The µPAC-7186E provides two built-in COM ports, COM1 and COM2.

- COM1 – An RS-232 port that can use to connect to PC.
- COM2 – An RS-485 port that can use in a point to point connection.


µPAC
MiniOS 7
µPAC-7186EX
CPU: 80186-80
E1: Ethernet 10/100 Base TX
COM1: RS-232
COM2: RS-485
10~23: User Defined I/O Pins
Programmable Automation Controller
COM1
COM2

4.1.1. Types of COM port functions

There are two types of functions below for using COM port.

1. MiniOS7 COM port functions
2. (C style) Standard COM port functions

Tips & Warnings

⚠ You have the alternative of MiniOS7 COM ports functions or (C style) Standard COM port functions. If you choose the ones, then another cannot be used.

Summarize the results of the comparison between MiniOS7 COM port functions and (C style) Standard COM port functions:

Kinds of Functions	COM Port	Buffer		Functions			
		RX	TX	Check data	Send data	Read data	Show data
MiniOS7 COM port	1, 2, etc.	1 KB	1 KB	IsCom()	ToCom()	ReadCom()	printCom()
(C style) Standard COM port	1 (Note)	512 Bytes	256 Bytes	Kbhit()	Puts() Putch()	Getch()	Print()

4.1.2. API for MiniOS7 COM port

API for using COM ports

1. InstallCom()

Before any COM Port can be used, the driver must be installed by calling InstallCom().

2. RestoreCom()

If the program calls InstallCom(), the RestoreCom()must be called to restore the COM Port driver.

API for checking if there is any data in the COM port input buffer

3. IsCom()

Before reading data from COM port, the IsCom() must be called to check whether there is any data currently in the COM port input buffer.

API for reading data from COM ports

4. ReadCom()

After IsCom() confirms that the input buffer contains data, the ReadCom() must be called to read the data from the COM port input buffer.

API for sending data to COM ports

5. ToCom()

Before sending data to COM ports, the ToCom() must be called to send data to COM ports.

For example, reading and receiving data through the COM1.

```
#include <stdio.h>
#include “7186e.h”

void main(void)
{
 int quit=0, data;

 InitLib();      /* Initiate the 7186e library */
 InstallCom(1, 115200, 8, 0, 1);      /* Install the COM1 driver */

 while(!quit)
 {
  if(IsCom(1))      /* Check if there is any data in the COM port input buffer */
  {
   data=ReadCom(1);      /* Read data from COM1 port */
   ToCom(1, data);      /* Send data via COM1 port */
   if(data==’q’) quit=1;      /* If ‘q’ is received, exit the program */
  }
 }
 RestoreCom(1);      /* Uninstall the COM1 driver */
}
```

6. printCom()

Functions such as printfCom() in the C library allow data to be output from COM ports.

For example, showing data from the COM1 port.

```
#include <stdio.h>
#include “7186e.h”

void main(void)
{
 int i;

 /* Initiate the 7186e library */
 InitLib();
 InstallCom(1, 115200, 8, 0, 1);      /* Install the COM1 driver */
 for (i=0;i<10;i++)
 {
  printCom(1,”Test %d\n\r”, i);
 }
 Delay(10);      /* Wait for all data are transmitted to COM port */
 RestoreCom(1);
}
```

For more demo program about the COM port, please refer to:

CD:\NAPDOS\7186e\Demo\Basic\COM_Ports\
http://ftp.Icpdas.com/pub/cd/8000cd/napdos/7186e/demo/basic/bc_tc/com_port/

4.1.3. API for standard COM port

The standard COM port is used to download program from PC to the µPAC-7186E.

Tips & Warnings

The following configurations of the standard COM port are fixed:

Baudrate = 115200 bps, Data format = 8 bits

Parity check = none, Start bit = 1, Stop bit = 1

API for checking if there is any data in the input buffer

1. Kbhit()

Before reading data from standard I/O port, the kbhit() must be called to check whether there is any data currently in the input buffer.

API for reading data from standard I/O port

2. Getch()

After kbhit() confirms that the input buffer contains data, the Getch() must be called to read data from the input buffer.

API for sending data to standard I/O port

3. Puts() – For sending a string

Before sending data to standard I/O port, the Puts() must be called to send data to COM Port..

4. Putch( ) – For sending one character

Before sending data to standard I/O port, the Putch() must be called to send data to COM Port.

API for showing data from standard I/O port

5. Print()

Functions such as Print() in the C library allow data to be output from the COM port.

For example, reading and receiving data through COM1.

```
#include<stdio.h>
#include “7186e.h”

void main(void)
{
 int quit=0, data;

 InitLib();     /* Initiate the 7186e library */
 while(!quit)
 {
  if(Kbhit())     /* Check if any data is in the input buffer */
  {
   data=Getch();     /* Read data from COM1 */
   Putch(data);     /* Send data to COM1 */
   if(data==’q’) quit=1;     /* If ‘q’ is received, exit the program */
  }
 }
}
```

For example, showing data through COM1.

```
#include <stdio.h>
#include “7186e.h”

void main(void)
{
 int i;

 /* Initiate the 7186e library */
 InitLib();
 for(i=0;i<10;i++)
 {
  Print(“Test %d\n\r”,i);
 }
}
```

4.1.4. Comparison between MiniOS7 and Standard COM port function

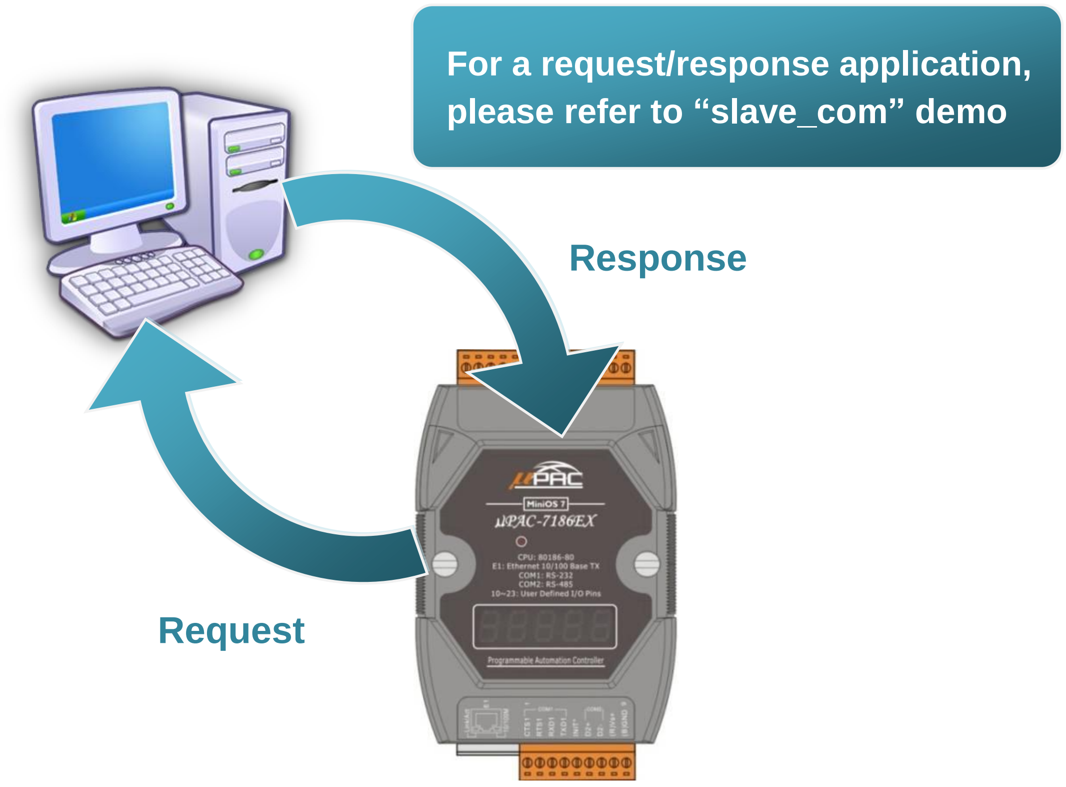
For example, learning to show the ASCII code.

MiniOS7 COM port functions	Standard COM port functions
#include<stdio.h>	#include<stdio.h>
#include “7186e.h”	#include “7186e.h”
void main(void)	void main(void)
{	{
unsigned char item;	unsigned char item;
InitLib();	InitLib();
InstallCom(1, 115200, 8, 0, 1);	
printCom(1,”Hits any key.\n”);	Print("Hits any key.\n");
printCom(1,”Hit the ESC to exit!\n”);	Print("Hits the ESC to exit !\n");
for(;;)	for(;;)
{	{
if(IsCom(1))	if(kbhit())
{	{
item=ReadCom(1);	item=Getch();
if(item==’q’)	if(item==’q’)
{	{
return;	return;
}	}
else	else
{	{
printCom(1,”----------\n\r”);	Print(”----------\n\r”);

printCom(1,”char:”);	Print(“char:“);
ToCom(1,item);	Putch(item);
printCom(1,"\n\rASCII(%c)\n\r”,item);	Print("\n\rASCII(%c)\n\r”,item);
printCom(1,“Hex(%02X)\n\r”,item);	Print(“Hex(%02X)\n\r”,item);
}	}
}	}
}	}
Delay(10);	
RestoreCom(1);	
}	}

4.1.5. Request/Response protocol define on COM port

Request/Response communication is very typical protocol architecture. If you want to design a command set of communication protocol as table below, you can refer to “slave_com” demo.


For a request/response application, please refer to “slave_com” demo
Response
Request

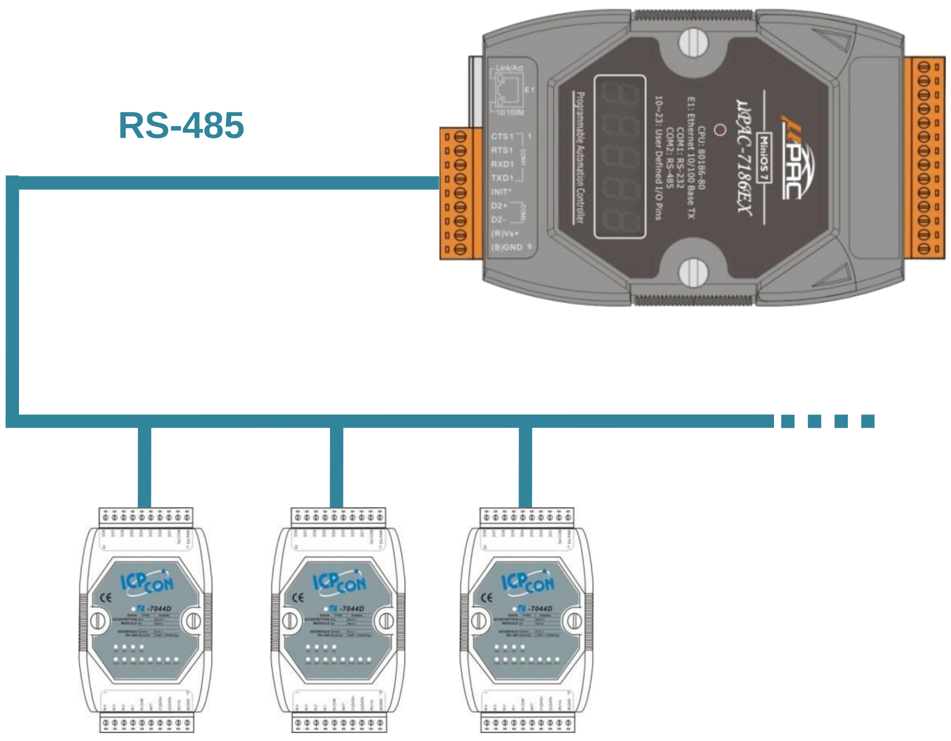
Request	Response
c1	Debug information: Command1 Command1
c2	Debug information: Command2 Command2
Q	Debug information: Quick program
Other command	Debug information: Unknown command

For more demo program about the COM port, please refer to:

CD:\NAPDOS\7186e\Demo\Basic\COM_Ports\
http://ftp.Icpdas.com/pub/cd/8000cd/napdos/7186e/demo/basic/bc_tc/com_port/

4.2. API for I/O Modules

The µPAC-7186E is equipped with a RS-485 communication interface, COM2, to access I-7K series I/O modules for a wide range of RS-485 network application, as shown below.



Steps to communicate with i-7K series I/O modules:

Step 1: Use Installcom() to install the COM port driver.

Step 2: Use SendCmdTo7000(2,…) to send commands

Step 3: Use ReceiveResponseFrom7000_ms() to get the response.

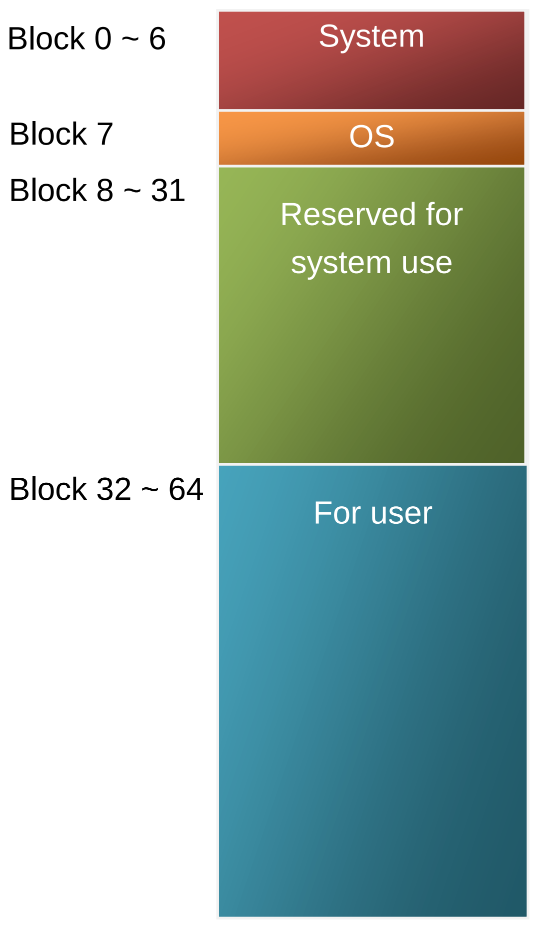
Step 4: Use RestoreCom() to restore the COM port driver

For example, to send a command ‘$01M’ to I-7K I/O module for getting the module name.

```
#include <stdio.h>
#include “7186e.h”

void main(void)
{
 unsigned char InBuf0[60];
 InitLib();     /* Initiate the 7186e library */

 InstallCom(1,115200,8,0,1);     /* Install the COM1 driver */
 InstallCom(2,115200,8,0,1);     /* Install the COM2 driver */

 SendCmdTo7000(2,”$01M”,0);     /* Send a command to COM2 */

 /* Timeout = 50ms, check sum disabled */
 ReceiveResponseFrom7000_ms(2,InBuf0,50,0);

 printCom(1,”Module Name = %s”, InBuf0);
 Delay(10);     /* Wait for all data are transmitted to COM port */
 RestoreCom(1);     /* Uninstall the COM1 driver */

 RestoreCom(2);     /* Uninstall the COM2 driver */
}
```

4.3. API for EEPROM

- The EEPROM contains 64 blocks (block 0 ~ 63), and each block has 256 bytes (address 0 ~ 255), with a total size of 16,384 bytes (16K) capacity.
- The default mode for EEPROM is write-protected mode.
- The system program and OS are stored in EEPROM that are allocated as shown below.



API for writing data to the EEPROM

1. EE_WriteEnable()

Before writing data to the EEPROM, the EE_WriteEnable() must be called to write-enable the EEPROM.

2. EE_WriteProtect()

After the data has finished being written to the EEPROM, the EE_WriteProtect() must be called to in order to write-protect the EEPROM.

3. EE_MultiWrite()

After using the EE_WriteEnable() to write-enable EEPROM, the EE_MultiWrite()must be called to write the data.

API for reading data from the EEPROM

4. EE_MultiRead()

The EE_WriteEnable() must be called to read data from the EEPROM no matter what the current mode is.

For example, to write data to block1, address 10 of the EEPROM:

```
#include <stdio.h>
#include “7186e.h”

void main(void)
{
 int data=0x55, data2;

 InitLib();     /* Initiate the 7186e library */
 EE_WriteEnable();
 EE_MultiWrite(1,10,1,&data);
 EE_WriteProtect();

 EE_MultiRead(1,10,1,&data2);     /* Now data2=data=0x55 */
}
```

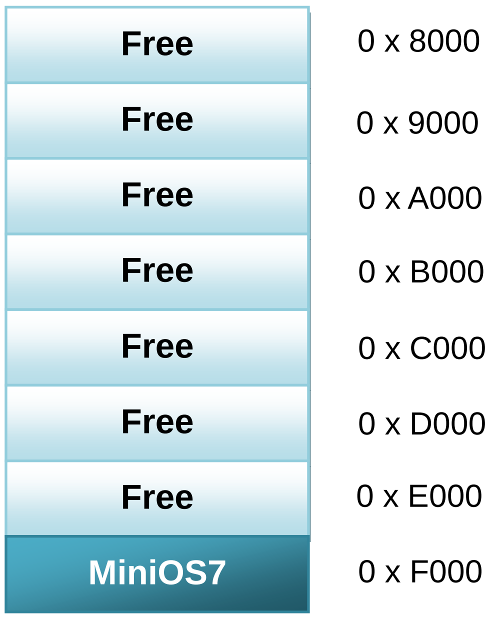
For more demo program about the EEPROM, please refer to:

CD:\NAPDOS\7186e\Demo\Basic\Memory\
http://ftp.Icpdas.com/pub/cd/8000cd/napdos/7186e/demo/basic/bc_tc/memory/

4.4. API for Flash Memory

- The µPAC-7186E module contains 512 Kbytes of Flash memory.
- MiniOS7 uses the last 64K bytes; the other parts of the memory are used to store user programs or data.
- Each bit of the Flash memory only e can be written from 1 to 0 and cannot be written from 0 to 1.
- Before any data can be written to the Flash memory, the flash must be erased, first which returns all data to 0xFF, meaning that all data bits are set to “1”. Once there is completed, new data can be written.

Free: 448 K bytes
MiniOS7: 64 K bytes
Total Size: 512 K bytes



API for writing data to the Flash Memory

1. FlashWrite()

The FlashWrite() must be called to write data to the Flash Memory.

API for reading data from the Flash Memory

2. FlashRead()

The FlashRead() must be called to read data from the Flash Memory.

For example, to write an integer to segment 0xD000, offset 0x1234 of the Flash memory.

```
#include <stdio.h>
#include “7186e.h”

void main(void)
{
int data=0xAA55, data2;
char *dataptr;
int *dataptr2;

InitLib();     /* Initiate the 7186e library */
dataptr=(char *)&data;
FlashWrite(0xd000,0x1234, *dataptr++);
FlashWrite(0xd000,0x1235, *dataptr);

/* Read data from the Flash Memory (method 1) */
dataprt=(char *)&data2;
*dataptr=FlashRead(0xd000,0x1234);
*(dataptr+1)=FlashRead(0xd000,0x1235);

/* Read data from the Flash Memory (method 2) */
dataptr2=(int far *)_MK_FP(0xd000,0x1234);
data=*data;
}
```

For more demo program about the flash memory, please refer to:

CD:\NAPDOS\7186e\Demo\Basic\Memory\
http://ftp.Icpdas.com/pub/cd/8000cd/napdos/7186e/demo/basic/bc_tc/memory/

4.5. API for NVRAM

- The µPAC-7186E is equipped with an RTC (Real Time Clock), 31 bytes of NVRAM can be used to store data.
- NVRAM is SRAM, but it uses battery to keep the data, so the data in NVRAM does not lost its information when the module is power off.
- NVRAM has no limit on the number of the re-write times. (Flash and EEPROM both have the limit on re-write times) If the leakage current is not happened, the battery can be used 10 years.

API for writing data to the NVRAM

1. WriteNVRAM()

The WriteNVRAM() must be called in order to write data to the NVRAM.

API for reading data from the NVRAM

2. ReadNVRAM()

The ReadNVRAM() must be called in order to write data to the NVRAM.

For example, use the following code to write data to the NVRAM address 0.

```
#include <stdio.h>
#include “7186e.h”

void main(void)
{
 int data=0x55, data2;
 InitLib();     /* Initiate the 7186e library */
 WriteNVRAM(0,data);
 data2=ReadNVRAM(0);     /* Now data2=data=0x55 */
}
```

For example, the following can be used to write an integer (two bytes) to NVRAM.

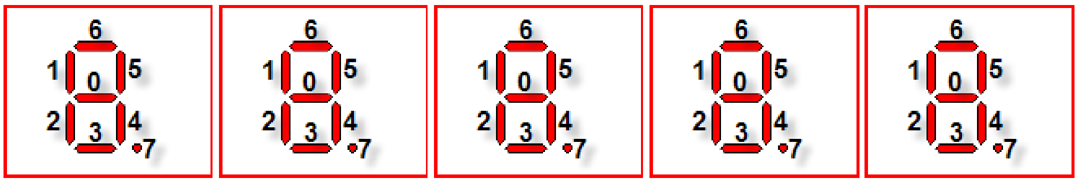
```
#include <stdio.h>
#include “7186e.h”

void main(void)
{
int data=0xAA55, data2;
char *dataptr=(char *)&data;

InitLib();     /* Initiate the 7186e library */
WriteNVRAM(0, *dataptr);     /* Write the low byte */
WriteNVRAM(1, *dataptr+1);     /* Write the high byte */
dataptr=(char *) &data2;
*dataptr=ReadNVRAM(0);     /* Read the low byte */
(*dataptr+1)=ReadNVRAM(1);     /* Read the high byte */
}
```

For more demo program about the NVRAM, please refer to:

CD:\NAPDOS\7186e\Demo\Basic\Memory\
http://ftp.Icpdas.com/pub/cd/8000cd/napdos/7186e/demo/basic/bc_tc/memory/

4.6. API for 5-Digital LED

The µPAC-7186E contains a 5-Digit 7-SEG LED with a decimal point on the left-hand side of each digit, which be used to display numbers, IP addresses, time, and so on.



API for starting the 5-Digit 7-SEG LED

1. Init5DigitLed()

Before using any LED functions, the Init5DigitLed() must be called to initialize the 5-Digit 7-SEG LED.

API for displaying a message on the 5-Digit 7-SEG LED

2. Show5DigitLed()

After the Init5DigitLed() is used to initialize the 5-Digit 7-SEG LED, the Show5DigitLed() must be called to display information on the 5-Digits 7-SEG LED.

For example, use the following code to display “8000E” on the 5-Digit 7-SEG LED.

```
#include <stdio.h>
#include “7186e.h”

void main(void)
{
 InitLib();     /* Initiate the 7186e library */

 Init5DigitLed();
 Show5DigitLed(1,8);
 Show5DigitLed(2,0);
 Show5DigitLed(3,0);
 Show5DigitLed(4,0);
 Show5DigitLed(5,14);     /* The ASCII code for the letter ‘E’ is 14 */

}
```

For more demo program about the 5-digit 7-SEG LEDs, please refer to:

CD:\NAPDOS\7186e\Demo\Basic\LED\
http://ftp.Icpdas.com/pub/cd/8000cd/napdos/7186e/demo/basic/bc_tc/led/

4.7. API for Timer

- The μPAC-7186E can support a single main time tick, 8 stop watch timers and 8 counts down timers.
- The μPAC-7186E uses a single 16-bit timer to perform these timer functions, with a timer accuracy of 1 ms..

API for starting the Timer

1. TimerOpen()

Before using the Timer functions, the TimerOpen() must be called at the beginning of the program.

API for reading the Timer

2. TimerResetValue()

Before reading the Timer, the TimerResetValue() must be called to reset the main time ticks to 0.

3. TimerReadValue()

After the TimerResetValue() has reset the main time ticks to 0, the TimerReadValue() must be called to read the main time tick.

API for stopping the Timer

4. TimerClose()

Before ending the program, the TimerClose() must be called to stop the Timer.

For example, the following code can be used to read the main time ticks from 0

```
#include <stdio.h>
#include “7186e.h”

void main(void)
{
 Unsigned long time iTime;

 InitLib();      /* Initiate the 7186e library */
 TimerOpen();
 While(!quit)
 {
  If(Kbhit())
  TimerResetValue();      /* Reset the main time ticks to 0 */

  iTime=TimerReadValue();      /* Read the main time ticks from 0 */
 }
 TimerClose();      /* Stop using the 8000e timer function */
}
```

For more demo program about the timer, please refer to:

CD:\NAPDOS\7186e\Demo\Basic\Timer\
http://ftp.Icpdas.com/pub/cd/8000cd/napdos/7186e/demo/basic/bc_tc/timer/

4.8. API for WatchDog Timer (WDT)

- The µPAC-7186E is equipped with MiniOS7, the small-cored operating system, MiniOS7 uses the Timer 2 (A CPU internal timer) as system Timer. It is 16-bits Timer, and generate interrupt every 1 ms. So the accuracy of system is 1 ms.
- The Watch Dog Timer is always enabled, and the system Timer ISR (Interrupt Service Routine) refreshes it.
- The system is reset by WatchDog. The timeout period of WatchDog is 0.8 seconds.

API for refreshing WDT

1. EnableWDT()

The WDT is always enabled, before user's programming to refresh it, the EnableWDT() must be called to stop refreshing WDT.

2. RefreshWDT()

After EnableWDT() stop refreshing WDT, the RefreshWDT() must be called to refresh the WDT.

3. DisableWDT()

After user's programming to refresh WDT, the DisableWDT() should be called to automatically refresh the WDT.

For example, to refresh the Watchdog Timer.

```
#include <stdio.h>
#include “7186e.h”

void main(void)
{
 Unsigned long time iTime;

 InitLib();     /* Initiate the 7186e library */
 Enable WDT();
 While(!quit)
 {
  RefreshWDT();
  User_function();
 }
 DisableWDT();
}
```

For more demo program about the WatchDog Timer, please refer to:

CD:\NAPDOS\7186e\Demo\Basic\Misc\
http://ftp.Icpdas.com/pub/cd/8000cd/napdos/7186e/demo/basic/bc_tc/misc/

4.9. API for MFS (For µPAC-7186EX-FD series only)

The µPAC-7186EX-FD series products equips an extra 64MB flash memory, the MFS is designed to read/write file from/to the 64MB flash memory.

For full usage information regarding the hardware supported, applications, and the specification, please refer to section “Appendix D. What is MiniOS7 File System (MFS)”

● Summarize of the MFS functions:

Function	Description
mfs_Init	Initialize the file system.
mfs_Stop	Allocated buffers are freed upon closing.
mfs_ResetFlash	Initialize the file system. All files will lose.
mfs_X600Fs_GetLibVersion	Gets the version number of function library.
mfs_GetLibDate	Gets the create date of function library.
mfs_GetFileNo	Gets the total number of files stored in the NAND Flash.
mfs_GetFreeSize	Gets the size of available space that can be used to append file.
mfs_GetBadSize	Gets the size of non-available space.
mfs_GetUsedSize	Gets the size of used space.
mfs_GetFileSize	Gets the size of file stored in the NAND Flash.
mfs_GetFileInfoByName	Uses the specified filename to retrieve file information.
mfs_GetFileInfoByNo	Uses the file number index to retrieve file information.
mfs_DeleteAllFiles	Delete all files stored in the NAND Flash.
mfs_DeleteFile	Delete one selected file that has been written to the NAND Flash.
mfs_OpenFile	1. Opens a file with a file name. 2. Creates a new file..
mfs_CloseFile	Closes a file with a file handle.

Function	Description
	All buffers associated with the stream are flushed before closing.
mfs_ReadFile	Reads specified bytes of data from a file.
mfs_WriteFile	Appends specified bytes of data to a file.
mfs_Getc	Gets a character from a file.
mfs_Putc	Outputs a character data to the file.
mfs_Gets	Gets a string from a file.
mfs_Puts	Outs a string a file.
mfs_EOF	Macro that tests if end-of-file has been reached on a file.
mfs_Seek	Repositions the file pointer of a file.
mfs_Tell	Returns the current file pointer.
mfs_EnableWriteVerify	Enable the data verification. By default, the data verification is enabling.
mfs_DisableWriteVerify	Disable the data verification.

API for starting 64MB flash memory

1. mfs_ Init()

Before using any MFS functions, the mfs_Init() must be called to initialize the 64MB flash memory.

2. mfs_Stop()

If the program calls the mfs_Init() to initialize the 64MB flash memory, the mfs_Stop() must be called to allocate buffers to free upon closing.

API for writing/reading files from the 64MB flash memory

3. mfs_OpenFile()

Before writing/reading data to/from the 64MB flash memory, the OpenFile() must be called to open the file.

4. mfs_CloseFile()

After the data has finished being written/read to/from the 64MB flash memory, the mfs_CloseFile() must be called to close the file with a file handle.

API for writing data to the 64MB flash memory

5. mfs_Puts()

After using the mfs_OpenFile() to open the file, the FlashRead() must be called to read data from the Flash Memory.

For example, writing data to the 64MB flash memory:

```
#include <stdio.h>
#include “7186e.h”
#include “MFS.h”

#define_DISK_A     0
#define_DISK_B     1

int   main(void)
{
 int iFileHandle, iRet;

 InitLib();      /* Initiate the 7186e library */
 iRet=mfs_Init();
 if(iRet<=0) return;

 iFileHandle=mfs_OpenFile(_DISK_A,”Test.txt”,”w”);
 if(iFileHandle>0)
 {
  Print(“Write string to Test.txt…”);
  mfs_Puts(iFileHandle,”test mfs on 64MB flash”);
  mfs_CloseFile(iFileHandle);
  Print(“done”);
 }
 else
 Print(“Open file error\n\r”);
 mfs_Stop();
 return;
}
```

6. mfs_Gets()

After using the mfs_OpenFile() to open the file, the mfs_Gets() must be called to read data from the 64MB flash memory.

For example, reading data from the 64MB flash memory:

```
#include <stdio.h>
#include “7186e.h”
#include “MFS.h”

#define_DISK_A     0
#define_DISK_B     1

int   main(void)
{
 int iFileHandle, iRet;

 InitLib();      /* Initiate the 7186e library */
 iRet=mfs_Init();
 if(iRet<=0) return;

 iFileHandle=mfs_OpenFile(_DISK_A,”Test.txt”,”r”);
 if(iFileHandle>0)
 {
  Print(“Read from Test.txt…\n\r”);
  iRet=mfs_Gets(iFileHandle,Data, 80);     /*max length is 80 bytes.*/
  if(iRet>0) Print(“Data=%s\n\r”,Data);

  mfs_CloseFile(iFileHandle);
```

```
   Print(“done”);
  }
  else
  Print(“Open file error\n\r”);
  mfs_Stop();
  return;
 }
```

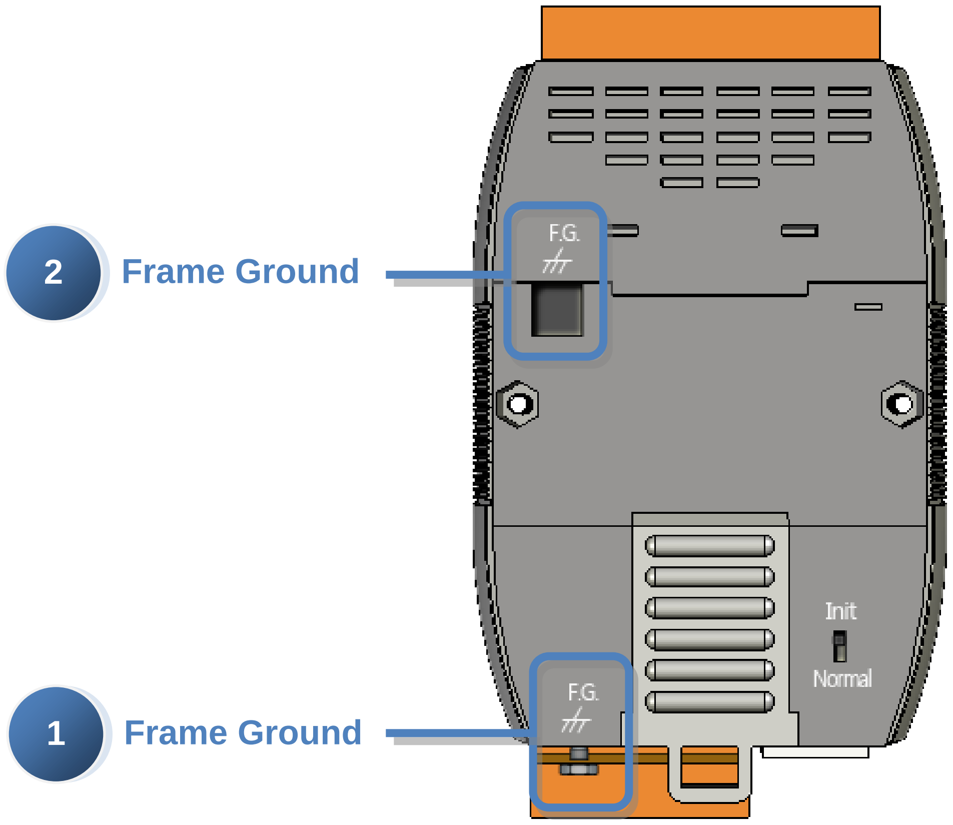
For more demo program about the Flash memory, please refer to:

CD:\NAPDOS\7186e\Demo\Basic\bc_tc\7186FD\
http://ftp.Icpdas.com/pub/cd/8000cd/napdos/7186e/demo/basic/bc_tc/7186fd/

Appendix A. Frame Ground

Electronic circuits are constantly vulnerable to Electro-Static Discharge (ESD), which become worse in a continental climate area. µPAC-7186E modules feature a new design for the frame ground, which provides a path for bypassing ESD, allowing enhanced static protection (ESD) capability and ensures that the module is more reliable.

The following options will provide a better protection for the module:
The µPAC-7186E has a metallic board attached to the back of the plastic basket as shown in the figure below, point 1.
When mounted to the DIN rail, connect the DIN rail to the earth ground because the DIN rail is in contact with the upper frame ground as shown in the figure below, point 2.



Appendix B. What is MiniOS7?

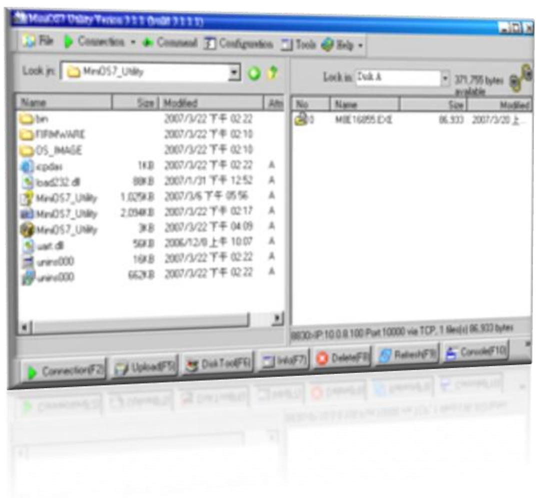
MiniOS7 is an embedded ROM-DOS operating system design by ICP DAS. It is functionally equivalent to other brands of DOS, and can run programs that are executable under a standard DOS.

⚠ DOS (whether PC-DOS, MS-DOS or ROMDOS) is a set of commands or code that tells the computer how to process information. DOS runs programs, manages files, controls information processing, directs input and output, and performs many other related functions.

The following table compares the features between MiniOS7 and ROM-DOS:

Feature	MiniOS7	ROM-DOS
Power-up time	0.1 sec	4 ~ 5 sec
More compact size	< 64 K bytes	64 K bytes
Support for I/O expansion bus	Yes	No
Support for ASIC key	Yes	No
Flash ROM management	Yes	No
OS update (Download)	Yes	No
Built-in hardware diagnostic functions	Yes	No
Direct control of 7000 series modules	Yes	No
Customer ODM functions	Yes	No
Free of charge	Yes	No

Appendix C. What is MiniOS7 Utility?



MiniOS7 Utility is a tool for configuring, uploading files to all products embedded with ICP DAS MiniOS7.

Since version 3.1.1, the Utility can allow users remotely access the controllers (7188E, 8000E..., etc) through the Ethernet.

Functions

* Supported connection ways

1. COM port connection (RS-232)
2. Ethernet connection (TCP & UDP)
   (Supported since version 3.1.1)

* Maintenance

1. Upload file(s)
2. Delete file(s)
3. Update MiniOS7 image

* Configuration

1. Date and Time
2. IP address
3. COM port
4. Disk size (Disk A, Disk B)

* Check product information

1. CPU type
2. Flash Size
3. SRAM Size
4. COM port number
   …, etc.

Including frequently used tools

a. 7188XW
b. 7188EU
c. 7188E
----
d. SendTCP
e. Send232
f. VxComm Utility

Download location:

http://ftp.Icpdas.com/pub/cd/8000cd/napdos/minios7/utility/minios7_utility/

Appendix D. What is MiniOS7 File System (MFS)?

MiniOS7 file system, MFS, offers an rugged alternative to mechanical storage systems. Designed for the 64MB NAND flash memory,

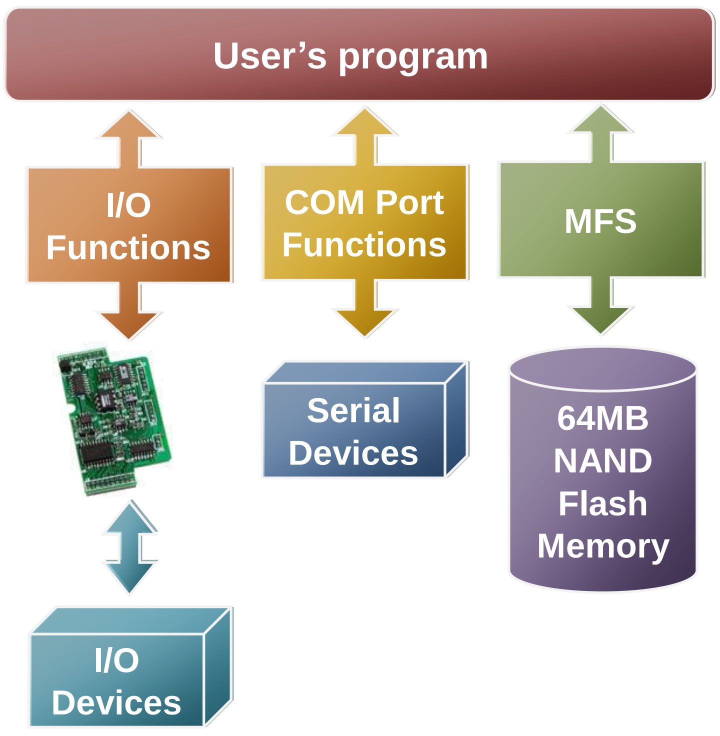
MFS implements a reliable file system with C language API for embedded data logger applications on MiniOS7.

Hardware Supported

µPAC-7186EX-FD (With 64MB Flash Memory), NVRAM: all of the 31 bytes.

Applications

Log data with timestamp, Log data and forward via the Ethernet



MFS Specifications

Item	Description
Disk size	1/2 size of the flash memory size
File number	456 files max. for each disk
File size	Disk Size max. for each file
File name	12 bytes max (case sensitive)
File operation modes	1. Read only 2. Write only: Creates a new file to write data, or overwrite a file (if the file is already exit). 3. Append: appends data to a file.
File handle	10 max for each disk. For read mode: the 10 file handles can all be used for reading operation on each disk. Total 20 files can be opened for reading mode. For write and append mode: only 1 file handle can be used for writing operation on all disks.
Writing verification	Yes. Default is enabled. Calling mfs_EnableWriteVerification and mfs_DisableWriteVerification can change the setting.
Automate file system recovery	Yes. If an unexpected reset or power loss occurs, closed files, and files opened for reading are never at risk. Only data written since the last writing operation (mfs_WriteFile,) might be lost. When the file system reboots, it restores the file system to its state at the time of the last writing operation.
Writing speed	mfs_WriteFile: 147.5 KB/Sec (verification enabled) (default) 244.0 KB/Sec (verification disabled) mfs_Puts: 142.1 KB/Sec (verification enabled) (default) 229.5 KB/Sec (verification disabled)
Reading speed	mfs_ReadFile: 734.7 KB/Sec mfs_Gets: 414.2 KB/Sec

Max. length of writing data	32767 bytes.
Max. length of reading data	32767 bytes.

Resources download:

* MFS SDKs:
  http://ftp.Icpdas.com/pub/cd/8000cd/napdos/7186e/demo/basic/bc_tc/lib/

* MFS Demos:
  http://ftp.Icpdas.com/pub/cd/8000cd/napdos/7186e/demo/basic/bc_tc/7186fd/

Appendix F. More C Compiler Settings

This section describes the setting of the following compilers:

- Turbo C 2.01 Compiler
- BC++ 3.1 IDE
- MSC 6.00 Compiler
- MSVC 1.50 Compiler

F.1. Turbo C 2.01

You have a couple of choices here, you can:

1: Using a command line

For more information, please refer to

CD:\8000\NAPDOS\8000\841x881x\Demo\hello\Hello_C\gotc.bat

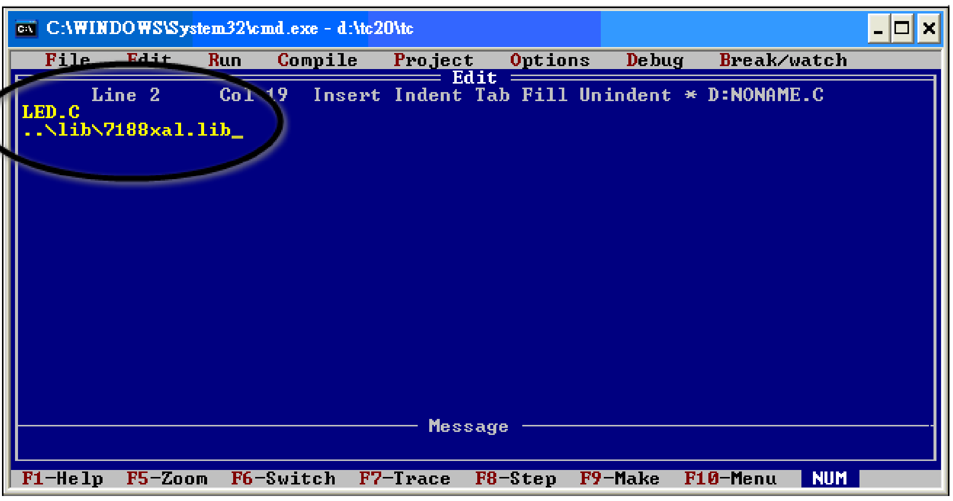
```
tcc -Ic:\tc\include -Lc:\tc\lib hello1.c ..\..\lib\8000e.lib
```

2: Using the TC Integrated Environment

Step 1: Executing the TC 2.01

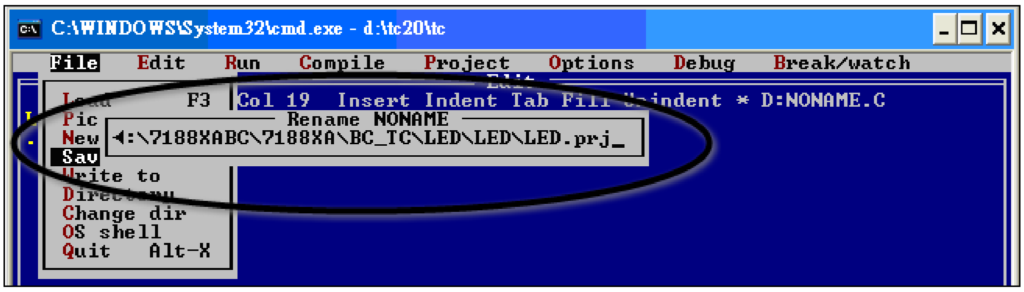
Step 2: Editing the Project file

Adding the necessary library and file to the project



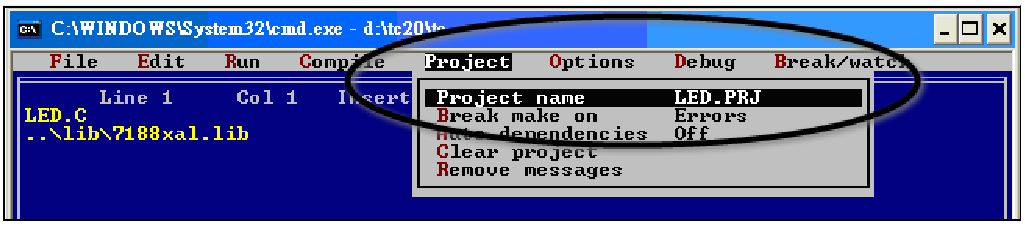
```
C:\WINDOWS\System32\cmd.exe - d:\tc20\tc
  File  Edit  Run  Compile  Project  Options  Debug  Break/watch
                              Edit
      Line 2    Col 19  Insert Indent Tab Fill Unindent * D:NONAME.C
LED.C
..\lib\7188xal.lib_

                              Message
F1-Help  F5-Zoom  F6-Switch  F7-Trace  F8-Step  F9-Make  F10-Menu  NUM
```

Step 3: Save the project and entering a name, such as LED.prj



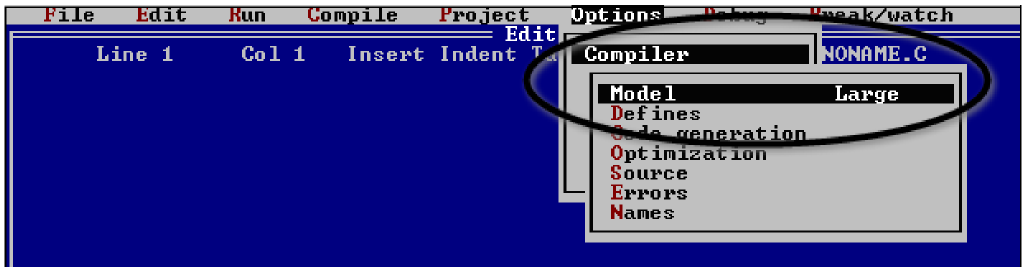
```
C:\WINDOWS\System32\cmd.exe - d:\tc20\tc
 File   Edit   Run   Compile   Project   Options   Debug   Break/watch
                                  Edit
  Load        F3  Col 19  Insert Indent Tab Fill Unindent * D:NONAME.C
  Pic                 Rename NONAME
  New   D:\7188XABC\7188XA\BC_TC\LED\LED\LED.prj_
  Sav
  Write to
  Directory
  Change dir
  OS shell
  Quit      Alt-X
```

Step 4: Load the Project

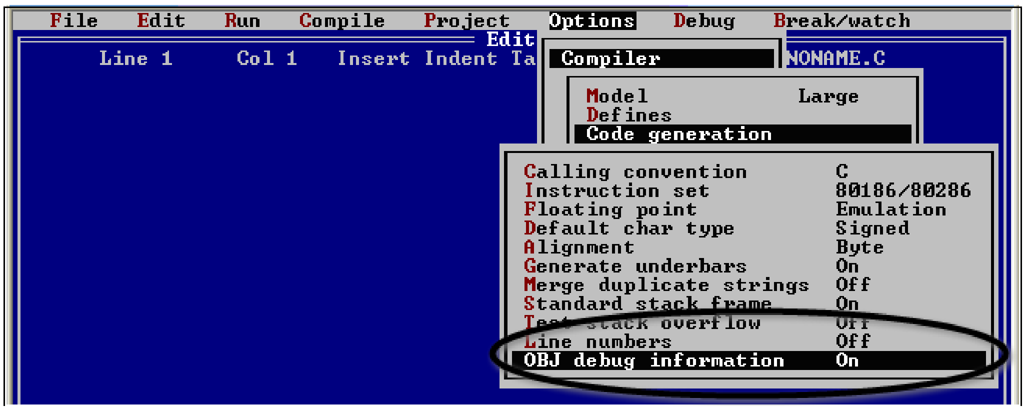


```
C:\WINDOWS\System32\cmd.exe - d:\tc20\tc
 File   Edit   Run   Compile   Project   Options   Debug   Break/watch
      Line 1      Col 1     Insert   Project name          LED.PRJ
LED.C                                Break make on         Errors
..\lib\7188xal.lib                   Auto dependencies     Off
                                     Clear project
                                     Remove messages
```

Step 5: Change the Memory model (Large for 8000e.lib) and set the Code Generation to 80186/80286

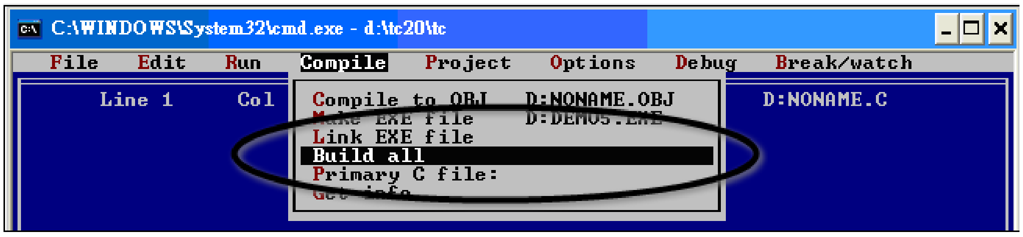


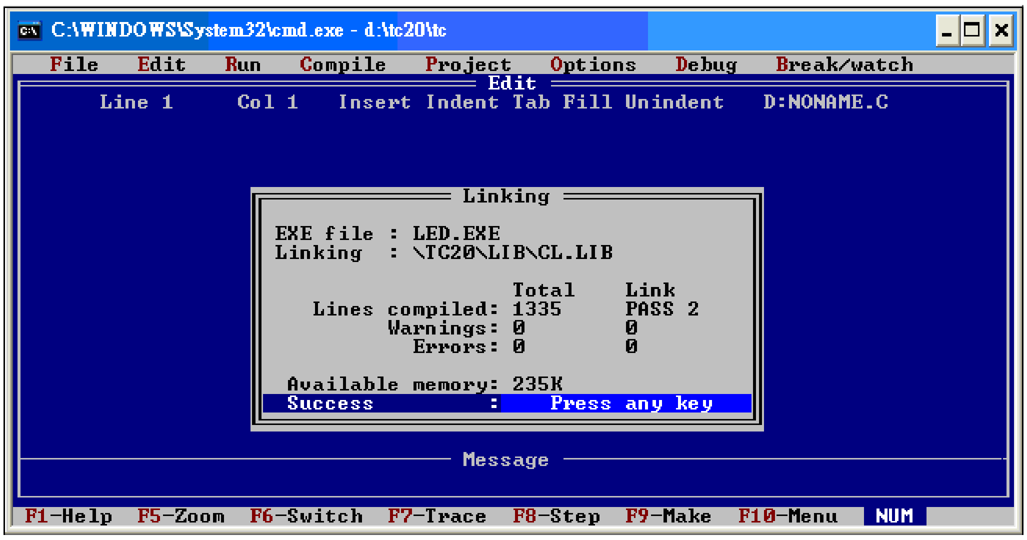
```
 File   Edit   Run   Compile   Project   Options   Debug   Break/watch
                                      Edit
      Line 1      Col 1    Insert Indent Ta  Compiler          NONAME.C
                                               Model              Large
                                               Defines
                                               Code generation
                                               Optimization
                                               Source
                                               Errors
                                               Names
```



```
 File   Edit   Run   Compile   Project   Options   Debug   Break/watch
                                      Edit
      Line 1      Col 1    Insert Indent Ta  Compiler          NONAME.C
                                               Model              Large
                                               Defines
                                               Code generation
                                     Calling convention          C
                                     Instruction set             80186/80286
                                     Floating point              Emulation
                                     Default char type           Signed
                                     Alignment                   Byte
                                     Generate underbars          On
                                     Merge duplicate strings     Off
                                     Standard stack frame        On
                                     Test stack overflow         Off
                                     Line numbers                Off
                                     OBJ debug information       On
```

Step 6: Building the project


C:\WINDOWS\System32\cmd.exe - d:\tc20\tc
File Edit Run Compile Project Options Debug Break/watch
Line 1 Col
Compile to OBJ D:NONAME.OBJ
Make EXE file D:DEMO5.EXE
Link EXE file
Build all
Primary C file:
Get info
D:NONAME.C

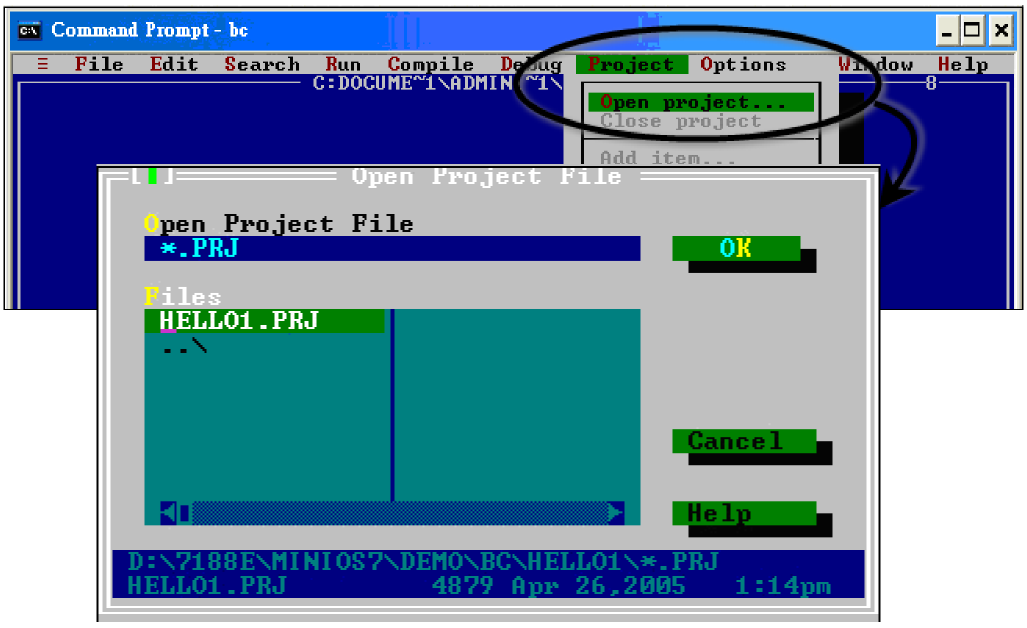

C:\WINDOWS\System32\cmd.exe - d:\tc20\tc
File Edit Run Compile Project Options Debug Break/watch
Edit
Line 1 Col 1 Insert Indent Tab Fill Unindent D:NONAME.C
Message
F1-Help F5-Zoom F6-Switch F7-Trace F8-Step F9-Make F10-Menu NUM

```
                 Linking

EXE file : LED.EXE
Linking  : \TC20\LIB\CL.LIB

                    Total     Link
   Lines compiled: 1335      PASS 2
         Warnings: 0         0
           Errors: 0         0

 Available memory: 235K
 Success          :    Press any key
```

F.2. BC++ 3.1. IDE

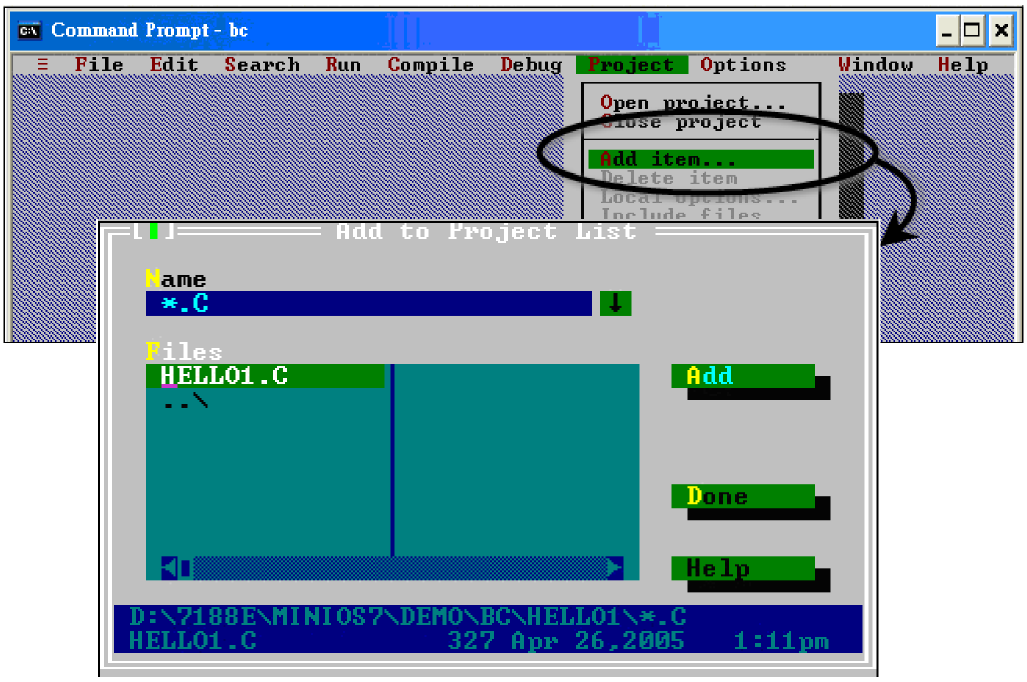
Step 1: Executing the Borland C++ 3.1

Step 2: Creating a new project file (*.prj)



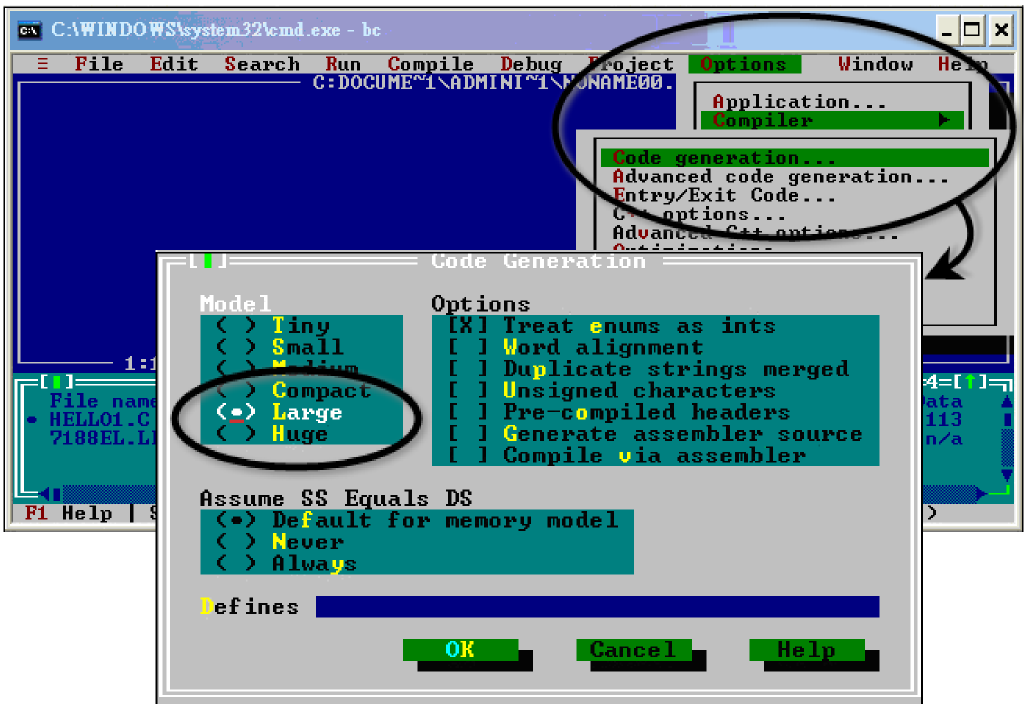
```
D:\7188E\MINIOS7\DEMO\BC\HELLO1\*.PRJ
HELLO1.PRJ          4879 Apr 26,2005    1:14pm
```

Step 3: Add all the necessary files to the project



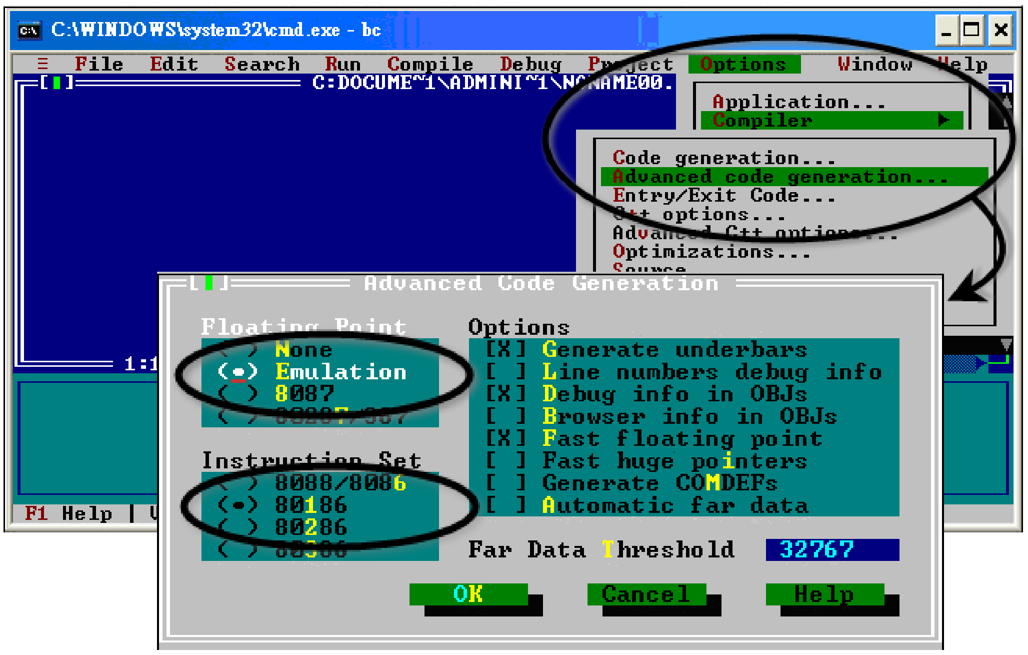
```
D:\7188E\MINIOS7\DEMO\BC\HELLO1\*.C
HELLO1.C            327 Apr 26,2005    1:11pm
```

Step 4: Change the Memory model (Large for 8000e.lib)



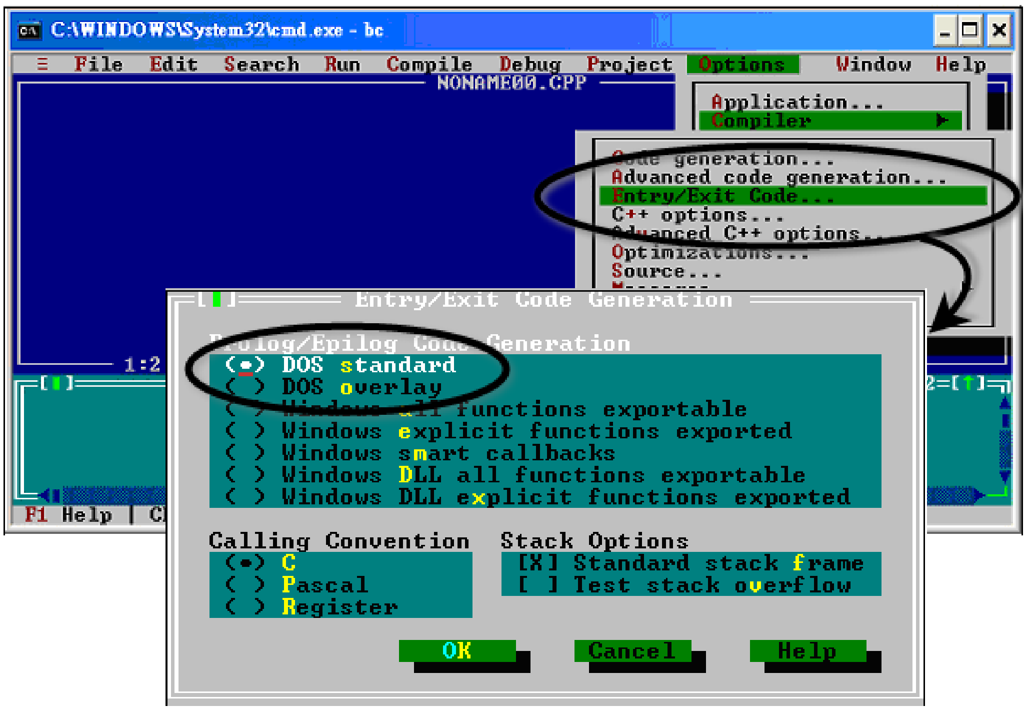
```
C:\WINDOWS\system32\cmd.exe - bc
≡  File  Edit  Search  Run  Compile  Debug  Project  Options  Window  Help
                    C:\DOCUME~1\ADMINI~1\NONAME00.
                                        Application...
                                        Compiler          ►
                                   Code generation...
                                   Advanced code generation...
                                   Entry/Exit Code...
                                   C++ options...
                                   Advanced C++ options...

[■]══════════ Code Generation ══════════
 Model              Options
  ( ) Tiny           [X] Treat enums as ints
  ( ) Small          [ ] Word alignment
  ( ) Medium         [ ] Duplicate strings merged
  ( ) Compact        [ ] Unsigned characters
  (•) Large          [ ] Pre-compiled headers
  ( ) Huge           [ ] Generate assembler source
                     [ ] Compile via assembler

 Assume SS Equals DS
  (•) Default for memory model
  ( ) Never
  ( ) Always

 Defines

          OK        Cancel       Help
```

Step 5: Set the Advanced code generation options and Set the Floating Point to Emulation and the Instruction Set to 80186



```
C:\WINDOWS\system32\cmd.exe - bc
≡  File  Edit  Search  Run  Compile  Debug  Project  Options  Window  Help
[■]═══════════════ C:\DOCUME~1\ADMINI~1\NONAME00.
                                        Application...
                                        Compiler          ►
                                   Code generation...
                                   Advanced code generation...
                                   Entry/Exit Code...
                                   C++ options...
                                   Advanced C++ options...
                                   Optimizations...

[■]═════════ Advanced Code Generation ═════════
 Floating Point        Options
  ( ) None              [X] Generate underbars
  (•) Emulation         [ ] Line numbers debug info
  ( ) 8087              [X] Debug info in OBJs
  ( ) 80287/387         [ ] Browser info in OBJs
                        [X] Fast floating point
 Instruction Set        [ ] Fast huge pointers
  ( ) 8088/8086         [ ] Generate COMDEFs
  (•) 80186             [ ] Automatic far data
  ( ) 80286
  ( ) 80386             Far Data Threshold  32767

          OK        Cancel       Help
```

Step 6: Set the Entry/Exit Code Generation option and setting the DOS standard



C:\WINDOWS\System32\cmd.exe - bc

≡ File Edit Search Run Compile Debug Project Options Window Help

NONAME00.CPP

Application...
Compiler ▶

Code generation...
Advanced code generation...
Entry/Exit Code...
C++ options...
Advanced C++ options...
Optimizations...
Source...

Entry/Exit Code Generation

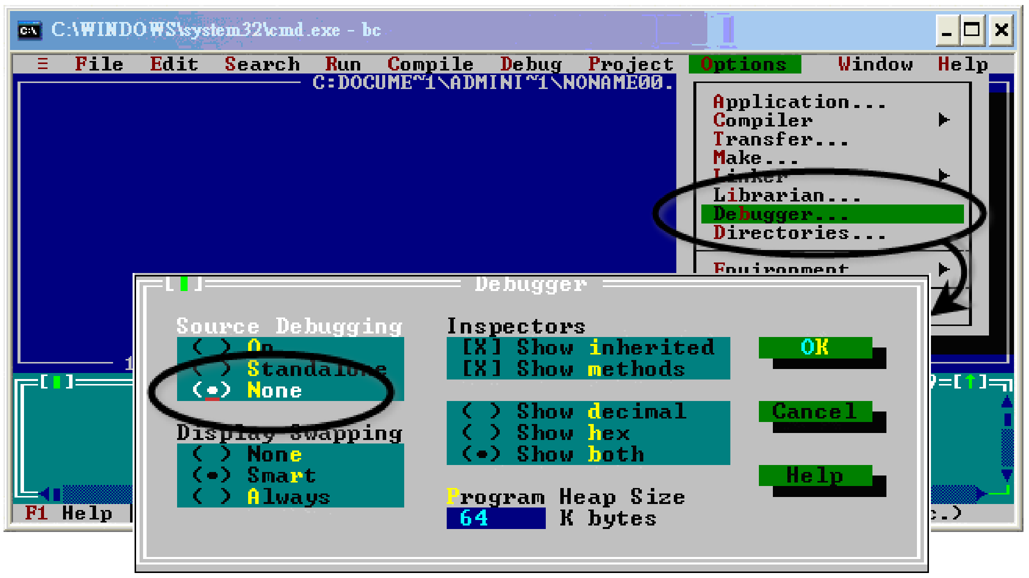
Prolog/Epilog Code Generation
(•) DOS standard
( ) DOS overlay
( ) Windows all functions exportable
( ) Windows explicit functions exported
( ) Windows smart callbacks
( ) Windows DLL all functions exportable
( ) Windows DLL explicit functions exported

Calling Convention
(•) C
( ) Pascal
( ) Register

Stack Options
[X] Standard stack frame
[ ] Test stack overflow

OK Cancel Help

Step 7: Choosing the Debugger…and set the Source Debugging to None



C:\WINDOWS\system32\cmd.exe - bc

≡ File Edit Search Run Compile Debug Project Options Window Help

C:\DOCUME~1\ADMINI~1\NONAME00.

Application...
Compiler ▶
Transfer...
Make...
Linker ▶
Librarian...
Debugger...
Directories...
Environment ▶

Debugger

Source Debugging
( ) On
( ) Standalone
(•) None

Display Swapping
( ) None
(•) Smart
( ) Always

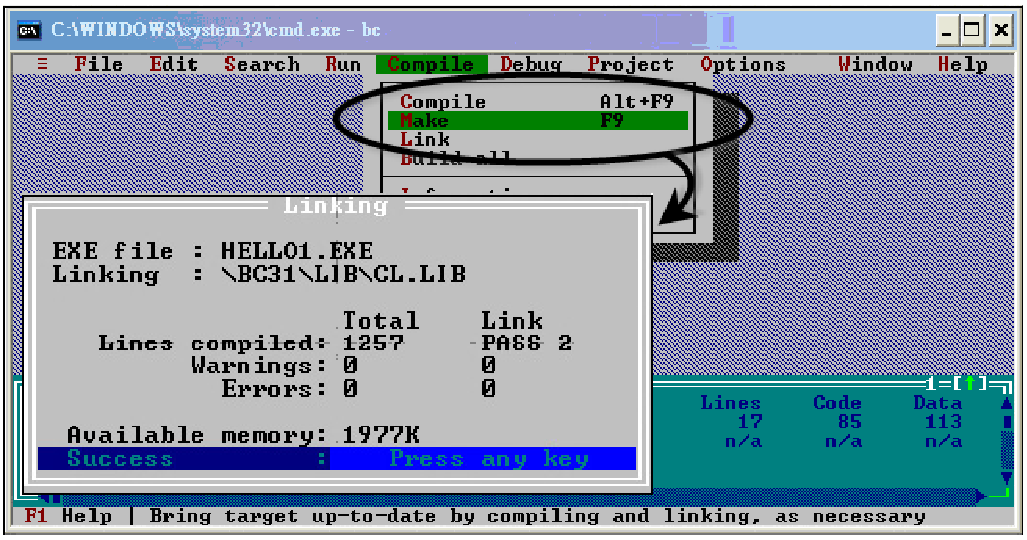
Inspectors
[X] Show inherited
[X] Show methods

( ) Show decimal
( ) Show hex
(•) Show both

Program Heap Size
64 K bytes

OK
Cancel
Help

Step 8: Make the project


C:\WINDOWS\system32\cmd.exe - bc
≡ File Edit Search Run Compile Debug Project Options Window Help
Compile Alt+F9
Make F9
Link
Build all
Information
Linking

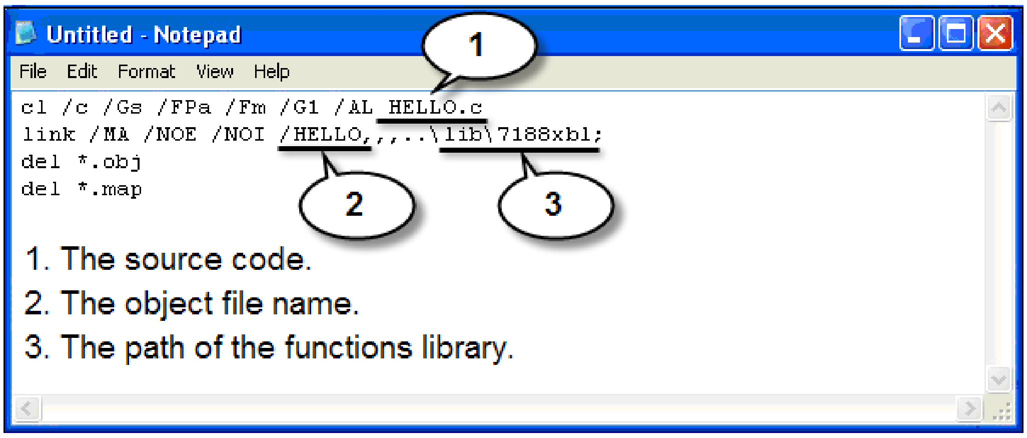
```
EXE file  : HELLO1.EXE
Linking   : \BC31\LIB\CL.LIB

                      Total      Link
   Lines compiled: 1257       PASS 2
         Warnings: 0          0
           Errors: 0          0

 Available memory: 1977K
 Success          :      Press any key
```

```
Lines    Code    Data
  17      85      113
 n/a     n/a     n/a
```

```
F1 Help | Bring target up-to-date by compiling and linking, as necessary
```

F.3. MSC 6.00

Step 1: In the source file folder, create a batch file called Gomsc.bat using the text editor



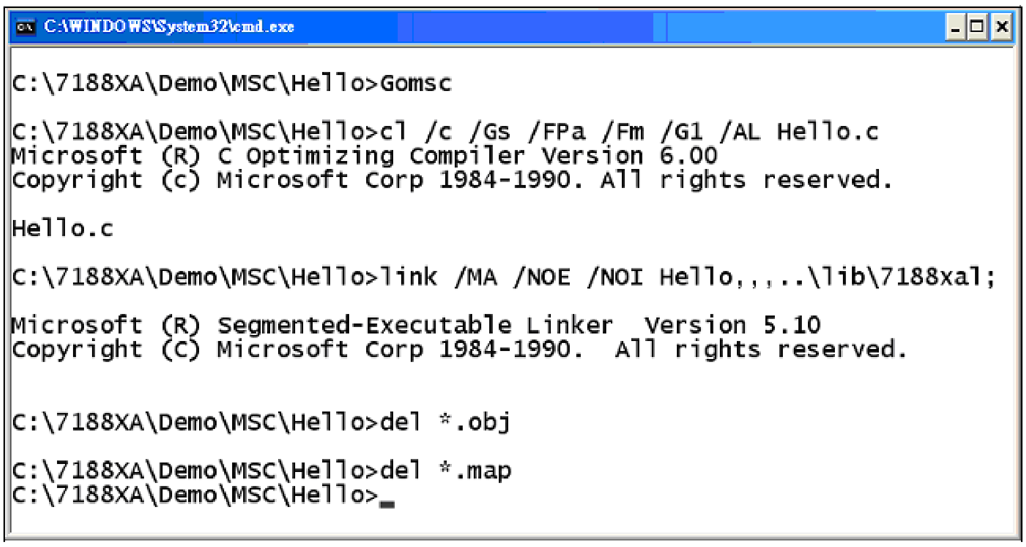
```
cl /c /Gs /FPa /Fm /G1 /AL HELLO.c
link /MA /NOE /NOI /HELLO,,,..\lib\7188xbl;
del *.obj
del *.map
```

1. The source code.
2. The object file name.
3. The path of the functions library.

Tip & Warnings

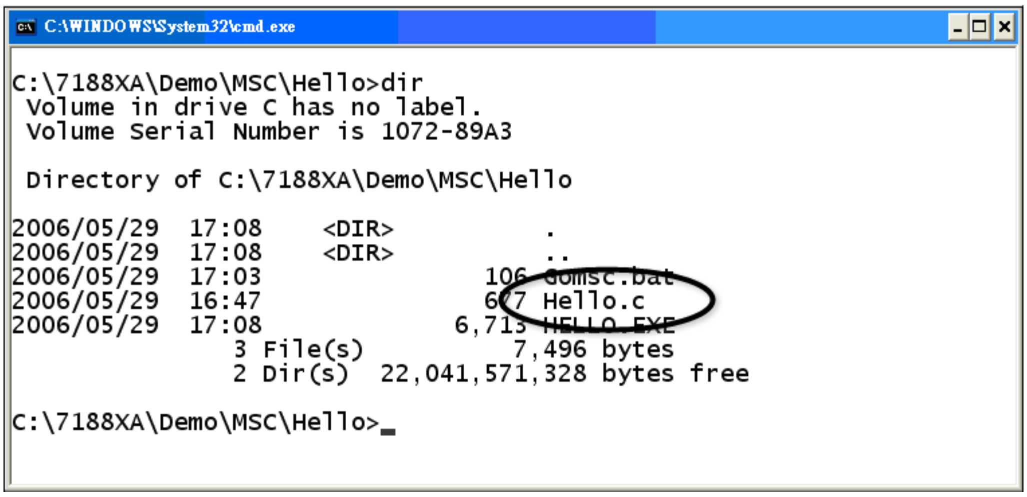
/C	Don't strip comments	/GS	No stack checking
/Fpa:	Calls with altmath	/Fm	[map file]
/G1:	186 instructions	/AL	Large model

Step 2: Run the Gomsc.bat file



```
C:\7188XA\Demo\MSC\Hello>Gomsc

C:\7188XA\Demo\MSC\Hello>cl /c /Gs /FPa /Fm /G1 /AL Hello.c
Microsoft (R) C Optimizing Compiler Version 6.00
Copyright (c) Microsoft Corp 1984-1990. All rights reserved.

Hello.c

C:\7188XA\Demo\MSC\Hello>link /MA /NOE /NOI Hello,,,..\lib\7188xal;

Microsoft (R) Segmented-Executable Linker  Version 5.10
Copyright (C) Microsoft Corp 1984-1990.  All rights reserved.


C:\7188XA\Demo\MSC\Hello>del *.obj

C:\7188XA\Demo\MSC\Hello>del *.map
C:\7188XA\Demo\MSC\Hello>_
```

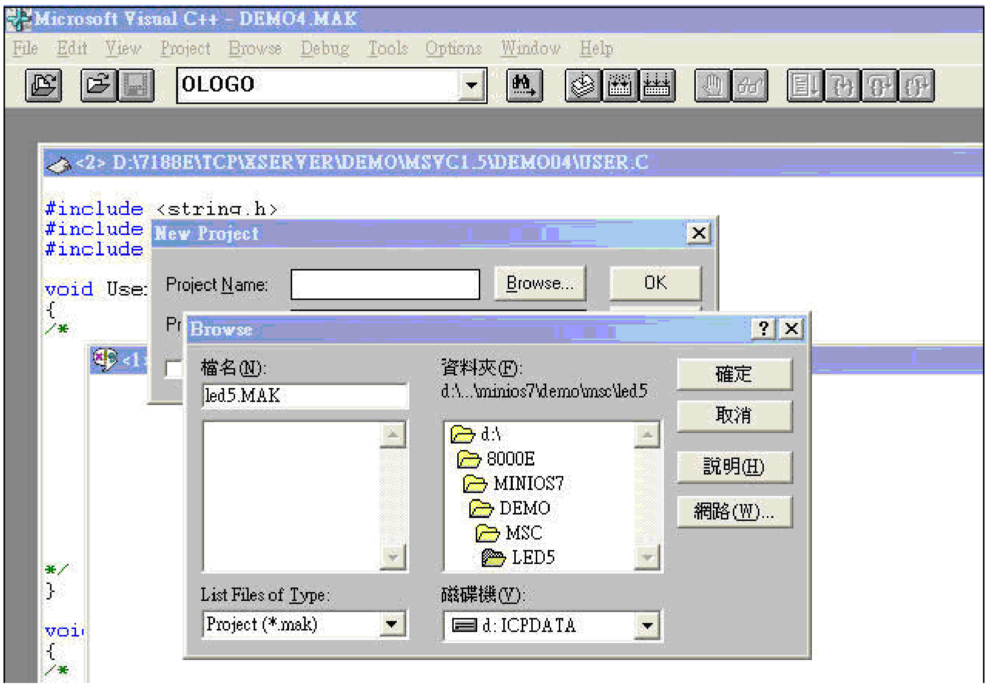
Step 3: A new executable file will be created if it is successfully compiled



```
C:\7188XA\Demo\MSC\Hello>dir
 Volume in drive C has no label.
 Volume Serial Number is 1072-89A3

 Directory of C:\7188XA\Demo\MSC\Hello

2006/05/29  17:08    <DIR>          .
2006/05/29  17:08    <DIR>          ..
2006/05/29  17:03               106 Gomsc.bat
2006/05/29  16:47               677 Hello.c
2006/05/29  17:08             6,713 HELLO.EXE
               3 File(s)          7,496 bytes
               2 Dir(s)  22,041,571,328 bytes free

C:\7188XA\Demo\MSC\Hello>_
```

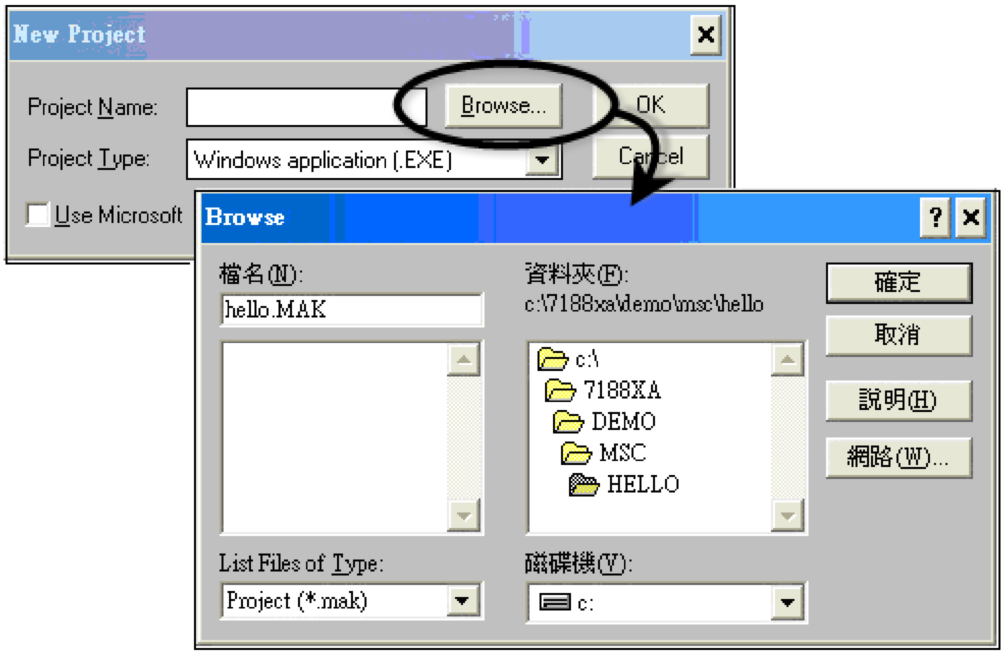
F.4. MSVC 1.50

Step 1: Run MSVC.exe

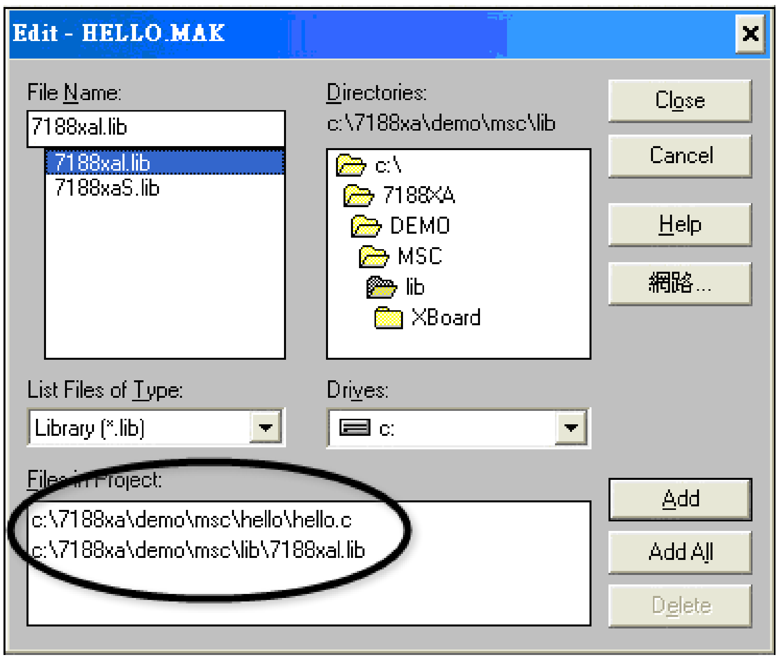


```
#include <string.h>
#include
#include

void Use
{
/*
```

Step 2: Create a new project (*.mak) by entering the name of the project in the Project Name field and then select MS-DOS application (EXE) as the Project type



Step 3: Add the user's program and the necessary library files to the project


Edit - HELLO.MAK

File Name: 7188xal.lib

7188xal.lib
7188xaS.lib

Directories: c:\7188xa\demo\msc\lib

c:\
7188XA
DEMO
MSC
lib
XBoard

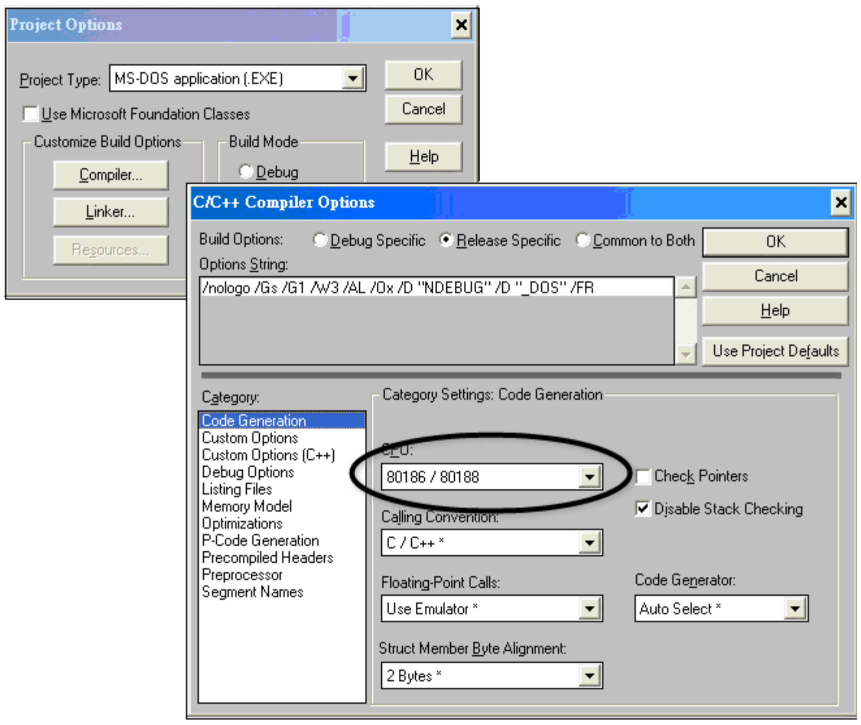
List Files of Type: Library (*.lib)

Drives: c:

Files in Project:

c:\7188xa\demo\msc\hello\hello.c
c:\7188xa\demo\msc\lib\7188xal.lib

Step 4: Set the Code Generation on the Compiler.


Project Options

Project Type: MS-DOS application (.EXE)

Use Microsoft Foundation Classes

Customize Build Options

Build Mode

Debug

C/C++ Compiler Options

Build Options: Debug Specific [✓ Release Specific] Common to Both

Options String:

/nologo /Gs /G1 /W3 /AL /Ox /D "NDEBUG" /D "_DOS" /FR

Category: Code Generation

Custom Options
Custom Options (C++)
Debug Options
Listing Files
Memory Model
Optimizations
P-Code Generation
Precompiled Headers
Preprocessor
Segment Names

Category Settings: Code Generation

CPU: 80186 / 80188

Calling Convention: C / C++ *

Floating-Point Calls: Use Emulator *

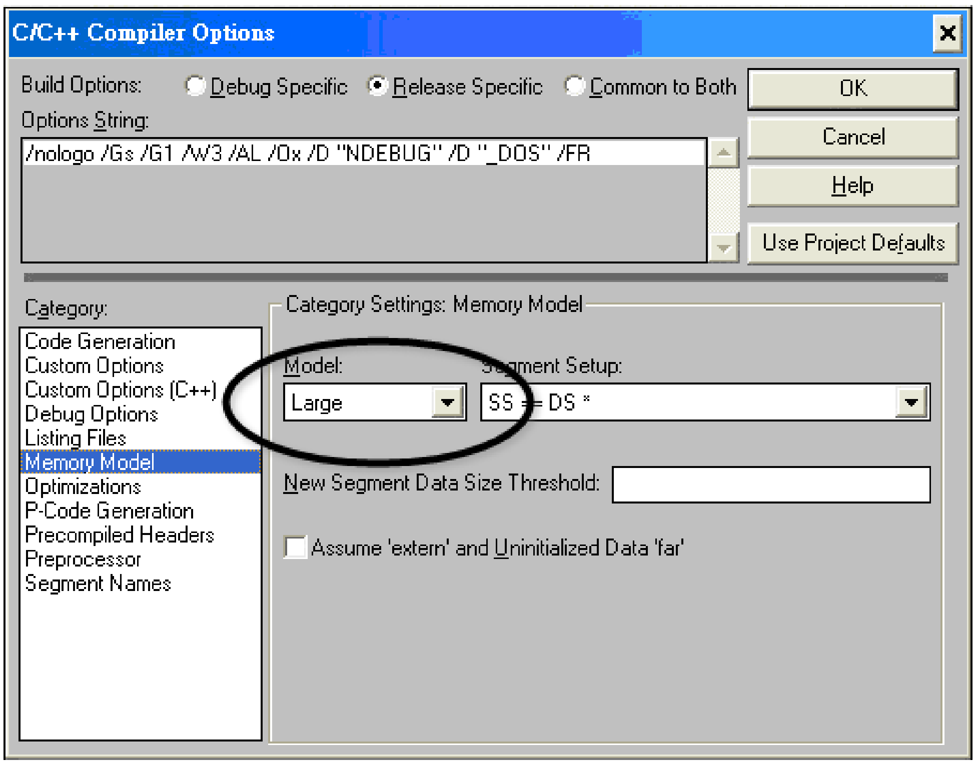
Struct Member Byte Alignment: 2 Bytes *

Code Generator: Auto Select *

Check Pointers

✓ Disable Stack Checking

Step 5: Change the Memory model (large for 8000e.lib)

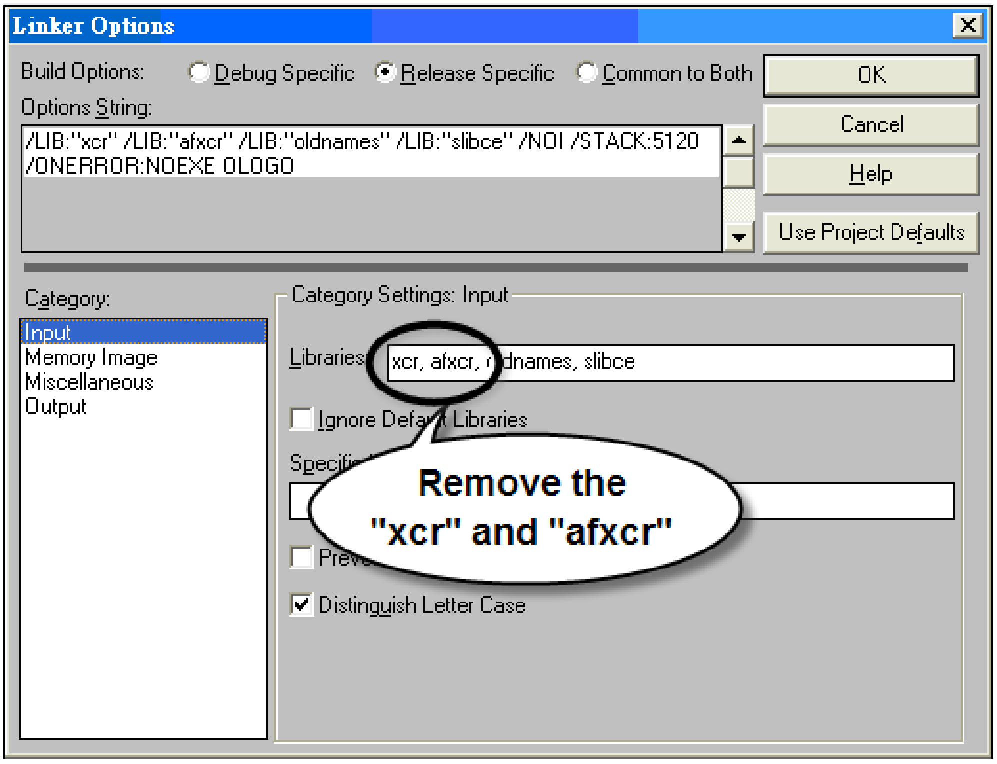


Options String: /nologo /Gs /G1 /W3 /AL /Ox /D "NDEBUG" /D "_DOS" /FR

Model: Large

Segment Setup: SS == DS *

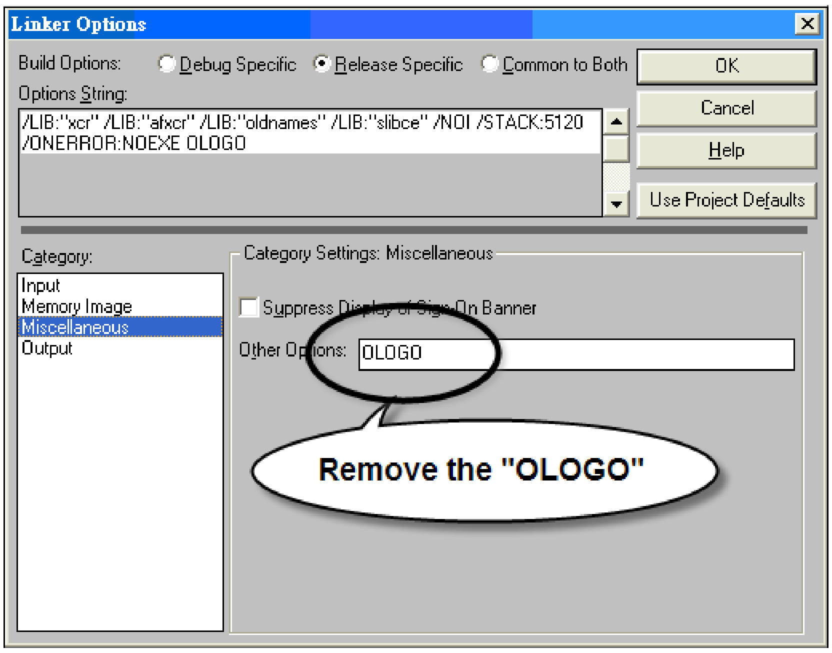
Step 6: Remove the xcr, afxcr library from the Input Category



Options String: /LIB:"xcr" /LIB:"afxcr" /LIB:"oldnames" /LIB:"slibce" /NOI /STACK:5120 /ONERROR:NOEXE OLOGO

Libraries: xcr, afxcr, oldnames, slibce

Step 7: Remove the OLOGO option from the miscellancous Category.

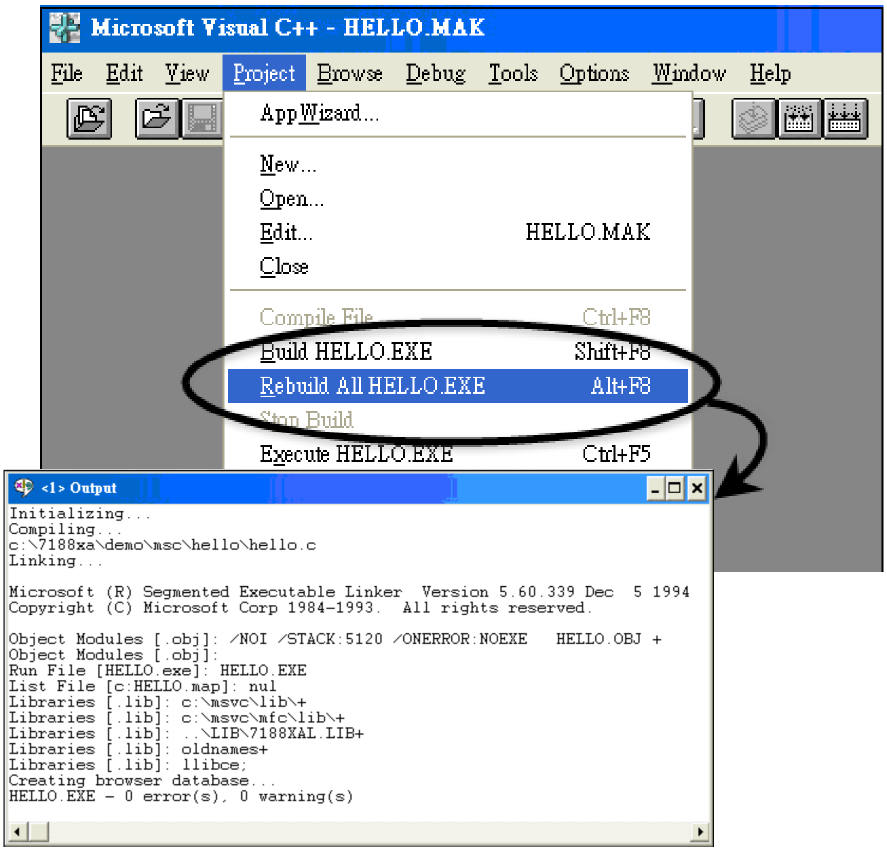


Build Options: Debug Specific [✓ Release Specific] Common to Both

Options String:
```
/LIB:"xcr" /LIB:"afxcr" /LIB:"oldnames" /LIB:"slibce" /NOI /STACK:5120
/ONERROR:NOEXE OLOGO
```

Other Options: OLOGO

Step 8: Rebuild the project



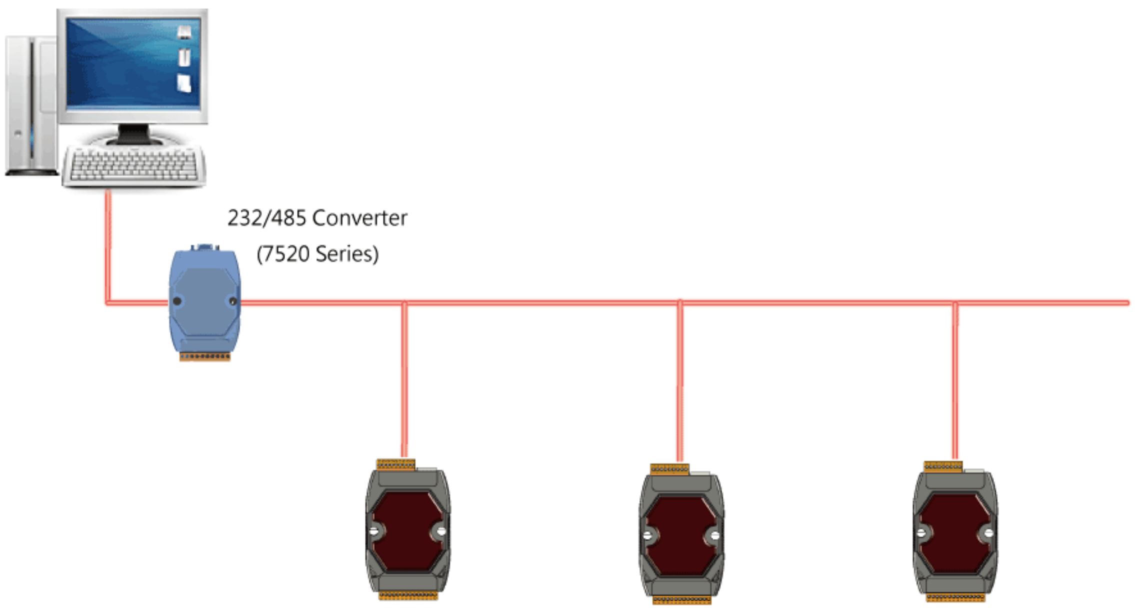
```
Initializing...
Compiling...
c:\7188xa\demo\msc\hello\hello.c
Linking...

Microsoft (R) Segmented Executable Linker  Version 5.60.339 Dec  5 1994
Copyright (C) Microsoft Corp 1984-1993.  All rights reserved.

Object Modules [.obj]: /NOI /STACK:5120 /ONERROR:NOEXE   HELLO.OBJ +
Object Modules [.obj]:
Run File [HELLO.exe]: HELLO.EXE
List File [c:HELLO.map]: nul
Libraries [.lib]: c:\msvc\lib\+
Libraries [.lib]: c:\msvc\mfc\lib\+
Libraries [.lib]: ..\LIB\7188XAL.LIB+
Libraries [.lib]: oldnames+
Libraries [.lib]: llibce;
Creating browser database...
HELLO.EXE - 0 error(s), 0 warning(s)
```

Appendix G. Application of RS-485 Network

The RS-485 length can be up to 4000 ft or 1.2 km over a single set of twisted–pair cables, if the RS-485 network is over 4000 ft or 1.2Km, the RS-485 repeater must be added to extend the RS-485 network.

G.1. Basic RS-485 network

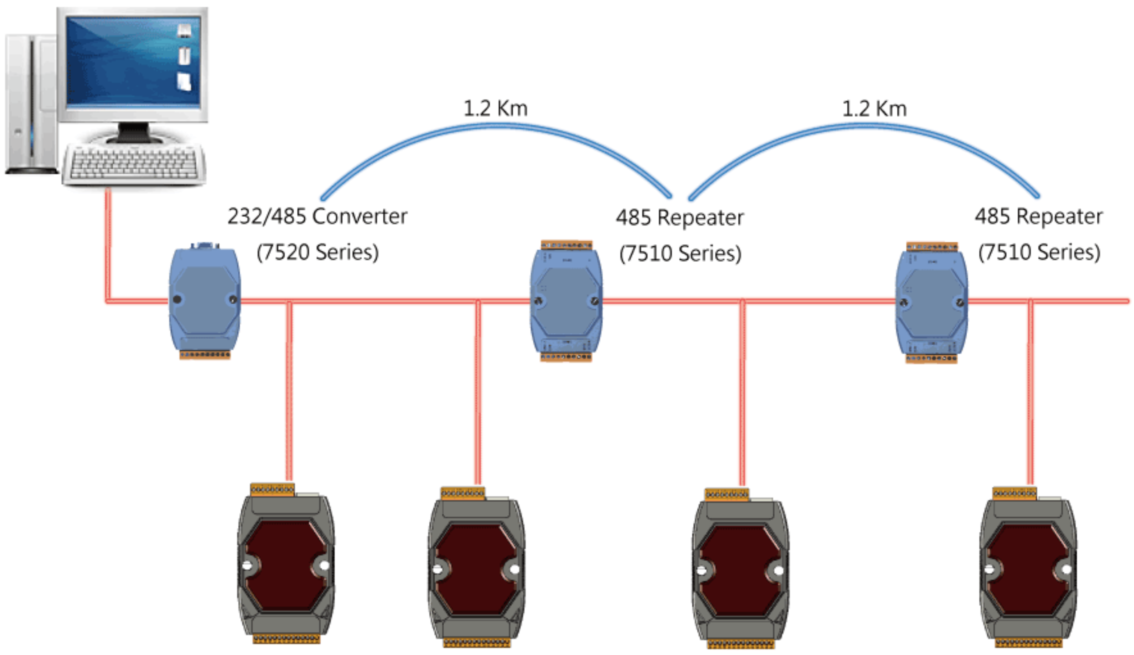
The basic component of the RS-485 network consist of a Master Controller (or using a PC as a host controller), and some RS-485 devices.



G.2. Daisy chain RS-485 network

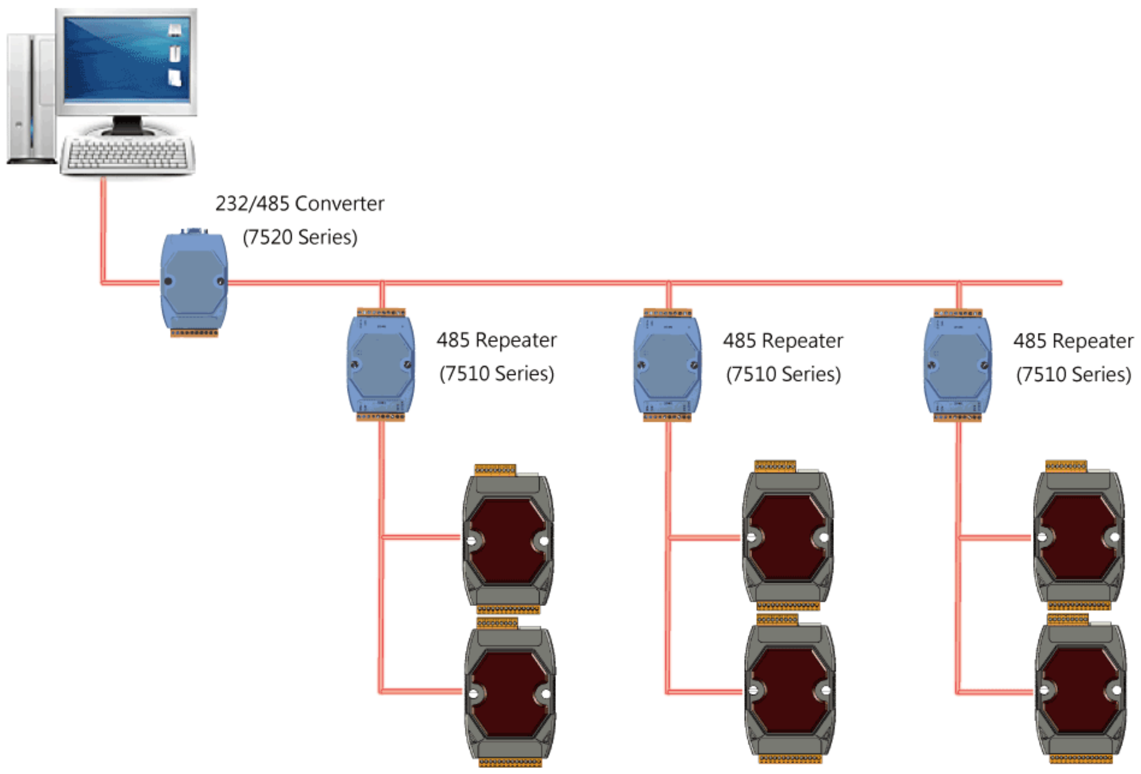
There are branches along the main network. In this case, it is better to have a repeater to isolate or filter the noise that is made by devices.

There is a better choice to use 7513 as a RS-485 hub on start type network.

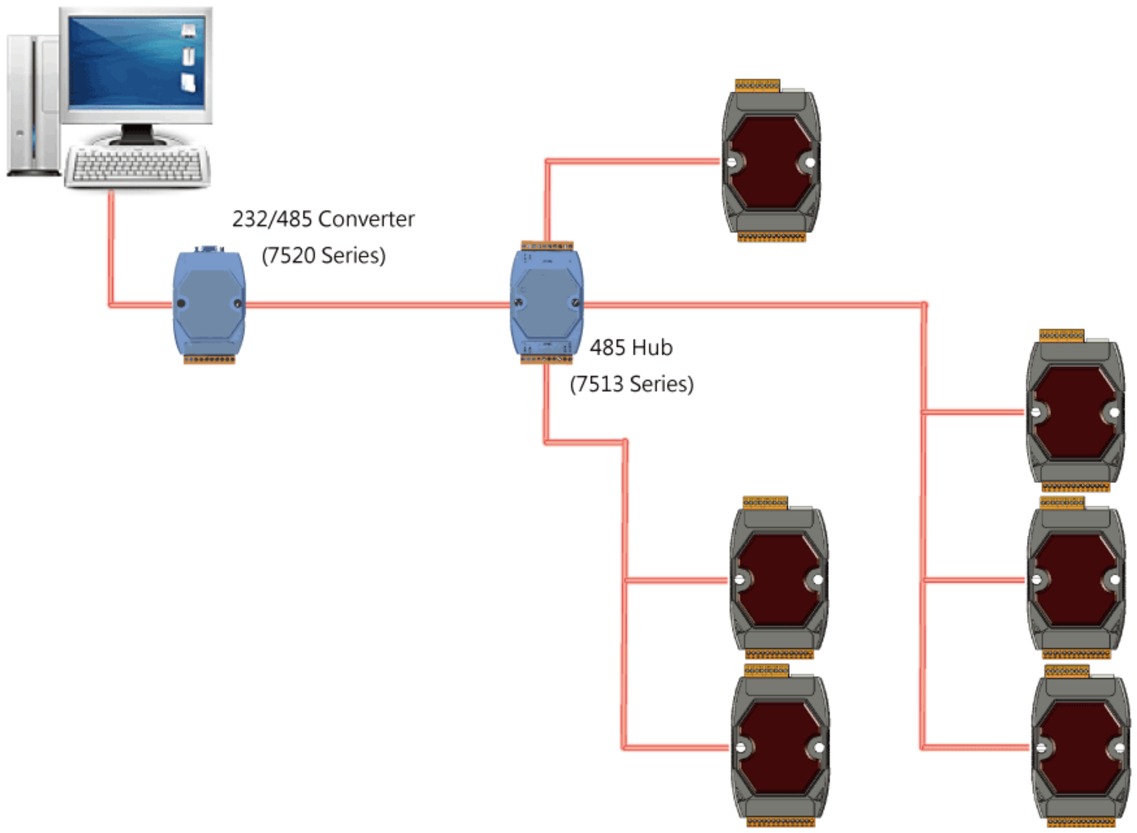


G.3. Star type RS-485 network

All RS-485 devices are wired directly to the main network, If the network is up to 1.2 Km, it will need a repeater (7510 series) to extend the network length.

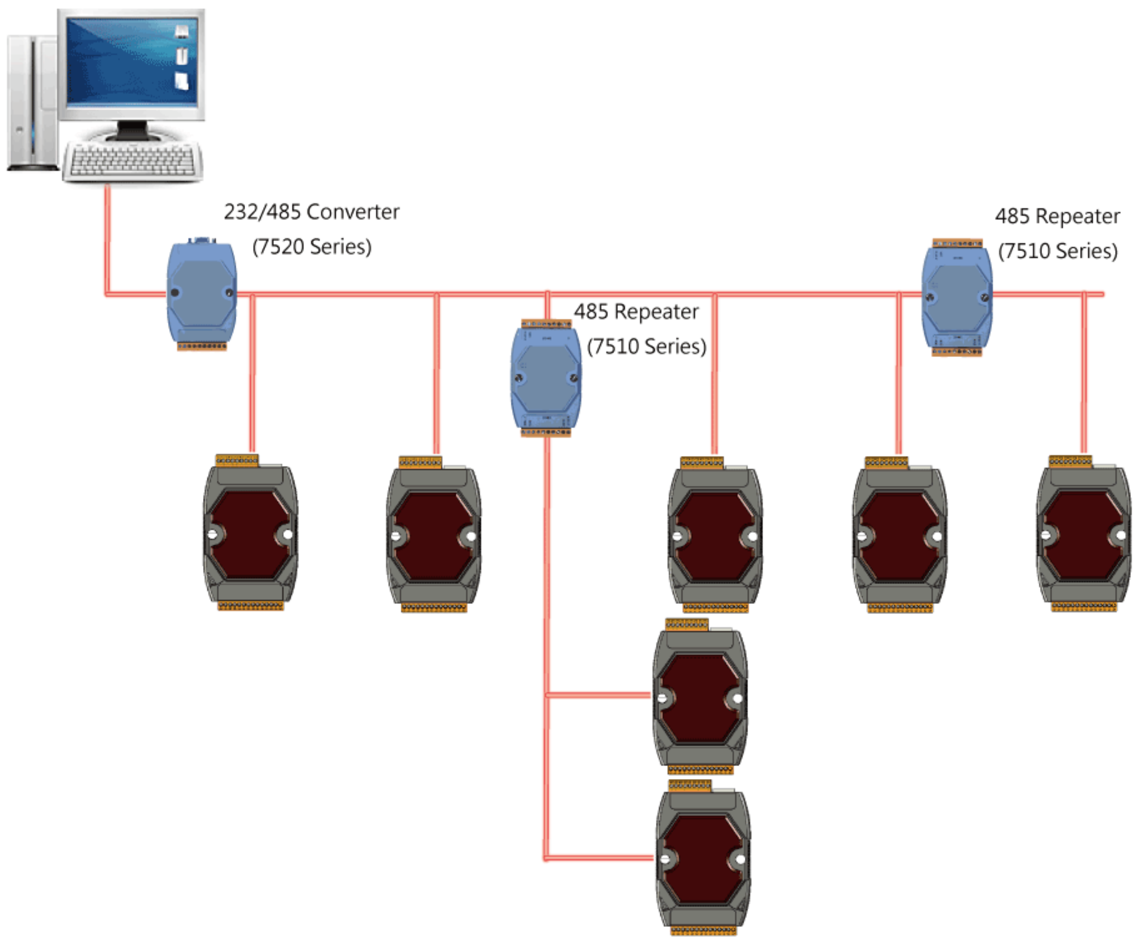


There is a better choice to use 7513 as a RS-485 hub on start type network.



G.4. Random RS-485 network

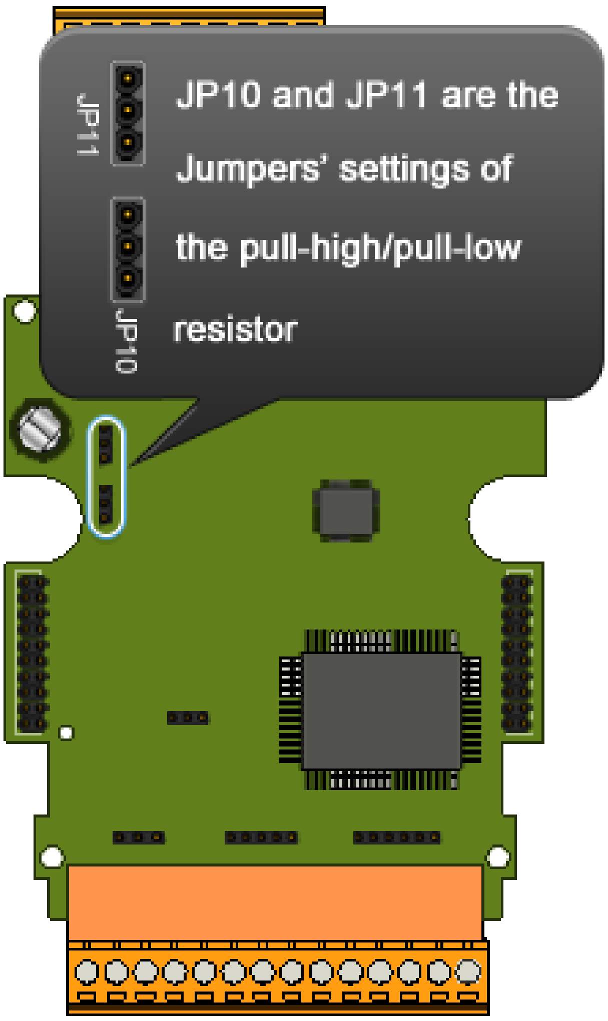
There are branches along the main wire. In this case, it is better to have a repeater to isolate or filter the noise that is made by devices.



G.5. µPAC-7186E Master-Slave Mode

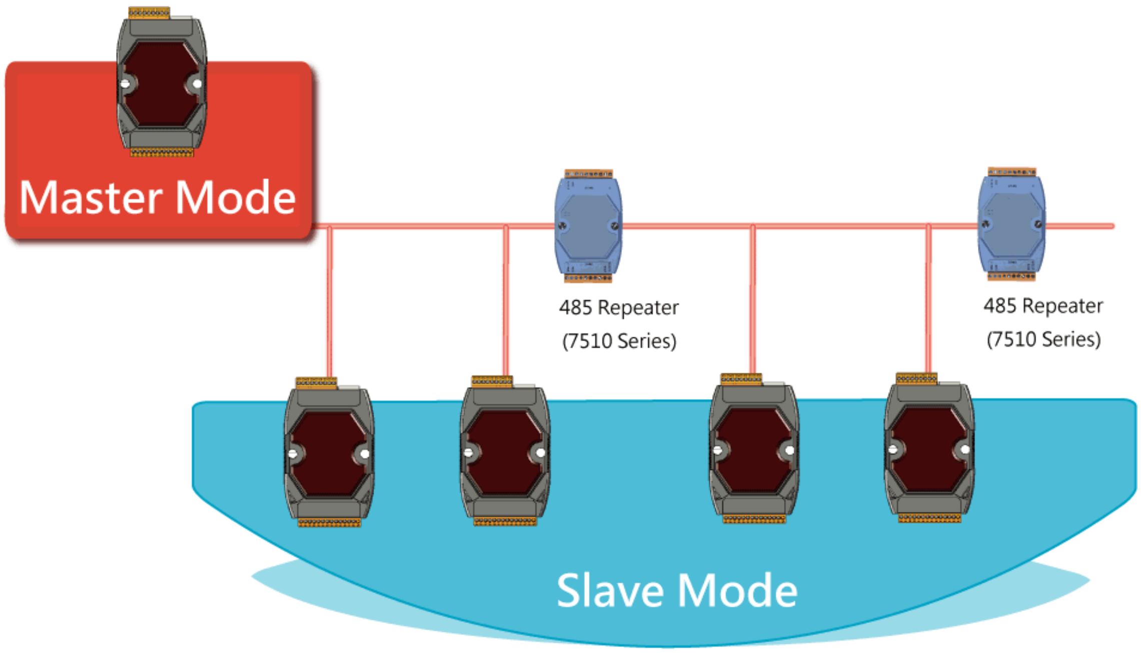
The RS-485 network based on master-slave architecture consists of a single master device and one or more slave devices.

The µPAC-7186EX provides a RS-485 communication interface based on the master-slave system architecture, all of which have a pull-high/pull-low resistor, this can be configurable through the JP10 and JP11 on the power board as below shown.

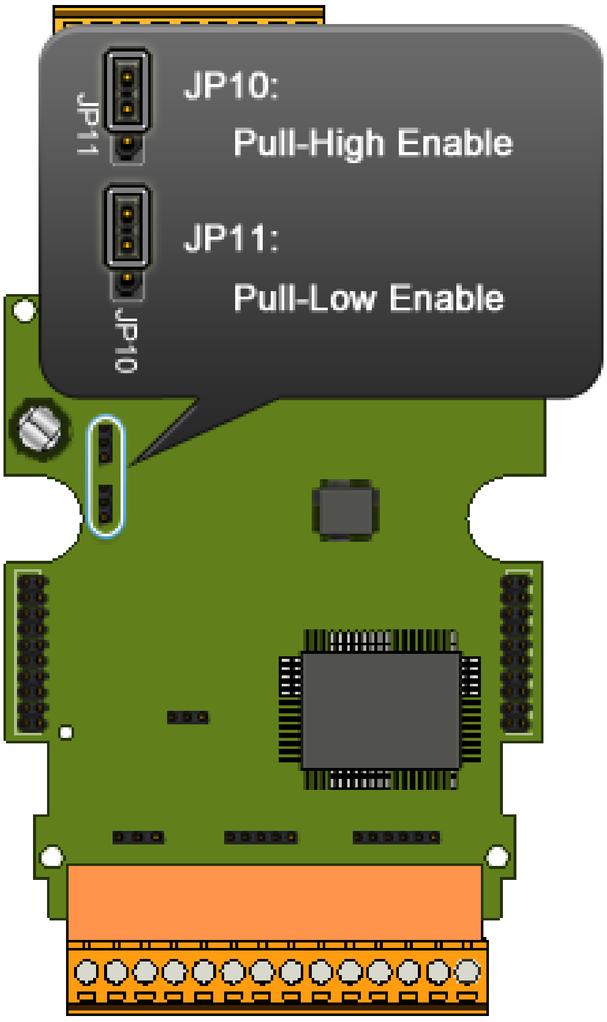

JP11
JP10
JP10 and JP11 are the Jumpers' settings of the pull-high/pull-low resistor

G.5.1. µPAC-7186E as a Master (Default)

When one of µPAC-7186E is set to master, then all the other devices on the same network must be slave mode. If the network is up to 1.2 KM, it will need a repeater (7510 series) to extend the network length.



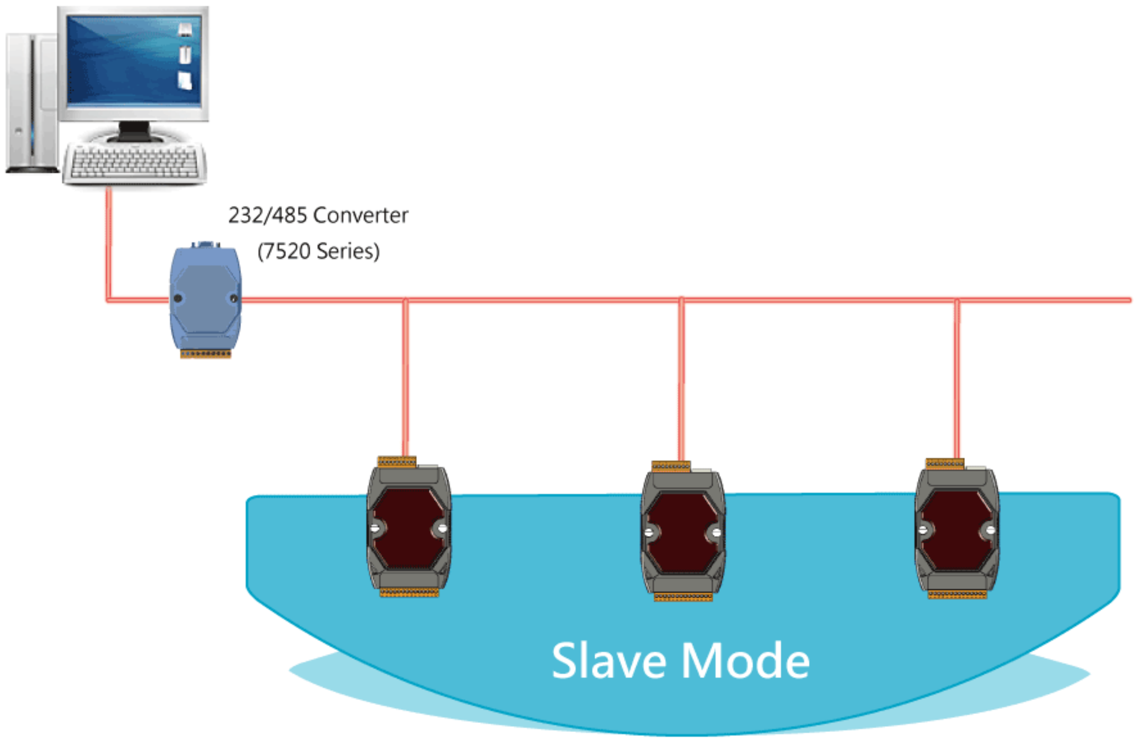
When µPAC-7186E as a master, the pull-high/pull-low resistor located on the power board must adjust to enable as shown below.



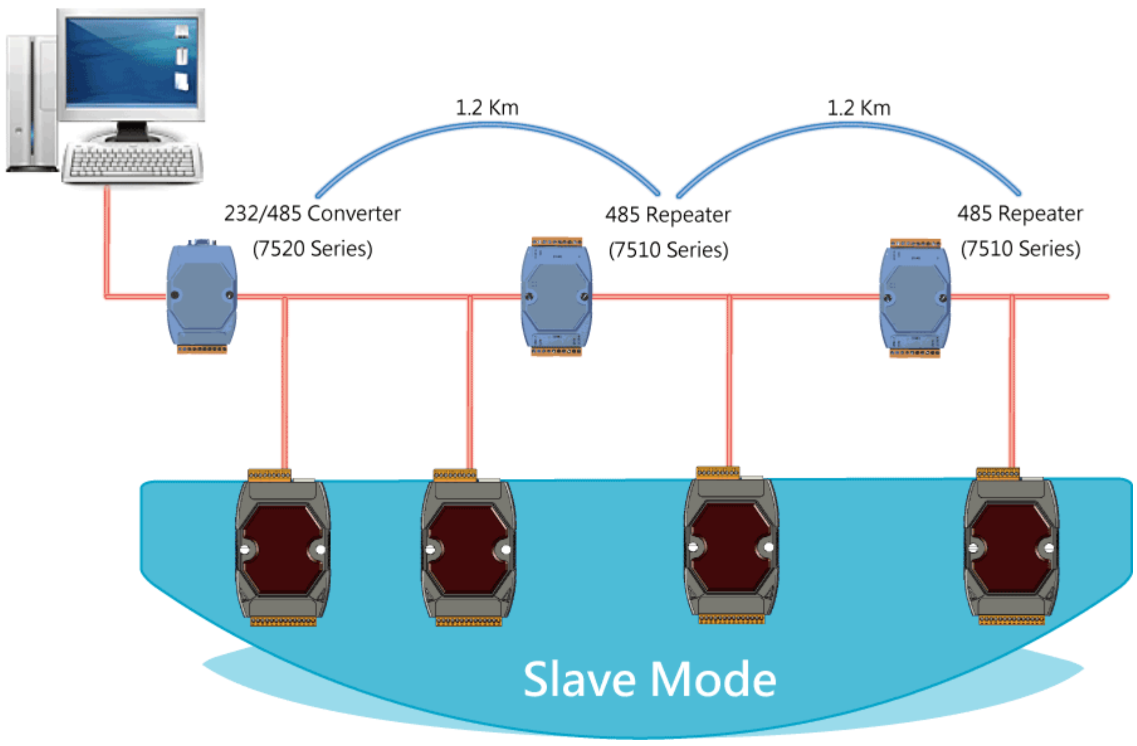
G.5.2. µPAC-7186E as a slave

For most of application, when using one 7520 series as RS-232/485 converter, its pull-high/pull-low resistors are set to enabled. Then the µPAC-7186E and all the other devices on this network must be slave mode (the pull-high/pull-low resistors must be disabled).

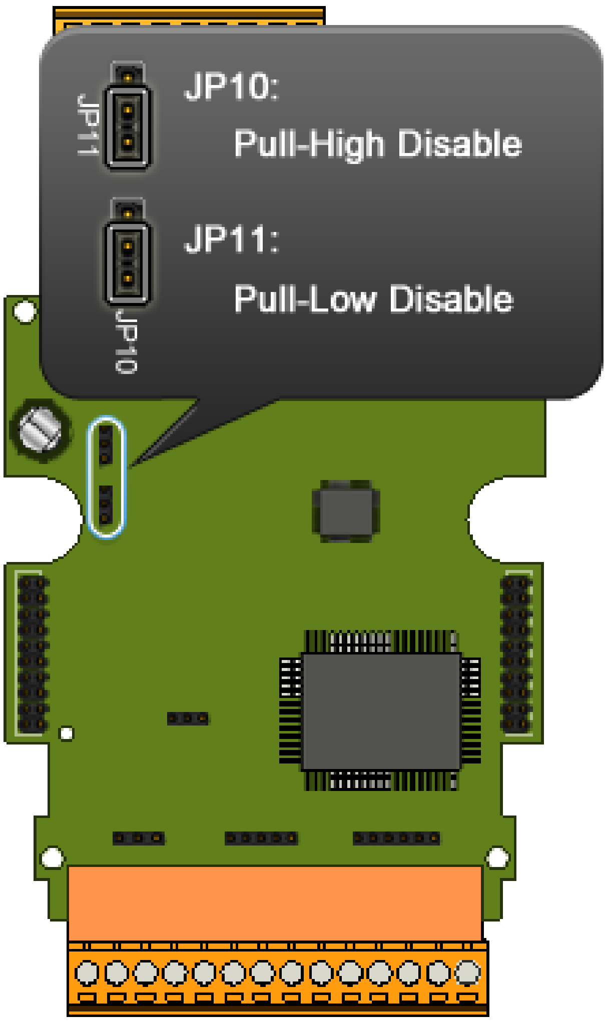
If there are repeaters on the RS-485 network, there will be pull-high/pull-low resistors on both sides of the repeaters (I-7510)



If there are repeaters on the RS-485 network, there will be pull-high/pull-low resistors on both sides of the repeaters (i-7510)



When µPAC-7186E as a slave, the pull-high/pull-low resistor located on the power board must adjust to disabled as shown below.


JP11
JP10
JP10:
Pull-High Disable
JP11:
Pull-Low Disable