8411/8811 User Manual
(C language solution)

Version 1.0, January 2008

Service and usage information for

i-8411

i-8811

i-8411-G

i-8811-G

Written by Hans Chen

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

ICP DAS assumes no liability for any damage resulting from the use of this product.
ICP DAS reserves the right to change this manual at any time without notice. The information furnished by ICP DAS is believed to be accurate and reliable. However, no responsibility is assumed by ICP DAS for its use, no for any infringements of patents or other rights of third parties resulting from its use.

Copyright

Trademarks

The names used in this manual are for identification purpose only and may be registered trademarks of their respective companies.

Table of Contents

Table of Contents

CHAPTER 1

Introduction

The i-8411/ i-8811 modules are embedded controllers with 4/8 I/O slots. Both are equipped with MiniOS7, an embedded OS similar to DOS that was developed by ICP DAS Co., Ltd.

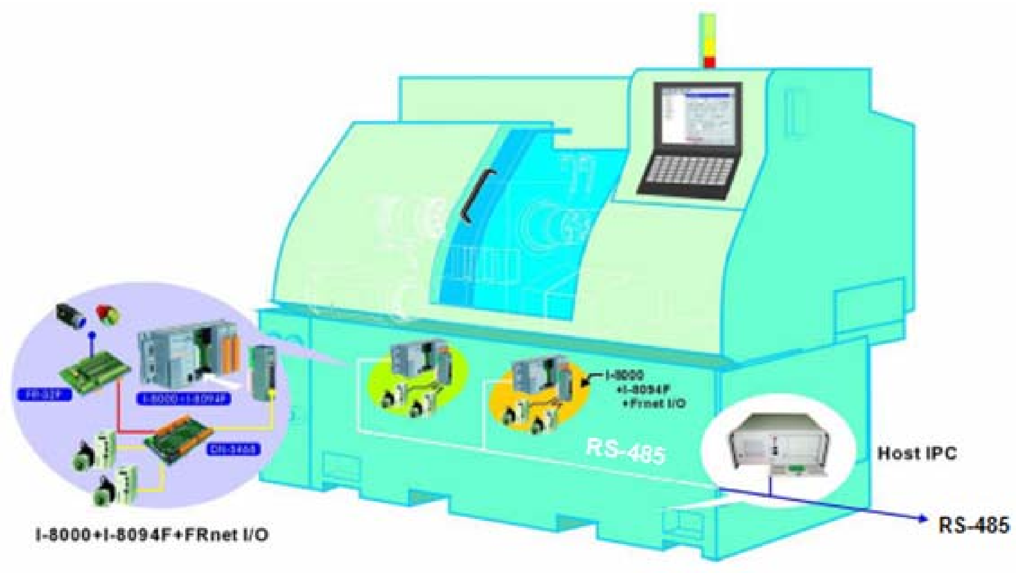
The MiniOS7 can boot up in a very short time (0.4~0.8 seconds). It has a built-in hardware diagnostic function, and supports the full range of functions required to access all i-8K and i-87K series I/O modules, such as DI, DO, DIO, AI, AO, Counter/Frequency, motion modules, etc.

The i-8411/i-8811 back panel is equipped with four serial COM ports, including RS-232 and RS-485 ports, and can be used for remote data acquisition and control applications, including environment monitoring, power management and factory automation. By using S-256 (256 KBytes) or S-512 (512 KBytes) battery backup SRAM, they provide data logger function.

Note: S256 and S512 are optional accessories.

► For more information about MiniOS7, please refer to "**Appendix B. What is MiniOS7**"

► For more information on the I/O modules for the i-8411/i-8811 controllers, please refer to CD:\Napdos\dcon\io_module\
ftp://ftp.icpdas.com/pub/cd/8000cd/napdos/dcon/io_module/



Optional Accessories	
S256	256 K SRAM module with battery backup
S512	512 K SRAM module with battery backup
KA-52F	100 ~ 250 V_{AC} input, 24 V_{DC}/1 A output, flat-type power supply
DIN-KA52F	KA-52F with DIN-Rail mount
DP-665	85 ~ 270 V_{AC} input, 24 V_{DC}/1.7 A and 5 V_{DC}/0.5 A output power supply
DP-660	24 V_{DC}/1.7 A 5 V_{DC}/0.5 A power supply
DP-1200	24 V_{DC}/5 A power supply

1.1. Features

■ Serial Port-based embedded controller

The i-8411/i-8811 modules are serial port embedded controllers that allows COM port applications to access and control remote I/O data in RS-232 or industrial RS-485 networks.

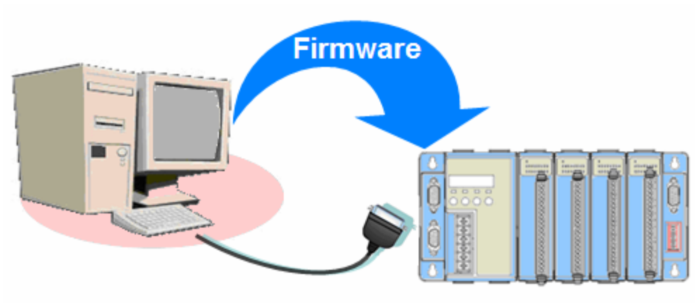
■ Equipped with MiniOS7 (A DOS like OS)

Each i-8411/i-8811 module is equipped with MiniOS7, a friendly DOS like OS developed by ICP DAS. C compilers that can create 16 bit executable files (*.exe) can be used to develop custom programs, which can then be downloaded to the i-8411/i-8811 module.

■ Provides API Functions for: i-8K, i-87K I/O, 7-SEG LED display, RTC (Real Time Clock), EEPROM, and more

Each i-8411/i-8811 module supports MiniOS7 API functions that includes hundreds of pre-defined functions, such as i-8000, i-87K I/O, 7-SEG LED, RTC, EEPROM, etc., and provides the demo code mostly required for users to program their own applications.

■ Updating the firmware, and download programs via the RS-232 port



When should the firmware be updated?

→ The firmware should be updated when ICPDAS announces:

- Support for new I/O modules
- The addition of new functions
- Bug fixes and revisions

The COM1 port of the i-8411/i-8811 module can be used to download programs and update the MiniOS image file.

■ Hardware designed to protect software

The i-8411/i-8811 module is equipped with a unique onboard 64-bit hardware serial number. Custom application software can be used to check this number to prevent illegal copying of software. An alternative method of achieving this goal is to use the ASICKey approach. ASICKeys can be numbered from 00 ~ 99. Each individual number is only sold to a single customer. Custom software can be used to check the specific ASICKey number to determine whether the application will quit or continue to execute.

64-bit built-in hardware serial number

ASICKey (optional)

► For more information regarding the 64-bit hardware serial number and ASICKey, please refer to "**Appendix G. How to prevent illegal copying of software**".

■ Innovation design on reliability, flexibility and expansibility

Each i-8411/i-8811 module is equipped with 4/8 I/O slots and multiple serial ports.
It not only supports i-8K and i-87K series I/O modules, such as DI, DO, DIO, AI, AO and Counter/Frequency for I/O slot applications, but also i-7K series I/O modules to allow a wide range of RS-485 network applications.
Each I/O module allows a range of channel numbers. For example, when combined with the i-8040 or i-8041, the i-8411/i-8811 provides a maximum of 256 digital input or digital output channels.

► For more information on i-8K and i-87K series modules, please refer to "**Appendix C. i-8K and i-87K series I/O modules**".

■ Built-in WatchDog Timer

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

■ Input protection circuitry

The input protection circuitry on both the network and power supply protects the system from external signals, such as mains spikes and ambient electrical noise. In addition, the central processing module is isolated from external signals in three ways. This is achieved through an I/O isolation of up to 3KV, power isolation of up to 3KV and network isolation of up to 2KV.

■ High-performance integrated power supply

The built-in 20W isolated power supply is rated to perform linearly up to full loading.

■ Ventilated housing designed to work between -25℃ ~ +75℃

Each i-8411/i-8811 module is housed in a plastic-based box with a column-like ventilator that can help to cool the work environment inside the box and allow the i-8411/i-8811 module to operate between -25℃ and +75℃.

1.2. Specifications

Module	
CPU	80188 or compatible (16-bit and 40MHz)
SRAM	512KBytes
Flash	512KBytes
EEPROM	2KBytes
NVRAM	31 byes
RTC (Real Time Clock)	Yes
64-bit Hardware Serial Number	Yes
Built-in Watchdog Timer (0.8 second)	Yes

SMMI	
5 - Digit LED Display	Yes
3 - Programmable LED Indicators	Yes
4 - Push Buttons	Yes

Dimensions	
8411	230 x 110 x 75.5 mm
8811	354 x 110 x 75.5 mm

I/O Expansion Slots	
8411	4 Slots
8811	8 Slots

Power Supply	
Protection	Power reverse polarity protection
Power requirement	10 ~ 30 V_{DC}
Power supply	20W
Power consumption	i-8411: 3.9 W
	i-8811: 5.1 W

Operating Environment	
Operating Temperature	–25°C ~ +75°C
Storage Temperature	–30°C ~ +85°C
Humidity	5 ~ 95%, Non-condensing

Communication Interface (Cont.)

COM0 (Internal RS-485 interface that can communication with i-87K I/O modules)

Baud Rate – 115200 bps

Data Bits – 8

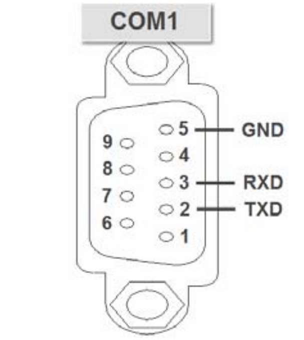
Parity – None, Even, Odd

Stop Bits – 1

FIFO – 1 byte

Note: CPU internal uart

COM1 (RS-232 used to update firmware)



Baud Rate – 115200, 57600, 38400, 19200, 9600, 4800, 2400, 1200 bps

Data Bits – 7, 8

Parity – None, Even, Odd

Stop Bits – 1

FIFO – 1 byte

Note: CPU internal uart

COM2 (RS-485)

Baud Rate – 115200, 57600, 38400, 19200, 9600, 4800, 2400, 1200 bps

Data Bits – 5, 6, 7, 8

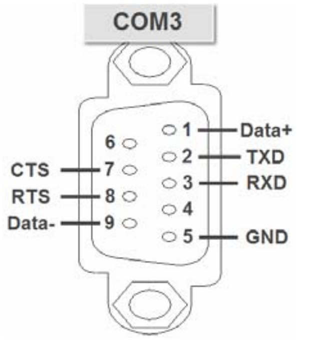
Parity – None, Even, Odd, Mark (Always 1), Space (Always 0)

Stop Bits – 1, 2

FIFO – 16 bytes

Note: 16C550 compatible

COM3 (RS-232/RS-485)



Baud Rate – 115200, 57600, 38400, 19200, 9600, 4800, 2400, 1200 bps

Data Bits – 5, 6, 7, 8

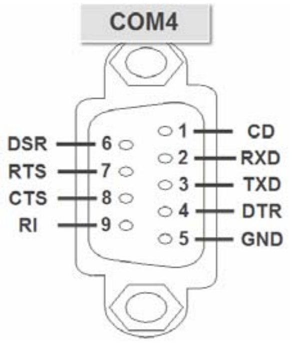
Parity – None, Even, Odd, Mark (Always 1), Space (Always 0)

Stop Bits – 1, 2

FIFO – 16 bytes

Note: 16C550 compatible

COM4 (RS-232)



Baud Rate – 115200, 57600, 38400, 19200, 9600, 4800, 2400, 1200 bps

Data Bits – 5, 6, 7, 8

Parity – None, Even, Odd, Mark (Always 1), Space (Always 0)

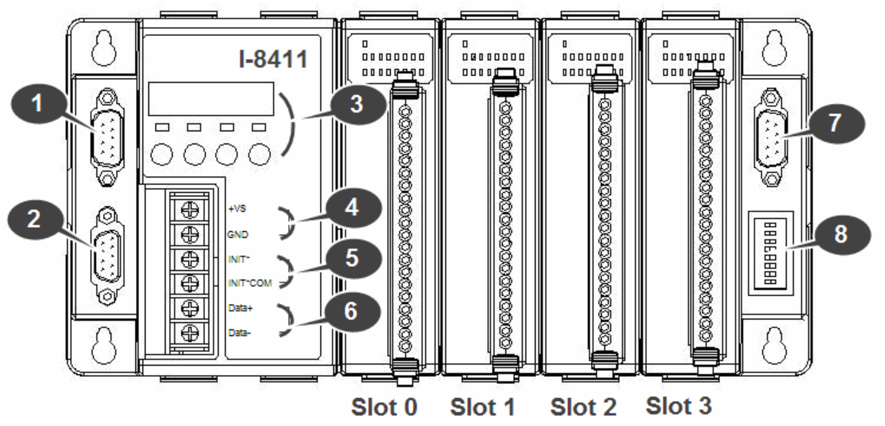
Stop Bits – 1, 2

FIFO – 16 bytes

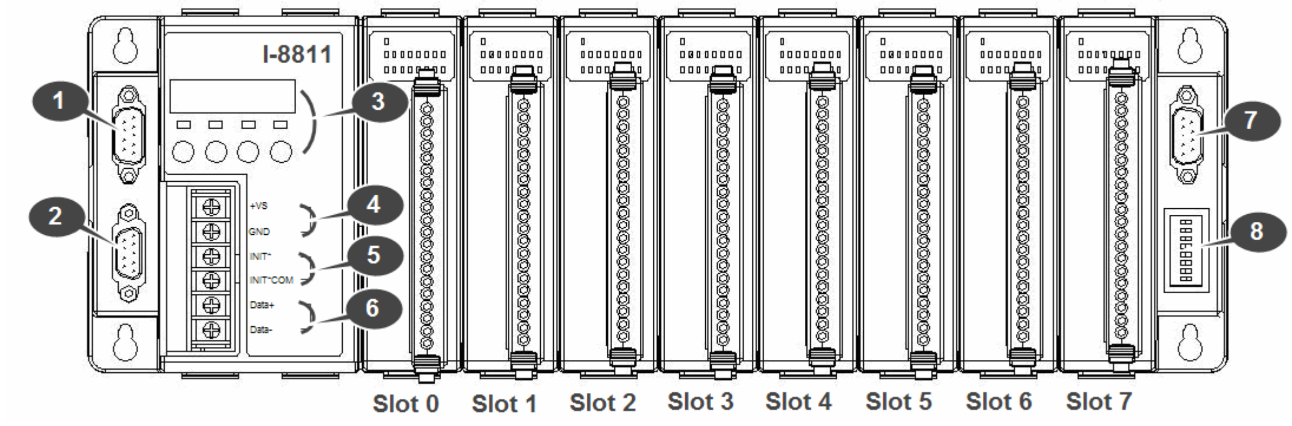
Note: 16C550 compatible

1.3. Overview

i-8411



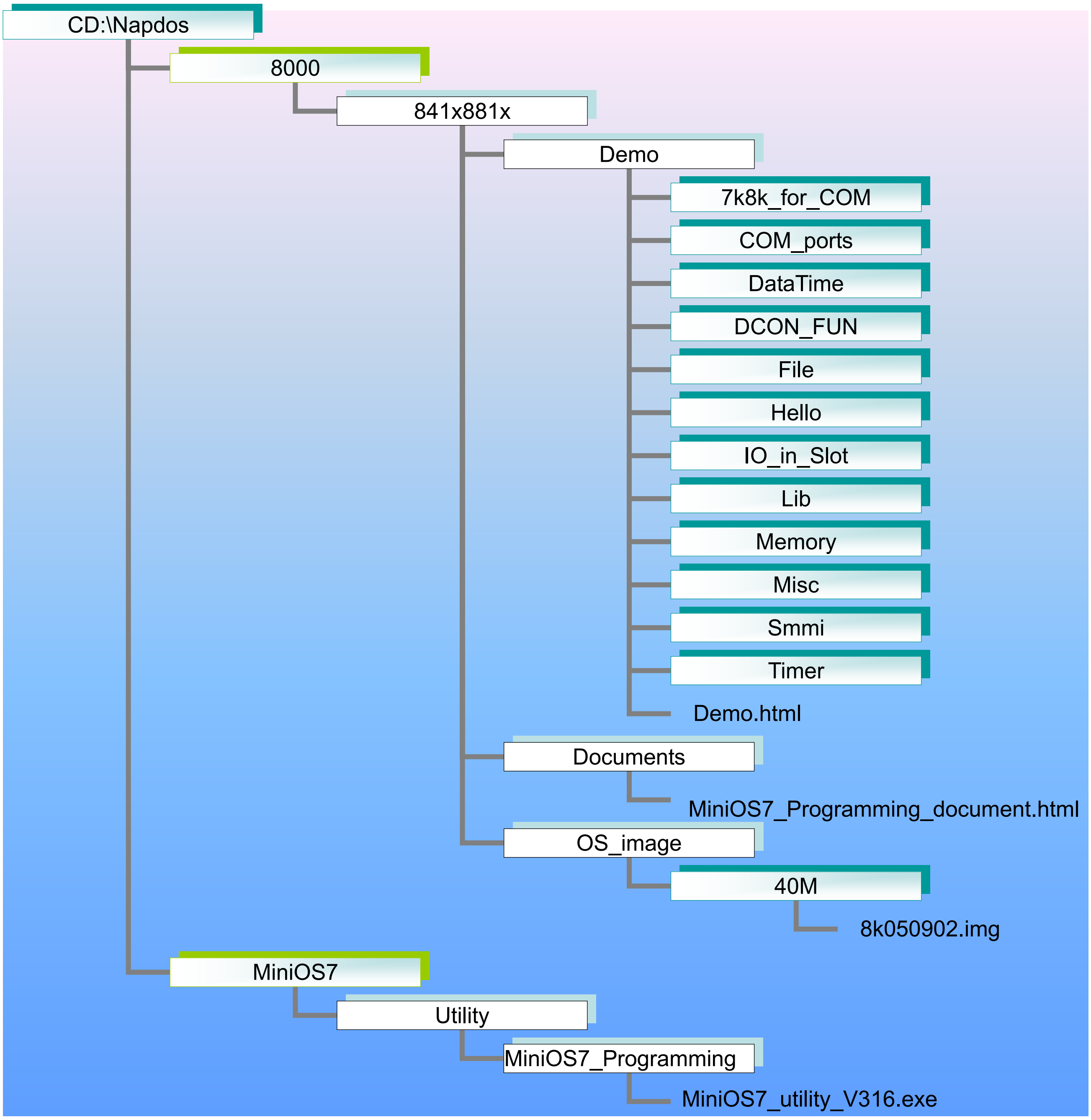
i-8811



1. COM3	RS-232/RS485	**5. Initialize**	INIT* and INIT*COM
2. COM1	RS232	**6. COM2**	RS-485 **(**Data+ and Data-)
3. SMMI	Small Main Machine Interface	**7. COM4**	RS-232
4. Power	+VS and GND	**8. NET ID.**	

1.4. Companion CD

This section describes the content of the companion CD, which provides the documentation and software related to the i-8411 and i-8811 module. The directory tree below will help you to quickly search the contents of the CD.



Notes: The software, documentation and manual are subject to change.

The latest Versions of the files are always available at:

http://ftp.icpdas.com/pub/cd/8000cd/napdos

CHAPTER
2

Quick Start

2.1. Hardware Installation

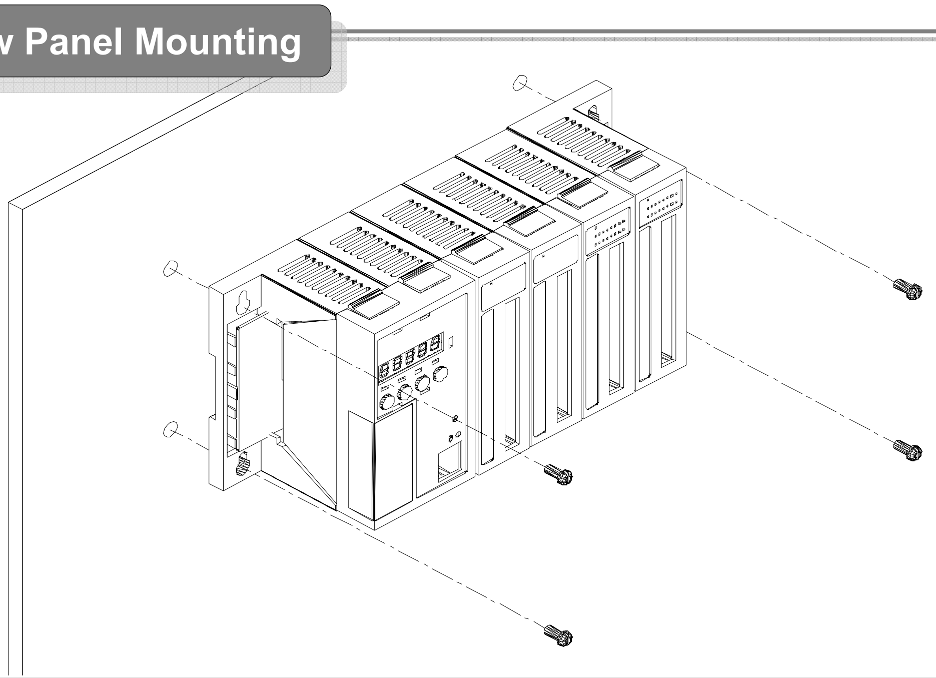
2.1.1. Installing the controller

Step 1: Mount the controller

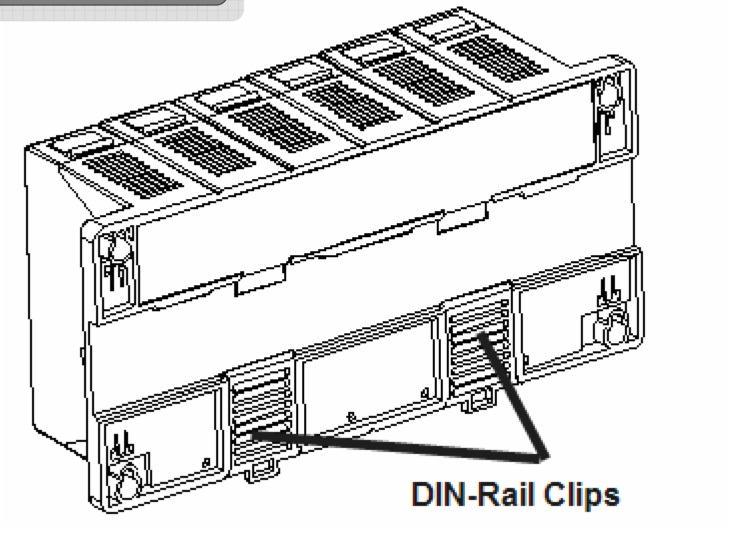
The controller can be mounted in two different ways:

Screw panel or DIN-Rail mounting.

Screw Panel Mounting

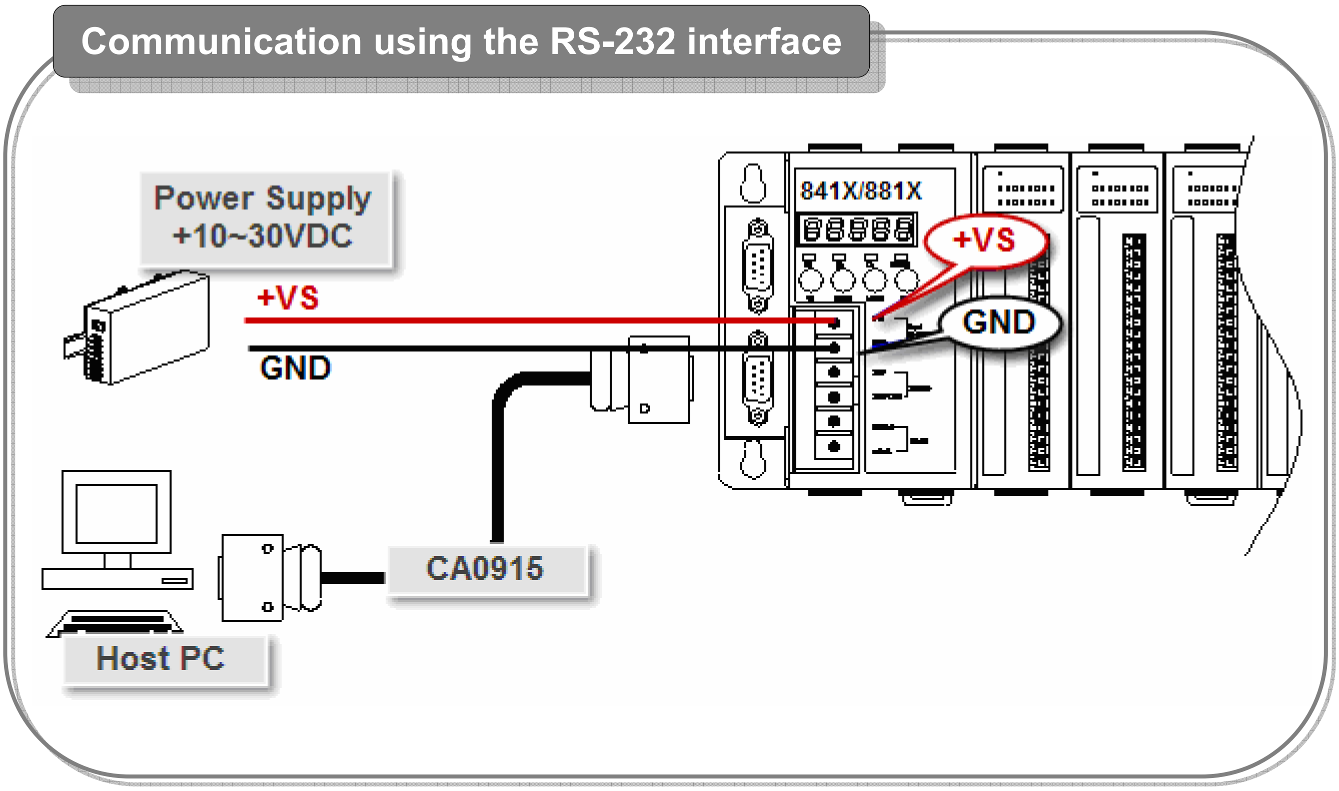


DIN-Rail Mounting

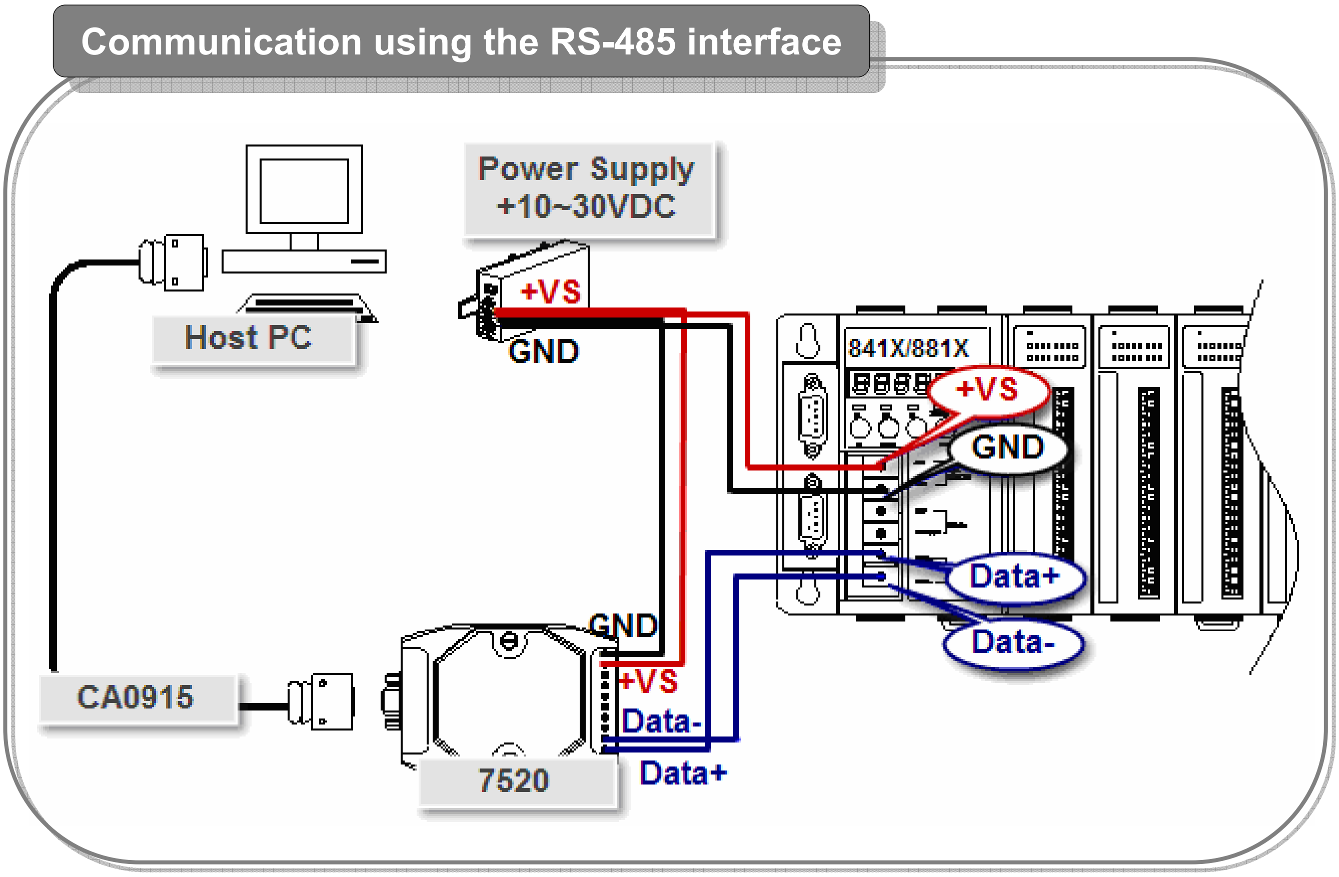


Step 2: Connect the power supply (10 ~ 30 V_{DC})

Communication using the RS-232 interface



Communication using the RS-485 interface



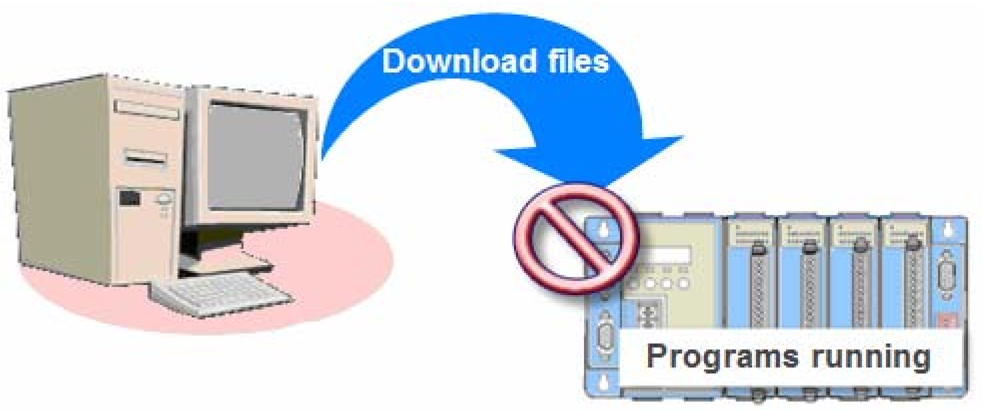
2.1.2. Operating modes of the controller

After apply power, the i-8411/i-8811 module includes the following modes for protecting the system. This section describes when the following modes boot.

1. Running mode

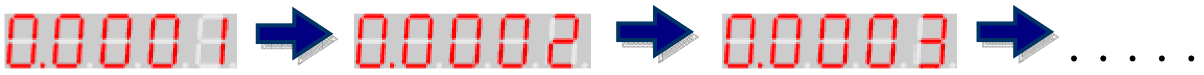
The running mode represents there is the program running on the i-8411/i-8811 module, and the 5-digits 7-SEG LED will show the message according to the running program, but if during this time there is another program running on the i-8411/i-8811 module, the 5-digits 7-SEG LED isn't managed with this program, it will stop motion at the present state.

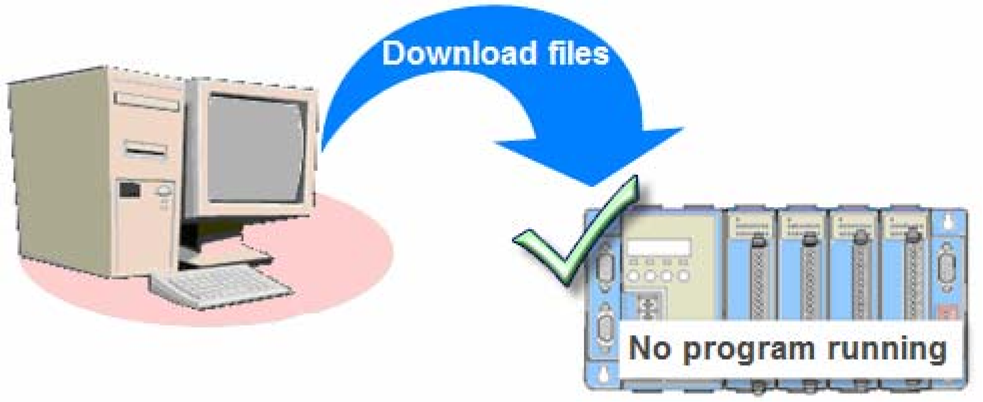
Note: If you want to stop the running program, please refer the point 3. Switching the running mode into the console mode.



2. Console mode

The Console mode represents there is no program running on the i-8411/i-8811 module, and the 5-digits 7-SEG LED will count the number as shown below:



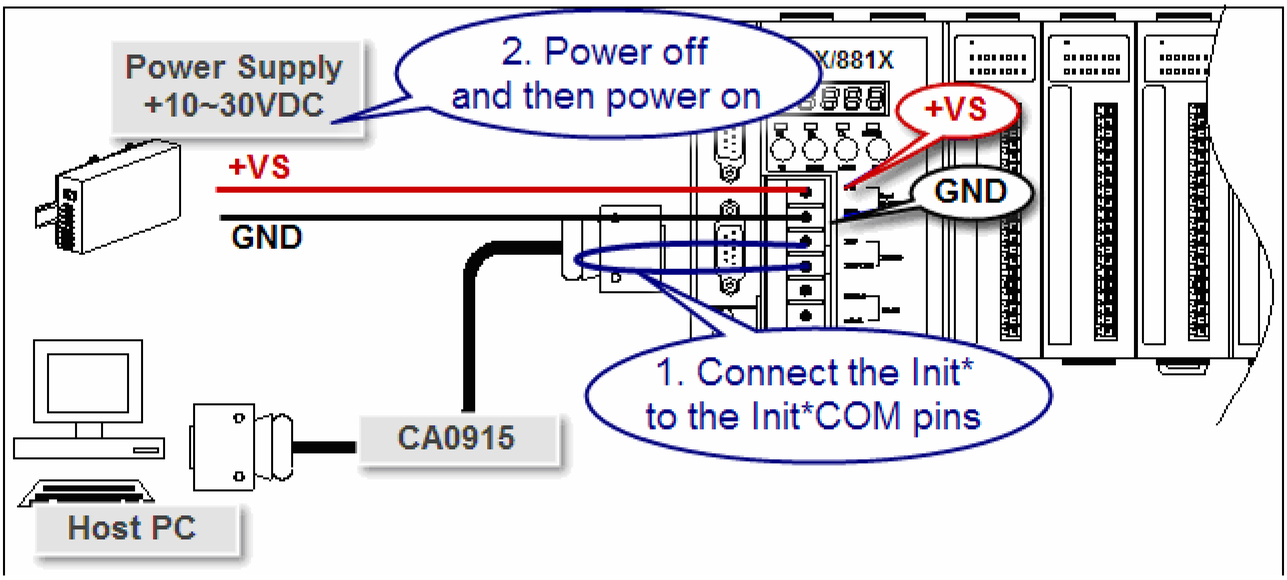


3. Switching the running mode into the console mode

To switch the running mode into the console mode, follows the following steps to stop all programs running on the i-8411/i-8811 module.

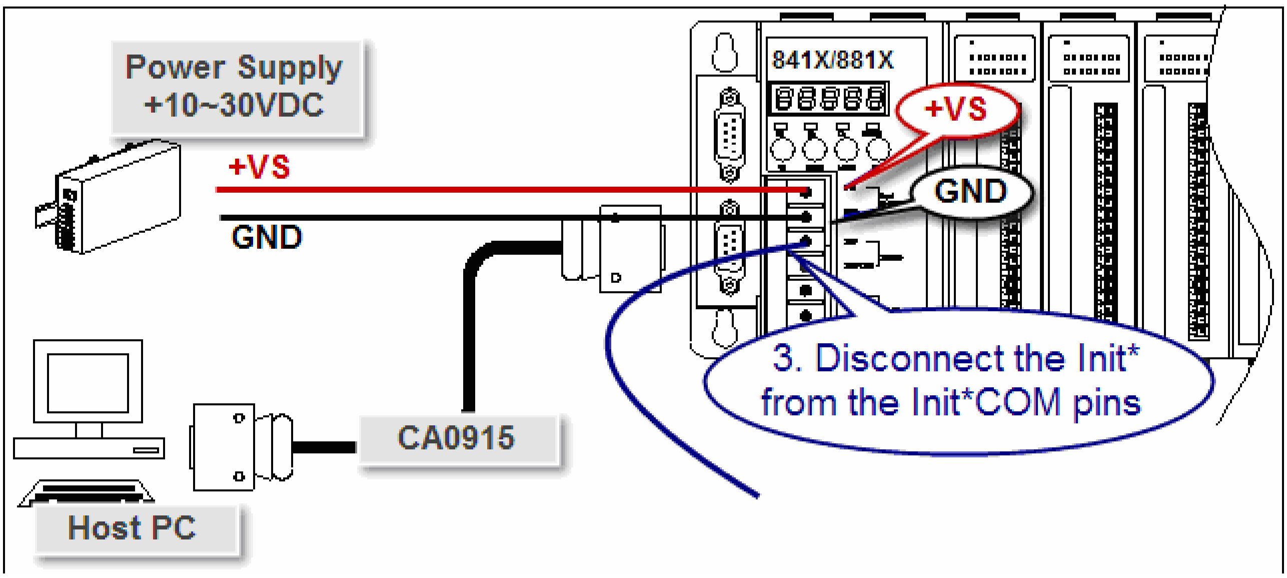
Step 1: Connect the Init* to the Init*COM pins

Step 2: Power off and then power on

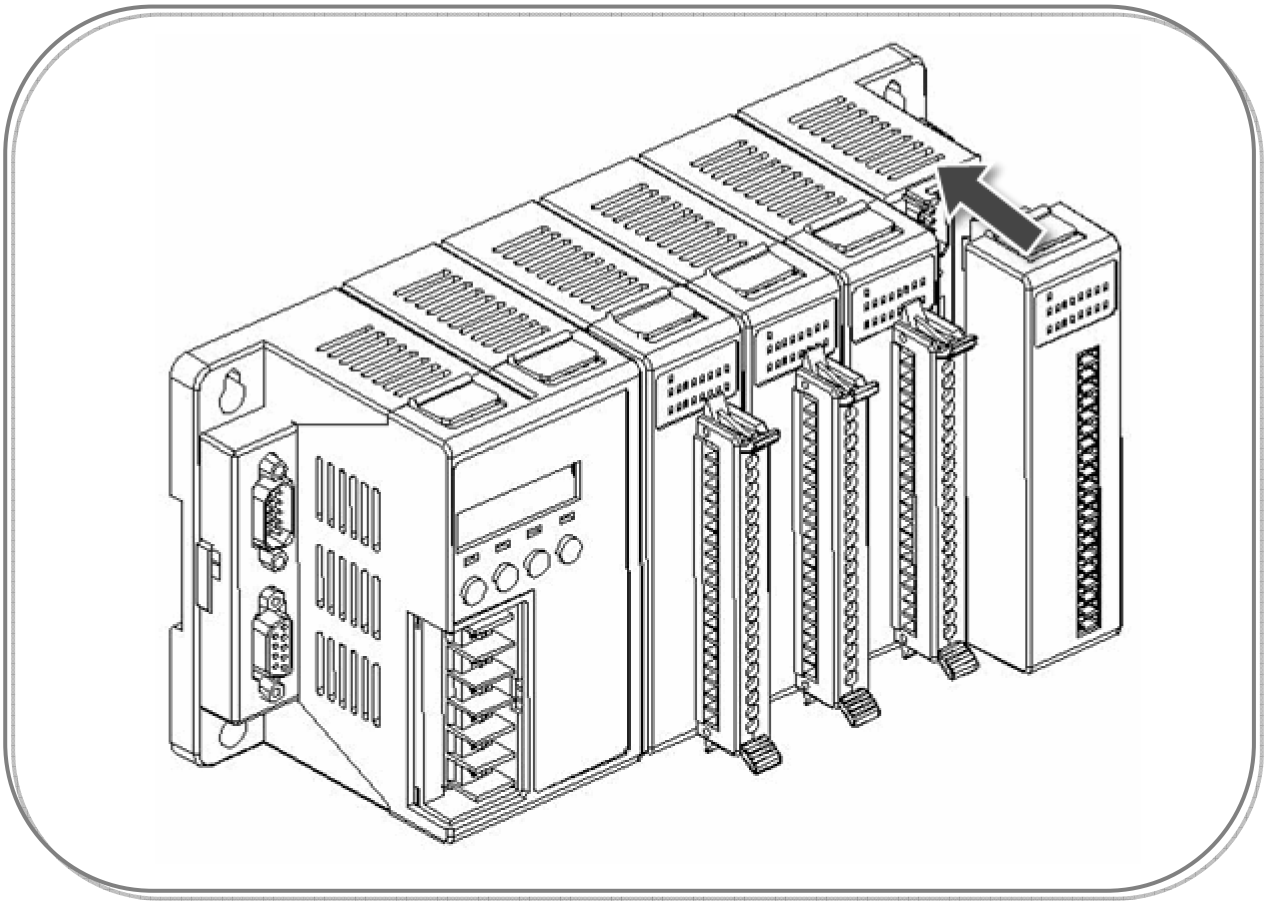


Power Supply +10~30VDC
2. Power off and then power on
X/881X
+VS
GND
+VS
GND
1. Connect the Init* to the Init*COM pins
CA0915
Host PC

Step 3: Disconnect the Init* from the Init*COM pins



2.1.3. Inserting the I/O module



Step 1: Read the relevant documentation

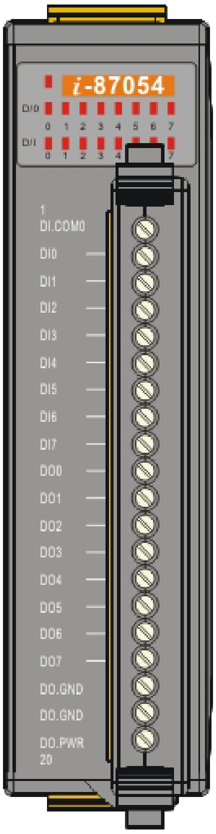
► The documentation for i-8K series modules is located at:
CD:\Napdos\DCON\IO_Module\hw_dcon_on_8KUnit\8k
ftp://ftp.icpdas.com/pub/cd/8000cd/napdos/dcon/io_module/hw_dcon_on_8kunit/8k/

► The documentation for i-87K series modules is located at:
CD:\ Napdos\DCON\IO_Module\hw_dcon_on_8KUnit\87k
ftp://ftp.icpdas.com/pub/cd/8000cd/napdos/dcon/io_module/hw_dcon_on_8kunit/87k/

All documents includes the I/O module specifications, pin assignments and wiring connections.

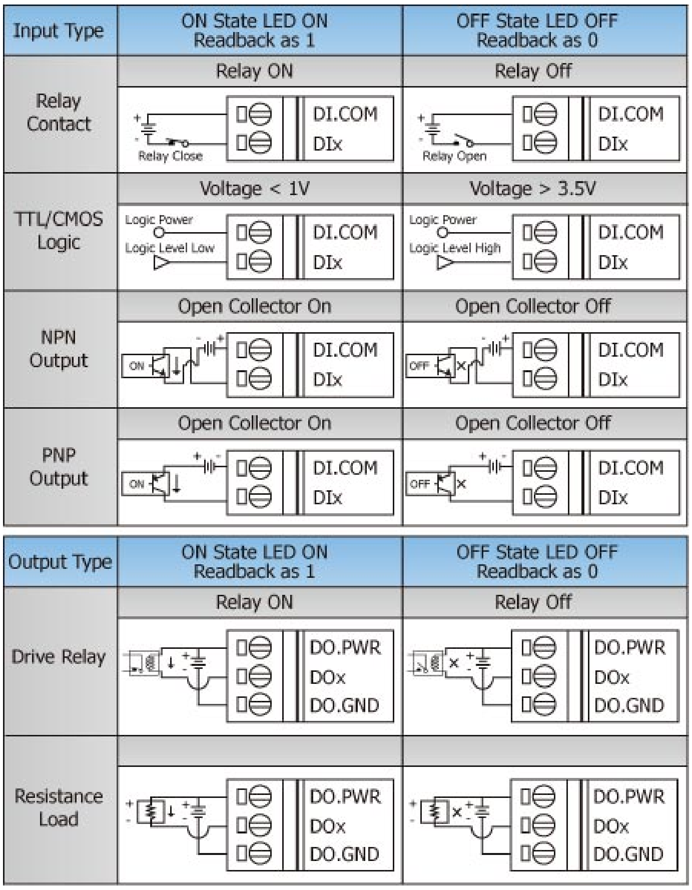
For example, Pin Assignments and Wiring connections for the i-87054 module are as follows:

Pin Assignments



Terminal No.	Pin Assignment Name
01	DI.COM0
02	DI0
03	DI1
04	DI2
05	DI3
06	DI4
07	DI5
08	DI6
09	DI7
10	DO0
11	DO1
12	DO2
13	DO3
14	DO4
15	DO5
16	DO6
17	DO7
18	DO.GND
19	DO.GND
20	DO.PWR

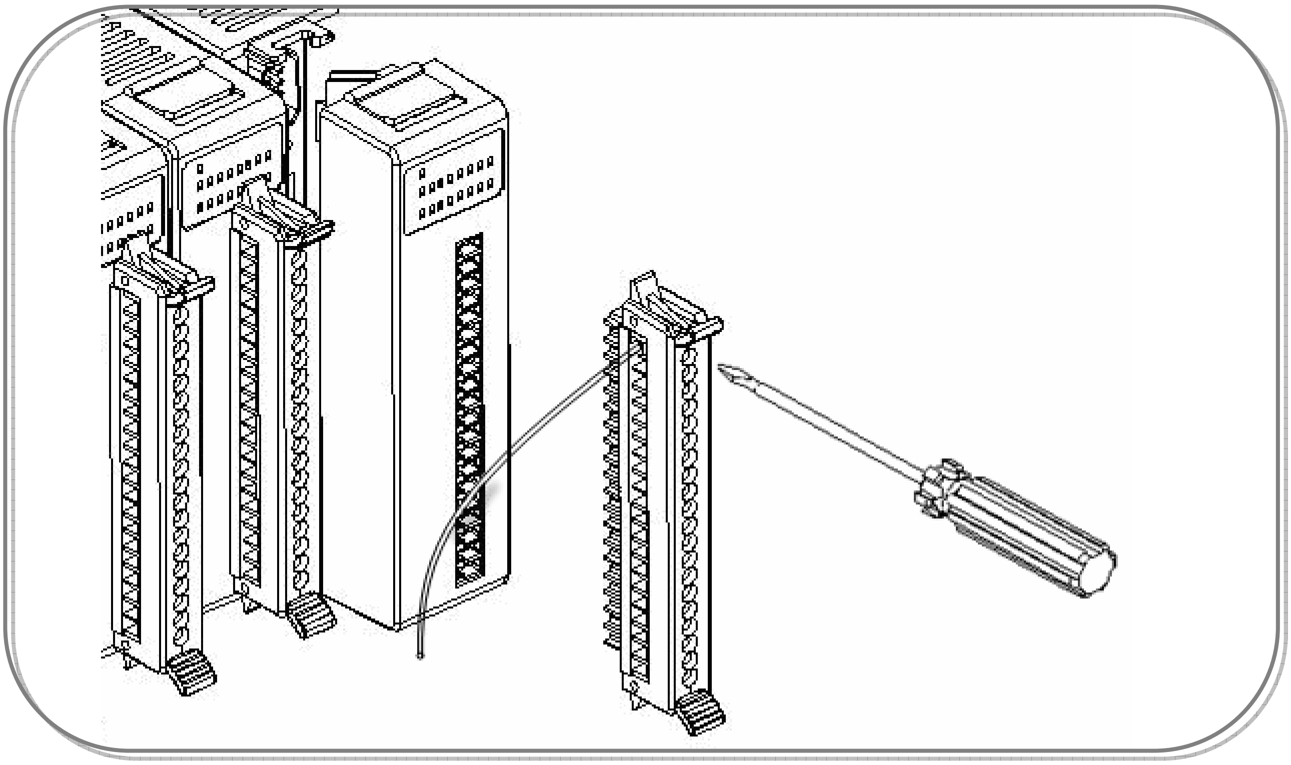
Wire Connection



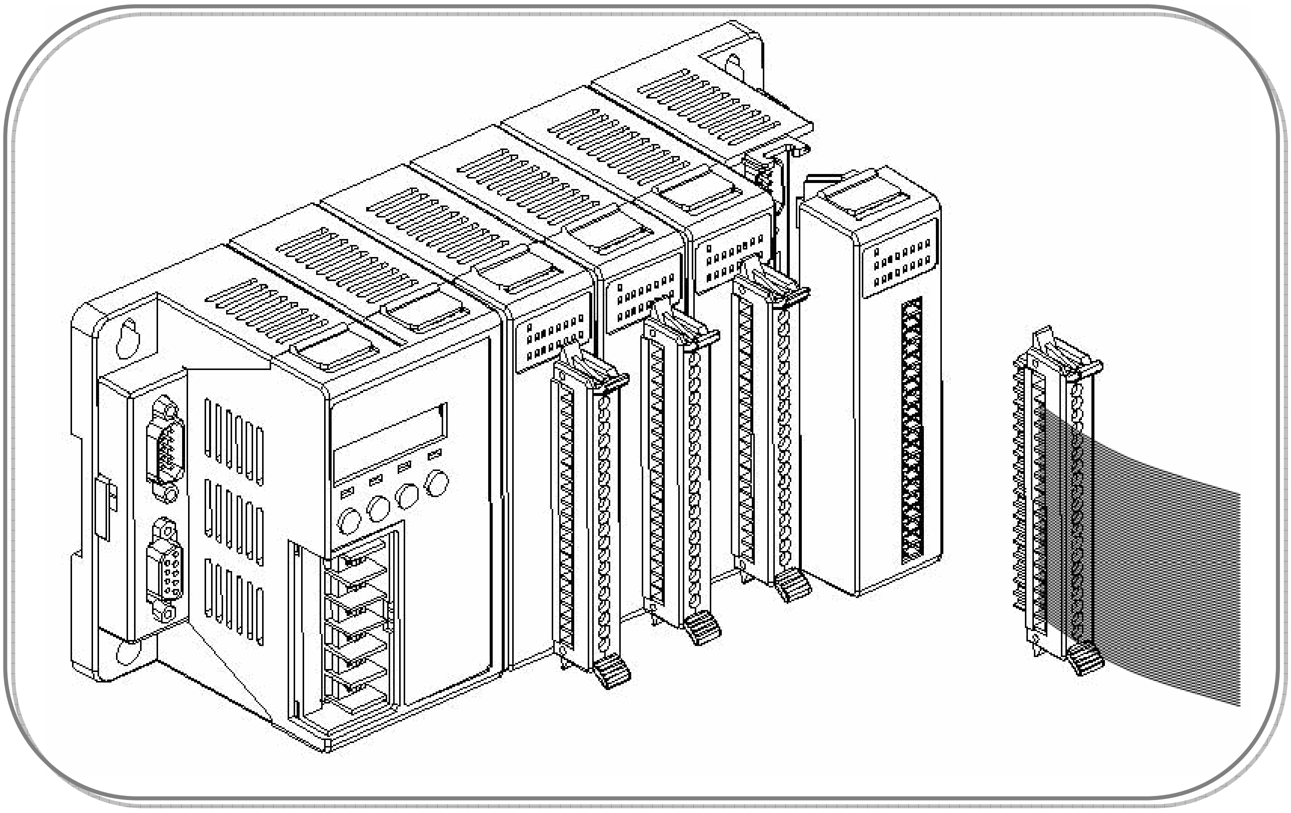
Input Type	ON State LED ON Readback as 1	OFF State LED OFF Readback as 0
	Relay ON	Relay Off
Relay Contact	Relay Close DI.COM DIx	Relay Open DI.COM DIx
	Voltage < 1V	Voltage > 3.5V
TTL/CMOS Logic	Logic Power Logic Level Low DI.COM DIx	Logic Power Logic Level High DI.COM DIx
	Open Collector On	Open Collector Off
NPN Output	ON DI.COM DIx	OFF DI.COM DIx
	Open Collector On	Open Collector Off
PNP Output	ON DI.COM DIx	OFF DI.COM DIx

Output Type	ON State LED ON Readback as 1	OFF State LED OFF Readback as 0
	Relay ON	Relay Off
Drive Relay	DO.PWR DOx DO.GND	DO.PWR DOx DO.GND
Resistance Load	DO.PWR DOx DO.GND	DO.PWR DOx DO.GND

Step 2: Connect the wires



Step 3: Insert the I/O module

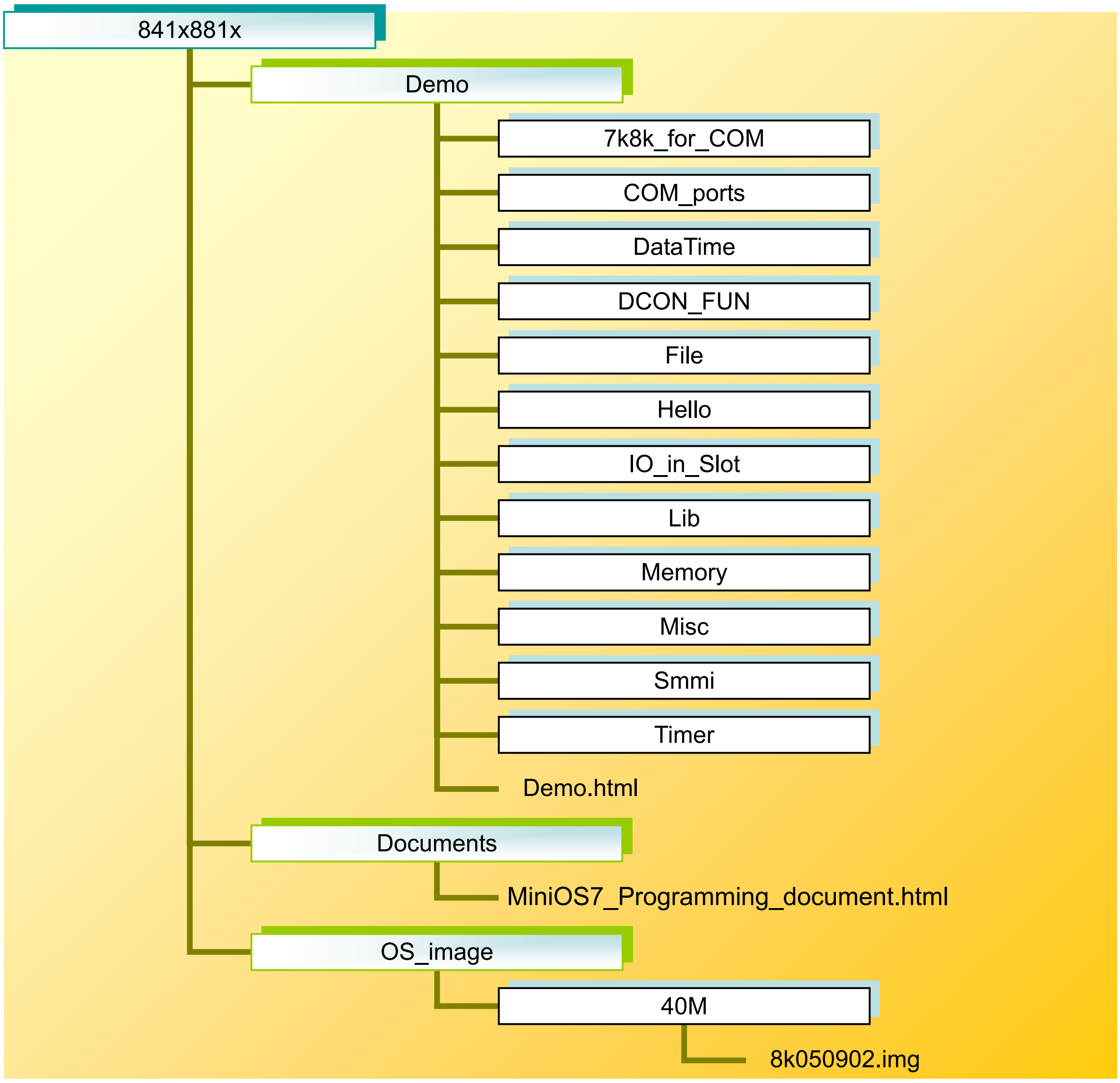


2.2. Software Installation

Step 1: Copy the 841x881x file folder to your Host PC

CD:\Napdos\8000\

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



Step 2: Install the MiniOS7 Utility

The MiniOS7 Utility is a tool that can be used to configure and upload files to the controller and is located at:

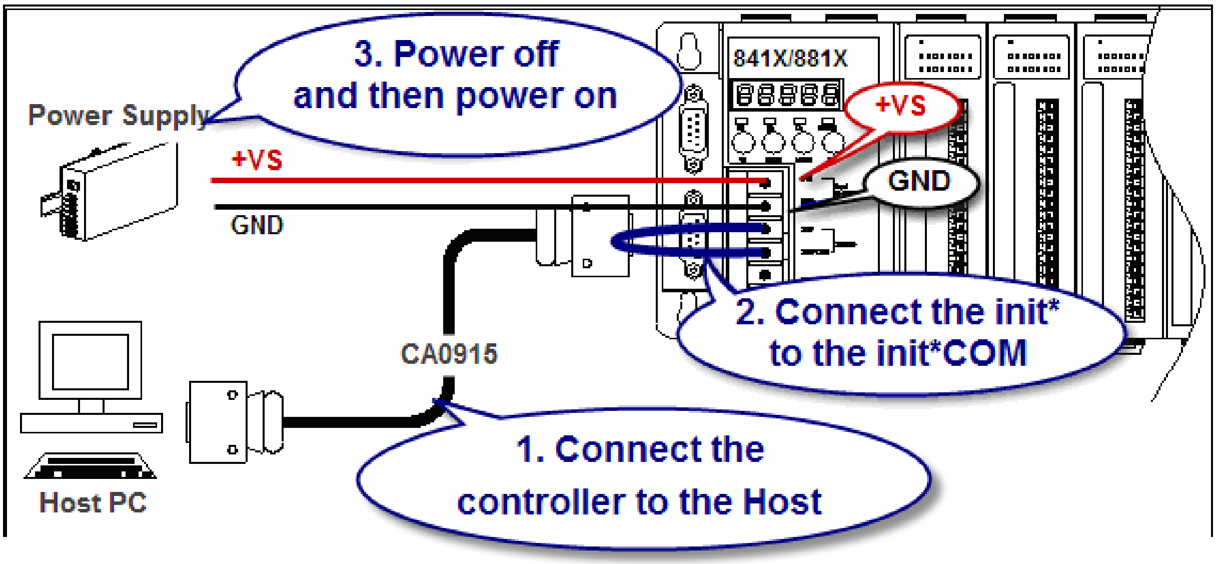
CD:\Napdos\minios7\utility\minios7_utility\

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

2.3. Download programs to the controller

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

2.3.1. Establishing a connection and disabling the running program



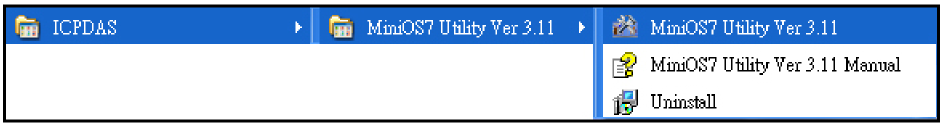
Step 1: Use the CA0915 cable to connect the controller to the Host PC

Step 2: Disable the running program, connect the Init* to the Init*COM pins

Step 3: Power off and then power on the module

The CPU doesn't run the autoexec.bat during the power on stage.

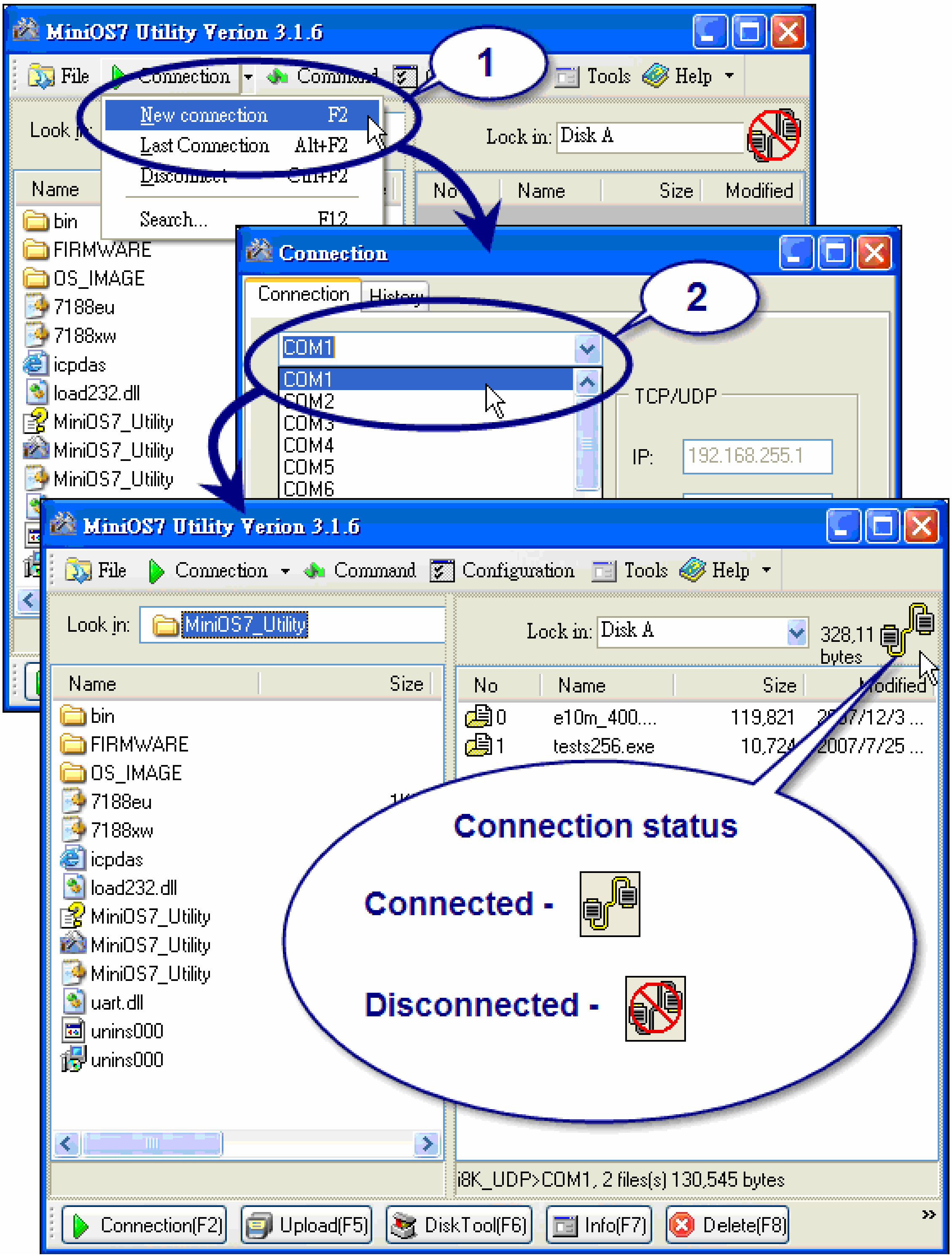
Step 4：Run the MiniOS7 Utility



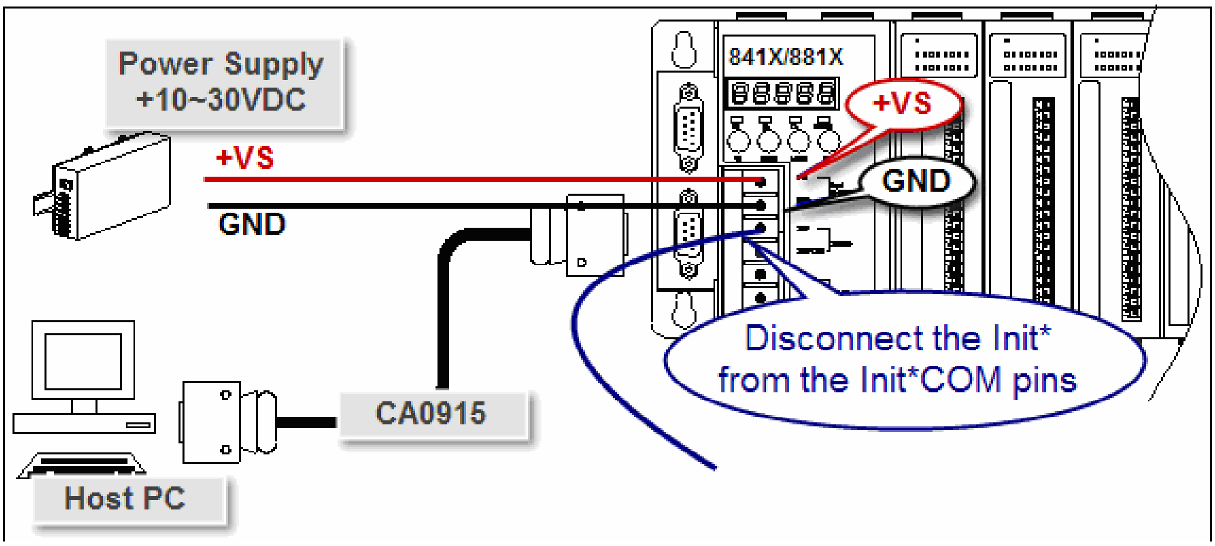
Step 6: Select the controller COM port that is connected to your Host PC

1. Click on "New connection" from the Connection menu or press F2 to create a new connection.

2. Select the correct COM port from the drop down menu in the connection tab.

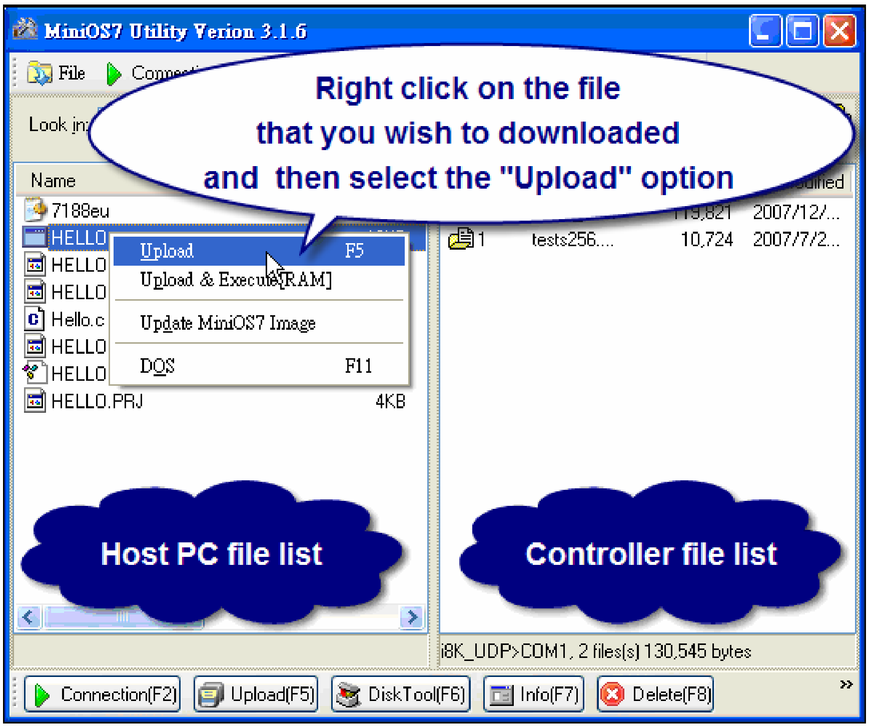


Step 7: Disconnect the Init* to the Init*COM pins



2.3.2. Download and executing programs on the controller

Step 1: Right click on the file that you wish to downloaded and then select the “Upload” option to upload it on the controller.

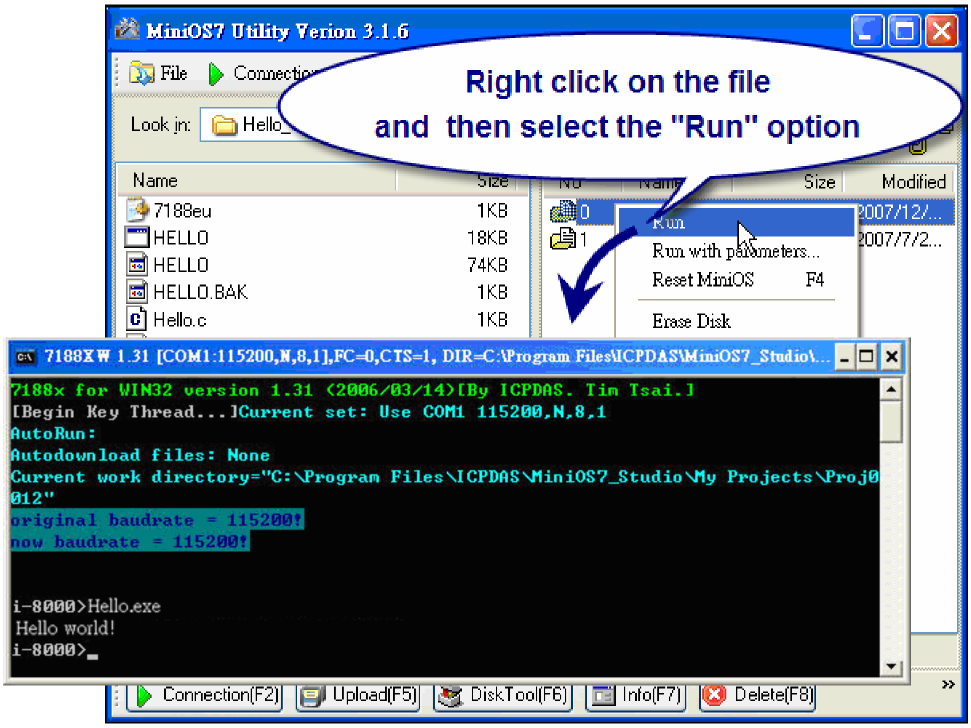


Right click on the file that you wish to downloaded and then select the "Upload" option

Host PC file list

Controller file list

Step 2：Right click on the file and then select “Run” option to execute the program



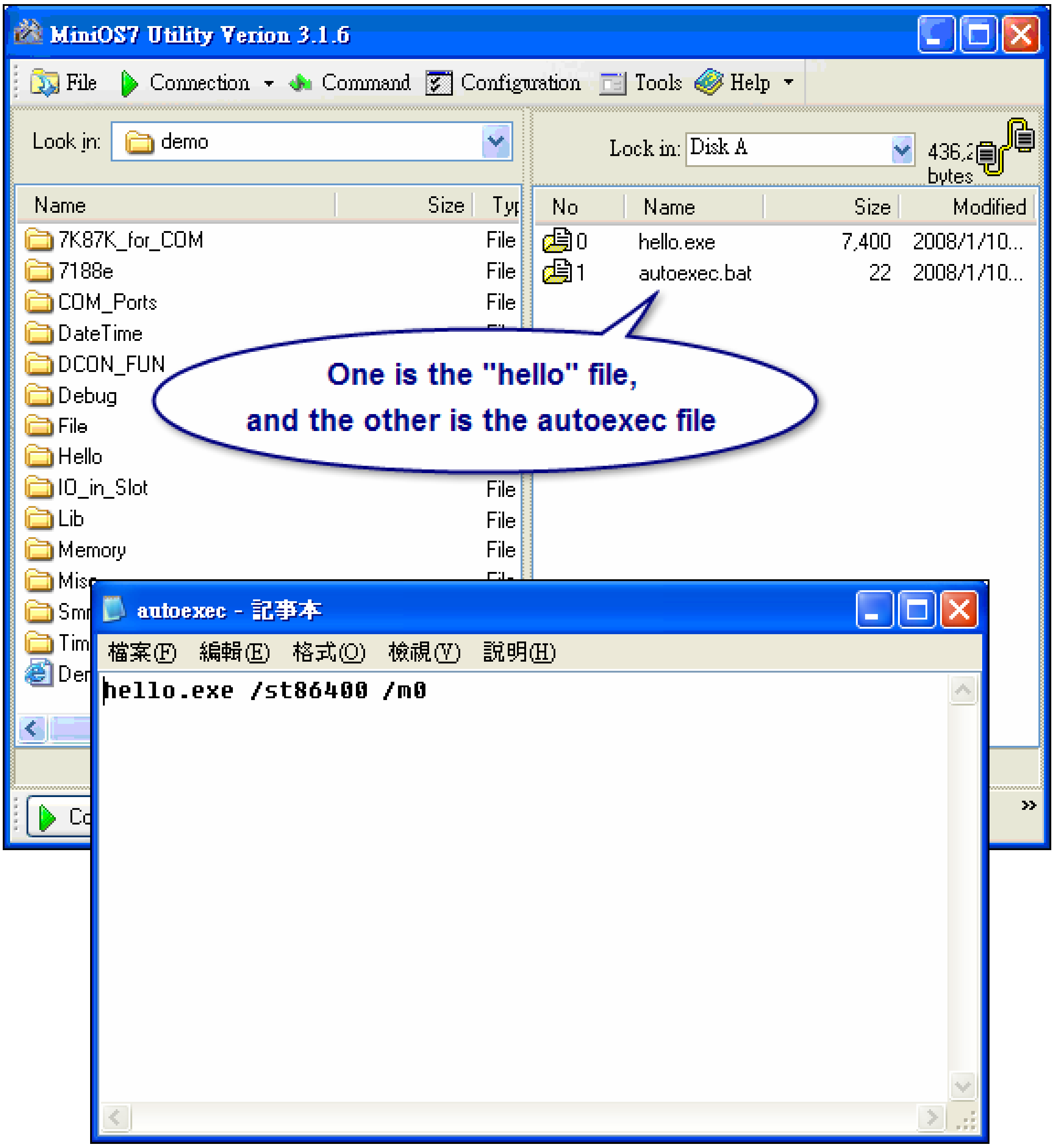
Right click on the file and then select the "Run" option

```
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:\Program Files\ICPDAS\MiniOS7_Studio\My Projects\Proj0
012"
original baudrate = 115200!
now baudrate = 115200!


i-8000>Hello.exe
 Hello world!
i-8000>_
```

2.3.3. Making programs start automatically

After download programs on the i-8411/i-8811 module, if you need the program to start automatically after the i-8411/i-8811 start-up, it is easy to achieve it, to create a batch file called autoexec.bat and then upload it on the i-8411/i-8811 controller, the program will start automatically in the next start-up.

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



No	Name	Size	Modified
0	hello.exe	7,400	2008/1/10...
1	autoexec.bat	22	2008/1/10...

```
hello.exe /st86400 /m0
```

2.4. Upgrading the MiniOS7 image file

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

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

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

CD:\Napdos\8000\841x881x\OS_image\40m\

http://ftp.icpdas.com/pub/cd/8000cd/napdos/8000/841x881x/os_image/40m/

The format of the image file name is: TTYYMMDD.img

TT: The type of product.

YY: The year this image was released

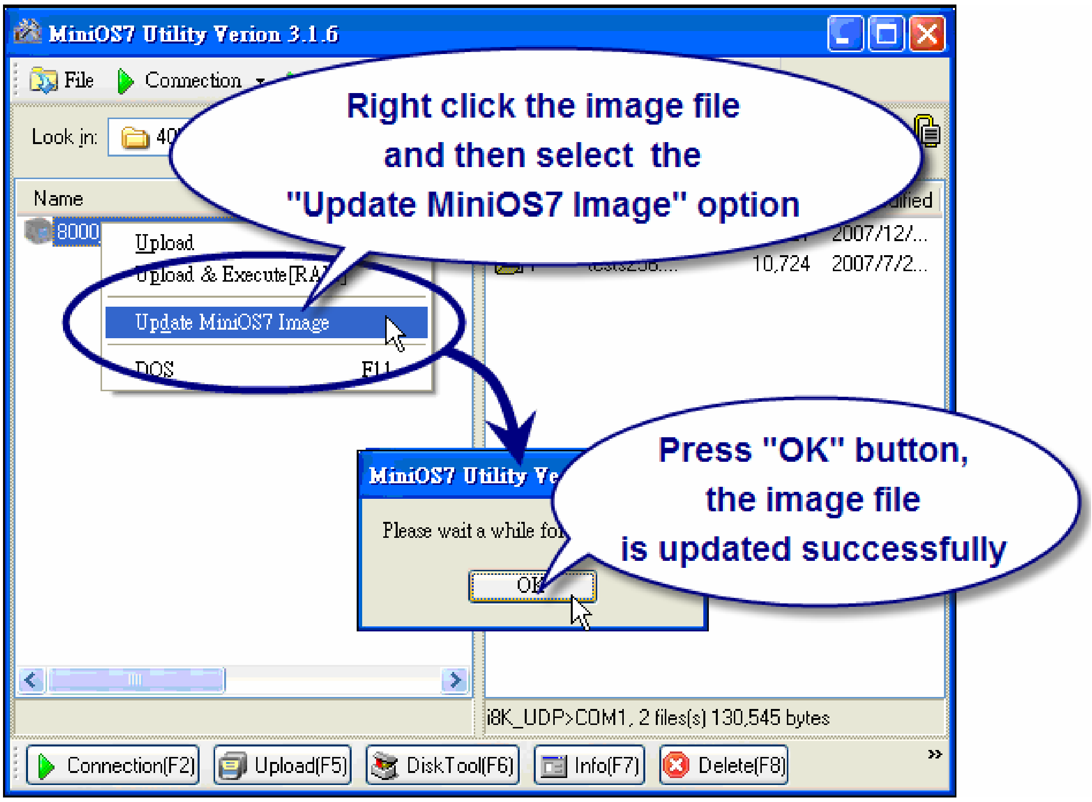
MM: The month this image was released

DD: The day this image was released

Step 2: Establish a connection

Refer to "Section **2.3.1. Establishing a Connection**" for more details

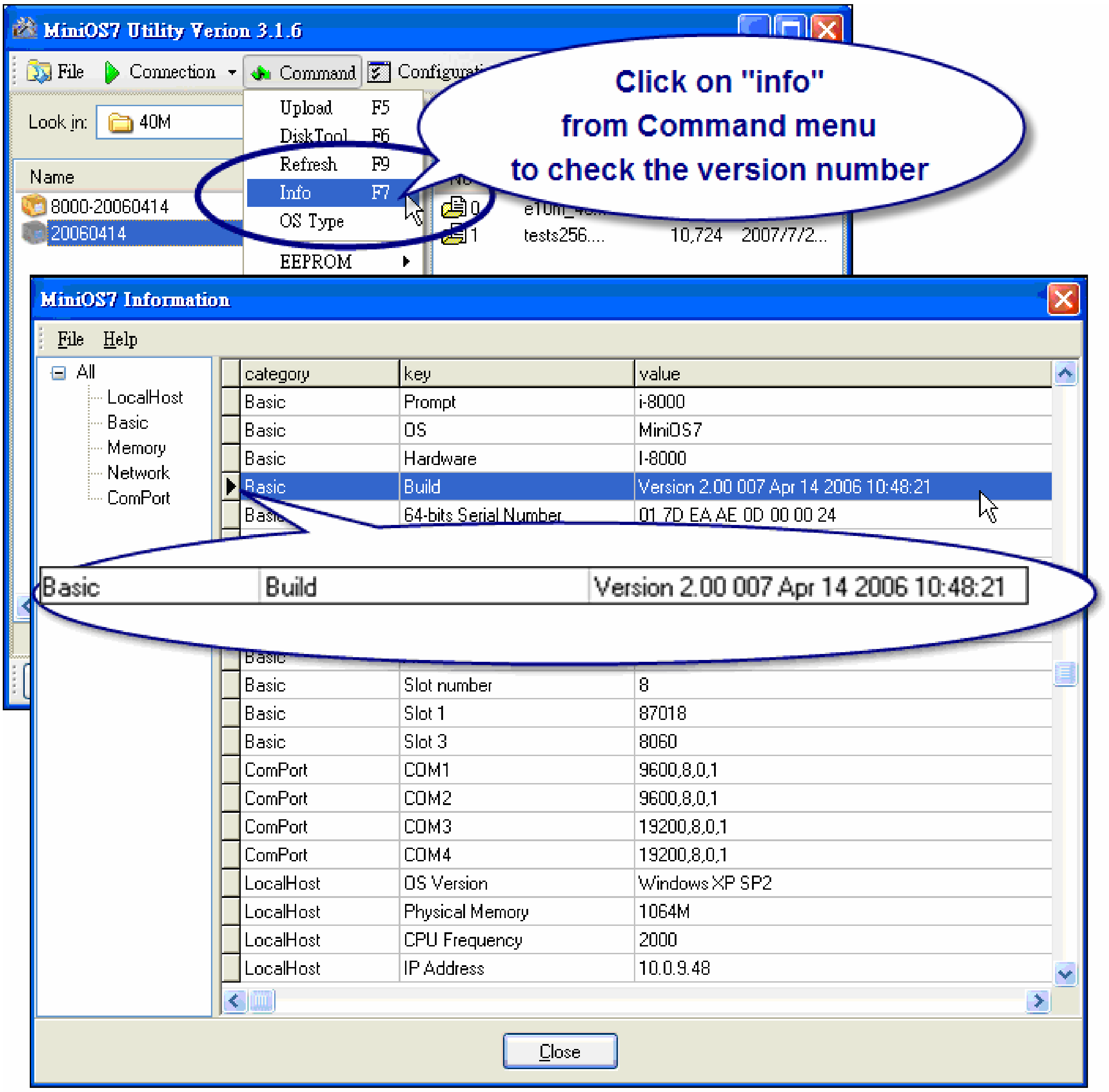
Step 3: Select the latest version of the MiniOS7 image file from the Host PC



Right click the image file and then select the "Update MiniOS7 Image" option

Press "OK" button, the image file is updated successfully

Step 4: Click on “Info” from the Command menu or press F7 to check the version number



Click on "info" from Command menu to check the version number

category	key	value
Basic	Prompt	i-8000
Basic	OS	MiniOS7
Basic	Hardware	I-8000
Basic	Build	Version 2.00 007 Apr 14 2006 10:48:21
Basic	64-bits Serial Number	01 7D EA AE 0D 00 00 24
Basic		
Basic	Slot number	8
Basic	Slot 1	87018
Basic	Slot 3	8060
ComPort	COM1	9600,8,0,1
ComPort	COM2	9600,8,0,1
ComPort	COM3	19200,8,0,1
ComPort	COM4	19200,8,0,1
LocalHost	OS Version	Windows XP SP2
LocalHost	Physical Memory	1064M
LocalHost	CPU Frequency	2000
LocalHost	IP Address	10.0.9.48

Basic	Build	Version 2.00 007 Apr 14 2006 10:48:21

Note: The latest version of the MiniOS7 image file is always available at:
http://ftp.icpdas.com/pub/cd/8000cd/napdos/8000/841x881x/os_image/40m/

CHAPTER
3

Your First Program

Before writing your first program, ensure that you have the necessary C/C++ compiler and the corresponding functions library for the i-8411/i-8811 on your system.

3.1. Setting up the compiler

The following compilers are available for the controller:

■ Turbo C++ Version 1.01 (Freeware)

■ Turbo C Version 2.01 (Freeware)

■ Borland C++ Versions 3.1 - 5.2.x

■ MSC

■ MSVC ++

Note: 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.)

► For more information about compiler settings, please refer to "**Appendix E. More Compiler Settings**"

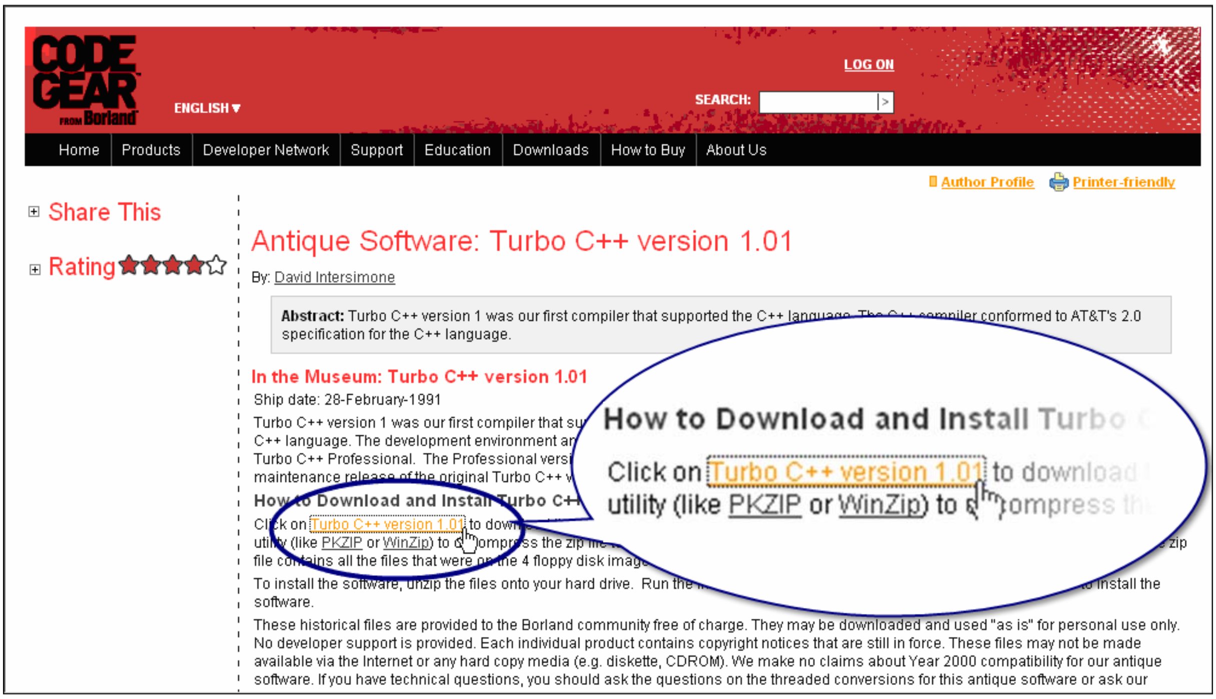
3.2.1. Installing the compiler

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: Go to the Borland web site and download Turbo C++ Version 1.01

Note: Free versions of the Turbo C++ Version 1.01 and Turbo C Version 2.01 compilers can be downloaded from the Borland web site.

- **Turbo C++ Version 1.01**
  http://dn.codegear.com/article/21751
- **Turbo C Version 2.01**
  http://dn.codegear.com/article/20841



Antique Software: Turbo C++ version 1.01

By: David Intersimone

Abstract: Turbo C++ version 1 was our first compiler that supported the C++ language. The C++ compiler conformed to AT&T's 2.0 specification for the C++ language.

In the Museum: Turbo C++ version 1.01

Ship date: 28-February-1991

Turbo C++ version 1 was our first compiler that su
C++ language. The development environment an
Turbo C++ Professional. The Professional versi
maintenance release of the original Turbo C++ v

How to Download and Install Turbo C++

Click on Turbo C++ version 1.01 to download
utility (like PKZIP or WinZip) to decompress the zip file
file contains all the files that were on the 4 floppy disk image

To install the software, unzip the files onto your hard drive. Run the install the software.

These historical files are provided to the Borland community free of charge. They may be downloaded and used "as is" for personal use only. No developer support is provided. Each individual product contains copyright notices that are still in force. These files may not be made available via the Internet or any hard copy media (e.g. diskette, CDROM). We make no claims about Year 2000 compatibility for our antique software. If you have technical questions, you should ask the questions on the threaded conversions for this antique software or ask our

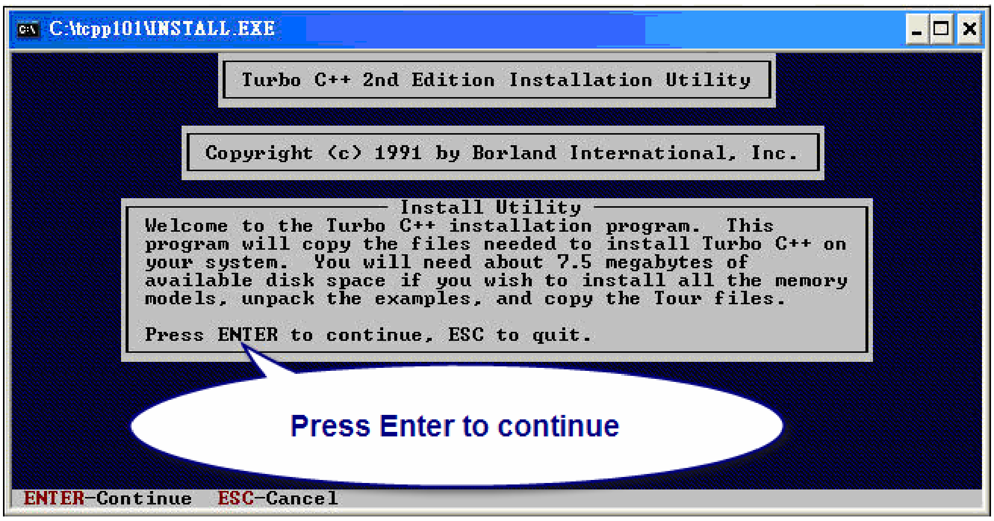
How to Download and Install Turbo C

Click on Turbo C++ version 1.01 to download

utility (like PKZIP or WinZip) to decompress th

Step 2: Double click the exe file icon to begin installation

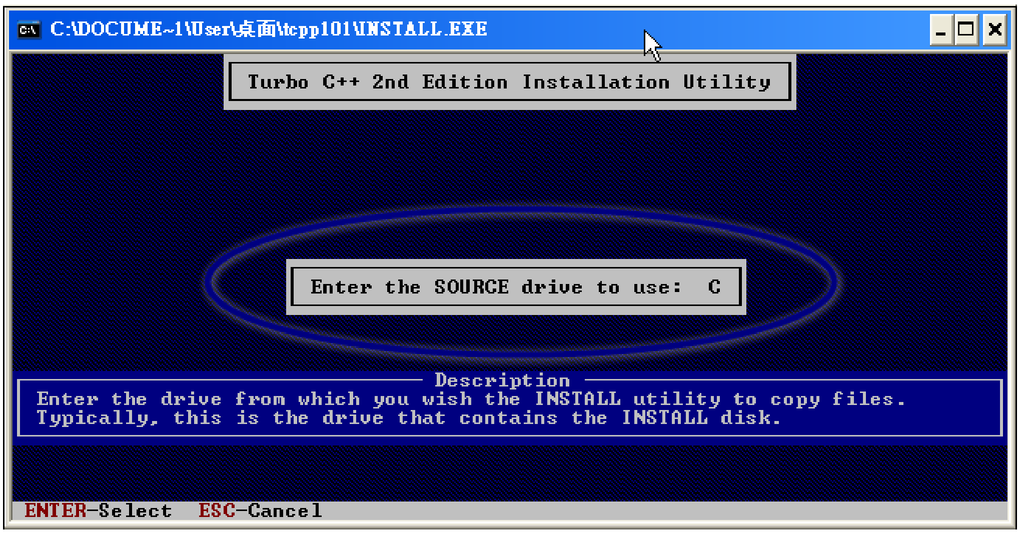
Step 3: Press "ENTER" to continue



```
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
```

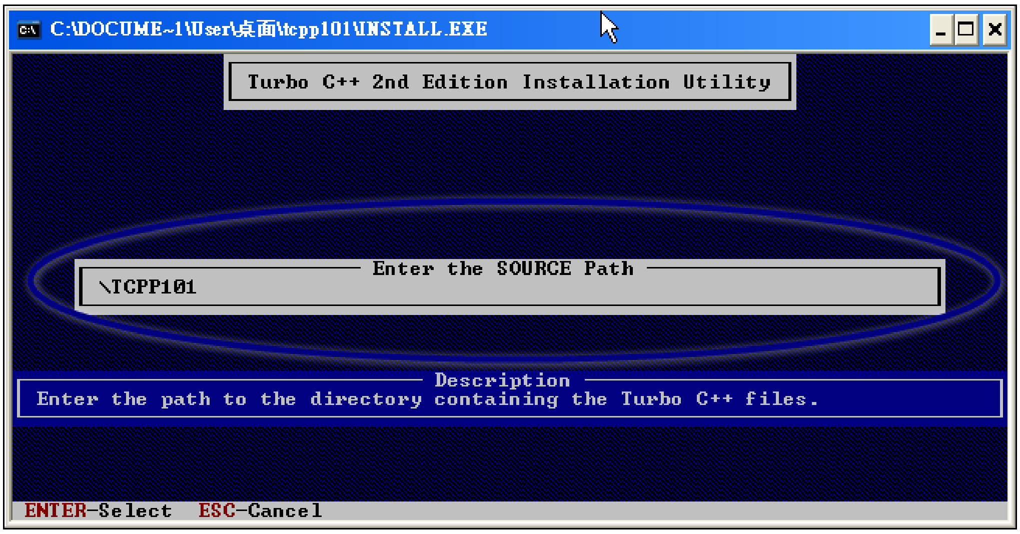
Press Enter to continue

Step 4: Enter the hard drive letter where you wish to install the software



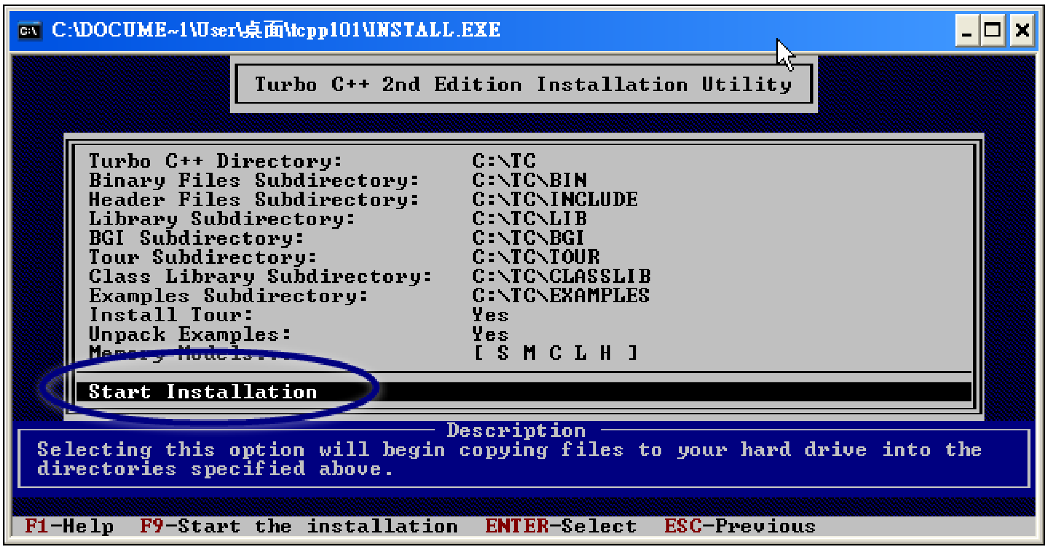
```
Turbo C++ 2nd Edition Installation Utility

Enter the SOURCE drive to use:  C

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 5: Enter the path to the directory that you wish to install the files to



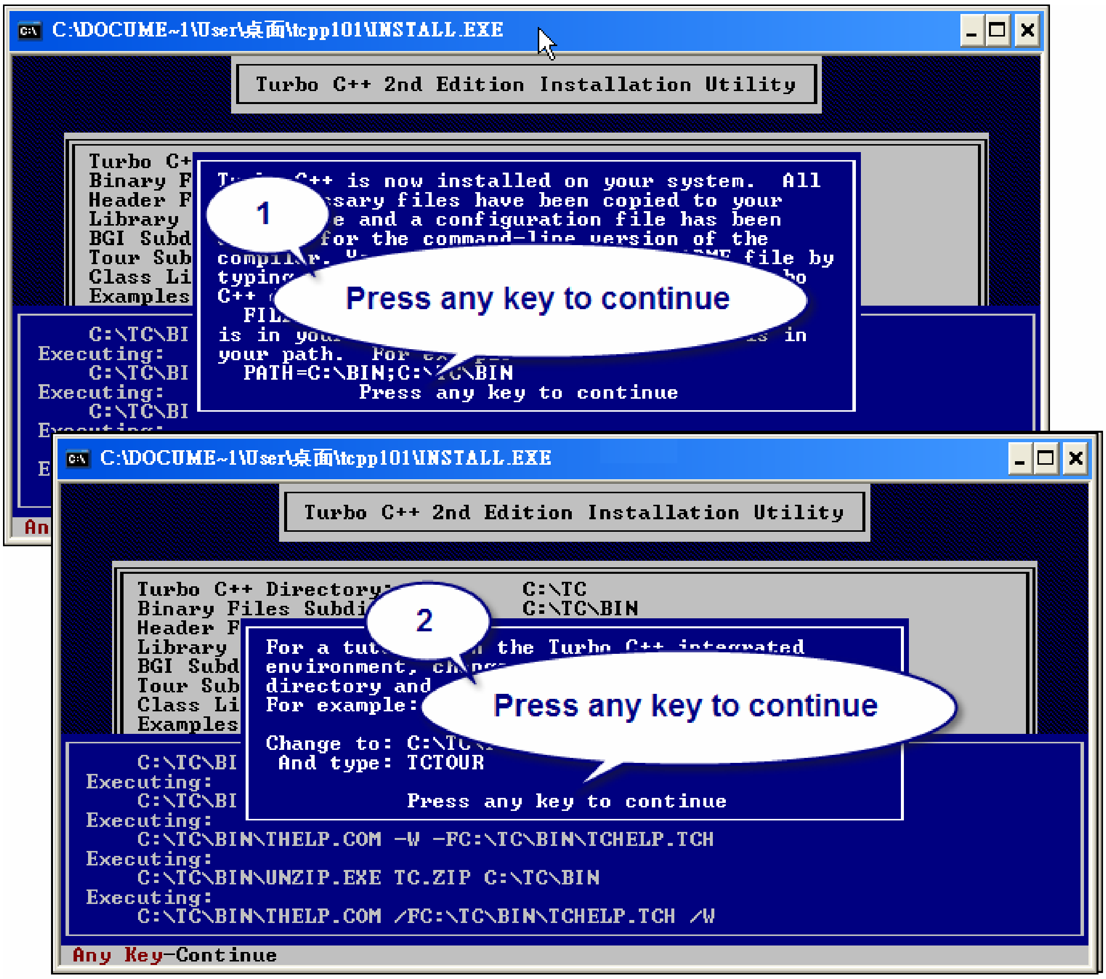
```
Turbo C++ 2nd Edition Installation Utility

Enter the SOURCE Path
\TCPP101

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

ENTER-Select   ESC-Cancel
```

Step 6: Select “Start Installation” to begin installing the compilers files



```
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 7: Press “ENTER”, and then press ”ENTER” again



```
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         ssary files have been copied to your
  Header F          e and a configuration file has been
  Library           for the command-line version of the
  BGI Subd   compil  r.                         file by
  Tour Sub   typing                                   to
  Class Li   C++
  Examples     FIL
    C:\TC\BI is in you                             is in
 Executing:  your path.  For
    C:\TC\BI   PATH=C:\BIN;C:\  C\BIN
 Executing:             Press any key to continue
    C:\TC\BI
 Executing:

 An
```

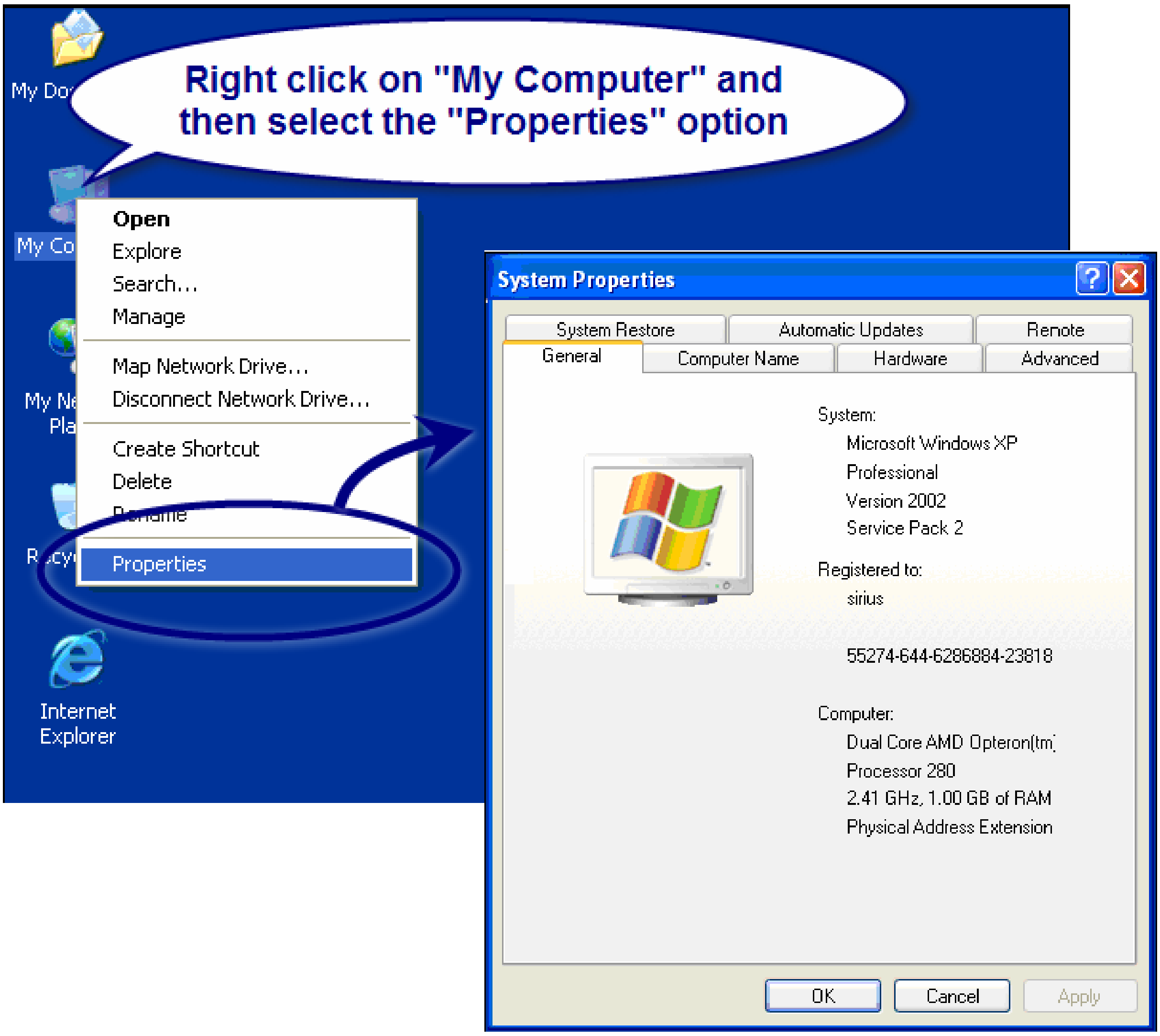
```
C:\DOCUME~1\User\桌面\tcpp101\INSTALL.EXE

        Turbo C++ 2nd Edition Installation Utility

  Turbo C++ Directory:              C:\TC
  Binary Files Subdi                C:\TC\BIN
  Header F
  Library   For a tut       the Turbo C++ integrated
  BGI Subd  environment, ch
  Tour Sub  directory and
  Class Li  For example:
  Examples
    C:\TC\BI Change to: C:\TC\
 Executing:   And type: TCTOUR
    C:\TC\BI
 Executing:              Press any key to continue
    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

 Any Key-Continue
```

Step 8：Installation is completed

3.2.2. Setting 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 “My Computer” icon, and then select the “Properties” option



Right click on "My Computer" and then select the "Properties" option

System:
Microsoft Windows XP
Professional
Version 2002
Service Pack 2

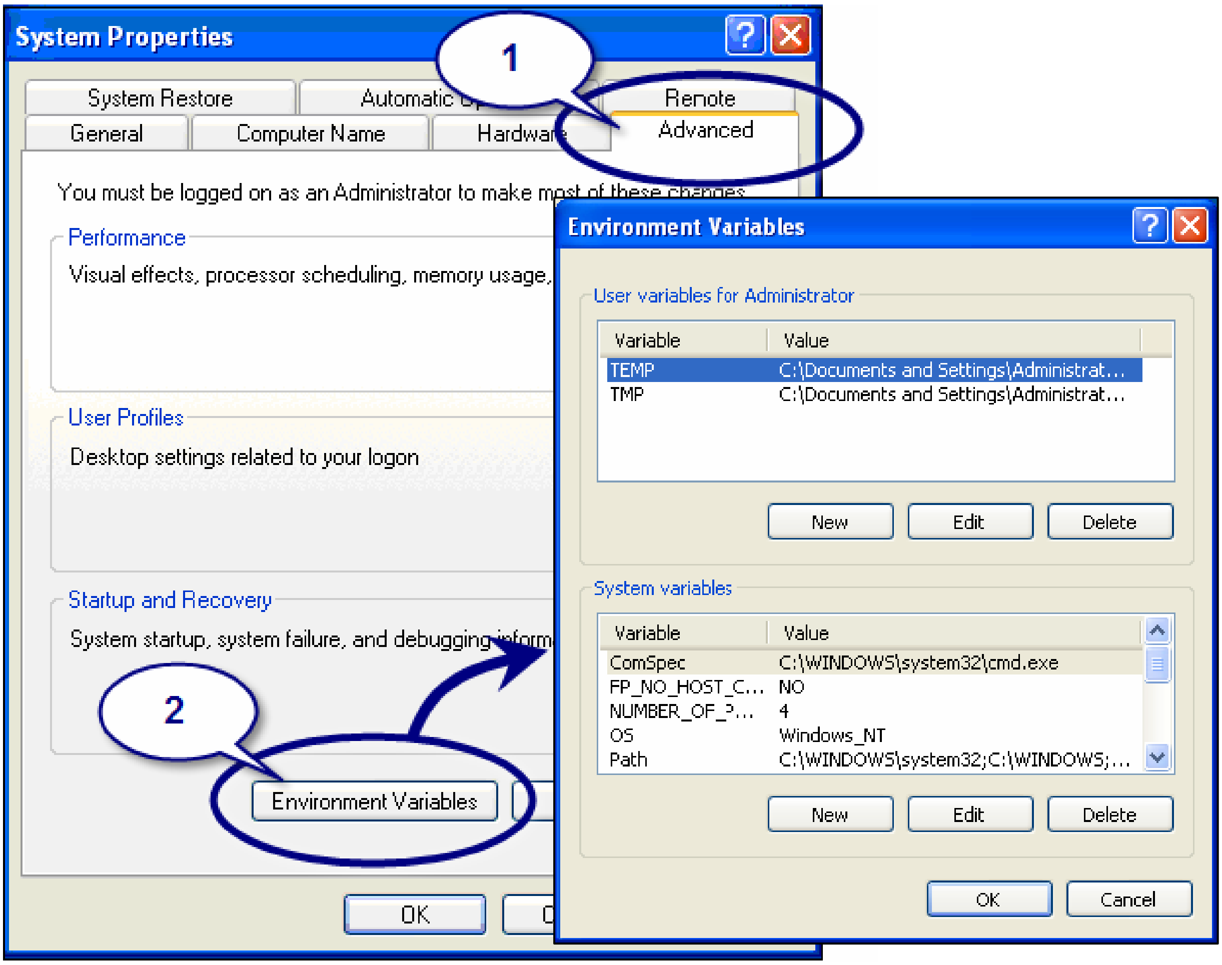
Registered to:
sirius

55274-644-6286884-23818

Computer:
Dual Core AMD Opteron(tm)
Processor 280
2.41 GHz, 1.00 GB of RAM
Physical Address Extension

Step 2: Click the "Advanced" Tab, and then click the "Environment Variables" Button

Step 3：Select "Path" under the System Variables option, and then click the "Edit" Button



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

Visual effects, processor scheduling, memory usage,

Desktop settings related to your logon

System startup, system failure, and debugging inform

User variables for Administrator

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

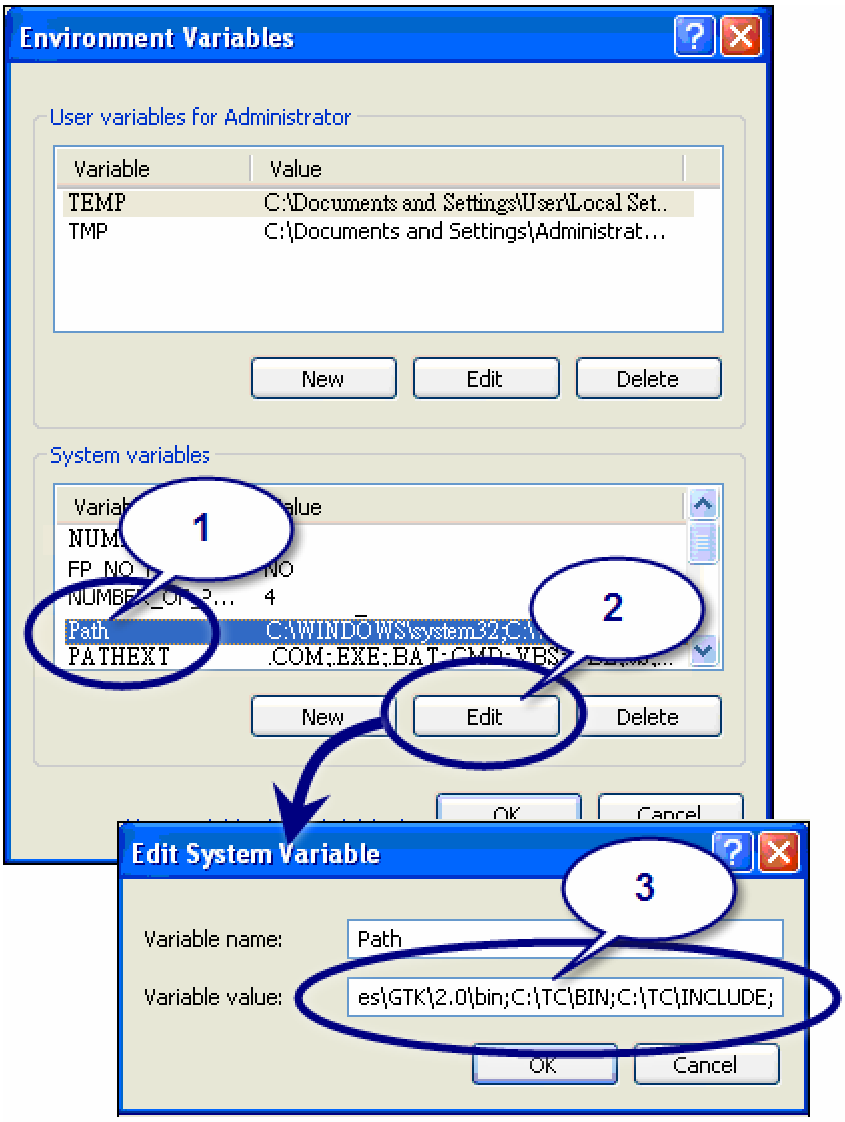
System variables

Variable	Value
ComSpec	C:\WINDOWS\system32\cmd.exe
FP_NO_HOST_C...	NO
NUMBER_OF_P...	4
OS	Windows_NT
Path	C:\WINDOWS\system32;C:\WINDOWS;...

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\"



Environment Variables

User variables for Administrator

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

System variables

Varia	alue
NUM	
FP_NO_	NO
NUMBER_OF_P...	4
Path	C:\WINDOWS\system32;C:\
PATHEXT	.COM;.EXE;.BAT;.CMD;.VBS;

Edit System Variable

Variable name: Path

Variable value: es\GTK\2.0\bin;C:\TC\BIN;C:\TC\INCLUDE;

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

3.2. API for i-8000 controller

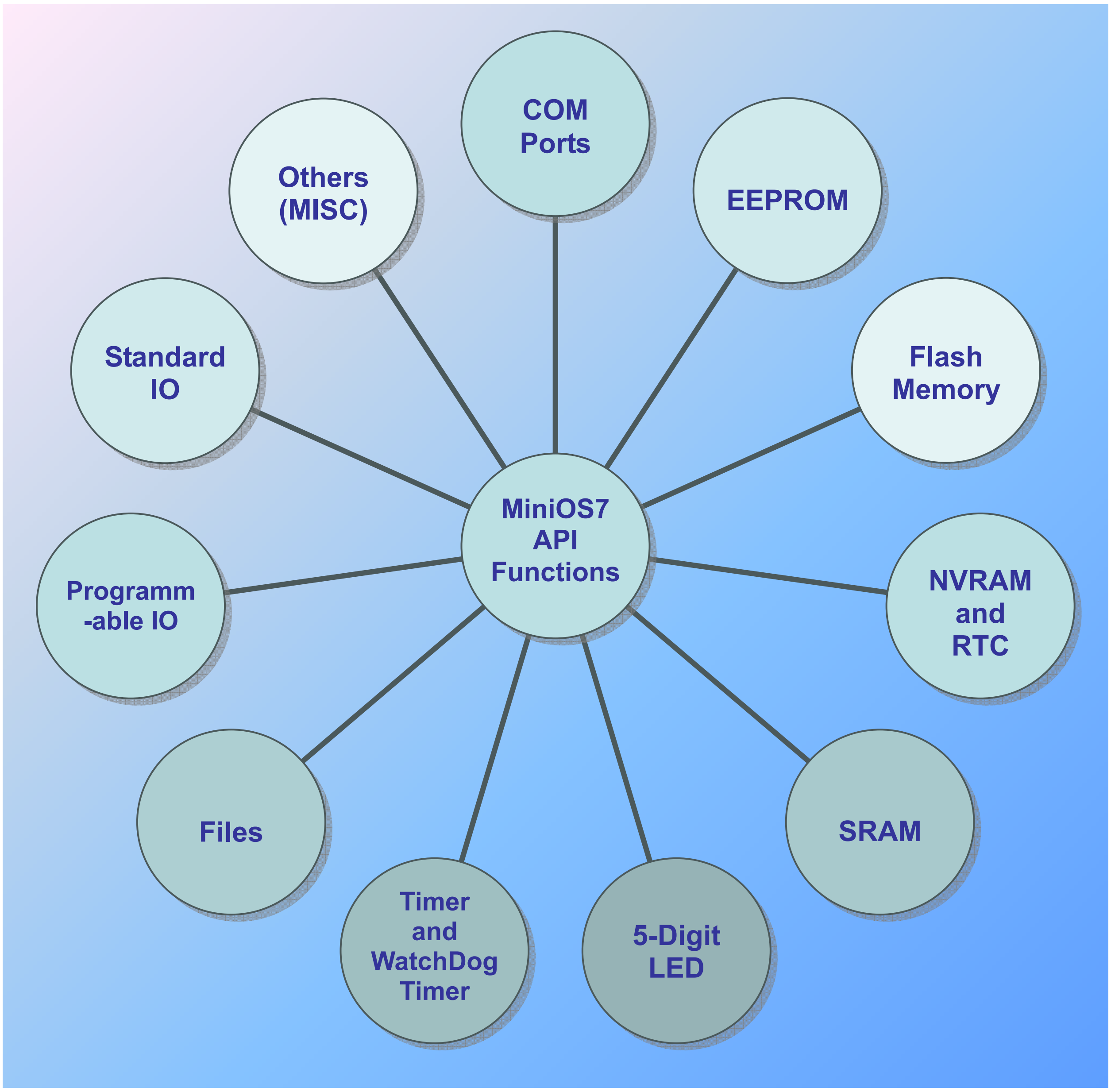
To develop a custom program, ensure that the files below are installed the Host PC. If they are not installed, refer to “section **2.2. Software Installation**”.

■ **Functions Library — 8000E.lib**

This file contains the MiniOS7 API (Application Programming Interface) and has hundreds of pre-defined functions related to your controller.

■ **Header File — 8000E.h**

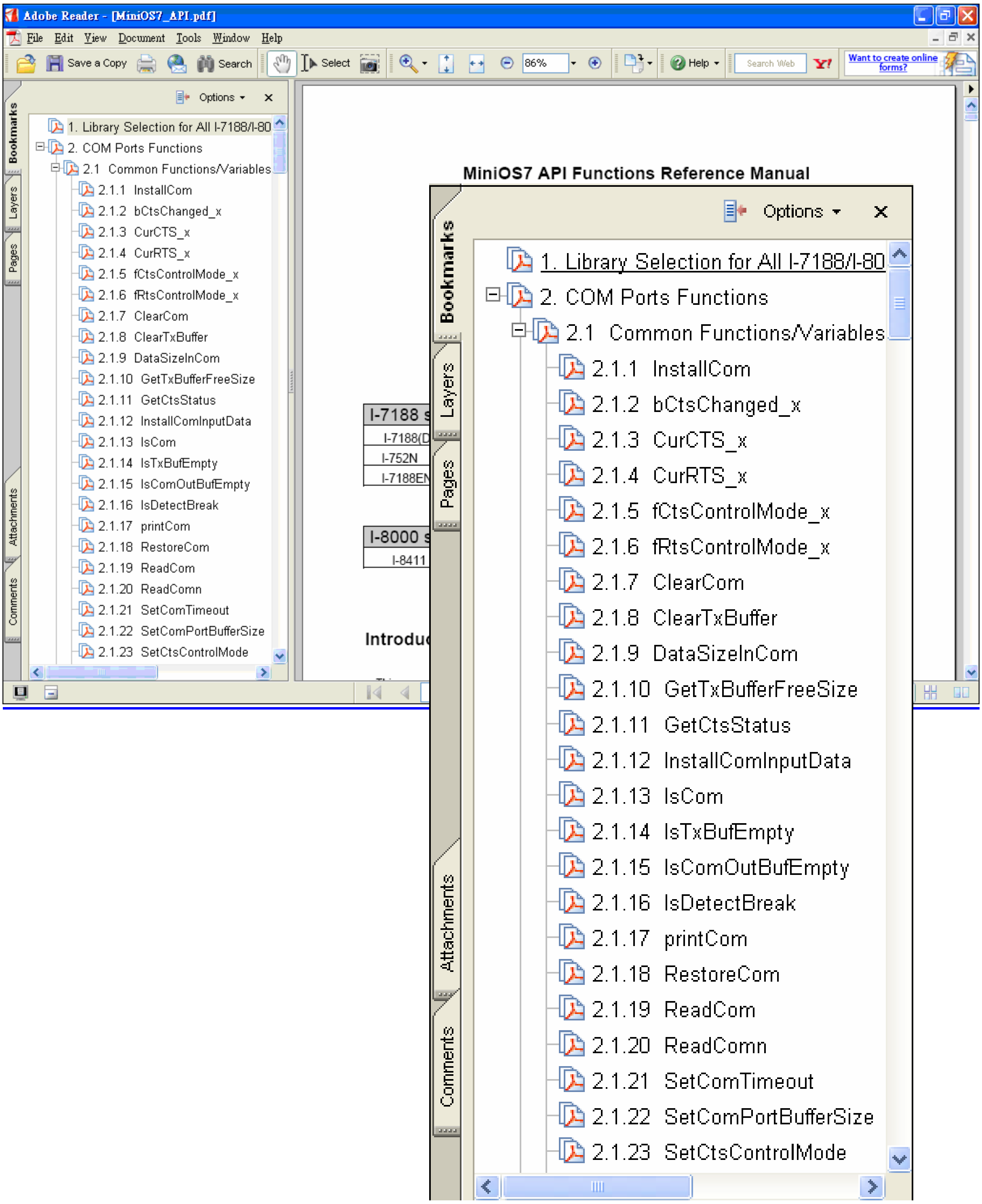
This file contains the forward declarations of subroutines, variables, and other identifiers used for the MiniOS7 API.



► 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\minios7_api_functions_ver1.0.pdf

http://ftp.icpdas.com/pub/cd/8000cd/napdos/minios7/document/minios7_api_functions_ver1.0.pdf


Adobe Reader - [MiniOS7_API.pdf]
File Edit View Document Tools Window Help
Save a Copy
Search
Select
86%
Help
Search Web
Want to create online forms?
Options
Bookmarks
Layers
Pages
Attachments
Comments
MiniOS7 API Functions Reference Manual
I-7188 s
I-7188(D
I-752N
I-7188EN
I-8000 s
I-8411
Introduc

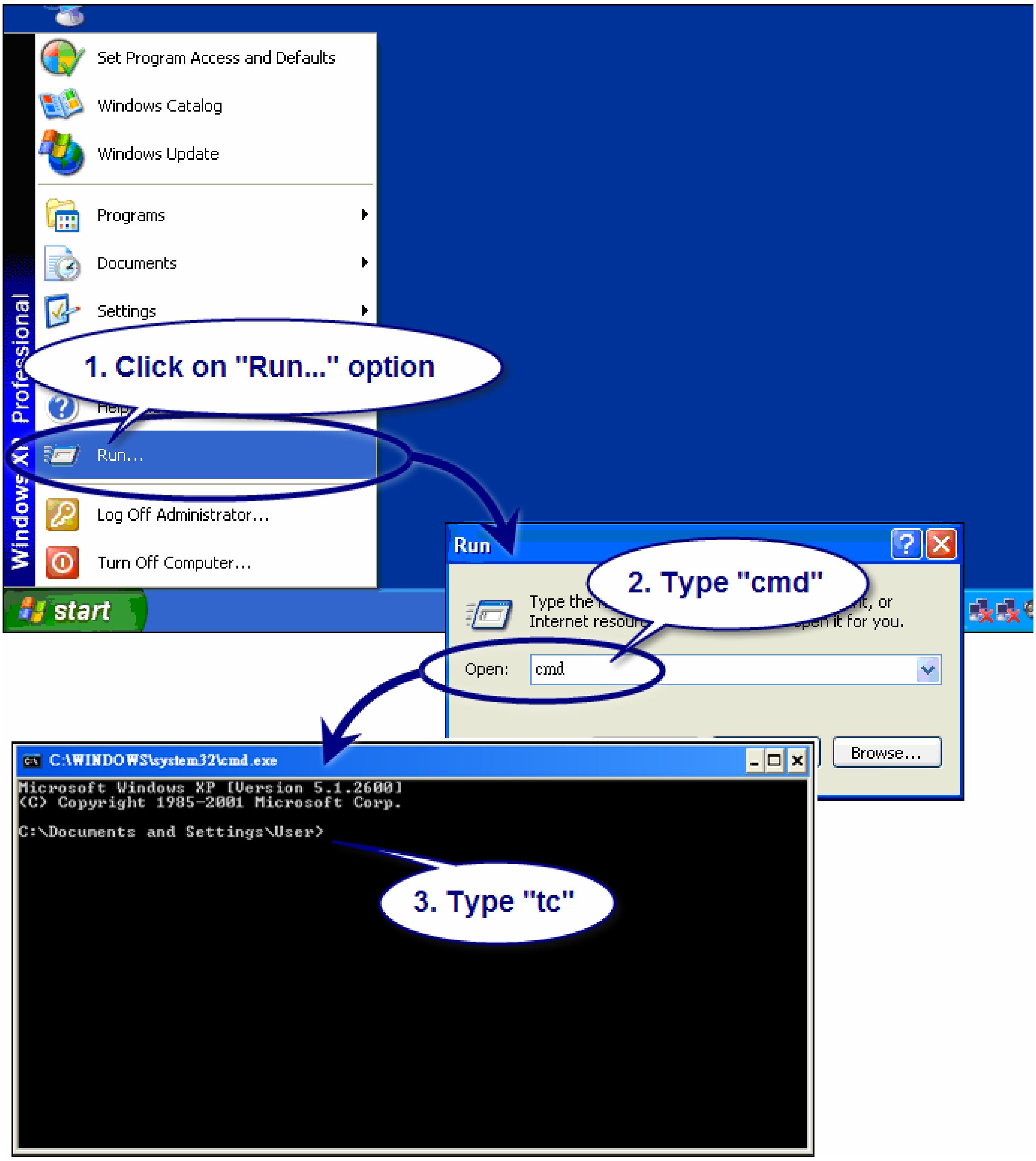
1. Library Selection for All I-7188/I-80
2. COM Ports Functions
2.1 Common Functions/Variables
2.1.1 InstallCom
2.1.2 bCtsChanged_x
2.1.3 CurCTS_x
2.1.4 CurRTS_x
2.1.5 fCtsControlMode_x
2.1.6 fRtsControlMode_x
2.1.7 ClearCom
2.1.8 ClearTxBuffer
2.1.9 DataSizeInCom
2.1.10 GetTxBufferFreeSize
2.1.11 GetCtsStatus
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. Creating your first program

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

Step 1: Open a MS-DOS command prompt

Step 2: At the command prompt, type “TC”, and then press “ENTER”



1. Click on "Run..." option

2. Type "cmd"

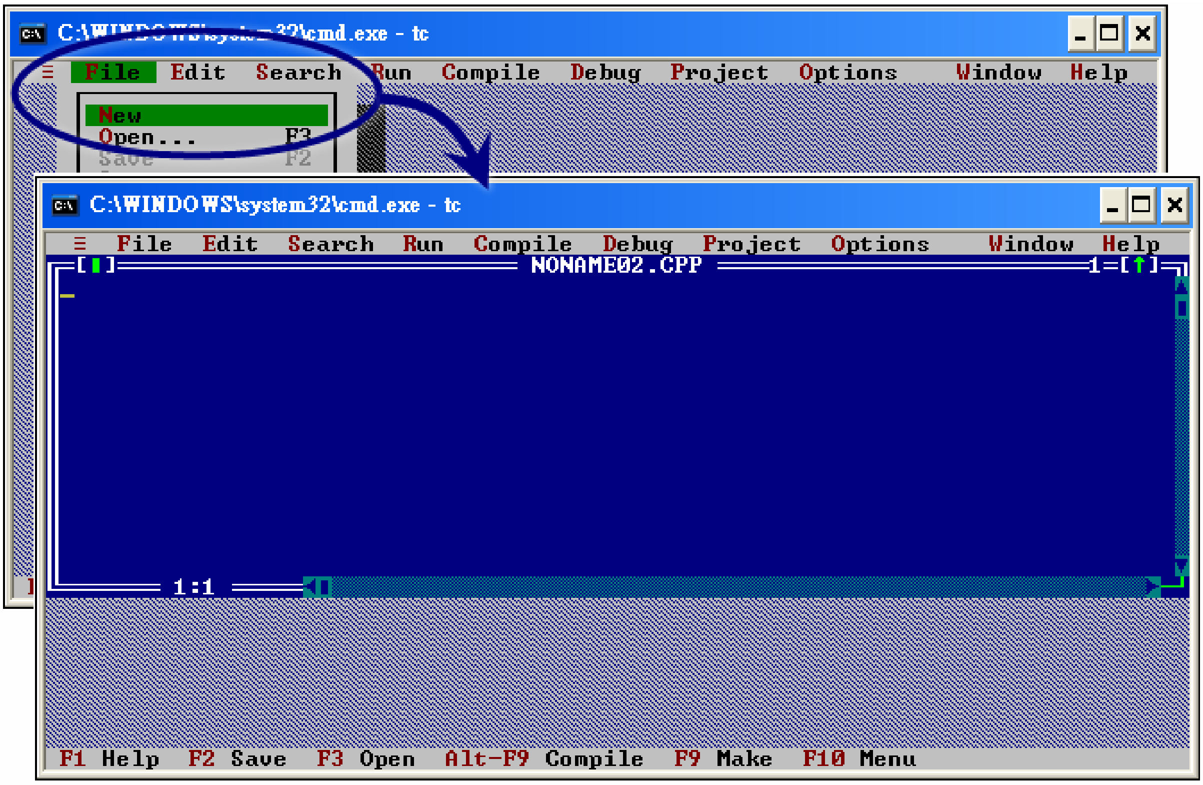
Open: cmd

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

C:\Documents and Settings\User>
```

3. Type "tc"

Step 3: Create a new source file

Select "File" from the menu, and then choose "New"


C:\WINDOWS\system32\cmd.exe - tc
≡ File Edit Search Run Compile Debug Project Options Window Help
New
Open... F3
Save F2
NONAME02.CPP
1:1
F1 Help F2 Save F3 Open Alt-F9 Compile F9 Make F10 Menu

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

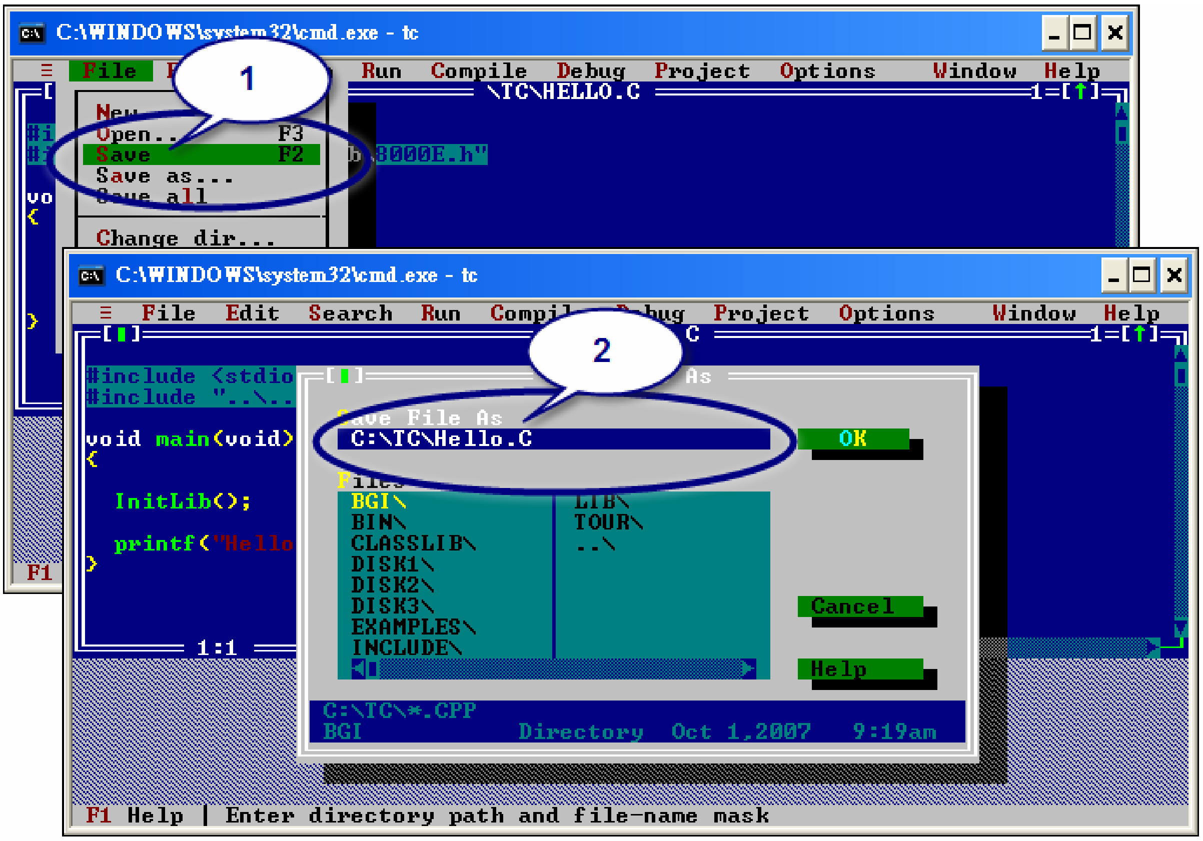
```
#include "8000E.h"
/* Include the header file that allows 8000e.lib functions to be used */
void main(void)
{
   InitLib();     /* Initiate the 8000e library */

   Print("Hello world!\r\n");     /* Print the message on the screen */
 }
```

Note: The source file for this example can be found at:

CD:\Napdos\8000\841x881x\demo\Hello\Hello_C\Hello.c

Step 5: Save the file

Select “File” from the menu, and then choose “Save” (or press F2). Enter the file name “Hello.C”, and then select the “OK” button.



```
\TC\HELLO.C
8000E.h"

#include <stdio
#include "..\..

void main(void)
{
   InitLib();
   printf("Hello
}
1:1
```

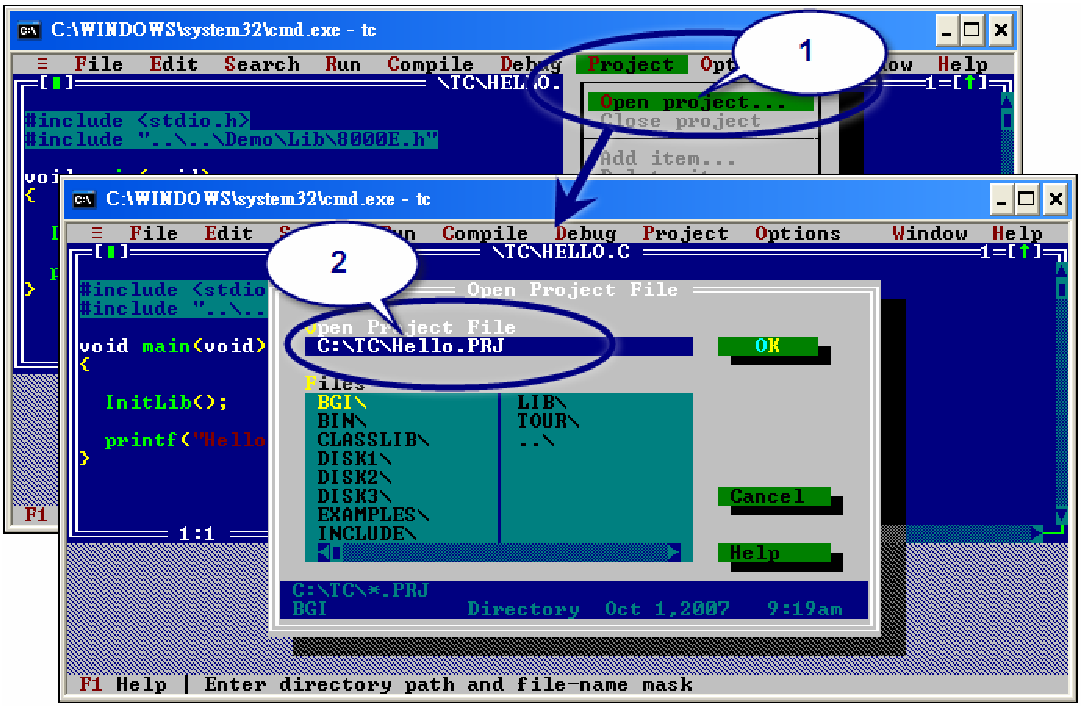
```
Save File As
C:\TC\Hello.C
Files
BGI\        LIB\
BIN\        TOUR\
CLASSLIB\   ..\
DISK1\
DISK2\
DISK3\
EXAMPLES\
INCLUDE\
C:\TC\*.CPP
BGI          Directory   Oct 1,2007    9:19am
```

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

Note: If there is a text editor you are familiar with or prefer to use such as Notepad or Edit, you may use it to write the code shown above. It should be noted that a word processor application cannot be used for this purpose, as the application must save the file as plain text. C language program files should always have a “.C” extension name.

Step 6: Create a new project (*prj)

Select “Project” from the menu, and then choose the “Open project…” option. Enter the project name Hello.prj“, and then select the “OK” button.



C:\WINDOWS\system32\cmd.exe - tc
≡ File Edit Search Run Compile Debug Project Options Window Help
Open project...
Close project
Add item...
1
2
Open Project File
OK
Cancel
Help

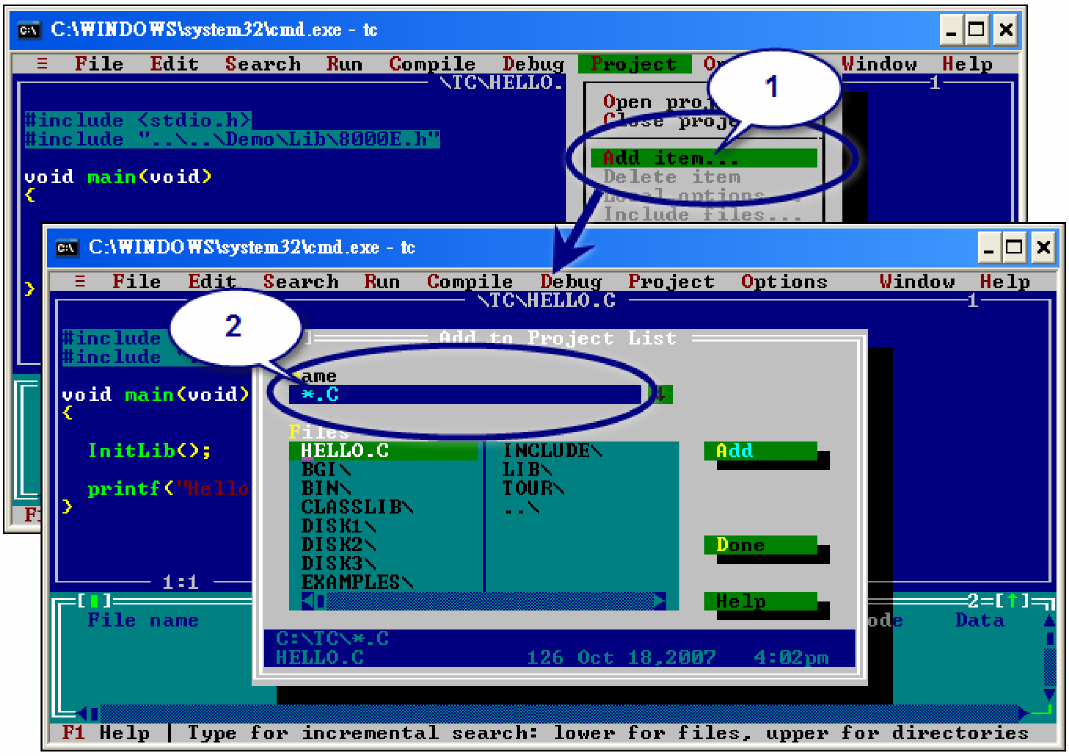
```
#include <stdio.h>
#include "..\..\Demo\Lib\8000E.h"

void main(void)
{
  InitLib();
  printf("Hello
}
```

Open Project File: C:\TC\Hello.PRJ

```
Files
BGI\        LIB\
BIN\        TOUR\
CLASSLIB\   ..\
DISK1\
DISK2\
DISK3\
EXAMPLES\
INCLUDE\

C:\TC\*.PRJ
BGI              Directory   Oct 1,2007    9:19am

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

Step 7: Add the necessary source files to the project

Select “Project” from the menu, and then choose the “Add item…” option. Select the source file(s) you wish to add to the project, and then select the “Add” button.



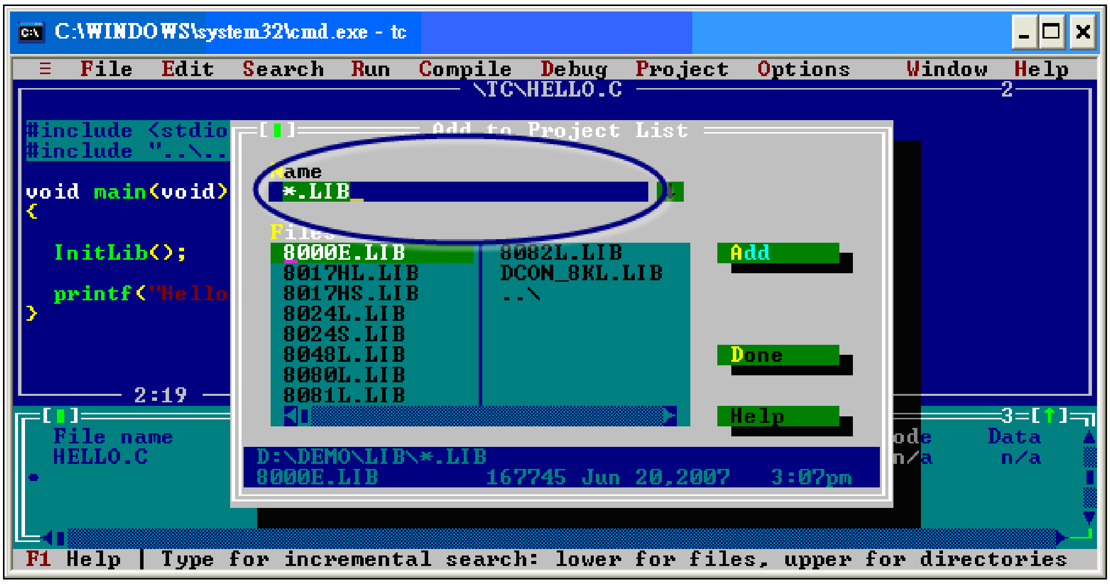
```
#include <stdio.h>
#include "..\..\Demo\Lib\8000E.h"

void main(void)
{
  InitLib();
  printf("Hello
}
```

Name: *.C

```
Files
HELLO.C     INCLUDE\
BGI\        LIB\
BIN\        TOUR\
CLASSLIB\   ..\
DISK1\
DISK2\
DISK3\
EXAMPLES\

C:\TC\*.C
HELLO.C               126  Oct 18,2007    4:02pm

File name                                   Code    Data

F1 Help | Type for incremental search: lower for files, upper for directories
```

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

Type “*.lib” to display a list of all available function library files. Choose the library file you require and then select the “Add” button.


C:\WINDOWS\system32\cmd.exe - tc
≡ File Edit Search Run Compile Debug Project Options Window Help
\TC\HELLO.C
Add to Project List
Add
Done
Help
2:19
File name
Code
Data

```
#include <stdio
#include "..\..

void main(void)
{

  InitLib();

  printf("Hello
}
```

Name: *.LIB

Files:

```
8000E.LIB    8082L.LIB
8017HL.LIB   DCON_8KL.LIB
8017HS.LIB   ..\
8024L.LIB
8024S.LIB
8048L.LIB
8080L.LIB
8081L.LIB
```

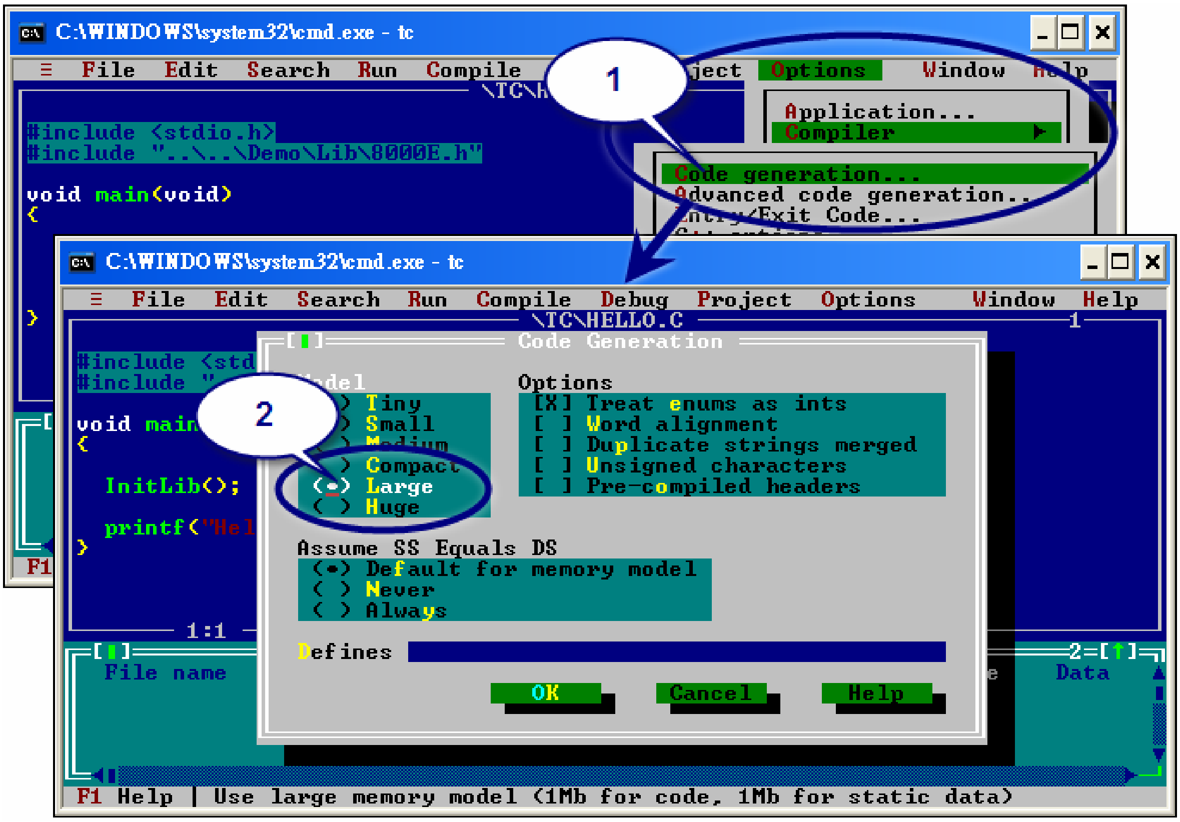
```
D:\DEMO\LIB\*.LIB
8000E.LIB          167745  Jun 20,2007    3:07pm
```

F1 Help | Type for incremental search: lower for files, upper for directories

Step 9: Select “Done” to exit

Step 10: Set the memory model to large

Select “Options” from the menu, and choose “Compiler”, and then choose “Code generation …”. Set the “Model” option to “Large”, and then select the “OK” button.


C:\WINDOWS\system32\cmd.exe - tc
≡ File Edit Search Run Compile Debug Project Options Window Help
1
Application...
Compiler ▶
Code generation...
Advanced code generation...
Entry/Exit Code...
\TC\HELLO.C
2
Code Generation
OK
Cancel
Help
1:1
File name
Data

```
#include <stdio.h>
#include "..\..\Demo\Lib\8000E.h"

void main(void)
{

  InitLib();

  printf("Hel
}
```

Model
( ) Tiny
( ) Small
( ) Medium
( ) Compact
(•) Large
( ) Huge

Options
[X] Treat enums as ints
[ ] Word alignment
[ ] Duplicate strings merged
[ ] Unsigned characters
[ ] Pre-compiled headers

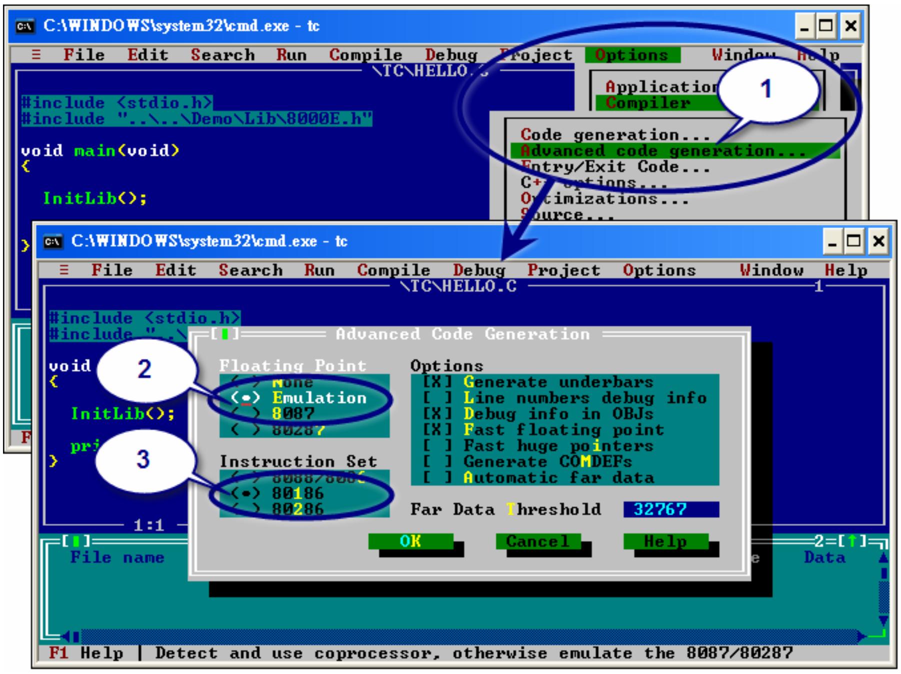
Assume SS Equals DS
(•) Default for memory model
( ) Never
( ) Always

Defines

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

Step 11: Set the “floating point” option to “emulation” and the “instruction” to “80186”

Select “Options” from the menu, and choose “Compiler”, and then choose “Advanced code generation…”. Set the “Floating Point” option to “Emulation” and the “Instruction” option to “80186”, and then select the “OK” button.



C:\WINDOWS\system32\cmd.exe - tc
≡ File Edit Search Run Compile Debug Project Options Window Help
Application...
Compiler
Code generation...
Advanced code generation...
Entry/Exit Code...
C++ options...
Optimizations...
Source...
1
2
3

```
#include <stdio.h>
#include "..\..\Demo\Lib\8000E.h"

void main(void)
{
  InitLib();
```

Advanced Code Generation

Floating Point
( ) None
(•) Emulation
( ) 8087
( ) 80287

Instruction Set
( ) 8088/8086
(•) 80186
( ) 80286

Options
[X] Generate underbars
[ ] Line numbers debug info
[X] Debug info in OBJs
[X] Fast floating point
[ ] Fast huge pointers
[ ] Generate COMDEFs
[ ] Automatic far data

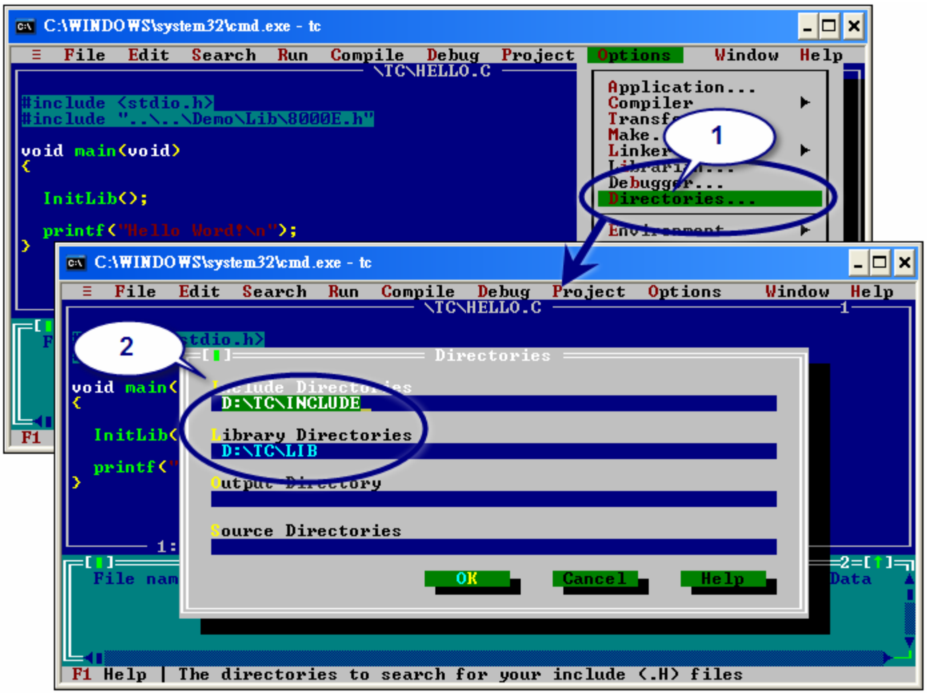
Far Data Threshold 32767

OK Cancel Help

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

Step 12: Set the TC++ 1.01 include and library directories

Select “Options” from the menu, and then choose “Directories…”. Set the “Include Directories” and “Library Directories” option, and then click the “OK” button.



C:\WINDOWS\system32\cmd.exe - tc
≡ File Edit Search Run Compile Debug Project Options Window Help
Application...
Compiler
Transfer...
Make...
Linker
Libraries...
Debugger...
Directories...
Environment
1
2

```
#include <stdio.h>
#include "..\..\Demo\Lib\8000E.h"

void main(void)
{
  InitLib();

  printf("Hello Word!\n");
}
```

Directories

Include Directories
D:\TC\INCLUDE

Library Directories
D:\TC\LIB

Output Directory

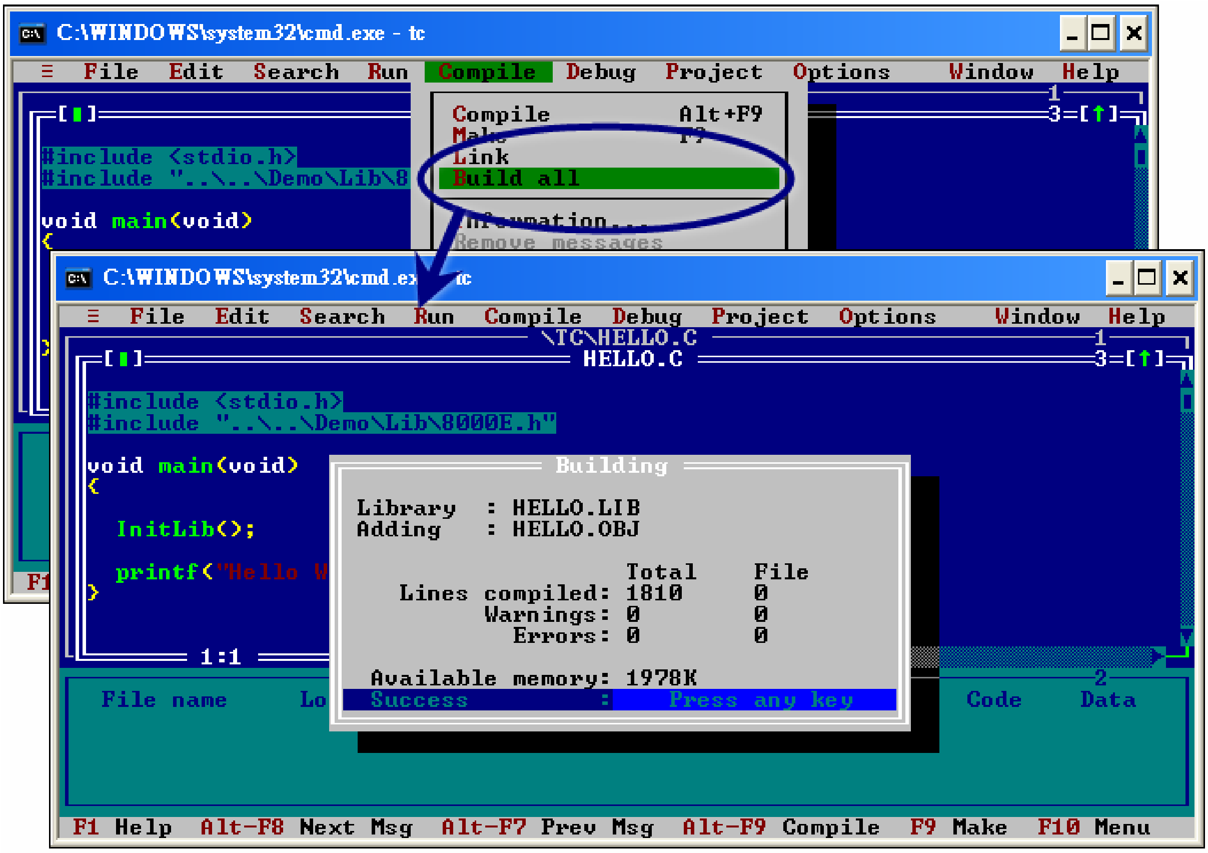
Source Directories

OK Cancel Help

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

Step 13: Build the project

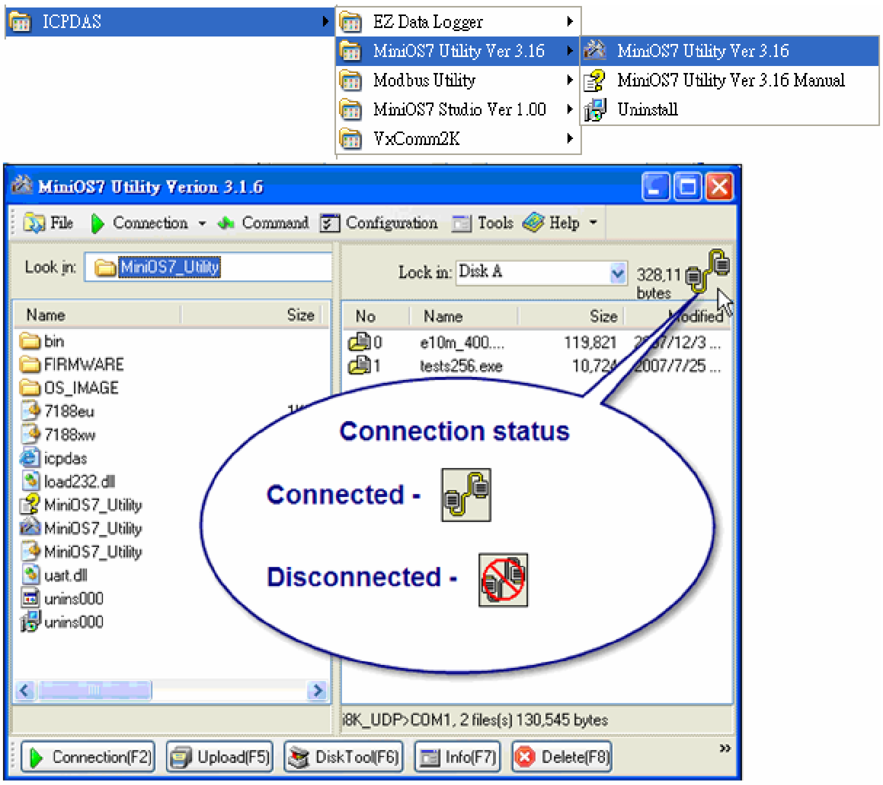
Select “Compile” from the menu, and then choose the “Build all” option.


C:\WINDOWS\system32\cmd.exe - tc
≡ File Edit Search Run Compile Debug Project Options Window Help
Compile Alt+F9
Make F9
Link
Build all
Information...
Remove messages
\TC\HELLO.C
HELLO.C
1:1
File name Lo
Code Data
F1 Help Alt-F8 Next Msg Alt-F7 Prev Msg Alt-F9 Compile F9 Make F10 Menu

```
#include <stdio.h>
#include "..\..\Demo\Lib\8000E.h"

void main(void)
{

   InitLib();

   printf("Hello W
}
```

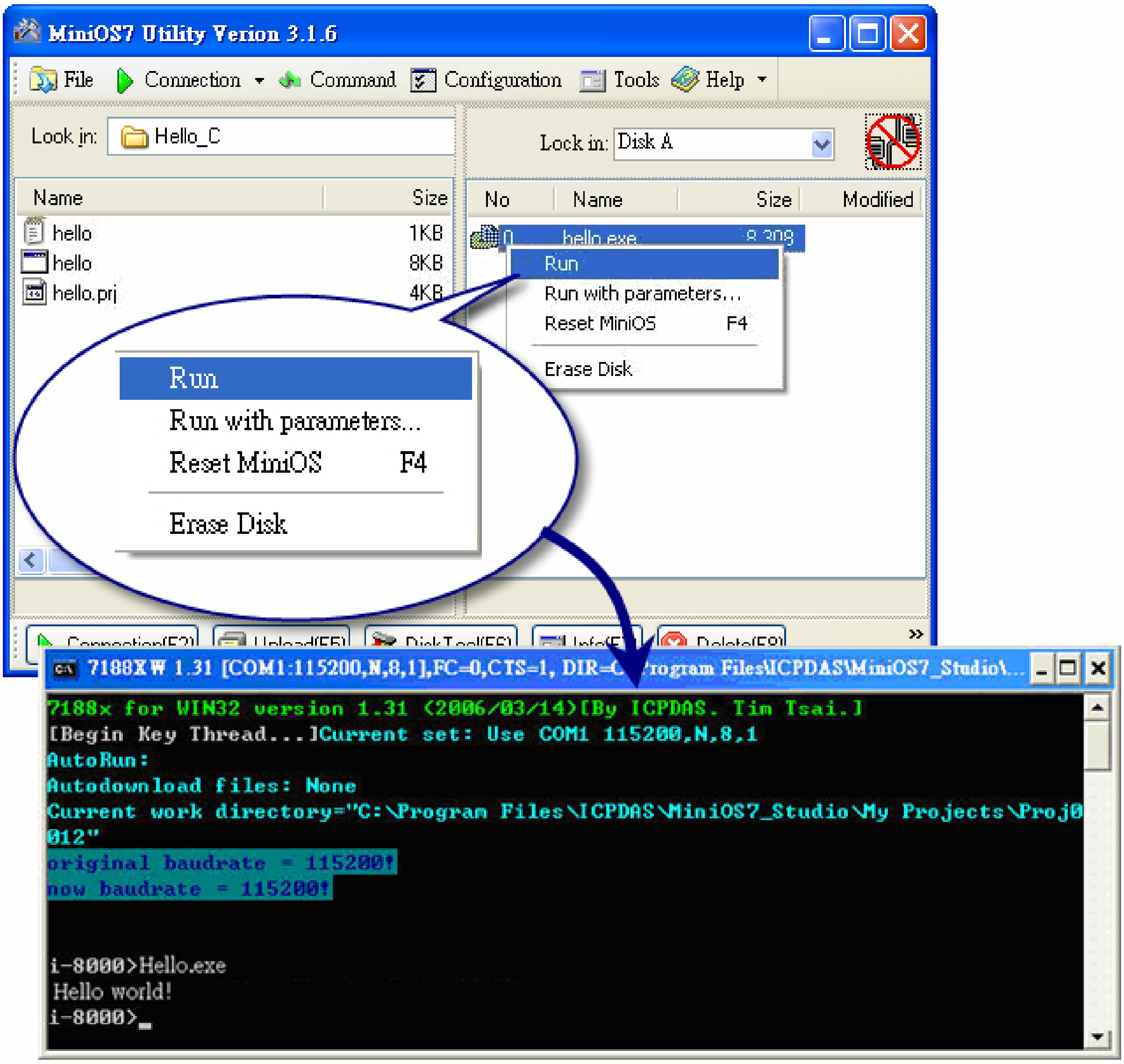
```
                  Building

 Library  : HELLO.LIB
 Adding   : HELLO.OBJ

                     Total     File
    Lines compiled:  1810      0
          Warnings:  0         0
            Errors:  0         0

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

Step 14: Use the MiniOS7 Utility to connect to your controller



Step 15: Download your first program to your controller and execute it

Note: For a more detailed introduction to downloading and executing programs on your controller, please refer to “Section **2.3. Downloading and executing programs to your controller**”.



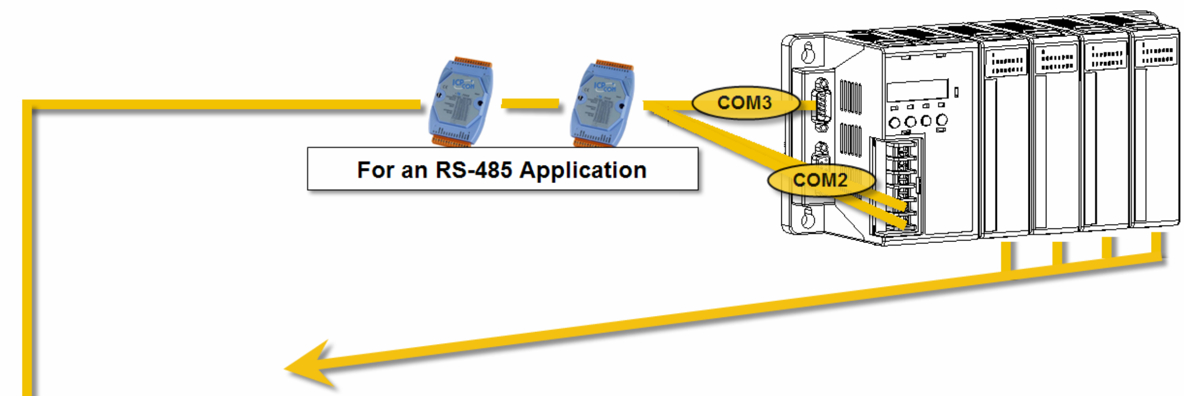
```
7188x for WIN32 version 1.31 (2006/03/14)[By ICPDAS. Tim Tsai.]
[Begin Key Thread...]Current set: Use COM1 115200,N,8,1
AutoRun:
Autodownload files: None
Current work directory="C:\Program Files\ICPDAS\MiniOS7_Studio\My Projects\Proj0
012"
original baudrate = 115200!
now baudrate = 115200!


i-8000>Hello.exe
 Hello world!
i-8000>_
```

CHAPTER 4

API and Demo Reference

There are several demo programs that have been designed for your controller. You can examine the demo source code, which includes numerous comments, to familiarize yourself with the MiniOS7 API, This will allow to quickly develop your own applications quickly by modifying these demo programs.

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.
Smmi	SystemKey	Shows how to operate the systemkey function simply and easily.
	Led	Shows how to control the red LED and 7-segment display.
Memory	S256	Shows how to read or write to the 256K byte battery backup.
DateTime	DateTime	Shows how to read and write the date and time from the RTC.
Timer	For details of the demo programs available, please refer to the followingmo/	
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.
… more demo programs location: ftp://ftp.icpdas.com.tw/pub/cd/8000cd/napdos/8000/common/minios7/de		



■ **i-8K and i-87K I/O series modules for I/O Slot Applications**

Folder	Demo	Explanation
IO_in_Slot	8K_DI	This demo program is used by 8K series DI modules, such as 8040, 8051., etc.
	8073	This demo program is used for 8073 General Functions.
	87K_DI	This demo program is used by 87K series DI modules in Com0, such as 87040, 87051, etc.
	87024	This demo program is used by the 87024 AO module.
… more demo programs		

■ **i-7K series modules for RS-485 Network Applications**

Folder	Demo	Explanation
7K 87K_for_Com	7K87K_DI_for_Com	"COM Port" can be used to connect and control i-7k or i-87k series modules. ■ For 8410/8810/8411/8811 module and can use, COM2, COM3. ■ For 8430/8830/8431/8831 module and (CPU 40 and 80M) can use, COM3, COM4.
	7K87K_DO_for_Com	
	7K87K_AI_for_Com	
	AO_22_26_for_Com	
	AO_024_for_Com	

► For more Information about these demo programs, please refer to:

CD:\Napdos\8000\841x881x\demo or

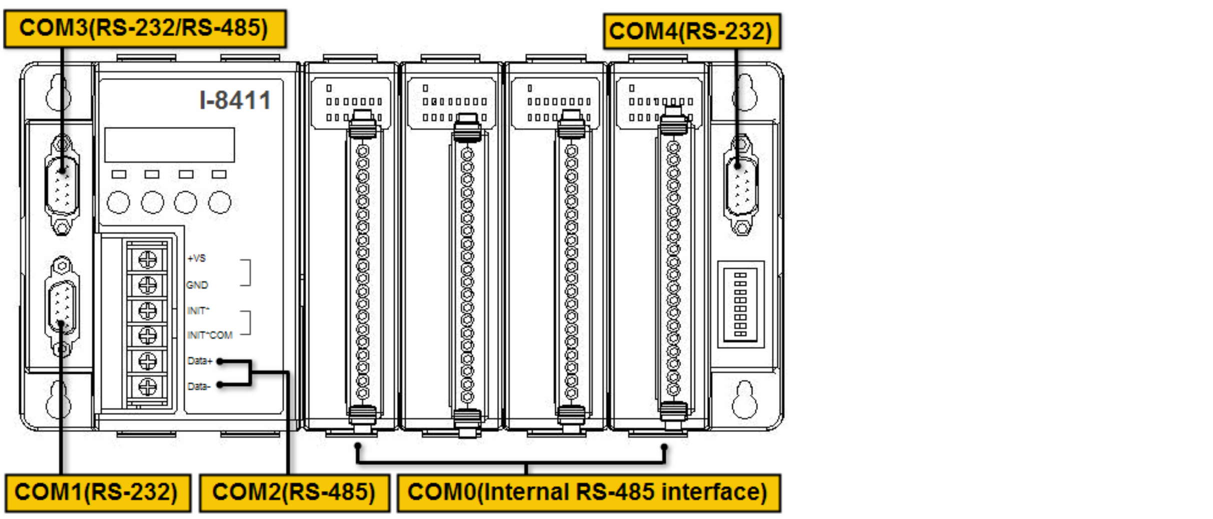
http://ftp.icpdas.com/pub/cd/8000cd/napdos/8000/841x881x/demo

⚠ Function **InitLib();** must be called at the beginning of the C program.
It is used to make the .exe file can run on all i-8000 controllers
no matter its CPU is 40MHz or 80MHz, with Ethernet or not.

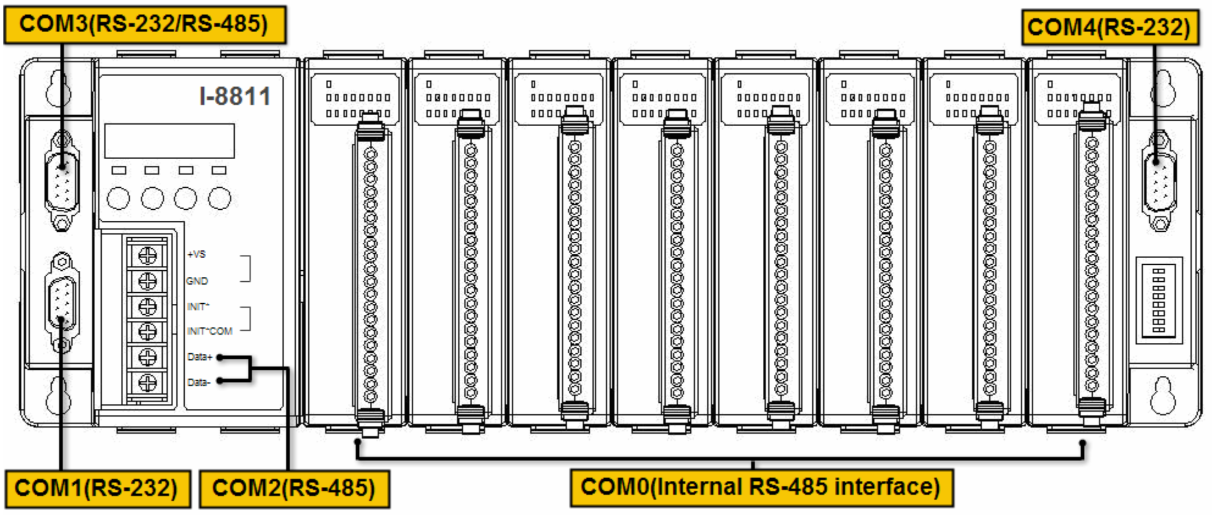
4.1. API for COM Port

■ The i-8411/i-8811 module includes five COM ports:

i-8411:



i-8811:



■ There are two kinds of functions below for using COM port.

□ MiniOS7 COM port functions

□ (C style) Standard COM port functions

You have the alternative of MiniOS7 COM ports functions or (C style) Standard COM port functions. If you choose the ones, then the another can not 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	0, 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()

Note: The standard COM port is the port that used to download program from PC to the i-8000 controller.

4.1.1. API for MiniOS7 COM ports

API for using COM ports

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

2. **AddCom2fun()**
   Before using COM2, the AddCom2fun() must be called to work for i-8411/i-8811 modules.

3. **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

4. **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

5. **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

6. **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 “8000E.h”

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

 InitLib();   /* Initiate the 8000e 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 */
}
```

API for showing data from COM ports

7. **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 “8000E.h”

void main(void)
{
  int i;

  /* Initiate the 8000e 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\8000\841x881x\demo\com_ports\
ftp://ftp.icpdas.com/pub/cd/8000cd/napdos/8000/841x881x/demo/com_ports/

4.1.2. API for standard COM port

□ The standard COM port is the port that used to download program from PC to the i-8000 controller.

Note: 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.

The following demo programs according to the same subject as demo programs of previous section, you can comparing different methods for using COM port.

For example, reading and receiving data through COM1:

```
#include<stdio.h>
#include“8000E.h”

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

  InitLib();      /* Initiate the 8000e 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 “8000E.h”

void main(void)
{
  int i;

  /* Initiate the 8000e library */
  InitLib();

  for(i=0;i<10;i++)
  {
     Print(“Test %d\n\r”,i);
  }
}
```

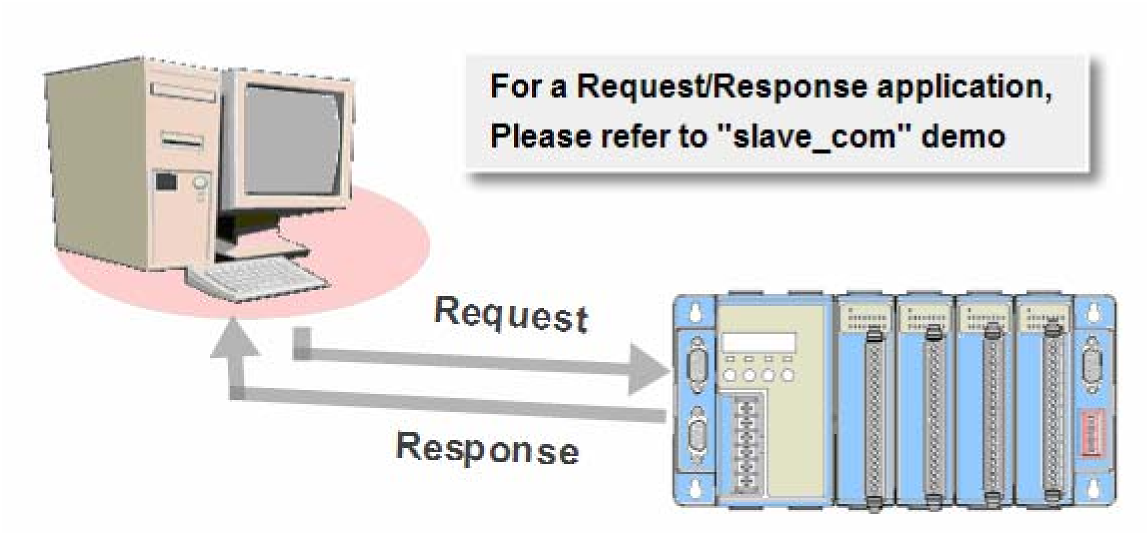
4.1.3. Comparison of MiniOS7 COM port function and standard COM port function

For example, learning to show the ASCII code:

MiniOS7 COM port functions	Standard COM port functions
#include<stdio.h>	#include<stdio.h>
#include"8000E.h"	#include"8000E.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);	}
}	

4.1.4. Request/Response protocol design 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
Request
Response

Request	Response
GetCounter	>1234
SetDO1	>OK
ResetDO2	>OK
GetVersion	>V1.0.0

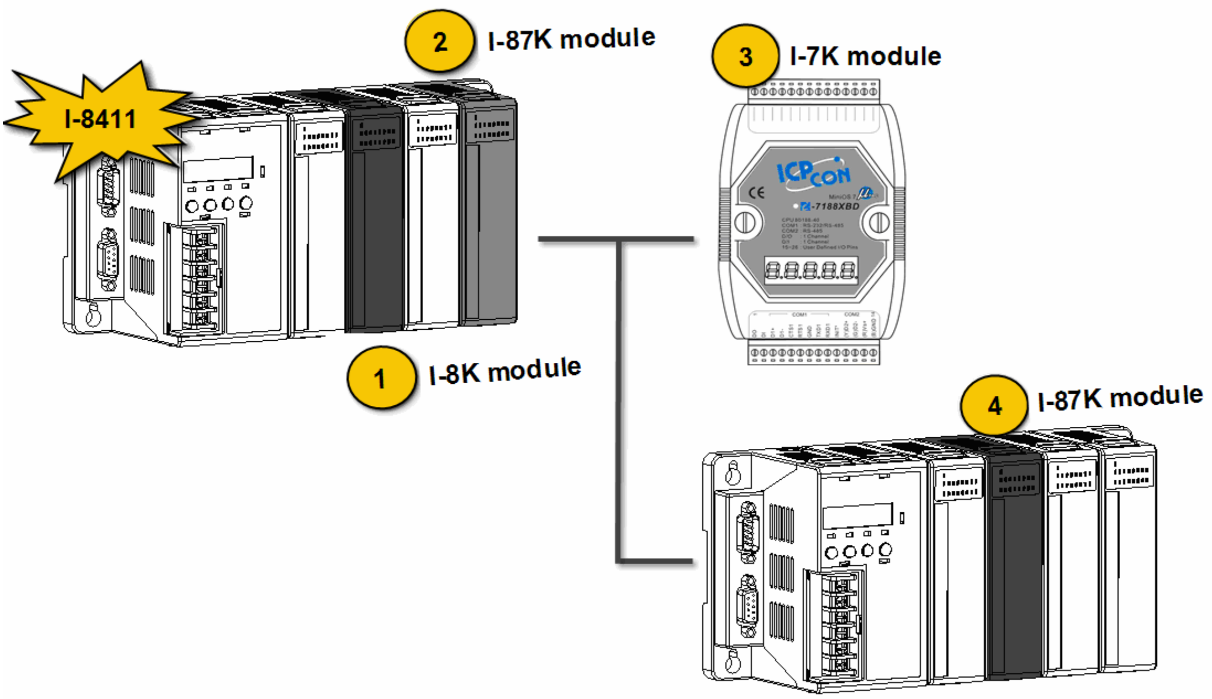
► For more demo program about the COM port, please refer to
CD:\Napdos\8000\841x881x\demo\com_ports\
ftp://ftp.icpdas.com/pub/cd/8000cd/napdos/8000/841x881x/demo/com_ports/

4.2. API for I/O Modules

■ The i-8411/i-8811 is equipped with 4/8 I/O slots to access the i-8K and i-87K series I/O modules, as shown the point 1 and point 2 in the figure below.

■ The i-8411/i-8811 is equipped with multi-serial ports to access the i-7K series I/O modules for a wide range of RS-485 network application, as shown the point 3 in the figure below.

■ The i-8411/i-8811 can connect to the original i-8000 series I/O expansion units, 87K4/87K5/87K8/87K9, to access the i-87K I/O series modules through an RS-485 to extend the number of available I/O modules, as shown the point 4 in the figure below.



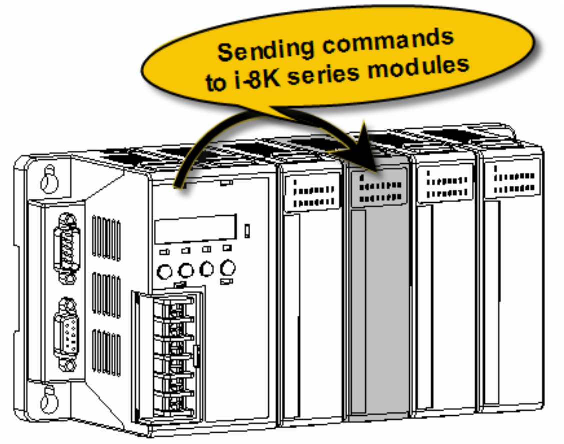
The demo programs used for i-7K, i-8K and i-87K can be divided into the following：

► For **i-8K** and **i-87K** I/O modules in slots, please refer to:
CD:\Napdos\8000\841x881x\demo\IO_in_Slot\
ftp://ftp.icpdas.com/pub/cd/8000cd/napdos/8000/841x881x/demo/IO_in_Slot/

► For **i-7K** and **i-87K** I/O modules is connected to COM ports, please refer to:
CD:\Napdos\8000\841x881x\demo\7K87K_for_COM\
ftp://ftp.icpdas.com/pub/cd/8000cd/napdos/8000/841x881x/demo/7K87K_for_com/

4.2.1. Steps to use i-8K I/O modules in slots

API for reading DI module



DI_8(), DI_16(), DI_32()

The DI_8(), DI_16() or DI_32() must be called to read the input value of DI modules.

For example, reading the input value of slot 3 DI modules:

```
#include <stdio.h>
#include “8000E.h”

 void main(void)
 {

     Int DI_data, iSlot=3;
     InitLib();     /* Initiate the 8000e library */

     for(;;)
     {
          /* Read the input value of Slot 3 DI module    */
           DI_data=DI_8(iSlot);
           Print("DI Status== %x \n\r",DI_data);
     }
 }
```

4.2.2. Steps to use i-87K I/O modules in slots

You must have to perform the following steps：

Step 1. Using **Installcom()** to Install the COM port driver.

Step 2. Using **ChangeToSlot()** to change to the slot which the i-87K module plugged in.

Step 3. Using **SendCmdTo7000(0,…)** to send command to the i-87K module.

Step 4. Using **ReceiveResponseFrom7000_ms()** to get the response from the i-87K module.

Step 5. Using **RestoreCom()** to restore the COM port driver.

⚠ 1. The following configurations of the COM0 are fixed.

Baudrate=115200 bps

Data bit=8 bits

Parity check=none

Stop bit=1

2. The following configurations of the i-87K module that plugged in the slots are fixed.

Address=0

Check Sum=Disable

Besides, the **ChangeToSlot()** function must be called.

For example, sending a command ‘$00M’ to slot 7’s i-87K for getting the module name:

```
#include <stdio.h>
#include “8000E.h”

 void main(void)
 {
    unsigned char InBuf0[60];

    InitLib();     /* Initiate the 8000e library */
    InstallCom(0, 115200, 8, 0, 1);     /* Install the COM0 driver */
    InstallCom(1, 115200, 8, 0, 1);     /* Install the COM1 driver */

    ChangeToSlot(7);

    SendCmdTo7000(0,"$00M",0);     /* Send a command to COM0 */

    /* Timeout = 50ms, checksum disabled */
    ReceiveResponseFrom7000_ms(0,InBuf0,50,0);

    printCom(1,"Module Name=%s",InBuf0);
    Delay(10);     /* Wait for all data are transmitted to COM port */
    RestoreCom(0);     /* Uninstall the COM0 driver */
    RestoreCom(1);     /* Uninstall the COM1 driver */
 }
```

4.2.3. Steps to use i-7K and i-87K I/O modules that connected to COM port

You must have to perform the following steps：

Step 1. Calling **Installcom** to install the COM port driver.

Step 2. Calling **AddCom2fun()** when using COM2.

Step 3. Calling **SendCmdTo7000()** to send command to i-7K or i-87K module.

Step 4. Calling **ReceiveResponseFrom7000_ms()** to get the response from i-7K or i-87K module.

Step 5. Calling **RestoreCom()** to restore the COM port driver.

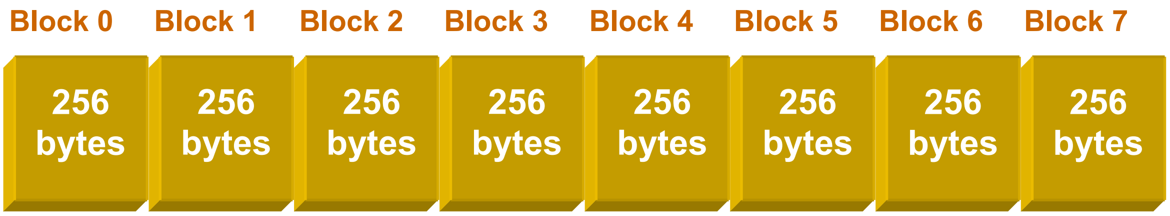
⚠ The **AddCom2fun()** must be called after calling InstallCom(2,…) when using COM2.

For example, sending a command ‘$00M’ to i-7K or i-87K series I/O module for getting the module name:

```
#include <stdio.h>
#include “8000E.h”

 void main(void)
 {
     unsigned char InBuf0[60];

     InitLib();     /* Initiate the 8000e library */
    InstallCom(1, 115200L, 8, 0, 0);     /* Install the COM1 driver */
     InstallCom(2, 115200L, 8, 0, 0);     /* Install the COM2 driver */
     AddCom2Fun();
     SendCmdTo7000(2,"$00M",0);     /* Send a command to COM2 */

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

      PrintCom(1, "Module Name=%s",InBuf);
     RestoreCom(1);     /* Uninstall the COM1 driver */
     RestoreCom(2);     /* Uninstall the COM2 driver */
 }
```

4.3. API for EEPROM

- The EEPROM contains 8 blocks, and each block has 256 bytes, with a total size of 2,048 (2K) bytes capacity.
- The default mode for EEPROM is write-protected mode.



Total Size is 2,048 (2K) bytes

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 “8000E.h”

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

    InitLib();    /* Initiate the 8000e library */
    EE_WriteEnable();
    EE_MultiWrite(1,10,1,&data);
    EE_WriteProtect();

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

  }
```

Note: To write an integer to the EEPROM, the EE_WriteEnable() function must be called twice, in the same manner as writing data to the NVRAM.

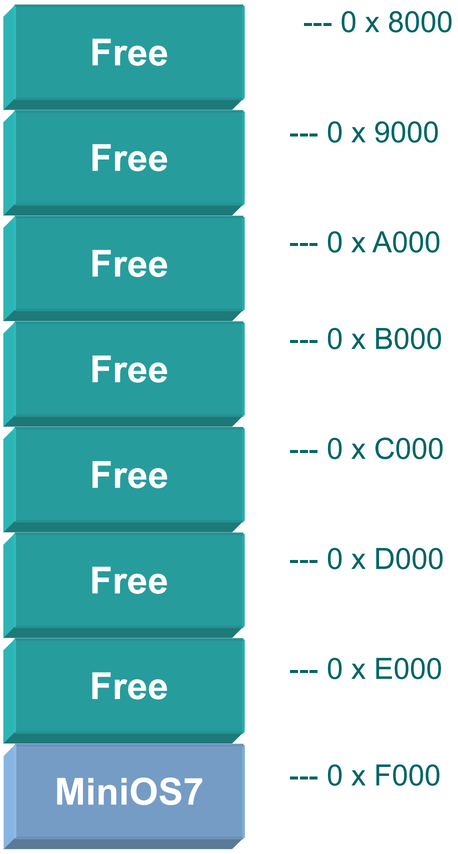
► For more demo programs related to the EEPROM, please refer to:
CD:\Napdos\8000\841x881x\demo\Memory\ or
ftp://ftp.icpdas.com/pub/cd/8000cd/napdos/8000/841x881x/demo/Memory/

4.4. API for Flash Memory

Free – 448 K bytes

MiniOS7 – 64 K bytes

Total Size – 512 K bytes



■ The i-8411/i-8811 module contains 512K bytes 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 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 their is completed, new data can be written.

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 “8000E.h”

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

    InitLib();     /* Initiate the 8000e 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 programs related to the Flash Memory, please refer to: CD:\Napdos\8000\841x881x\demo\Memory\ or ftp://ftp.icpdas.com/pub/cd/8000cd/napdos/8000/841x881x/demo/Memory/

4.5. API for NVRAM and RTC

■ The i-8411/i-811 module is equipped with an RTC (Real Time Clock), and 31 bytes of NVRAM memory can be used to store data.

■ NVRAM is the same as SRAM, but it uses a battery to retain the data, so the data store in the NVRAM is not lost when the module is powered off and can be used for 10 years.

■ NVRAM has no limit on the number of times the data can be written.
(Both Flash and EEPROM both have a limit on the numbers of data can be re-written.)

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 “8000E.h”

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

    InitLib();     /* Initiate the 8000e library */
    WriteNVRAM(0,data);
    data2=ReadNVRAM(0);     /* Now data2=data=0x55 */

  }
```

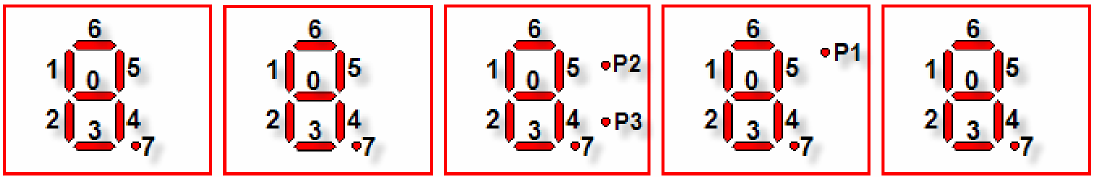
For example, the following can be used to write an integer (two bytes) to NVRAM:

```
#include “8000E.h”

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

    InitLib();     /* Initiate the 8000e 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 programs related to the NVRAM or the RTC, please refer to:
CD:\Napdos\8000\841x881x\demo\Memory\ or
ftp://ftp.icpdas.com/pub/cd/8000cd/napdos/8000/841x881x/demo/Memory/

4.6. API for 5-Digit LED

■ The i-8411/i-8811 module 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 controlling 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 “8000E.h”

 void main(void)
 {
    InitLib();      /* Initiate the 8000e 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 programs related to use the 5-Digit 7-SEG LED, please refer to: CD:\Napdos\8000\841x881x\demo\Smmi\ or ftp://ftp.icpdas.com/pub/cd/8000cd/napdos/8000/841x881x/demo/Smmi/

4.7. API for Timer

■ The i-8411/i-8811 can support a single main time tick, 8 Stop Watch timers and 8 Count Down timers.

■ The i-8411/i-8811 uses a single 16-bit timer to perform these timer functions, with a timer accuracy of 1 ms.

API that can be used to control 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 “8000E.h”

 void main(void)
 {
    Unsigned long time iTime;

    InitLib();     /* Initiate the 8000e 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 programs related to the Timer, please refer to:
CD:\Napdos\8000\841x881x\demo\Timer\ or
ftp://ftp.icpdas.com/pub/cd/8000cd/napdos/8000/841x881x/demo/Timer

4.8. API for WatchDog Timer (WDT)

■ The default WatchDog timer (WDT) value for the i-8411/i-8811 module is fixed at 0.8 seconds for MiniOS7 version 2.0.

■ When the i-8411/i-8811 module is first powered on, the WatchDog Timer will always be enabled.

■ The MiniOS7 for the i-8411/i-8811 module will automatically refresh the WatchDog Timer after being powered on. The software driver can be called by a user program to prevent the MinOS7 from refreshing the WatchDog Timer.

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:

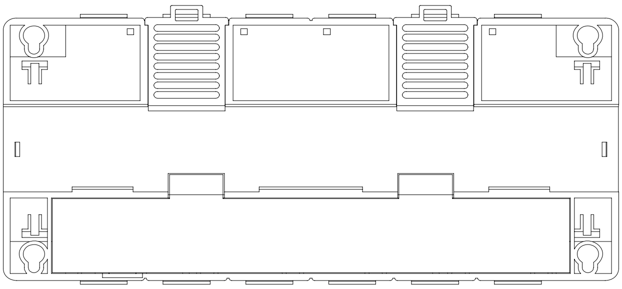
```
#include “8000E.h”

 void main(void)
 {
    Unsigned long time iTime;

    InitLib();     /* Initiate the 8000e library */
    Enable WDT();
    While(!quit)
    {
        RefreshWDT();
        User_function();
     }
    DisableWDT();
  }
```

► For more demo program about the WatchDog Timer, please refer to
CD:\Napdos\8000\841x881x\demo\Misc\
ftp://ftp.icpdas.com/pub/cd/8000cd/napdos/8000/841x881x/demo/Misc/

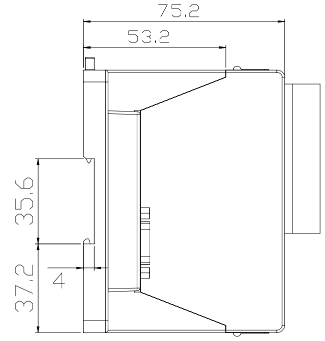
APPENDIX A

Dimension

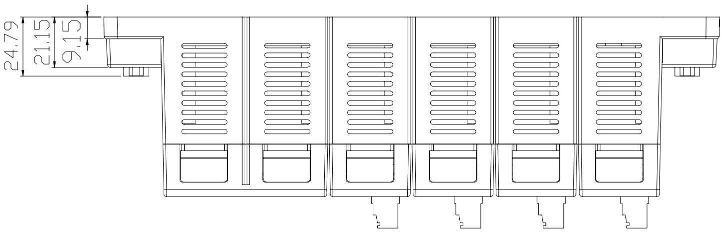
A.1. i-8411



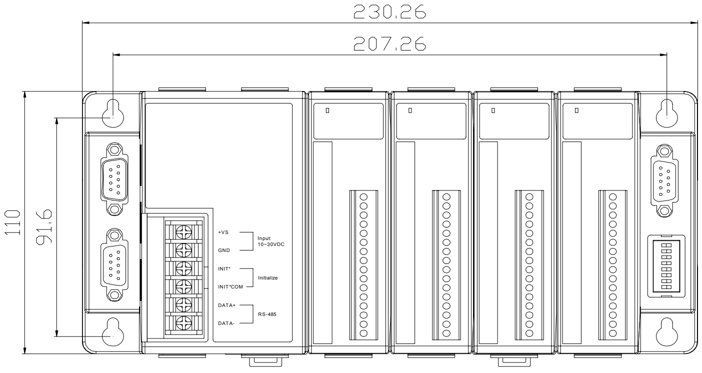
Back View



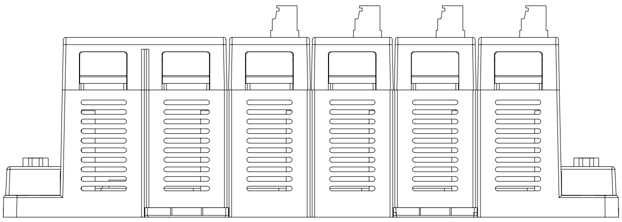
Side View



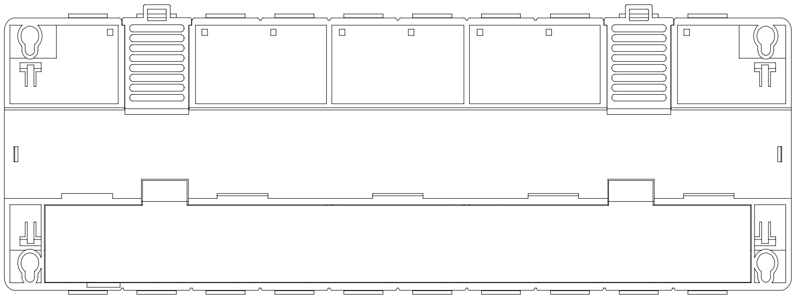
Top View

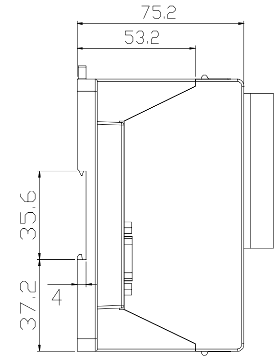


Front View



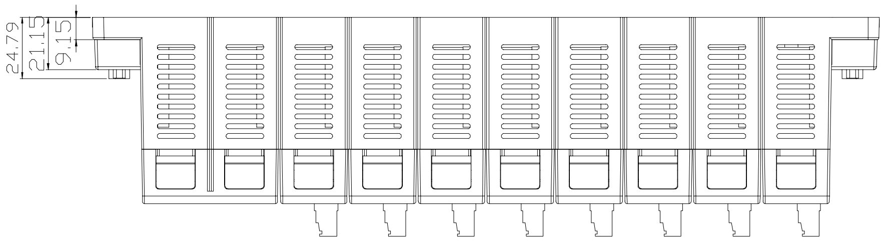
A.2. i-8811



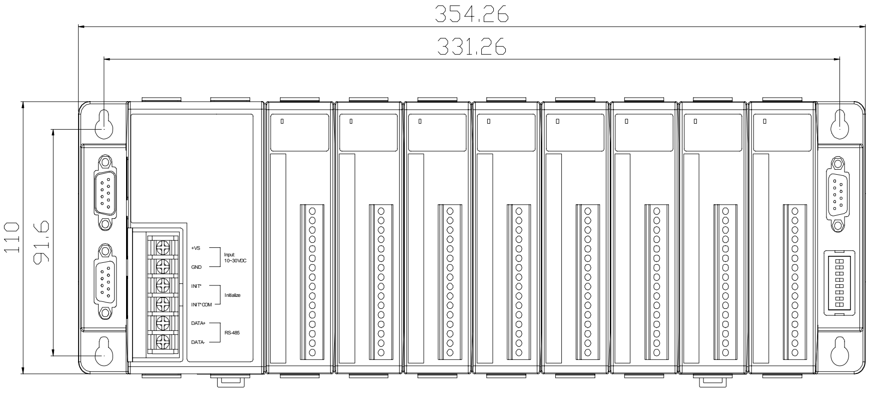


Back View

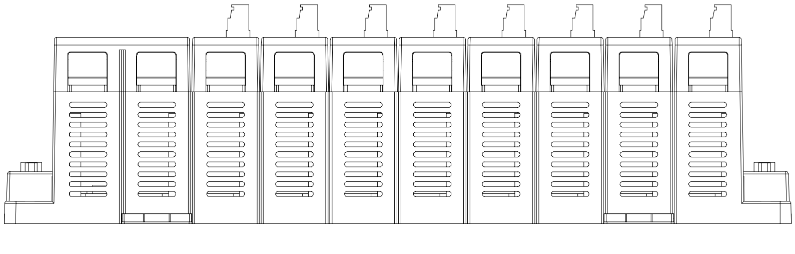
Side View



Top View



Front View



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.

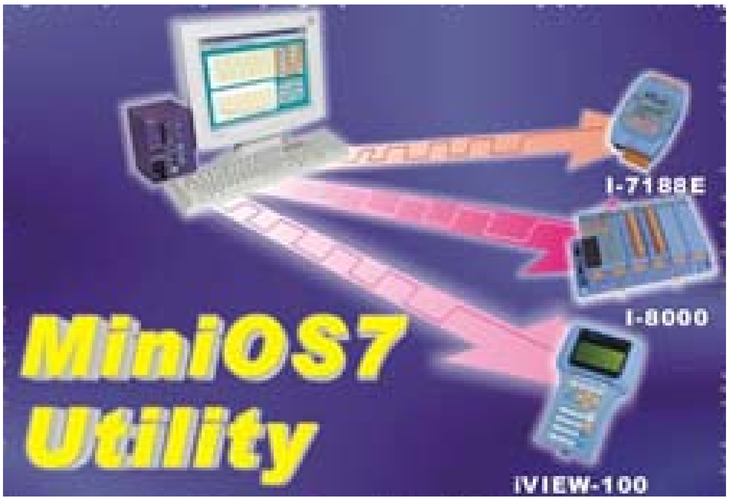
Note: DOS (whether PC-DOS, MS-DOS or ROMDOS) is a set of commands or code that tells the computer how to process information. DOS runs programs, manages files, controls information processing, directs input and output, and performs many other related functions.

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
O.S. 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 ICPDAS MiniOS7 with easiness and quickness.

Note：Since version 3.1.1, the Utility can allow users remotely access the controllers (7188E,8000E,…ect) 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

Including Frequently Used Tools

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

PC System Requirements

1. IBM compatible PC
2. Windows 95 /98/NT/2000/XP

Supported Products

1. 7188XA
2. 7188XB
3. 7188XC
4. 7188EX series
5. All i-8000 series
6. iView100
7. uPAC-7186XB
8. uPAC-7186EX
9. ET-6000 series
10. ET-7000 series

Download location：

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

APPENDIX

D

i-8K and i-87K Series I/O Modules

There are two types of buses on i-8411/i-8811 backplane. The first is a serial bus (RS-485 interface) for i-87K I/O modules and the second is a parallel bus for i-8K I/O modules. The MiniOS7,can support both i-8K and i-87K series I/O modules can both be connected into the same i-8411/i-8811.

The modules for DI, DO, DIO, AI, AO and Counter/Frequency purpose are supported. Other modules, such as multi-serial port (8112, 8144, 8142, 8144), MMC (8073), motion (8090, 8091), are not supported.

The differences between i-8K and i-87K series I/O modules：

Item	i-8K Series	i-87K Series
Microprocessor	No	Yes (8051)
Communication interface	Parallel bus (Note1)	Serial bus (Note2)
Communication speed	Fast	Slow
DI latched function	No	Yes
Counter input (for digital input module)	No	Yes (100 Hz)
Power on value	No	Yes
Safe value	No	Yes
Host watchdog	No	Yes
Module watchdog	No	Yes
Programmable slew-rate for AO module	No	Yes

Note：

1. Through the parallel bus, the CPU can communicate with I/O modules very fast, for digital I/O modules, the communication time takes 0.005 ~ 0.010 ms, for analog I/O modules, it depends on the modules.

2. Through the serial bus (RS-485), the communication speed is 115200 bps maximum. The communication time depends on the command and response length (bytes). Normally, for digital I/O modules, one module takes less then 1 ms. for analog I/O modules, one sample takes less than 2 ms.

3. The hardware design of the i-8K series I/O modules doesn't have the power on value and safe value in default of a microprocessor, users can develop their own program to let i-8K series I/O modules have these functions.

APPENDIX E

More 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

E.1. Turbo C 2.01 Compiler

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

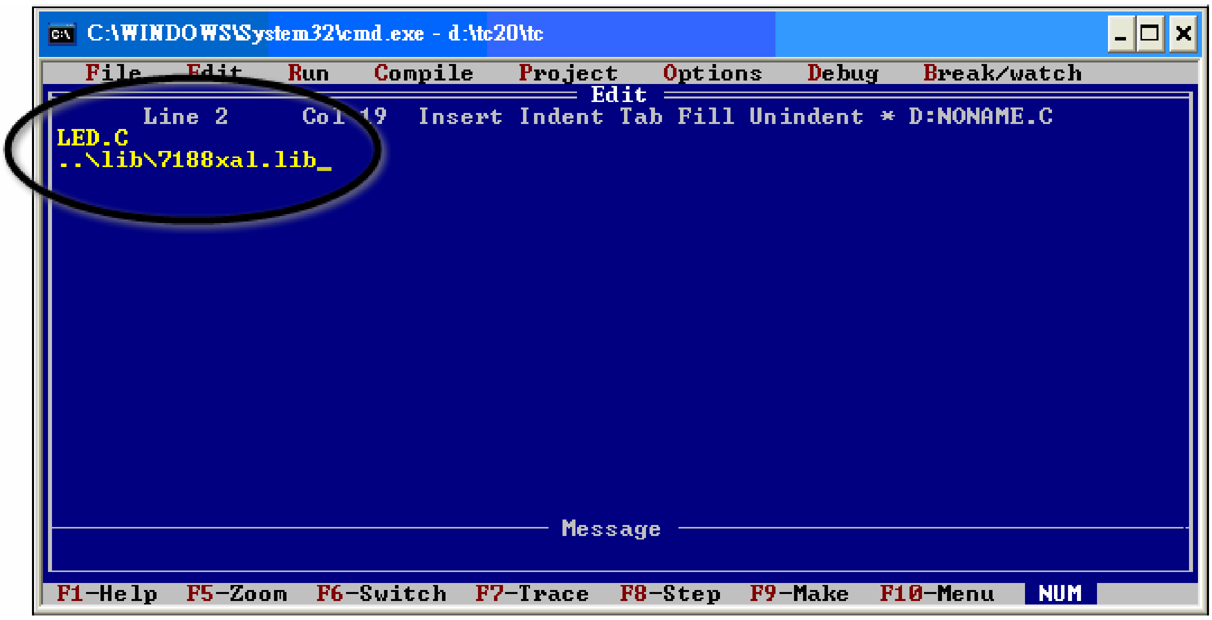
tcc -Ic:\tc\include -Lc:\tc\lib hello1.c ..\..\lib\8000e.lib

2：Using the TC Integrated Environment

Step 1：Executing the TC 2.01

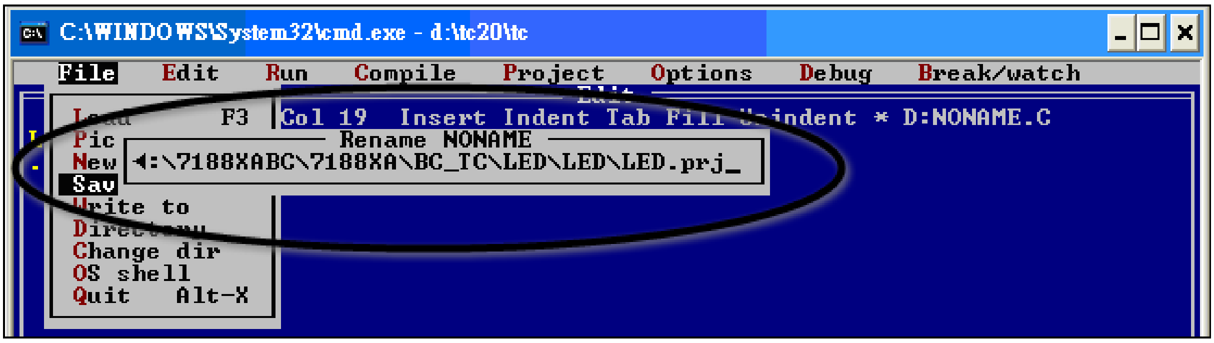
Step 2：Editing the Project file

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

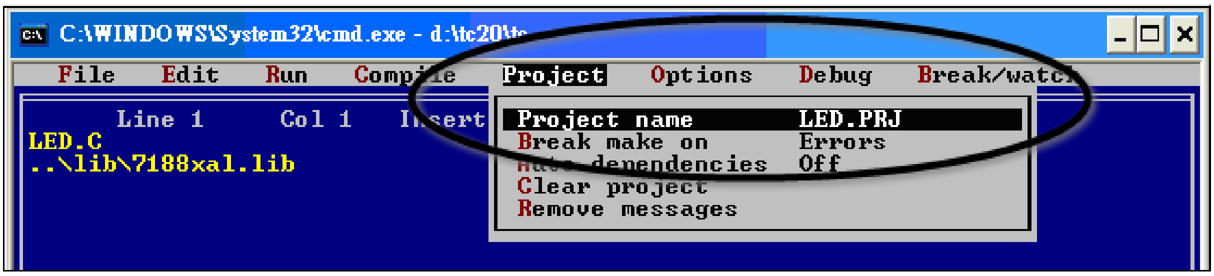
```
LED.C
..\lib\7188xal.lib_
```

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



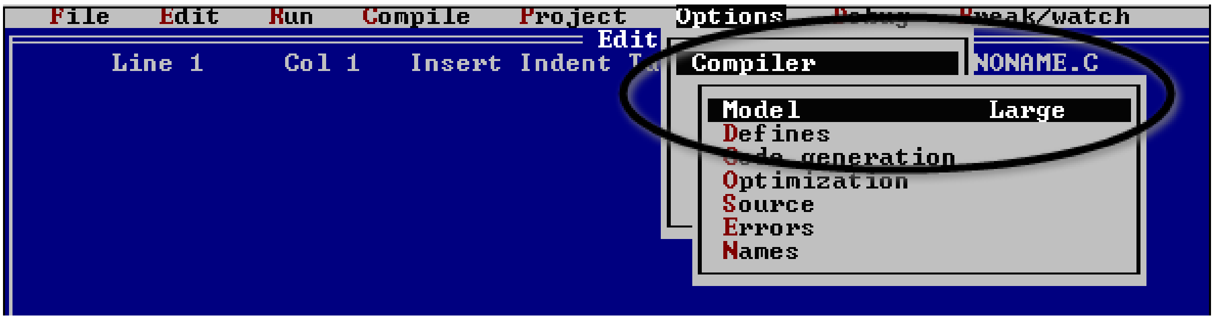
```
Col 19  Insert Indent Tab Fill Unindent * D:NONAME.C
              Rename NONAME
◄:\7188XABC\7188XA\BC_TC\LED\LED\LED.prj_
```

Step 4：Load the Project

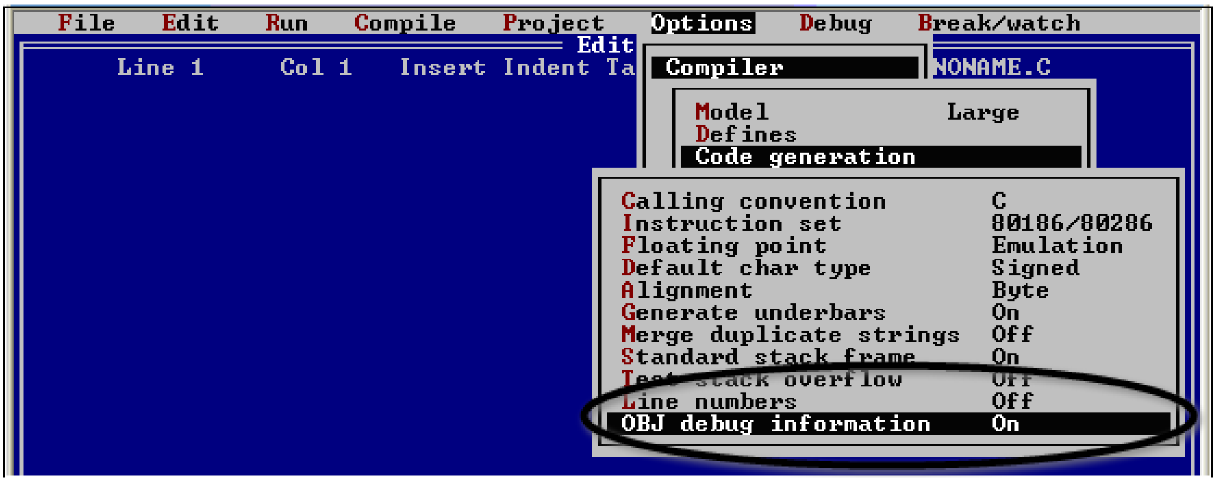


```
     Line 1      Col 1     Insert
LED.C
..\lib\7188xal.lib

Project name            LED.PRJ
Break make on           Errors
Auto dependencies       Off
```

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

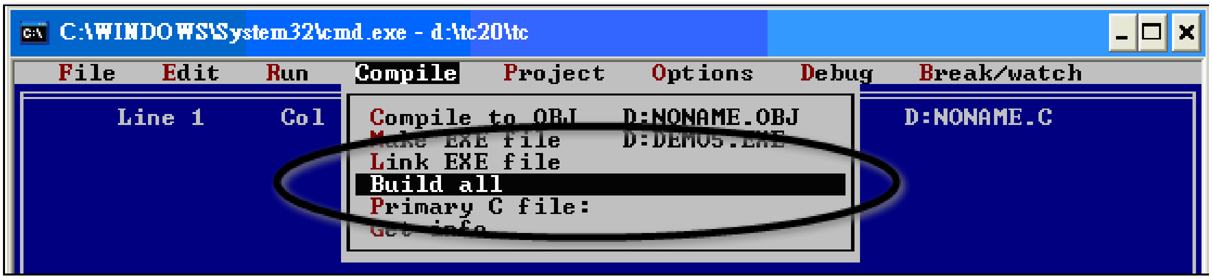


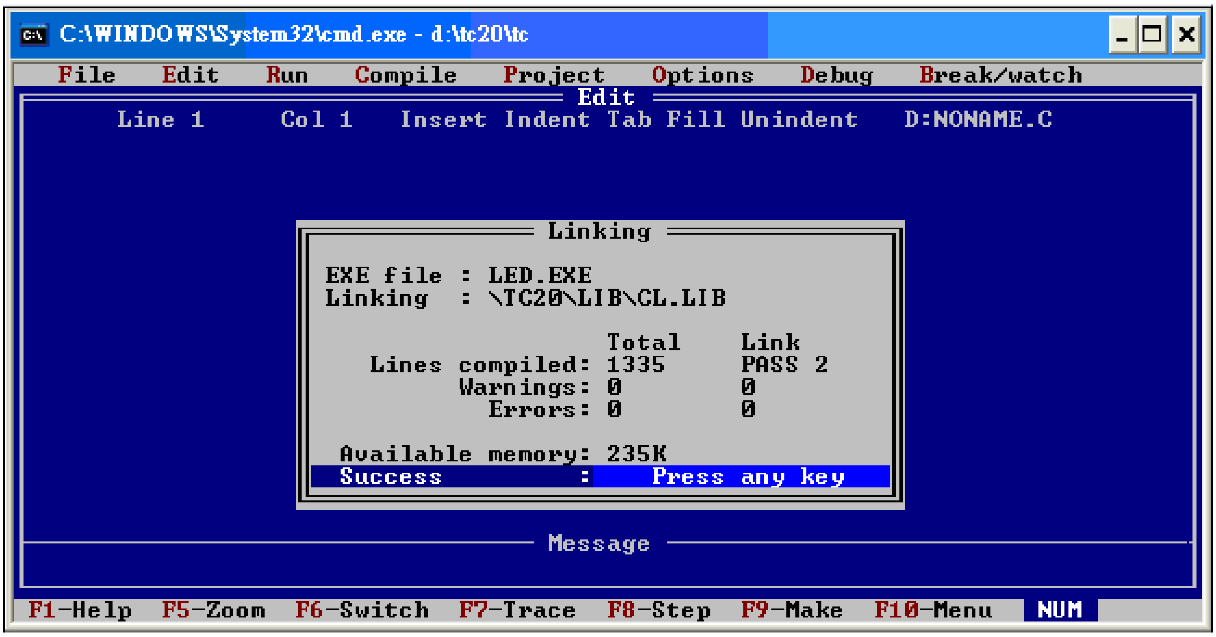
```
     Line 1      Col 1     Insert Indent T      NONAME.C
Model                   Large
```



```
     Line 1      Col 1     Insert Indent Ta     NONAME.C
Model                        Large

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

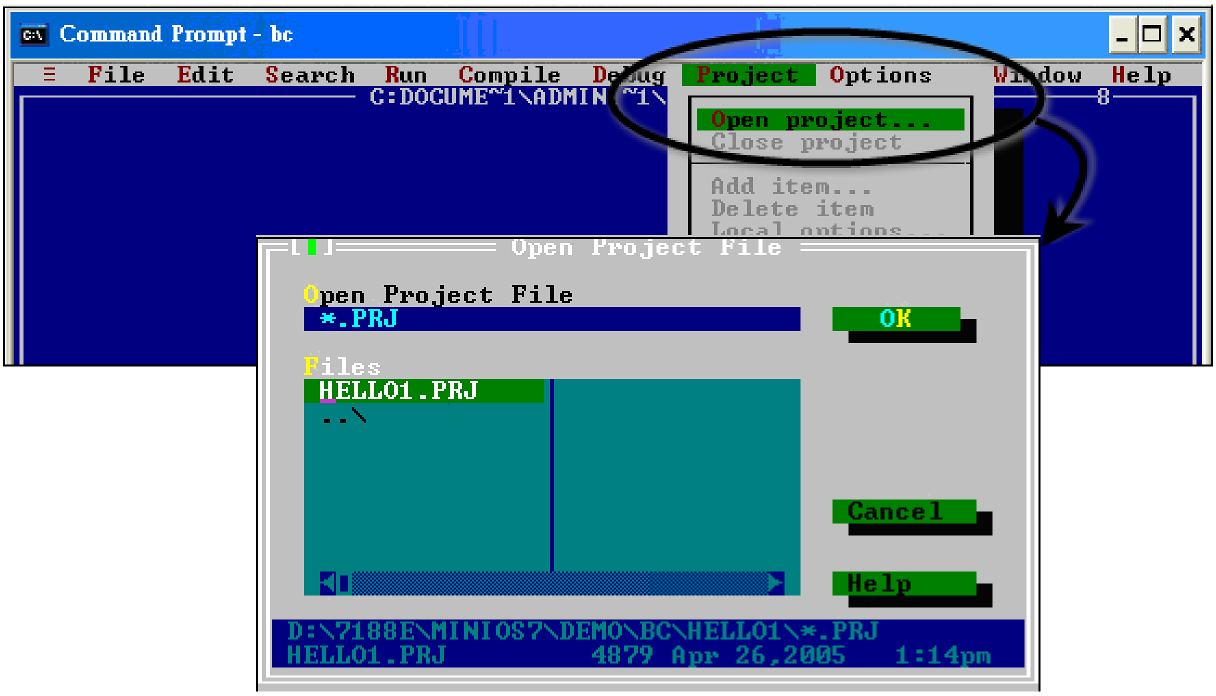

C:\WINDOWS\System32\cmd.exe - d:\tc20\tc
File Edit Run Compile Project Options Debug Break/watch
Edit
Line 1 Col 1 Insert Indent Tab Fill Unindent D:NONAME.C
Message
F1-Help F5-Zoom F6-Switch F7-Trace F8-Step F9-Make F10-Menu NUM

```
                 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
```

E.2. BC++ 3.1 IDE

Step 1：Executing the Borland C++ 3.1

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

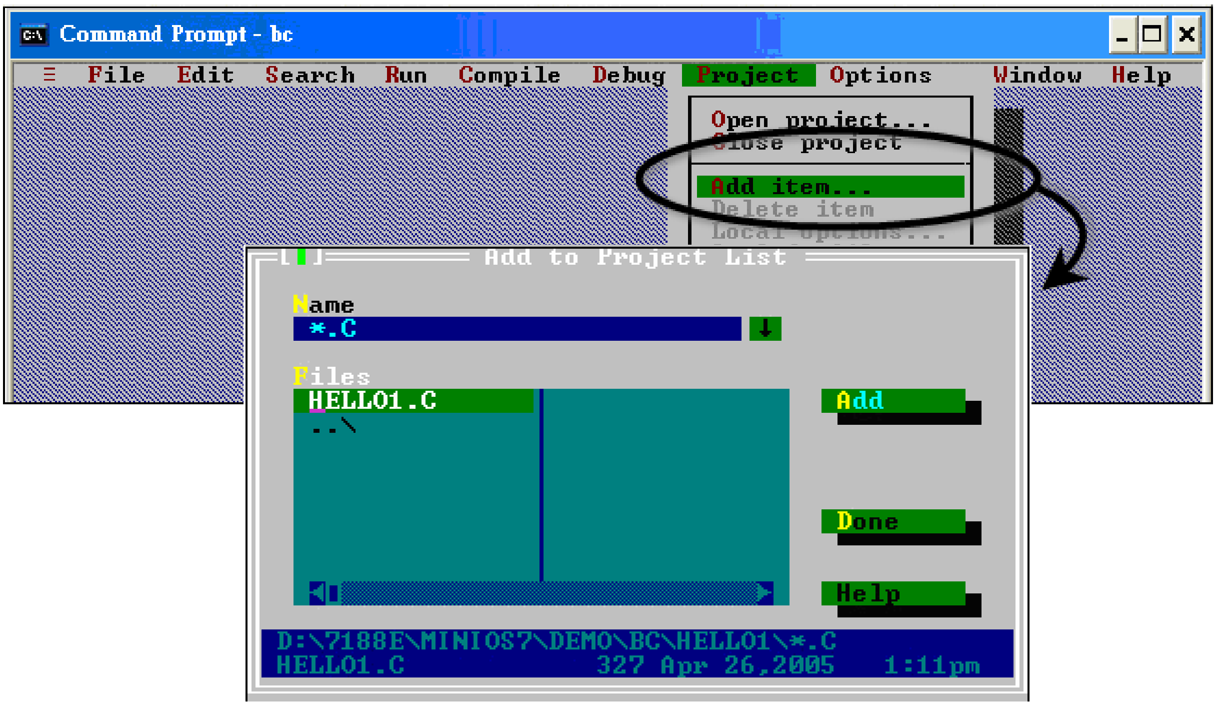


Open Project File: *.PRJ

Files:
```
HELLO1.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

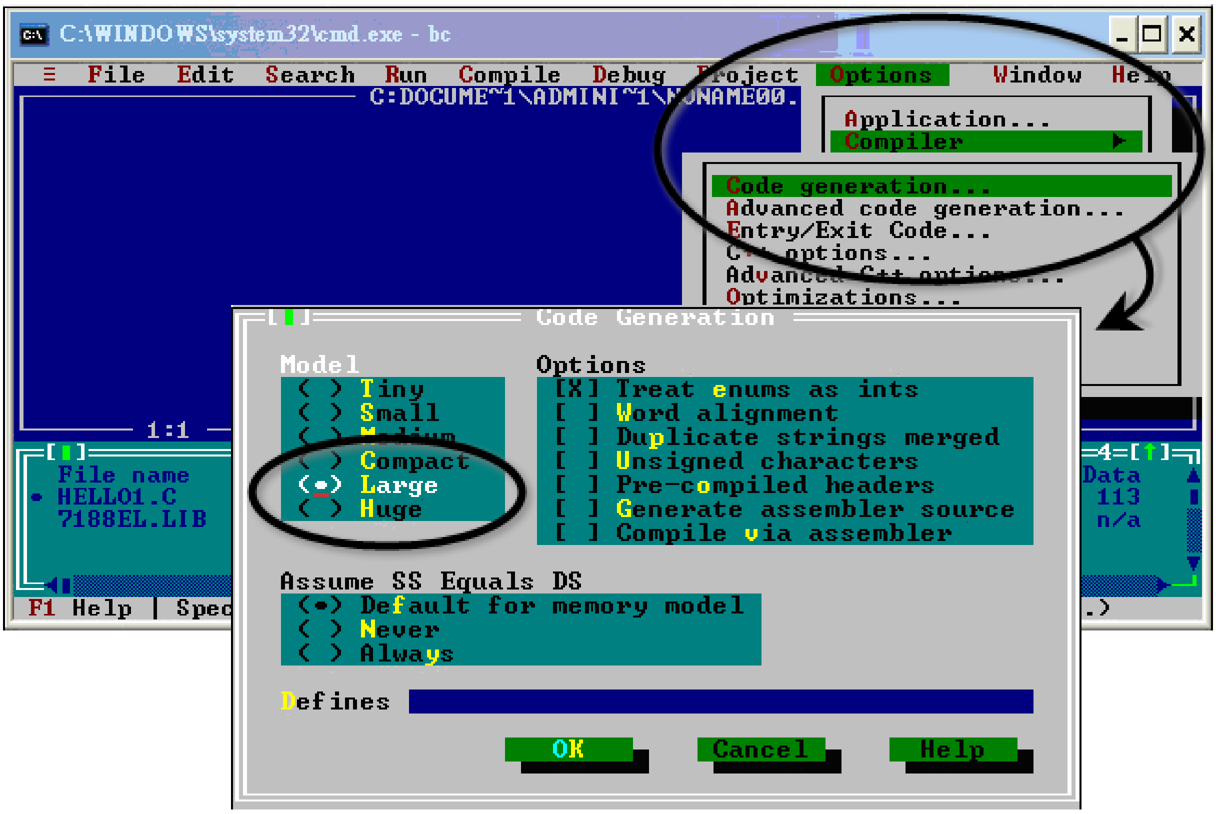


Name: *.C

Files:
```
HELLO1.C
..\
```

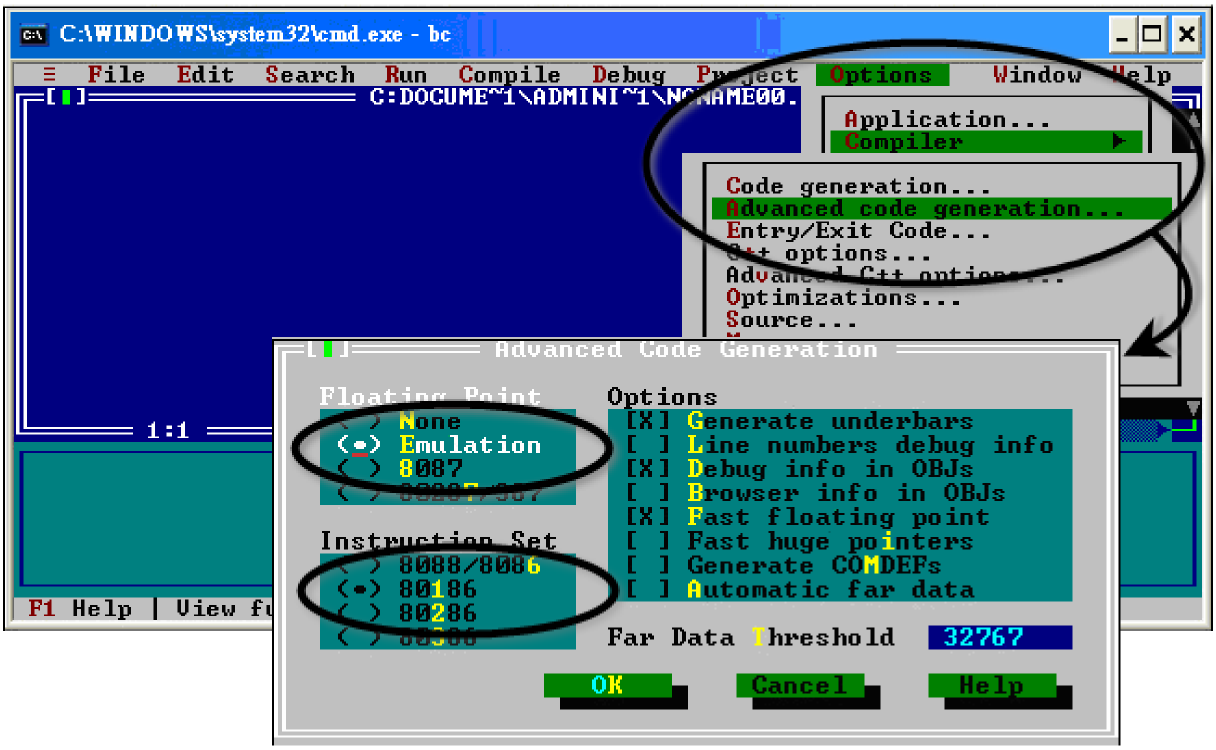
```
D:\7188E\MINIOS7\DEMO\BC\HELLO1\*.C
HELLO1.C                   327 Apr 26,2005     1:11pm
```

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



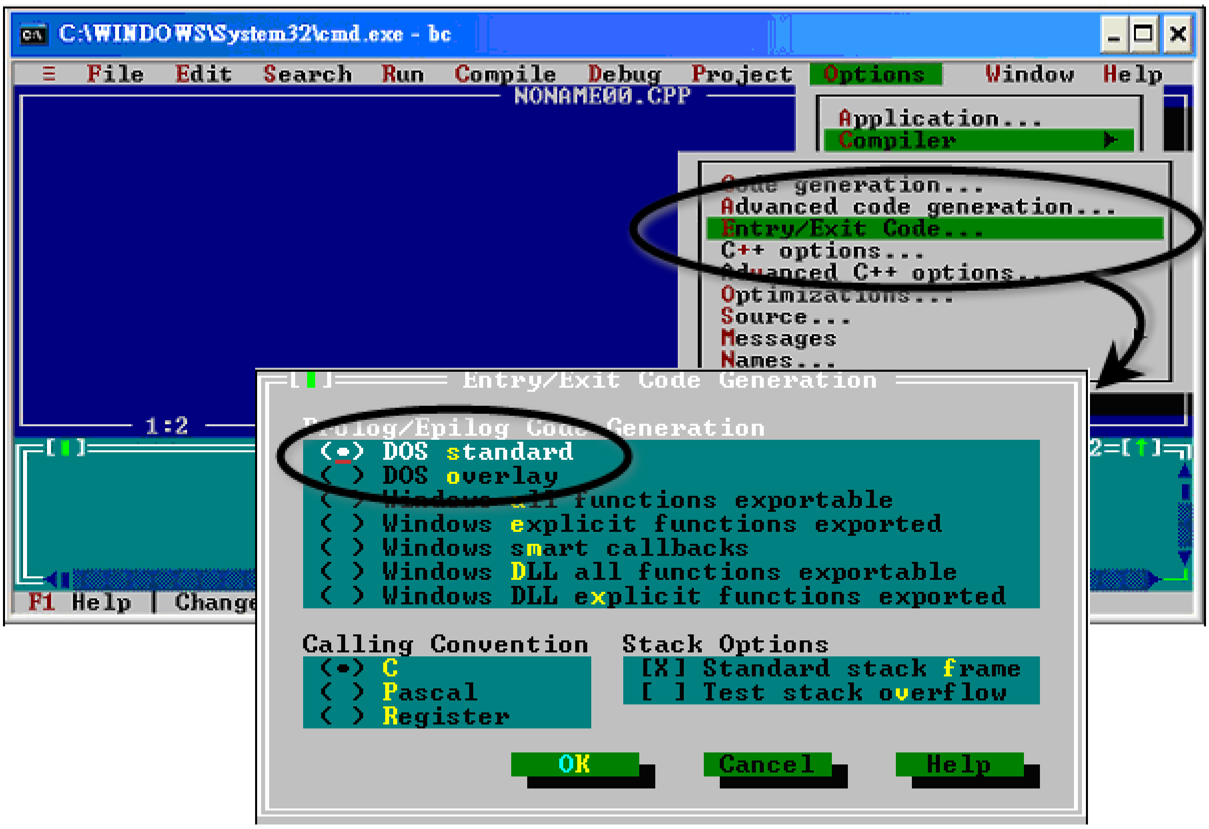
```
Code Generation

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...
Source...
1:1
F1 Help | View fu

```
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



Entry/Exit Code Generation

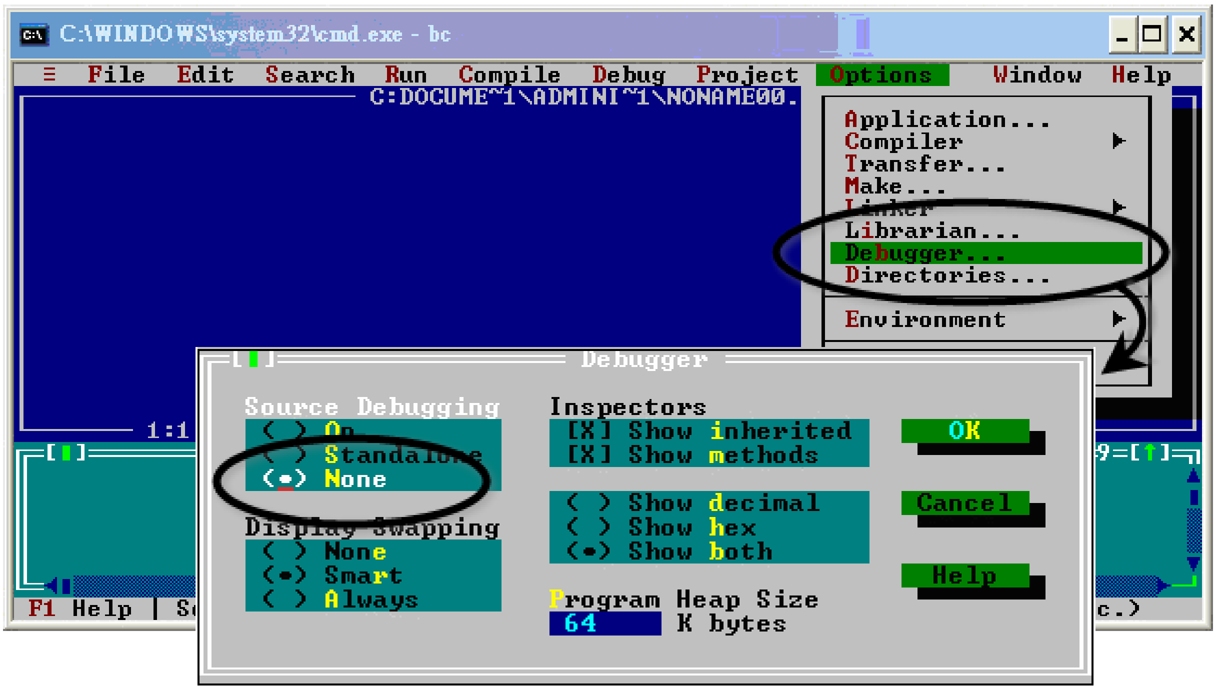
Prolog/Epilog Code Generation
(•) DOS standard
( ) DOS overlay
( ) Windows all functions exportable
( ) Windows explicit functions exported
( ) Windows smart callbacks
( ) Windows DLL all functions exportable
( ) Windows DLL explicit functions exported

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
1:1
F1 Help | S

Debugger

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

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

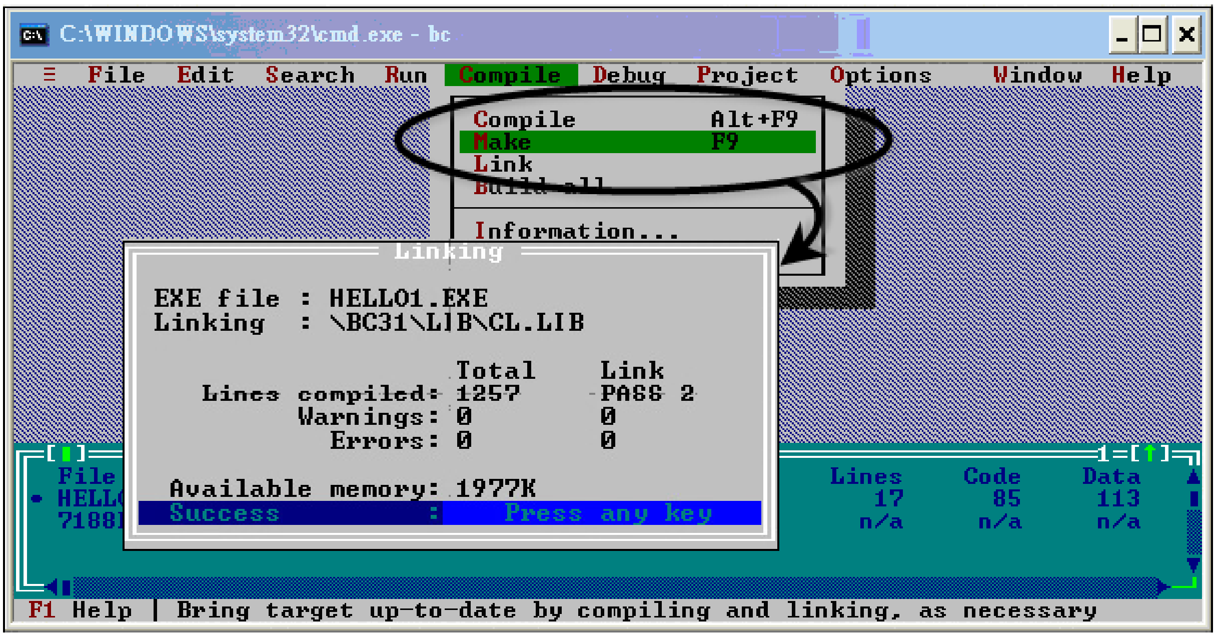
Inspectors
[X] Show inherited
[X] Show methods

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

Program Heap Size
64 K bytes

OK Cancel Help

Step 8：Make the project

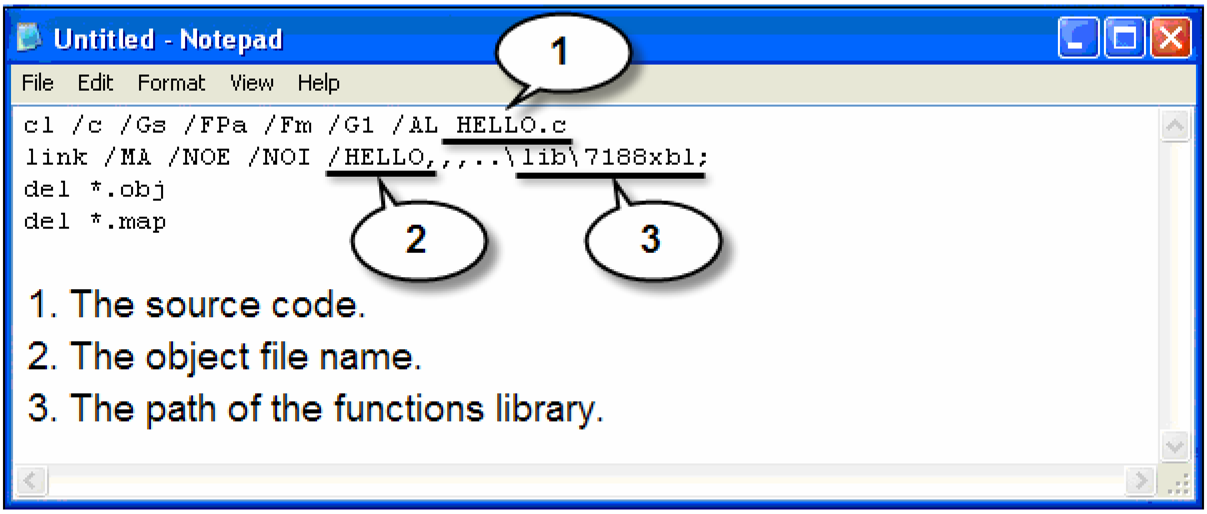


```
EXE file  : HELLO1.EXE
Linking   : \BC31\LIB\CL.LIB

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

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

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

E.3. MSC 6.00 Compiler

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

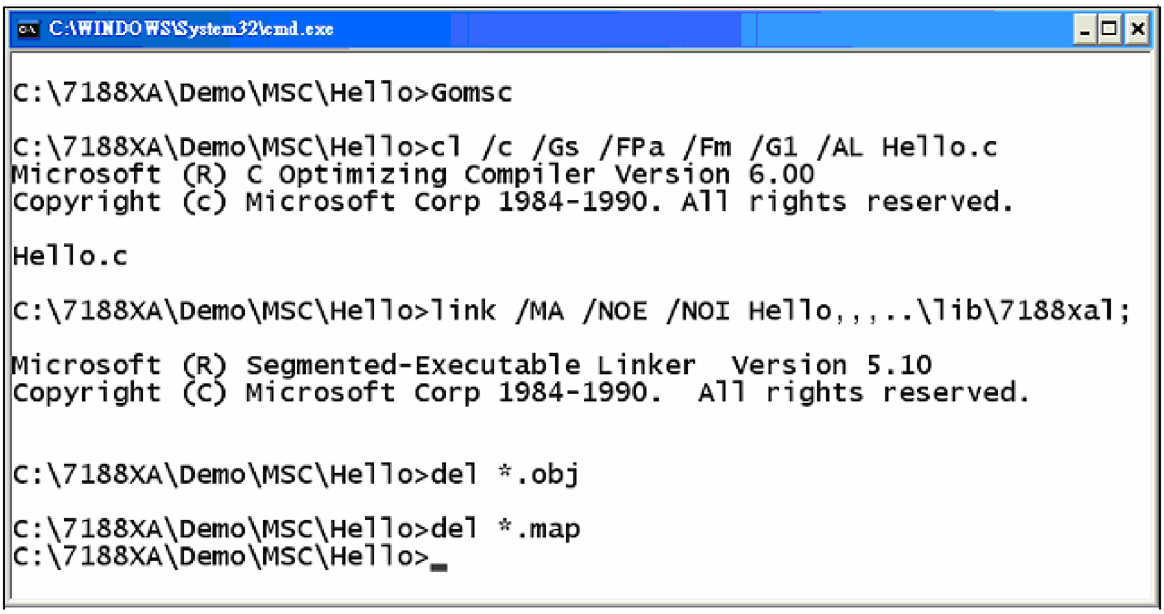


```
cl /c /Gs /FPa /Fm /G1 /AL HELLO.c
link /MA /NOE /NOI /HELLO,,,..\lib\7188xbl;
del *.obj
del *.map
```

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

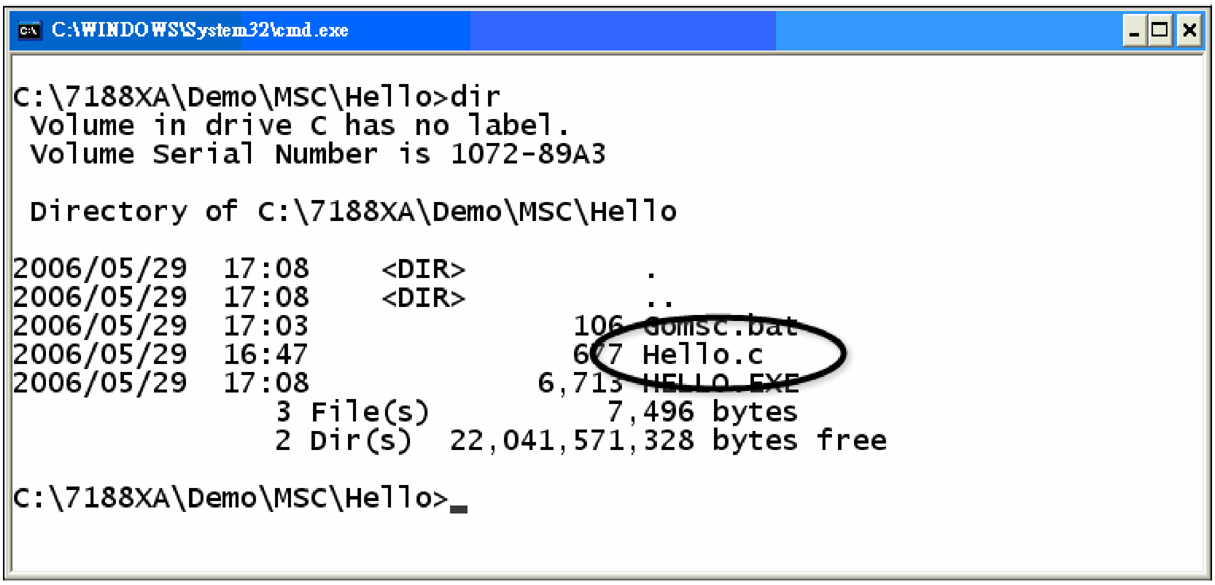
Note：/C：Don't strip comments
/Gs：No stack checking
/Fpa：Calls with altmath
/Fm：[map file]
/G1：186 instructions
/AL：large model

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>_
```

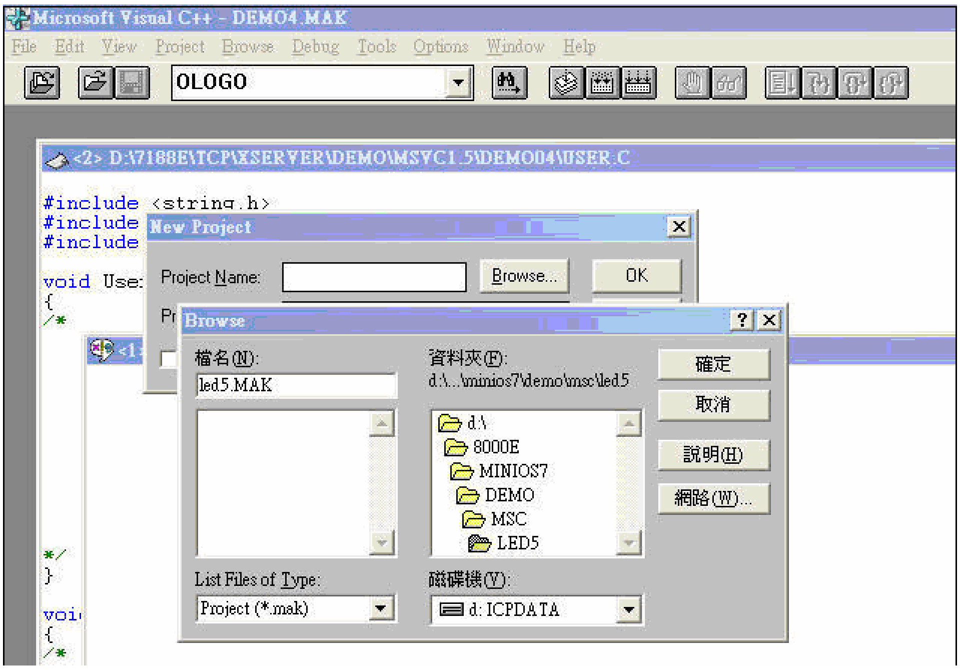
Step 3：A new executable file will be created if it is successfully compiled



```
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>_
```

E.4. MSVC 1.50 Compiler

Step 1：Run MSVC.exe


Microsoft Visual C++ - DEMO4.MAK
File Edit View Project Browse Debug Tools Options Window Help
OLOGO
<2> D:\7188E\TCP\XSERVER\DEMO\MSVC1.5\DEMO04\USER.C
New Project
Project Name:
Browse...
OK
Browse
檔名(N):
資料夾(F):
確定
取消
說明(H)
網路(W)...
List Files of Type:
磁碟機(V):

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

void Use:
{
/*

*/
}

voi
{
/*
```

檔名(N): led5.MAK

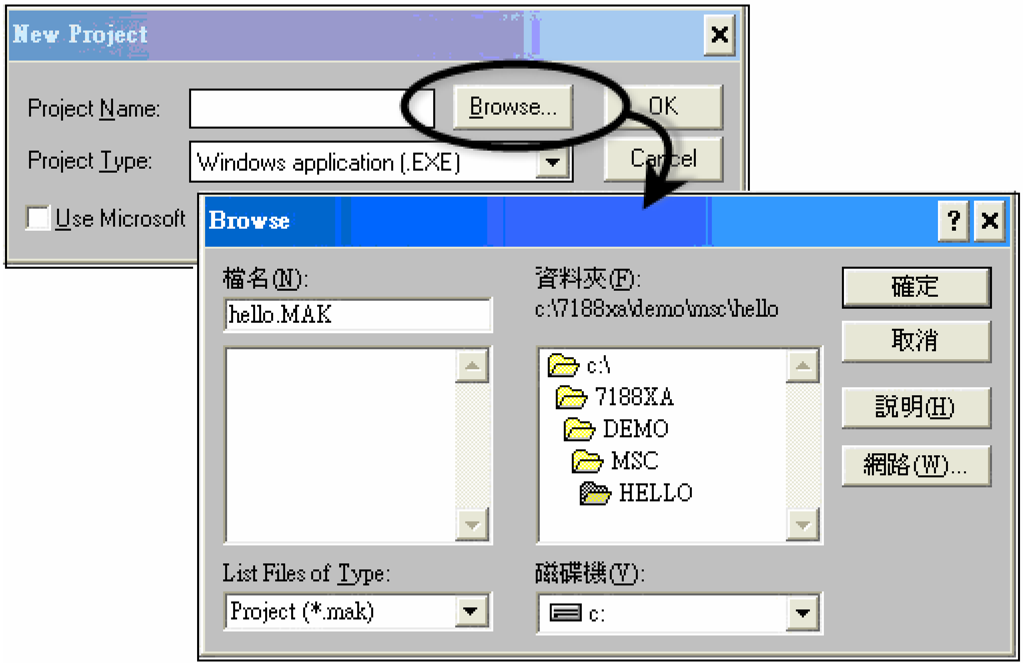
資料夾(F): d:\...\minios7\demo\msc\led5

d:\
8000E
MINIOS7
DEMO
MSC
LED5

List Files of Type: Project (*.mak)

磁碟機(V): d: ICPDATA

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



Project Type: Windows application (.EXE)

檔名(N): hello.MAK

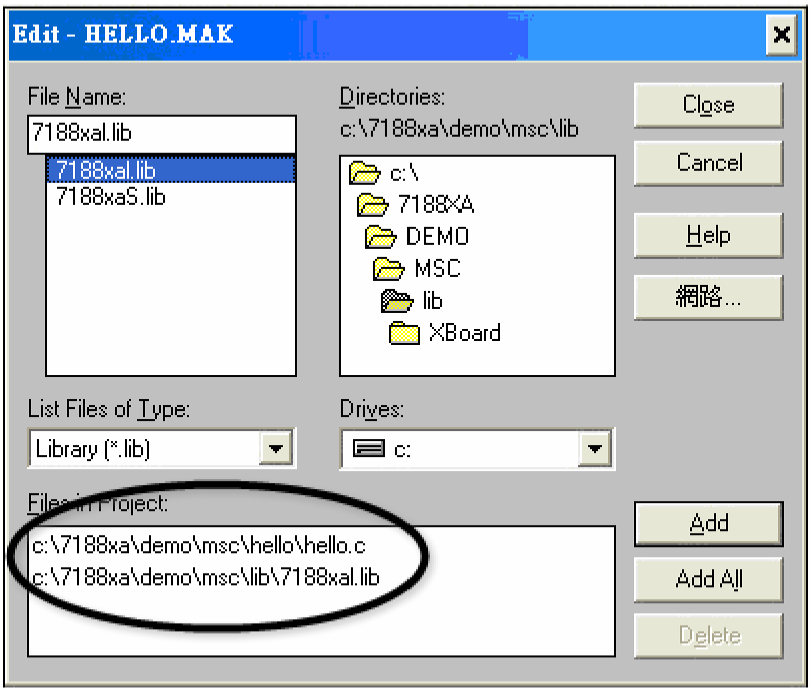
資料夾(F): c:\7188xa\demo\msc\hello

c:\
7188XA
DEMO
MSC
HELLO

List Files of Type: Project (*.mak)

磁碟機(V): c:

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



File Name: 7188xal.lib

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

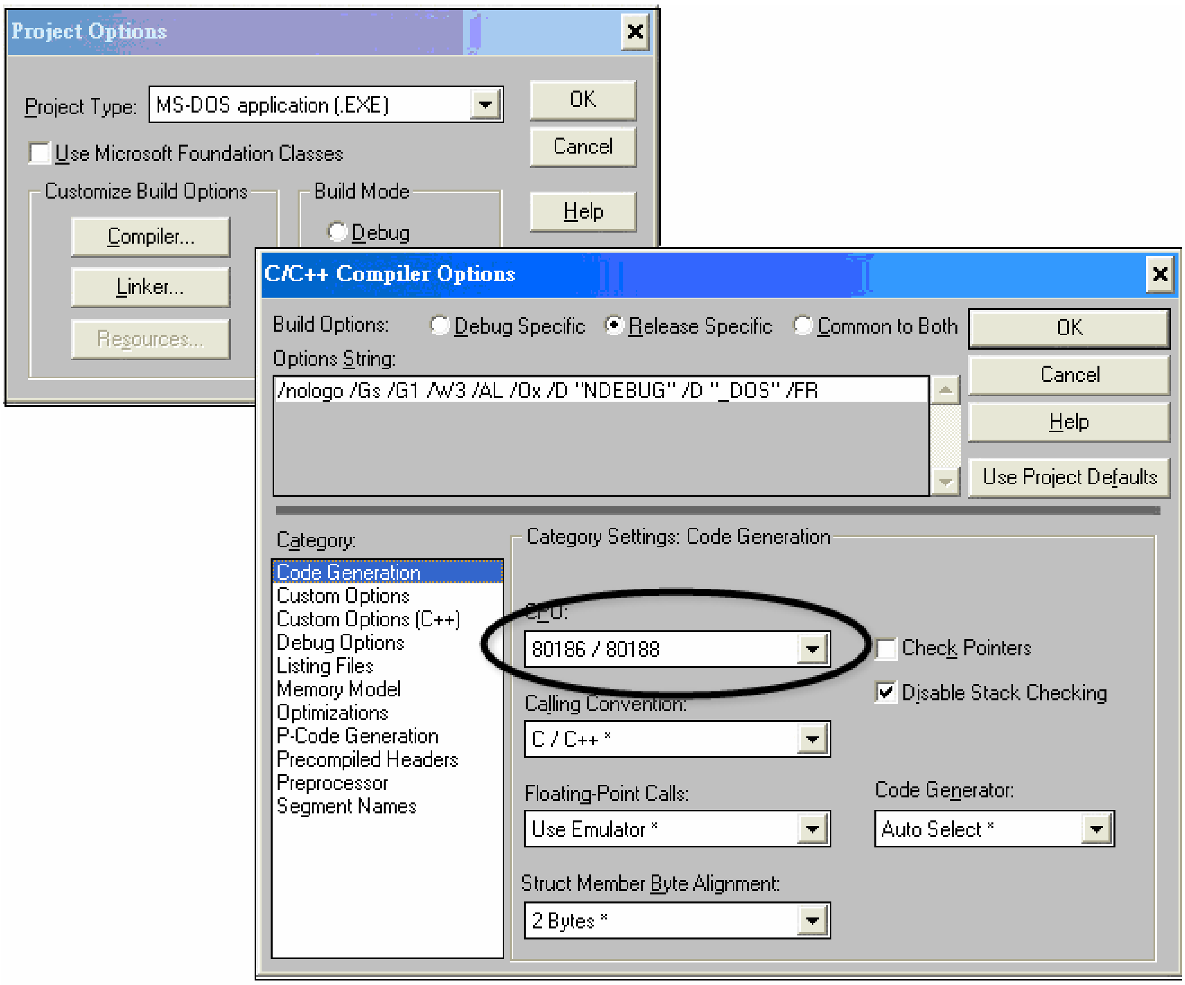
List Files of Type: Library (*.lib)

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 Type: MS-DOS application (.EXE)

□ Use Microsoft Foundation Classes

Build Mode: ○ Debug

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

□ Check Pointers

☑ Disable Stack Checking

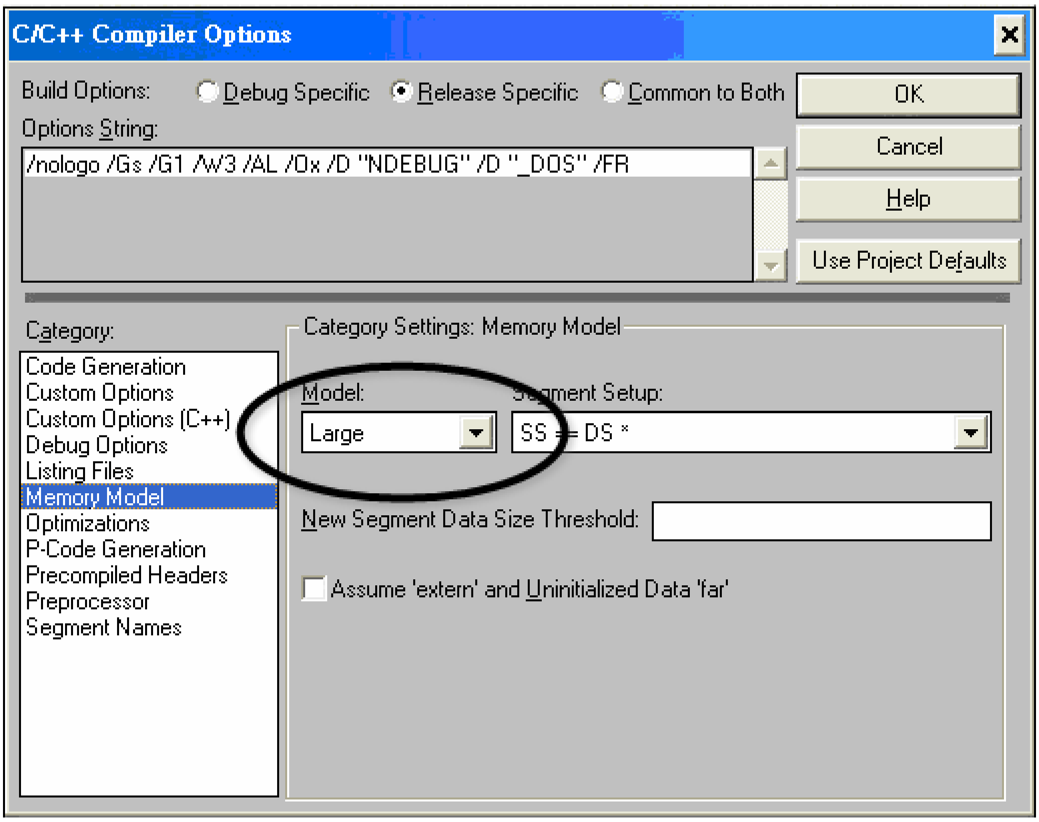
Calling Convention: C / C++ *

Floating-Point Calls: Use Emulator *

Code Generator: Auto Select *

Struct Member Byte Alignment: 2 Bytes *

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



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 Settings: Memory Model

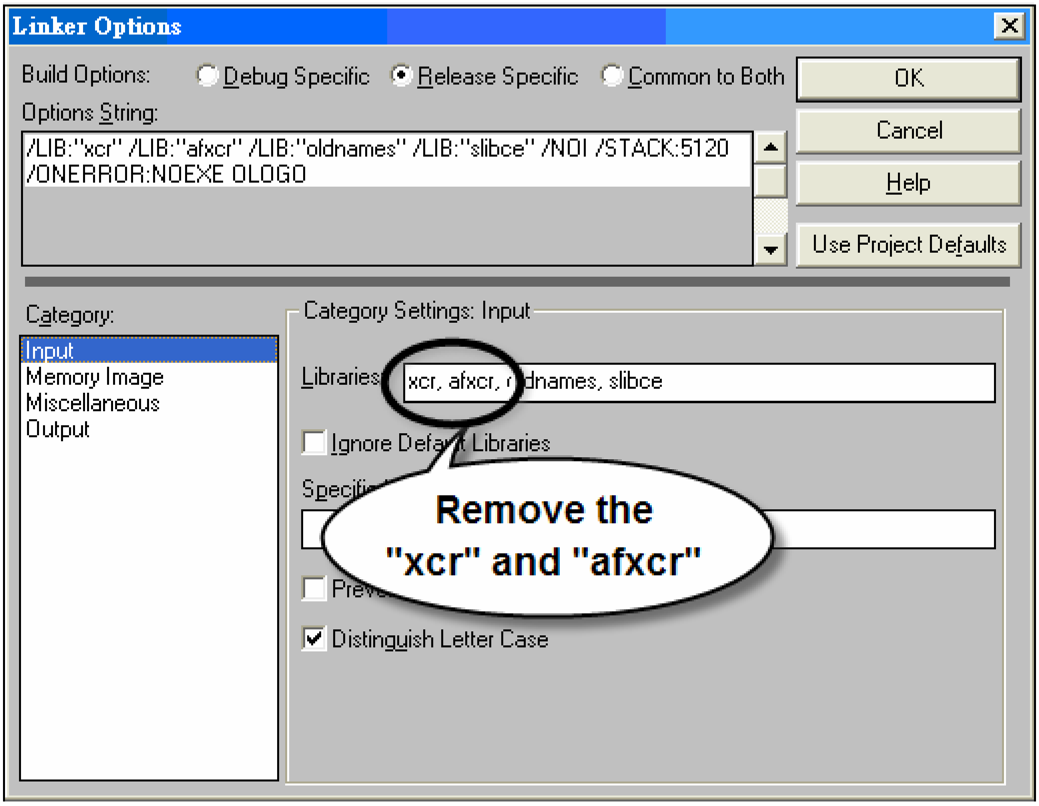
Model: Large

Segment Setup: SS == DS *

New Segment Data Size Threshold:

□ Assume 'extern' and Uninitialized Data 'far'

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



Linker Options

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
```

Category Settings: Input

Libraries: xcr, afxcr, oldnames, slibce

□ Ignore Default Libraries

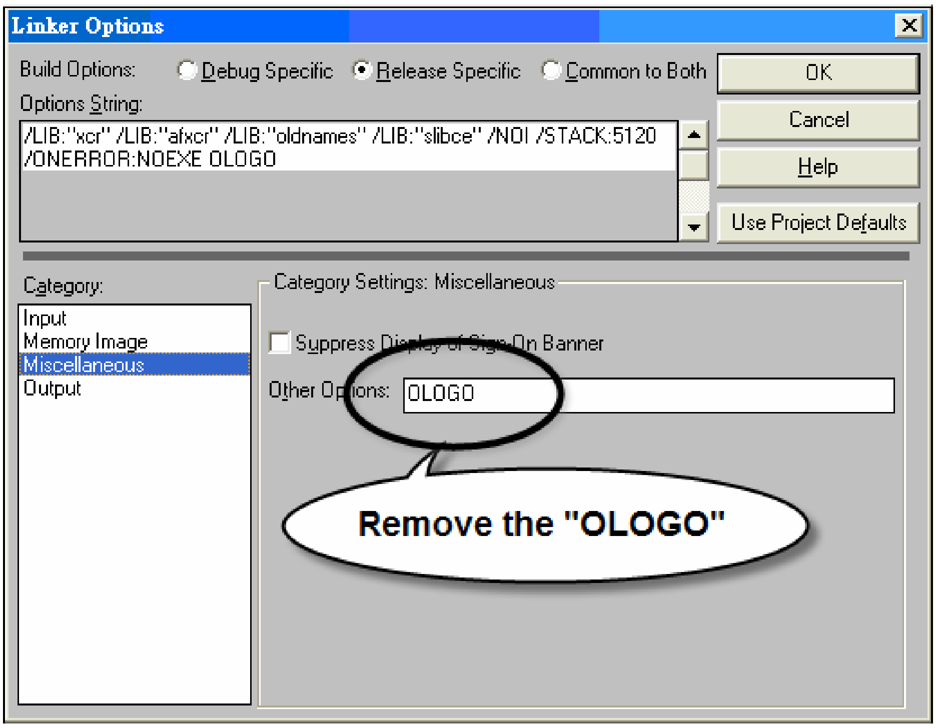
Specifi

□ Prev

☑ Distinguish Letter Case

Remove the "xcr" and "afxcr"

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
```

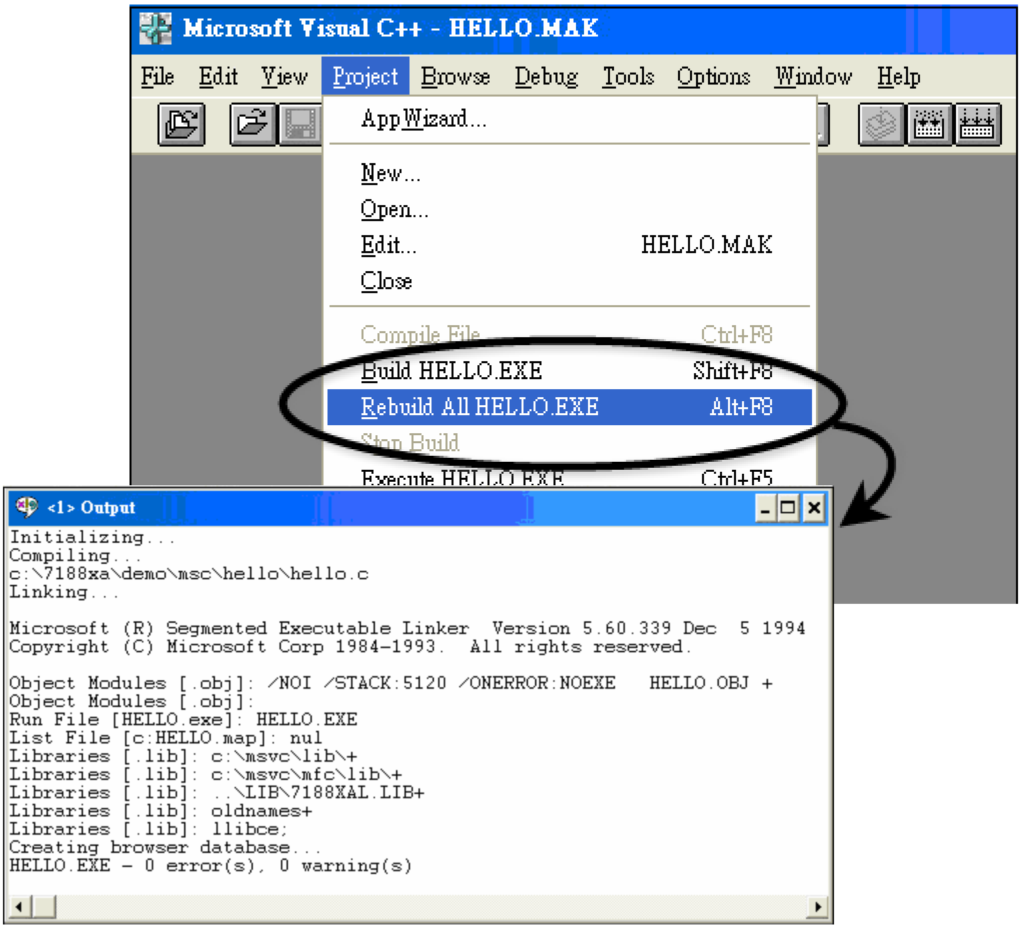
Category: Input, Memory Image, Miscellaneous, Output

Category Settings: Miscellaneous

□ Suppress Display of Sign-On Banner

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)
```

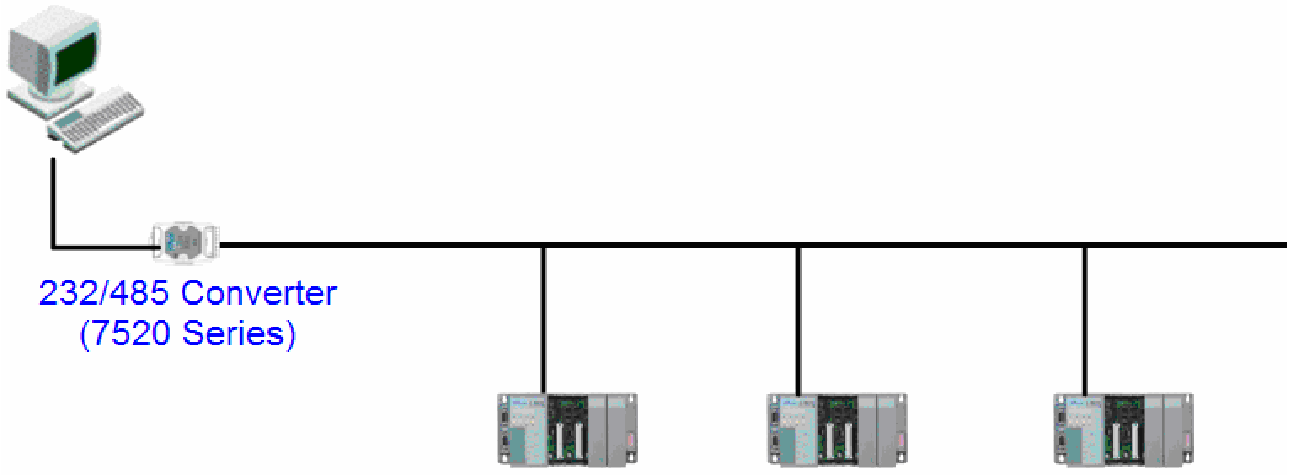
APPENDIX
F

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.

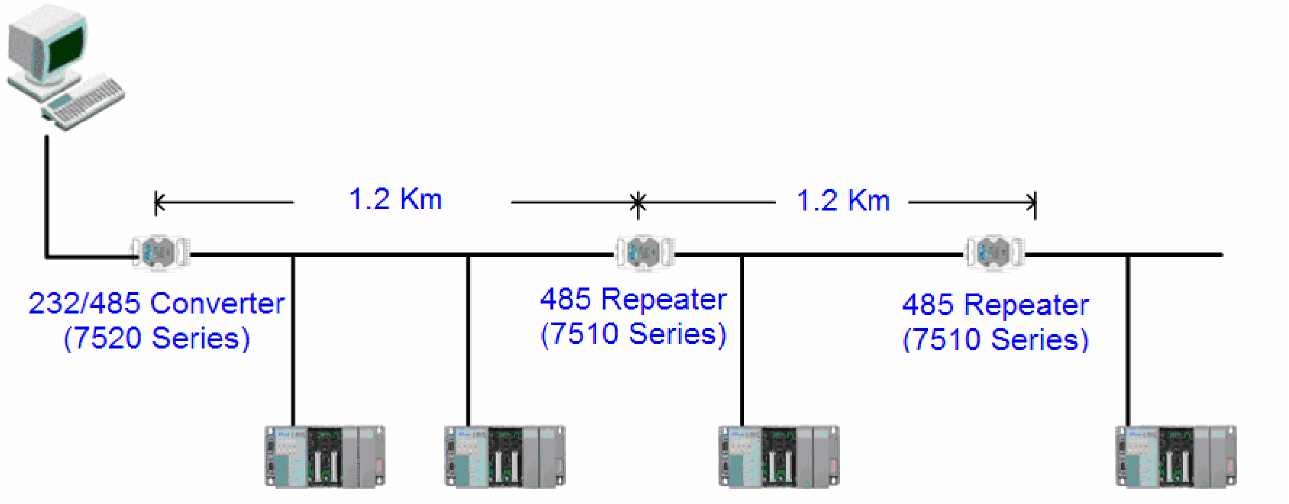
F.1. Basic RS-485 Network

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.



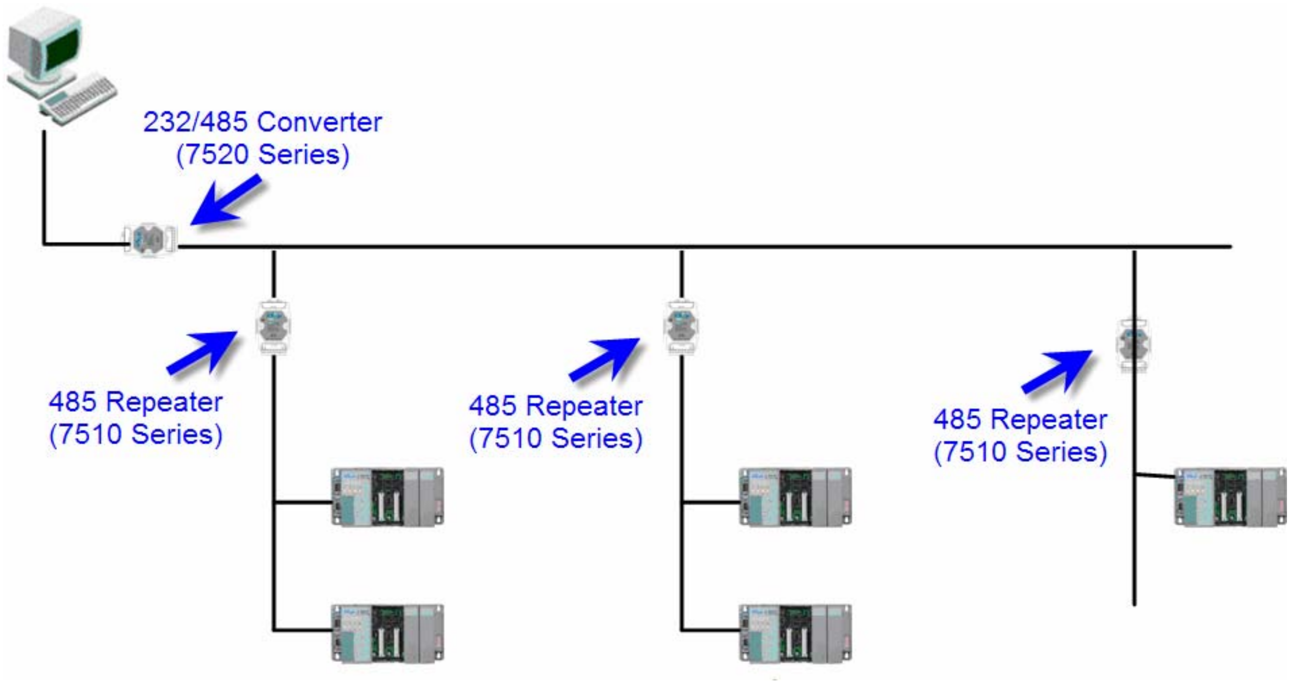
F.2. Daisy Chain RS-485 Network

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.

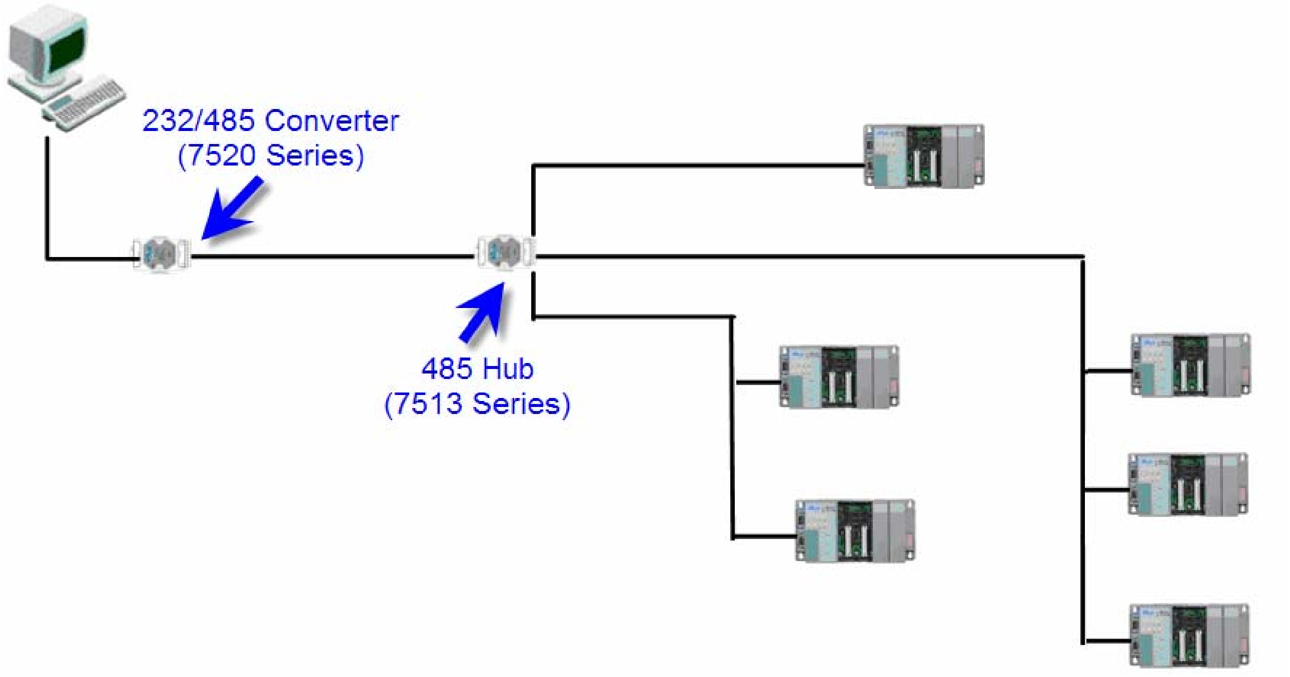


F.3. Star Type RS-485 Network

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.

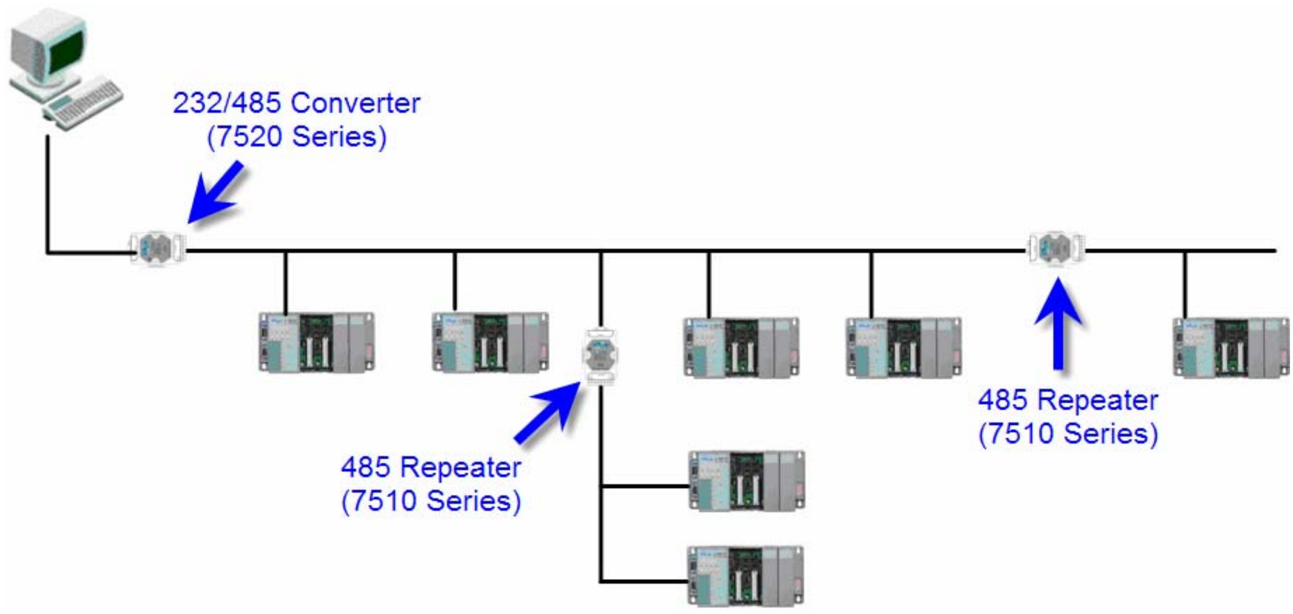


There is a better choice to use 7513 as a RS-485 hub on start type network.



F.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.



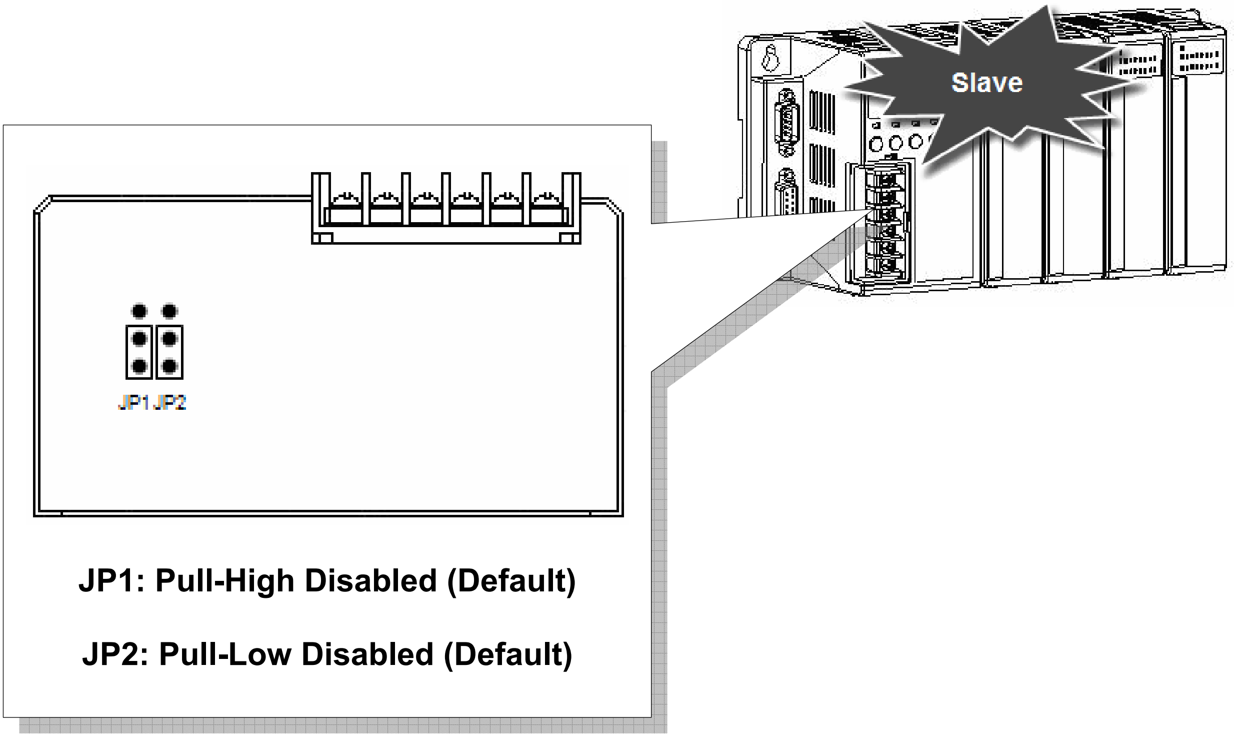
F.5. Pull-High/Pull-Low Resistor

There must be having one master to have a pull-high/pull-low resistor in the same network.

F.5.1. i-8411/i-8811 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 8410/8810/8411/8811 and all the other devices on this network must be slave mode (the pull-high/pull-low resistors must be disabled).

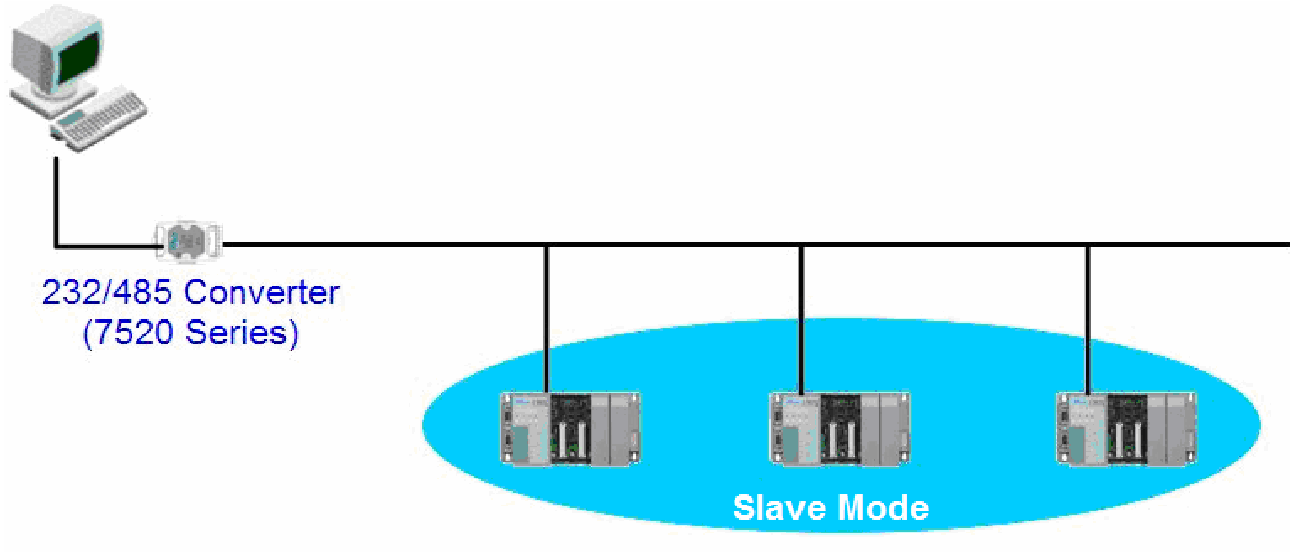
Please refer to the figure F-1 to for the jumpers' setting of the pull-high/pull-low resistors which are located at the power board of 8410/8810/8411/8811.



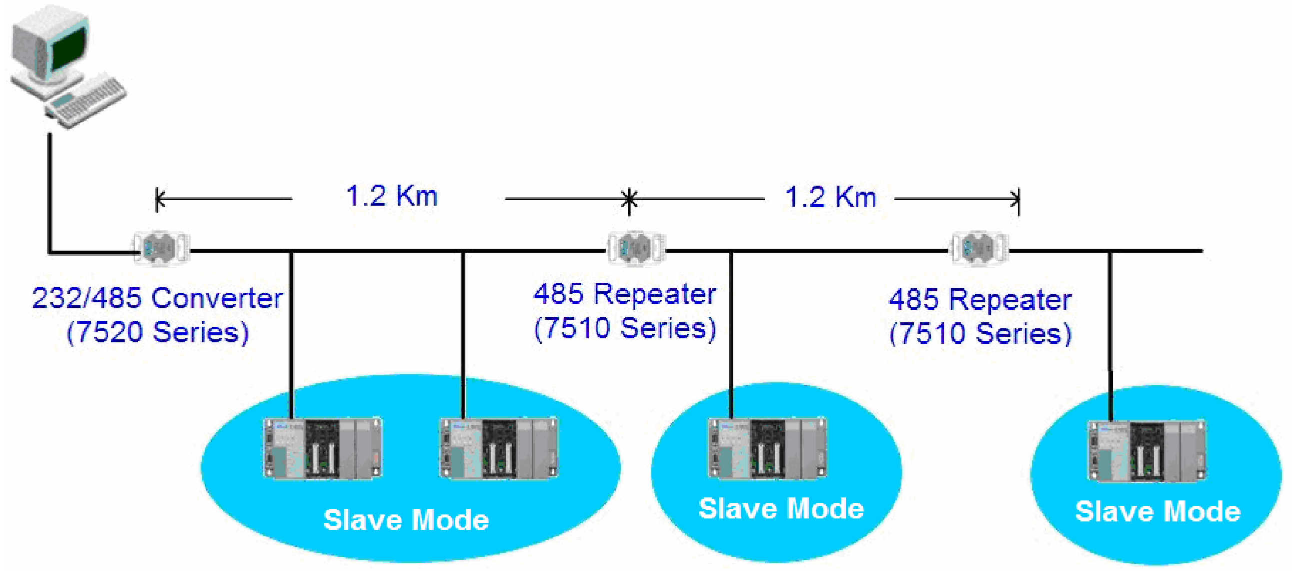
JP1: Pull-High Disabled (Default)

JP2: Pull-Low Disabled (Default)

Figure F-1



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)



F.5.2. i-8411/i-8811 as a Master

When one of 8410/8810/8411/8811 is set to master, then all the other devices on the same network must be slave mode. then the master one's (8410/8810/8411/8811) pull-high/pull-low resistors have to adjusted to enabled.

Please refer to the Figure F-2 to for the jumpers' setting of the pull-high/pull-low resistors which are located at the power board of 8410/8810/8411/8811.

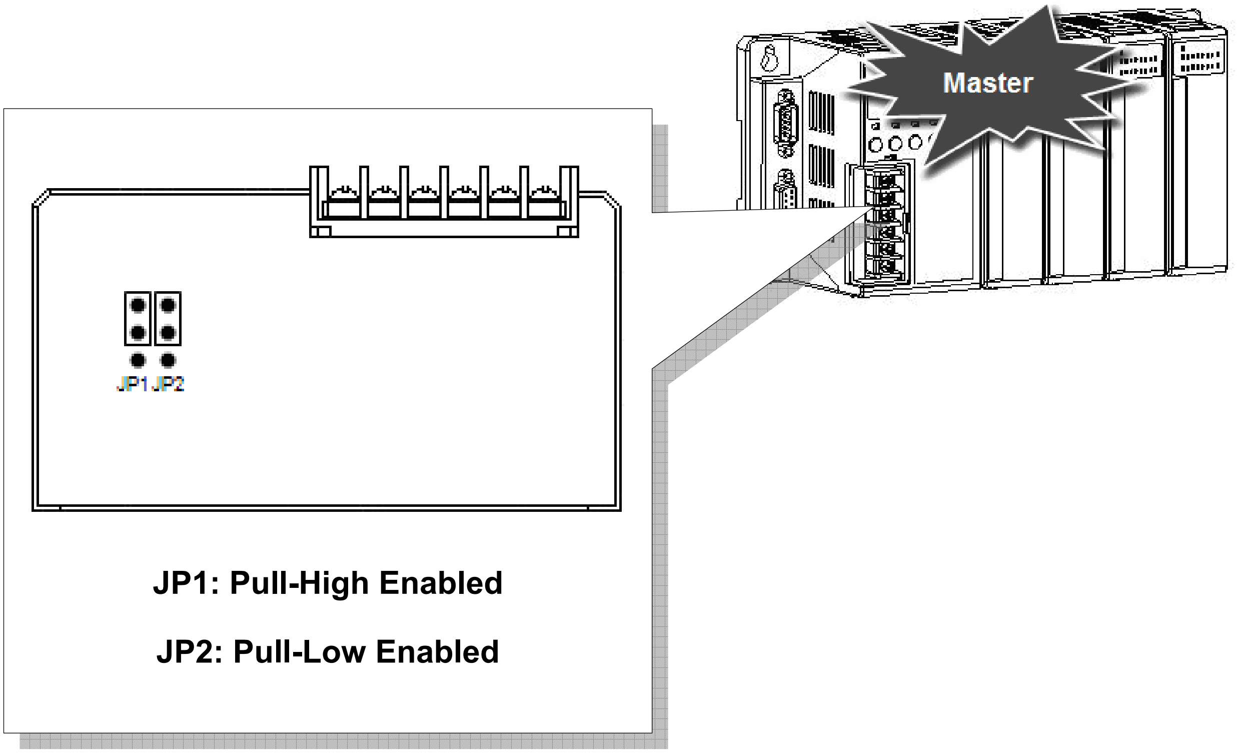
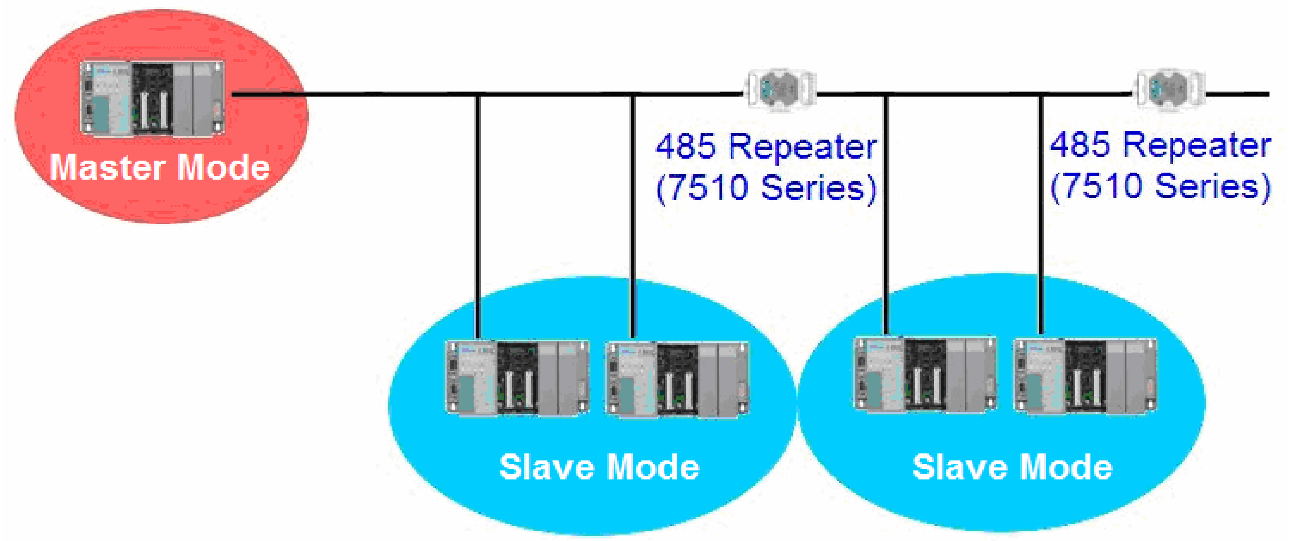


Figure F-2



APPENDIX
G

How to prevent illegal software copy

■ 64-bit hardware unique serial number

The i-8411/i-8811 is equipped with a 64-bit hardware serial number onboard, each hardware serial number is unique and individual. The application software can check this number for illegal copies. It is the most low cost protection mechanism.

The following function is declared in 8000E.H for reading the hardware serial number：

int GetSerialNumber(char *Serial);

The serial number length is 8 bytes, SystemSerialNumber[0] ~ SystemSerialNumber[7].

If the values are “-1” means can not find the serial number.
If the values are “-2” means serial number CRC check error.

If the application program read and check the hardware serial number, this program will be executed in this i-8411/i-8811 only. If someone copies this program and move to another i-8411/i-8811 or other controller, this program will read and check hardware serial number and then get error and stop to run.

■ AsicKey

The backplane supports AsicKey. The AsicKey is equipped with a complex state machine checking and 128 bytes of private data for validation checking. It provides very strong protection against the illegal copies. Every legal user has a unique AsicKey and unique software library, the user can check this key themselves, the MiniOS7 will check the key automatically. So it is nearly impossible to remove the AsicKey protection.