EMP-9000 Series
User Manual

V1.1.6 March 2022

EMP-9091/EMP-9051/EMP-9251/EMP-9651
EMP-9098/EMP-9058/EMP-9258/EMP-9658

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1. Introduction

This chapter provides an overview of the EMP-9000 and its components, and introduces the fundamental concepts for user familiar with the EMP-9000.

The EMP-9000 are Windows 10 IoT-based PACs that combine computing, I/O, and operator interface into a single unit, and provide the perfect solution for integrating HMI, data acquisition and control in an individual PAC. It is equipped with an Intel Core E3950/i5-8365UE CPU, 0/2/6 I/O expansion slots and a variety of connectives including dual Gigabit Ethernet, VGA, HDMI , USB port 2.0/3.0, RS-232 and RS-485 interface. Local I/O slots are available to use our I-9K and I-97K,e-9K series I/O modules and remote I/O expansions are available to use our Ethernet I/O modules and RS-485 I/O modules.

EMP-9000 has a built-in Windows 10 IoT Enterprise operating system, which can support both the Universal Windows App and traditional Windows applications simultaneously. For software development tools, it can maintain maximum sharing with Windows 10, and applications can be quickly ported to EMP-9000 and deployed in a variety of harsh environments.

Since Windows 10 IoT Enterprise has the same Win32 API as Windows 10, most popular applications on desktop can run on Windows 10 IoT Enterprise based controllers.

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1.1. Features

The EMP-9000 offers the most comprehensive configuration and remote system upgrade solutions to meet specific application requirements. The following list shows the software and hardware features designed to simplify installation, configuration and application.

Software Features

- Windows IoT (Windows 10 IoT Enterprise LTSC 2021)

Windows 10 IoT is a member of the Windows 10 family that brings enterprise-class power, security, and manageability to the Internet of Things. It leverages Windows' embedded experience, ecosystem, and cloud connectivity, allowing organizations to create their Internet of Things with secure devices that can be quickly provisioned, easily managed, and seamlessly connected to an overall cloud strategy.

• Traditional Windows Shell with Advanced Lockdown Features
• Full Windows UI support (e.g. UWP, WinForms, etc)

1. Rich Software Solutions
2. Visual Studio .Net and VC solution: SDK as well as demo programs for C#, VB.Net, and VC are provided.
3. eLogger HMI: A free charge and easy-to-use software to implement HMI and data logger, supporting Modbus TCP/RTU/ASCII master and MQTT protocols. (See more...)

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Hardware Features

Powerful CPU Module

1. E3950 (1.6~2.0 GHz, 4C4T) for EMP909x
2. i5-8365UE(1.6 ~ 4.1 GHz, 4C8T) for EMP9x5x

Built-in VGA and HDMI Port

A built-in VGA and HDMI port can be directly connected to a regular display. Users can operate the HMI or SCADA software (running on the EMP-9000) with the display, keyboard, and mouse just as how they usually did on regular PCs.

Memory Size:

- SDRAM (8 GB DDR4) for EMP-909x
- SDRAM (16 GB DDR4) for EMP-9x5x
- Flash (64 GB SSD)
- CFast Card (support up to 32 GB)

64-bit Hardware Serial Number

The 64-bit hardware serial number is unique and individual. Every serial number of EMP-9000 PAC is different. Users can add a checking mechanism to their AP to prevent software from pirating.

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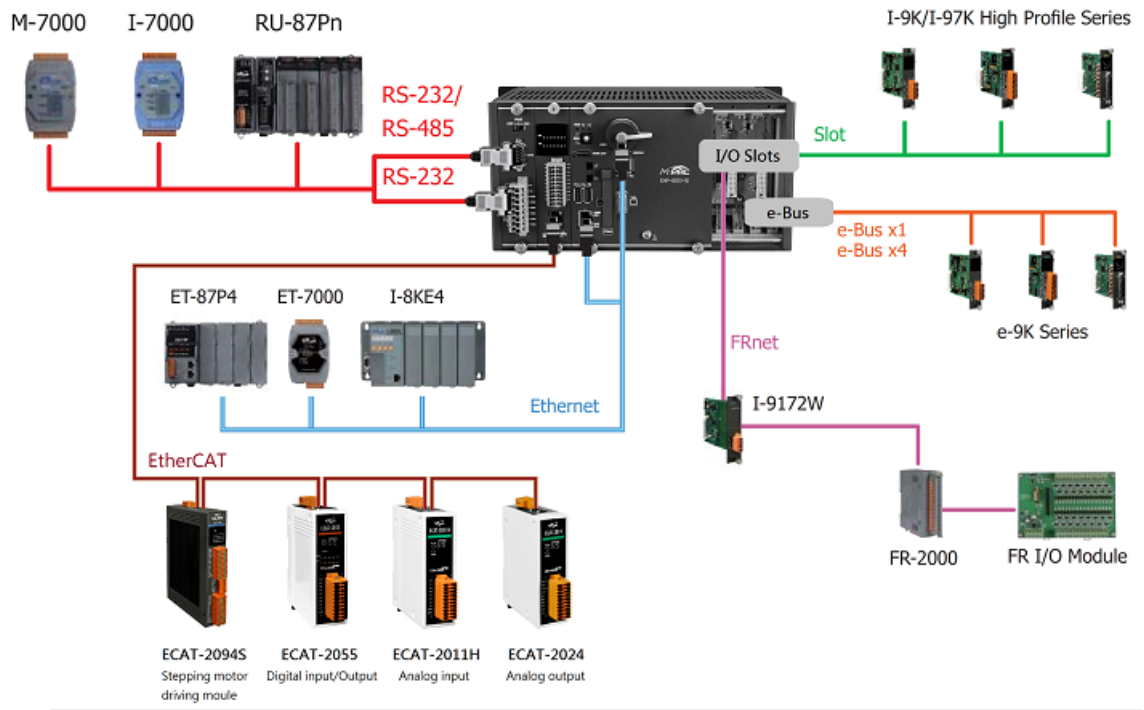
Rich I/O Expansion Ability(connect with serial/USB I/O and Ethernet I/O devices)

- EtherCAT
- I/O Slots
- RS-232/RS-485
- FRnet
- USB



Besides the local I/O slots, EMP-9000 also provides EtherCAT prot, several RS-232/RS-485/USB ports and two Ethernet ports to connect with EtherCAT, serial/USB I/O and Ethernet I/O devices.

Dual Ethernet Ports

EMP-9000 provides two Gigabit Ethernet ports. The two Ethernet ports can be used to implement redundant Ethernet communication and separate Ethernet communication (one for a global Internet, one for private Ethernet).

Dual Watchdog Timer

A system could be hanged up when the OS or the AP fails. There are two watchdogs (CPU watchdog and Backplane watchdog) designed to automatically reset the CPU/Backplane when the situations happen. The design will increase the reliability of the system.

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Redundant Power Inputs

To prevent the EMP-9000 from failing by the power loss, the power module is designed with two inputs. The EMP-9000 can keep working even one power input fails, and meanwhile, there is a relay output for informing the power failure.

Operating Temperature：

- -25°C to +60°C

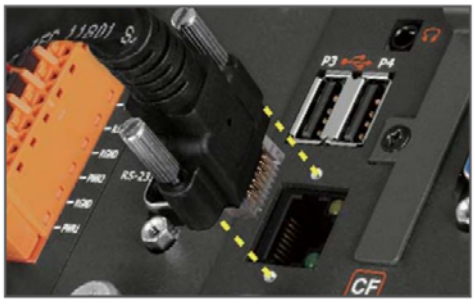
Rugged RJ-45 connector

LAN1

The EMP-9000 is equipped with a rugged and dustproof RJ-45 connector on the LAN1 port that can protect against both liquid and dust contaminants in harsh industrial environments, as well as protection against vibration and shock.

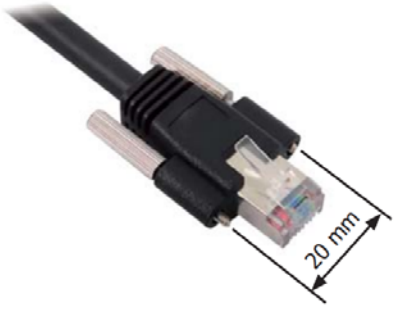
LAN2

Screw-lockable RJ-45 connector on the LAN2 port and there are screw holes (spacing 20mm) on both sides of the RJ45 connector, you can lock the RJ45 cable connector with them, to reduce the risk of the Ethernet cable falling off due to vibration occurring. Meanwhile, you can also choose a general RJ45 cable connector for your needs



▲Screw-lockable RJ45 Connector

▲Regular Ethernet Cable



▲Ethernet Cable with Screw Lock

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Power/Communication spring clamp terminal connector

The spring clamp terminal block that is used for the Power/Communication connector in the EMP-9000 offers advantages including anti-vibration, stable clamping, and easier installation.

Metal Enclosure

The EMP-9000 features a durable metal casing to provide high levels of impact resistance and flame resistance and higher protection on EMS or other electromagnetic noises.

Advanced CPU Heat Sink Design for EMP-9000 series

With the new heat sink design using a larger heat sink and fan, the specific metal mechanism design can reduce the temperature of the entire CPU by nearly 10°C; moreover, it can also extend the service life of electronic parts. We specially selected the new long-life type of cooling fan, and the fan can work for 180,000 hours by test. (180,000 hrs ≒ 20 years)., the operating temperature range is -25°C to +60°C for the EMP-9000 series.

▲Long Life CPU Heat Sink Design

▲Long Life Design

▲Regular Design

Improved storage disk performance

CFast cards used on EMP-9000 series replaces the CompactFlash(CF) card used on XP-9000 series since they support SATA III interface, enabling much faster write/read speeds.

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1.2. Specifications

The table below summarizes the specifications of EMP-9000.

Models	EMP-909x	EMP-905x	EMP-925x	EMP-965x
System Software				
OS	Windows 10 IoT Enterprise (64-bit)			
Framework Support	.Net Compact Framework 3.5~4.8			
SDK Provided	Dll for VC, Dll for Visual Studio.Net			
Multilanguage Support	English, German, French, Spanish, Portuguese, Russian, Italian, Korean, Japanese, Simplified Chinese, Traditional Chinese			
CPU Module				
CPU	E3950 (1.6~2.0 GHz, 64-bit, 4C4T)	Intel® Core™ i5-8365UE Processor (1.6 ~ 4.1 GHz, 4C8T)		
SDRAM	8 GB DDR4 SDRAM	16 GB DDR4 SDRAM		
MRAM	128 KB			
Flash(SSD)	mSATA slot with one 64 GB SSD			
EEPROM	16 KB			
Memory Expansion	CFast socket with one 32GB CFast card			
RTC (Real Time Clock)	Provide second, minute, hour, date, day of week, month, year			
64-bit Hardware Serial Number	Yes, for software copy protection			
Dual Watchdog Timers	Yes (0.8 second)			
Programmable LED Indicator	2 (L1, L2)			

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Rotary Switch	Yes (0 ~ 9)			
VGA, HDMI & Communication Ports				
Signal	VGA, HDMI			
Resolution	VGA 1920 x 1200 @ 60Hz, HDMI 4096 x 2160 @ 30P			
Ethernet Port	RJ-45, 10/100/1000M Base-TX (Auto-negotiating, Auto MDI/MDI-X, LED indicators)			
USB port	USB 2.0 x 2, USB 3.0 x 2			
COM1	Internal communication with the I-97K series modules in slots			
COM2	RS-232/485 (RxD, TxD and GND for RS-232; Data+, Data- for RS-485); 3000 V_{DC} isolated			
COM3	RS-485 (Data+, Data-); 3000 V_{DC} isolated			
Audio	Mic-in and Earphone-out			
I/O Expansion I-9K, I-97K series	N/A	N/A	Slot *2	Slot *6
Mechanical				
Dimensions (W x H x D, unit: mm)	239 x 164 x 133(W x L x H)	239 x 164 x 133(W x L x H)	300 x 164 x 133(W x L x H)	422 x 164 x 133(W x L x H)
Installation	Wall mounting / 2DIN-rail mounting			
Environmental				
Operating Temperature	-25 °C to +60 °C			
Storage Temperature	-30 °C to +80 °C			
Ambient Relative Humidity	10 % to 90 % RH (non-condensing)			
Power				
Input Range	+19 V_{DC} to +30 V_{DC}			
Isolation	2 kV			
Redundant Power Inputs	Yes, with one power relay (1 A @ 24 V_{DC}) for alarm			
Capacity	25W supply to CPU and backplane, 25W	80 W supply to CPU and backplane, 40 W supply to I/O expansion slots and USB ports, 120 W in total		

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	supply to I/O expansion slots and USB ports, 50 W in total			
Consumption	19 W (0.77 A @ 24 VDC)	30.5 W (Typical) 71 W (CPU Full Load)	31.5 W (Typical) 72 W (CPU Full Load)	32.6 W (Typical) 73 W (CPU Full Load)
Cooling				
Cooling Type	CPU Heat Sink and 180,000 hour long-life fan with Smart Fan function			

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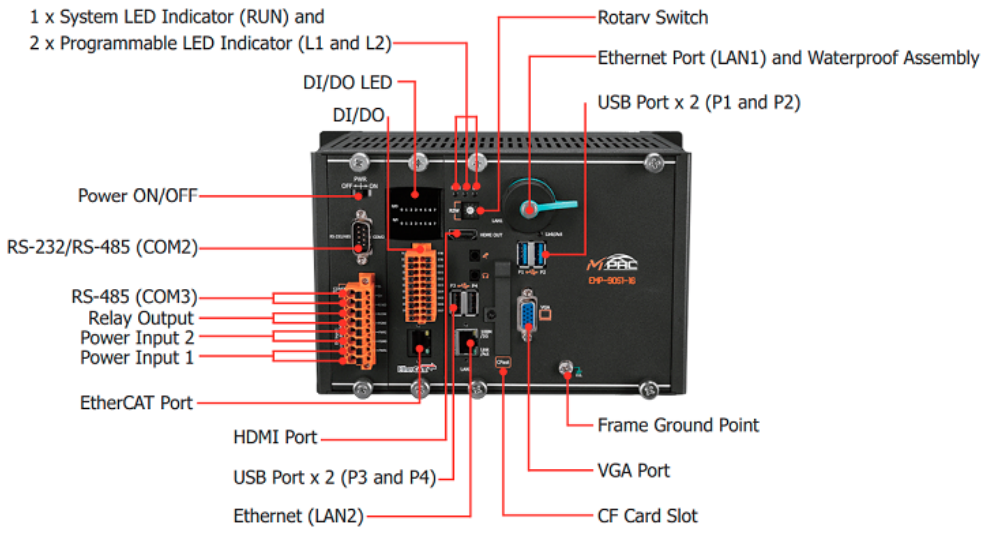
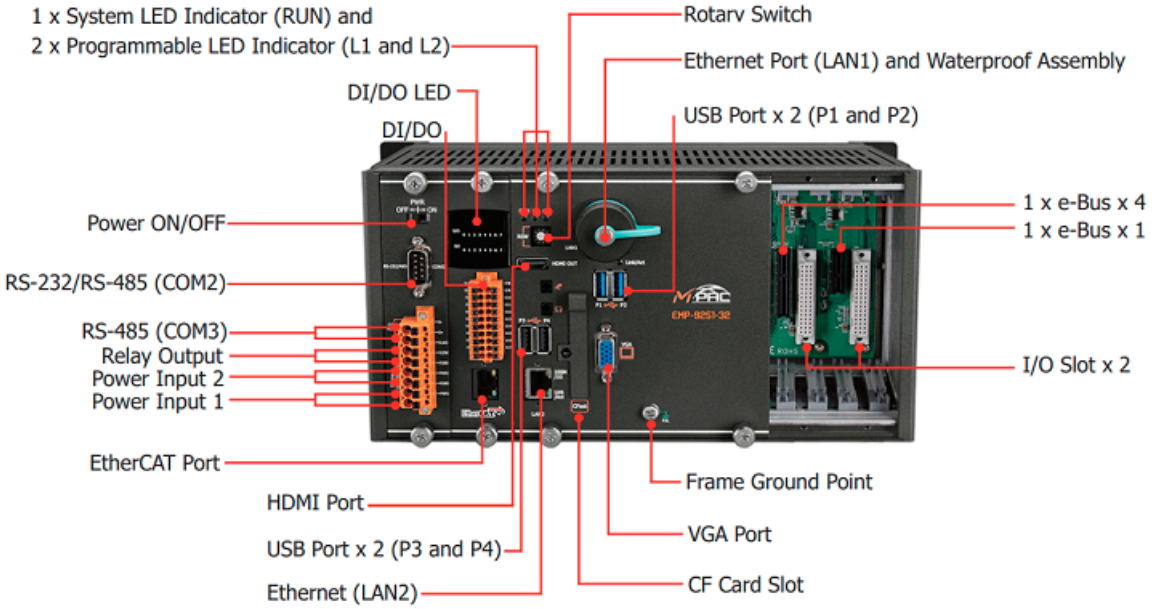
1.3. Overview

The EMP-9000 Series modules are equipped with several interfaces and peripherals that can be integrated with external systems. Here is an overview of the components and its descriptions.

EMP-90xx



EMP-925x



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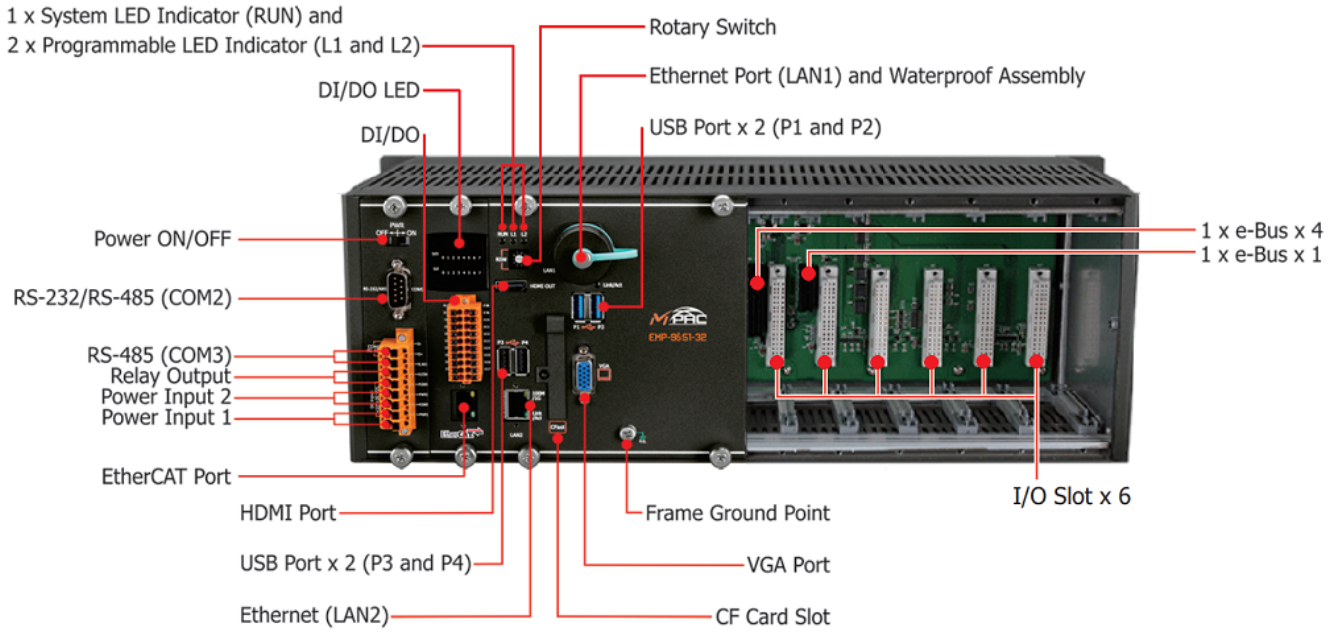
EMP-965x



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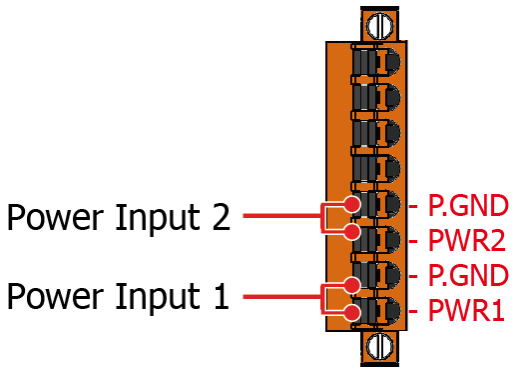
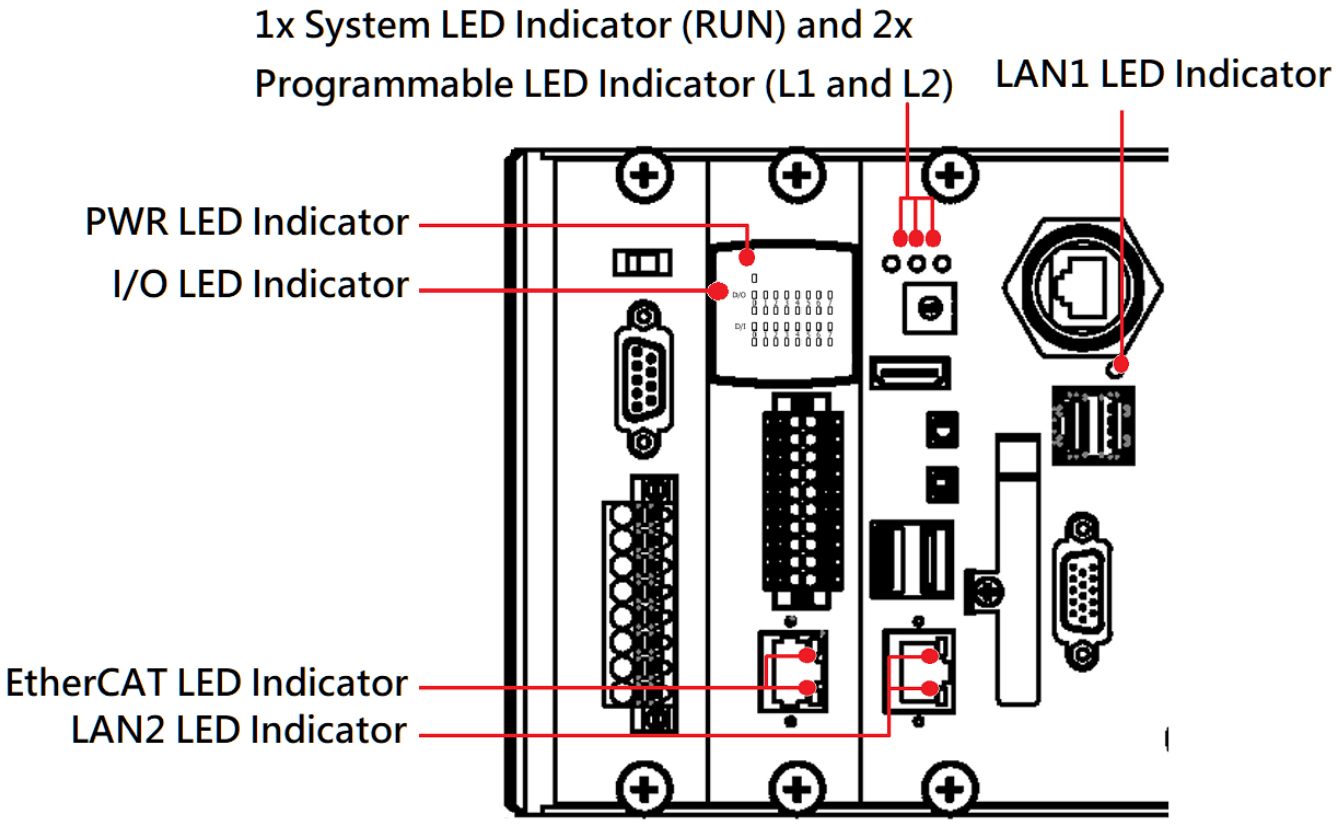
The details of these items are as follows:

Redundant Power (PWR1 and PWR2)

The EMP-9000 has a terminal with 8-wire; there are 4-wire for redundant power inputs, the details of the redundant power are shown to the side.



LED Indicators



LED Indicator	Label	State (Color)	Meaning
Programmable LED Indicators	L1 and L2	-	Programmable LED indicators
System LED indicator	RUN	Orange	Programmable LED indicators
PWR LED Indicator	PWR	Red	Power is on
LAN1 LED indicator	Link/Act	Green	The Link is active

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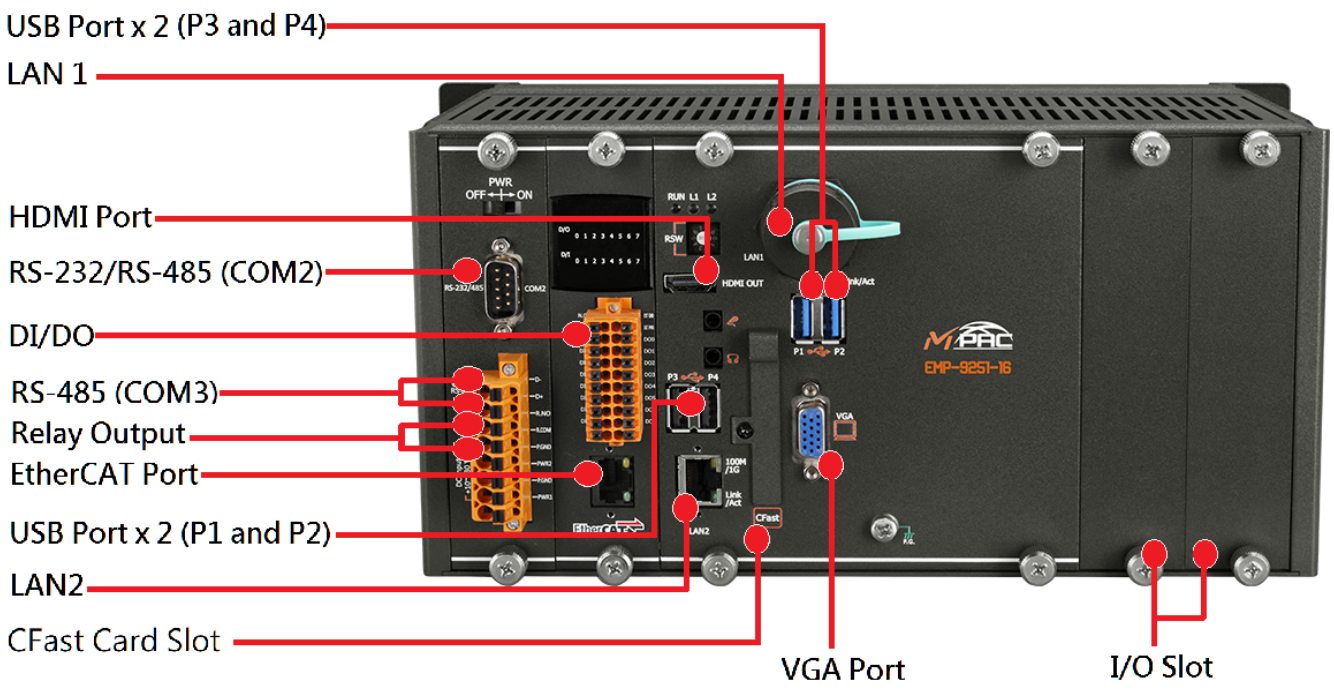
		Blinking	Network activity
	1G	Yellow	The network speed is 1 G
LAN2 LED indicator	Link/Act	Green	The Link is active
		Blinking	Network activity
	1G	Orange	The network speed is 1 G
EtherCAT LED indicator	Link/Act	Green	The Link is active
		Blinking	Network activity
I/O LED indicator	DI/DO	Green/Red	DI/DO is activity

Communication Ports



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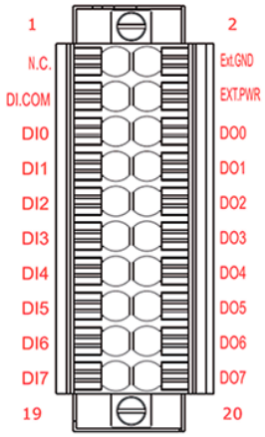
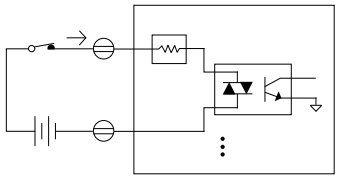
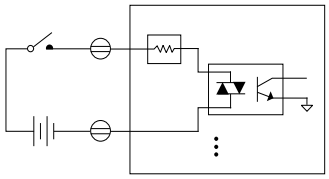
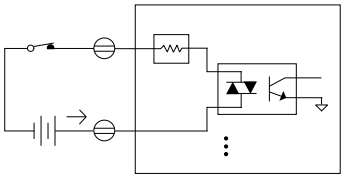
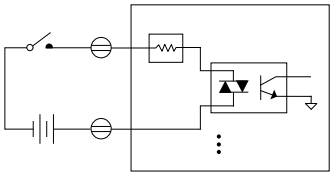
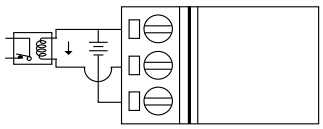
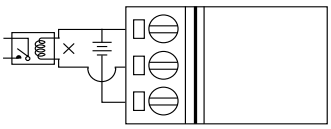
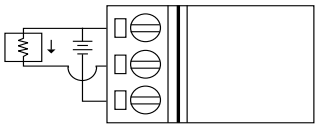
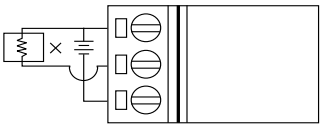
● **DI/DO**

The EMP-9000 has Local 8 DI/DO that can be used



Digital Input	Readback as 1	Readback as 0
Sink	+19 ~ +24 V_{DC}	OPEN or < 11 V_{DC}
		
Source	+19 ~ +24 V_{DC}	OPEN or < 11 V_{DC}
		

Digital Output	ON State Readback as 1	OFF State Readback as 0
Driver Relay		
Resistance Load		

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- **CFast Socket with a CFast Card Inside**

  The EMP-9000 comes with a CFast card inside the CFast socket. The CFast card can be used to restore the EMP-9000 system and expand the memory up.

- **LAN Ports, LAN1 and LAN2**

  The EMP-9000 has two Ethernet ports that can be used to connect the router to the Internet or to other devices.

- **USB 2.0 Ports, P1, P2, USB 3.0 Ports, P3 and P4**

  The EMP-9000 has four USB 2.0/3.0 ports that can be used to connect the USB devices such as mouse, keyboard or an external USB hard drive.

- **Relay Output**

  The EMP-9000 has a relay output that can be used to control a light, siren, or other low voltage device when an alarm occurs.

- **VGA Port**

  The EMP-9000 has a VGA port that can be used with a variety of supported VGA resolutions, and the output resolution covers, 1920 x 1200.

- **HDMI Port**

  The EMP-9000 has a HDMI port that can be used with a variety of supported HDMI resolutions, and the output resolution covers, 4096 x 2160.

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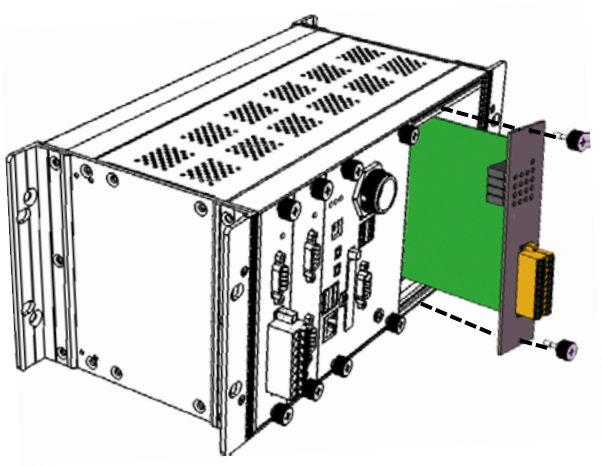
- **COM1, Expansion I/O Slot**

The EMP-9000 has 2/6 I/O slots that can be used to integrate high performance parallel I/O modules (I-9K Series) or serial I/O modules (I-97K series).



- **COM2 (RS-232/RS-485)**

The COM2 port is a 9-pins RS-232/RS-485 connector that can be configured as either RS-232 or RS-485, that only can select one at a time and its configuration depends on the pin connections as follows:

RS-232 (RXD, TXD and GND)

RS-485 (Data+ and Data-)

There is no software configuration or hardware jumper needed.

The details of the COM2 port specifications are shown to the side.

Note: 16C550 compatible

Port Type: Male

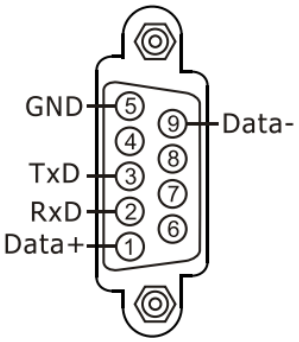
Baud Rate: 115200, 57600, 38400, 19200, 9600, 4800, 2400, 1200 bps

Data Bits: 5, 6, 7, 8

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

Stop Bits: 1, 2

FIFO: 64 bytes



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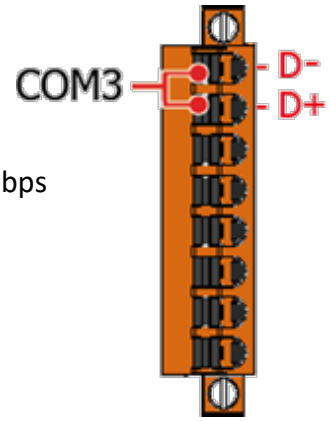
- **COM3 (2-wire RS-485)**



Note: 16C550 compatible

Port Type: Terminals

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: 128 bytes

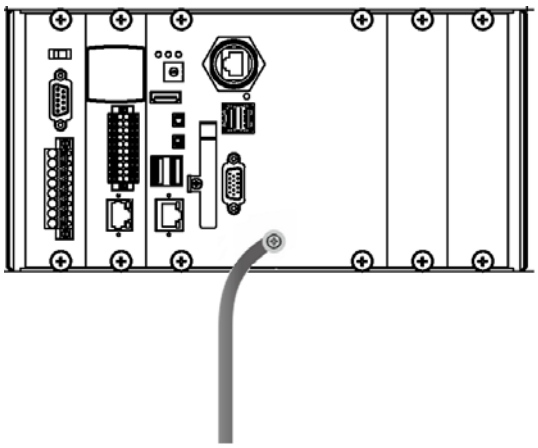
Tips & Warnings

The table below shows the data bit and their corresponding stop bit for COM2 and COM3.

Word Length	Number of Stop Bits
5, 6, 7, 8	1
5	1.5
6, 7, 8	2

Frame Ground Point

The frame ground point is a small piece of metal that can be used to terminate the shield.



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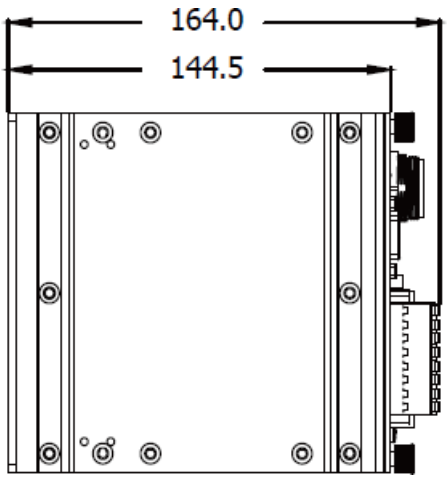
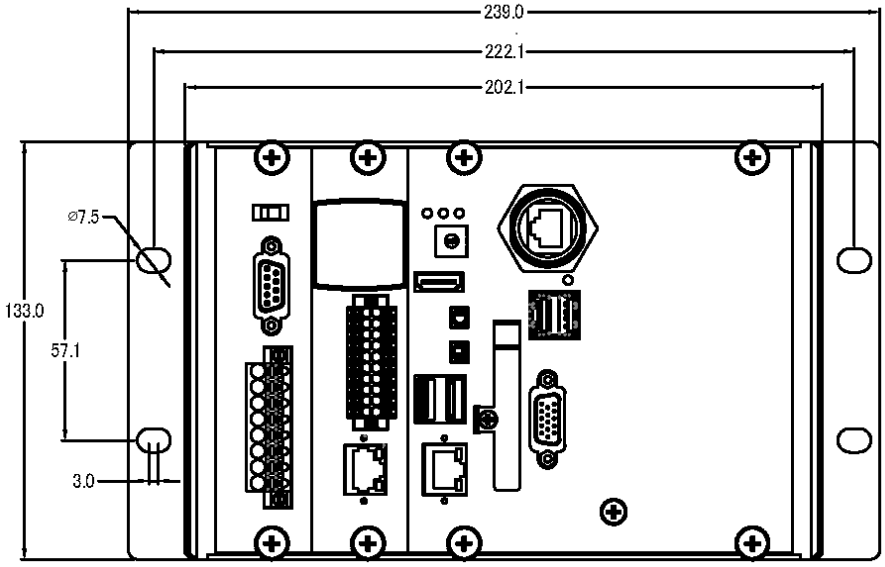
1.4. Dimensions

The diagrams below provide the dimensions of the EMP-9000 to use in defining your enclosure specifications. Remember to leave room for potential expansion if you are using other components in your system.

The height dimension is the same for all EMP-9000. The width depending on your choose of I/O expansion slots. All dimensions are in millimeters.



EMP-90xx



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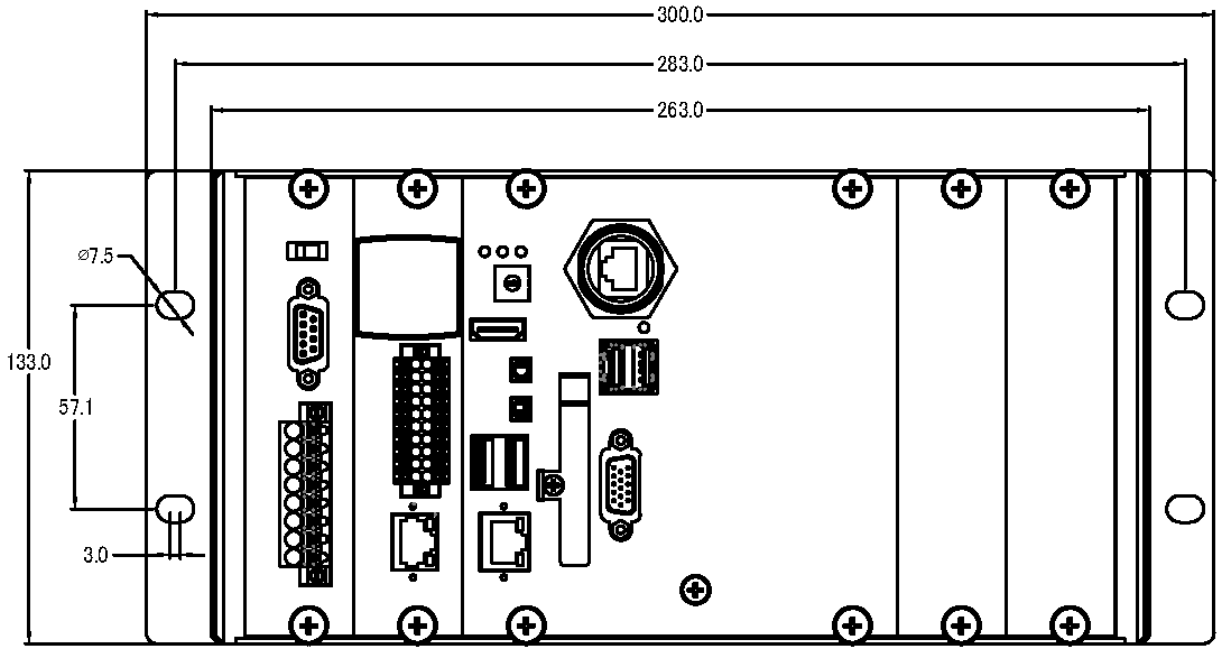
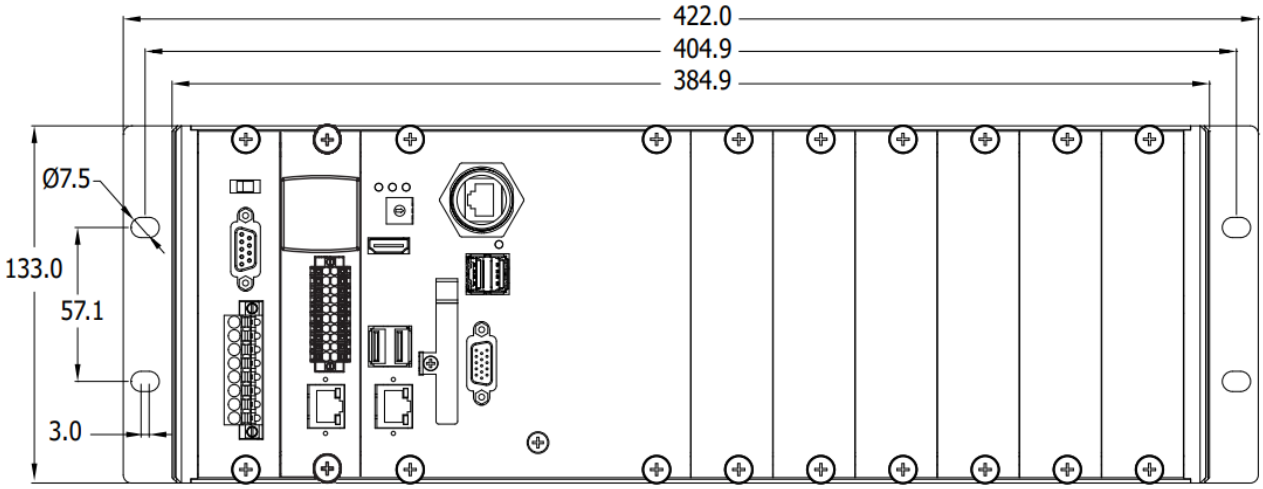
EMP-92xx



EMP-96xx



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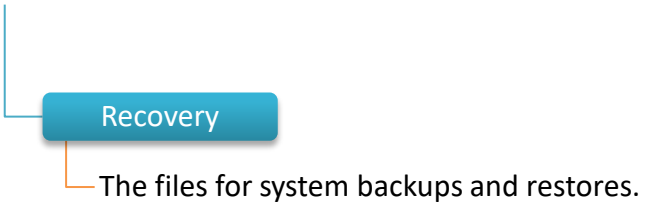
1.5. Rescue CFast Card

The EMP-9000 comes with a rescue compact flash card that supports rescue mechanism for the EMP-9000. All of them are listed below.

Rescue CF Card



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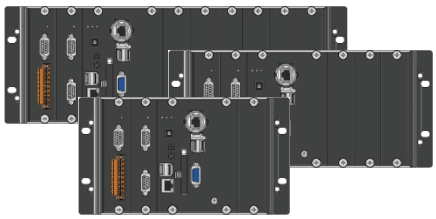
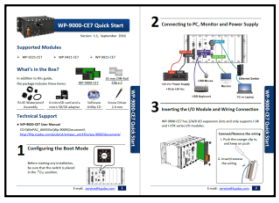
2. Getting Started

This chapter provides a guided tour of the EMP-9000 installation and configuration that describes the steps needed to download, install, configure, and run the basic procedures for user working with the EMP-9000 for the first time.

Before starting any task, please check the package contents. If any of the following package contents are missing or damaged, contact your dealer, distributor.



EMP-9091-16/EMP-9091-32
EMP-9098-16/EMP-9098-32
EMP-9051-16/EMP-9051-32
EMP-9058-16/EMP-9058-32
EMP-9251-16/EMP-9251-32
EMP-9258-16/EMP-9258-32
EMP-9651-16/EMP-9651-32
EMP-9658-16/EMP-9658-32



Quick Start Guide

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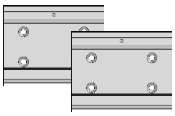
RJ-45 Waterproof Assembly



44 mm DIN-Rail Clip * 2

M3x6L Screw * 8

CFast socket with one CFast Card

Screw Driver (1C016) 2.4 mm

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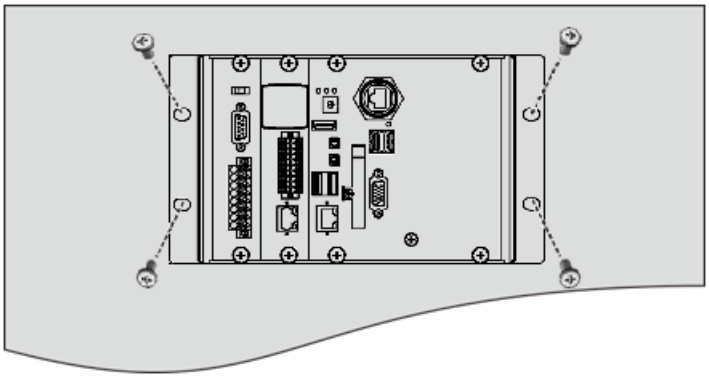
2.1. Mounting the EMP-9000

The EMP-9000 can be mounted either directly to a wall/panel, or onto a stainless 35mm DIN rail.

Wall/Panel mounting

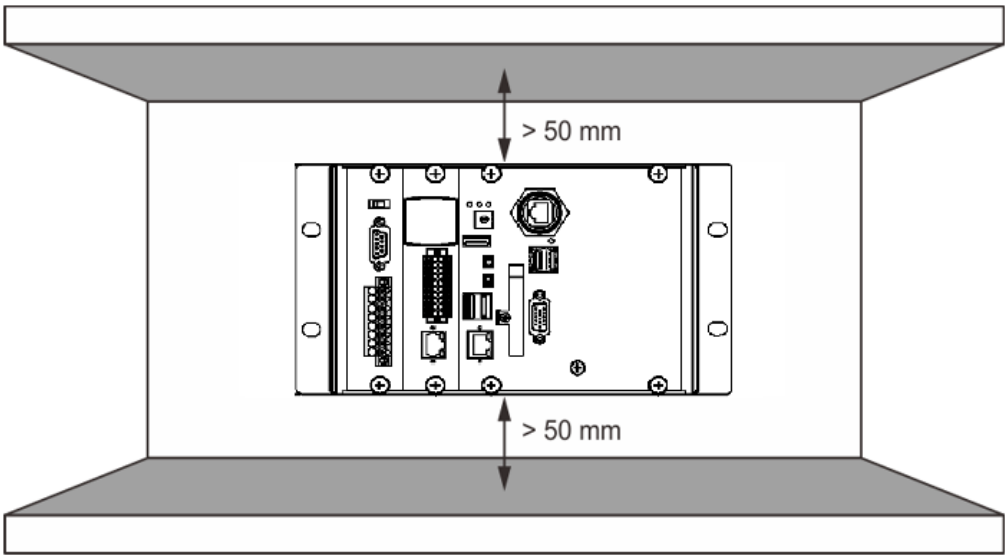
Step 1: Install the four mounting screws into the 4 keyhole mounting holes

Step 2: Fasten the screws securely



Tips & Warnings

There must be a minimum clearance of 50mm between the EMP-9000 and the top and bottom side of the enclosure panel.



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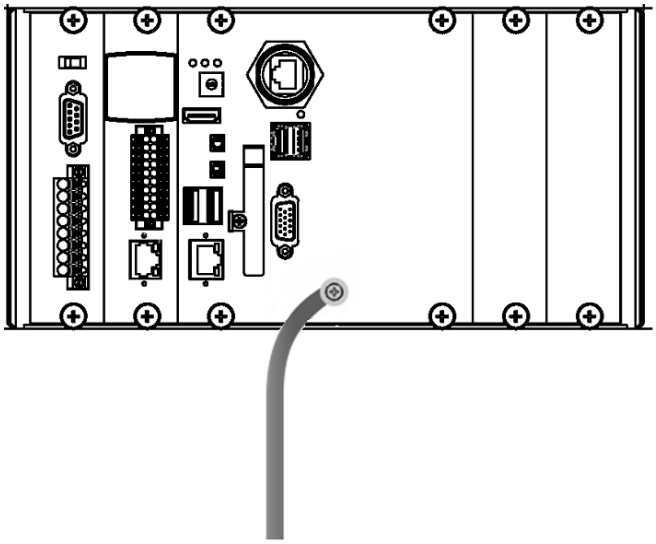
Step 3: Connect the ground lead to the frame ground point



Tips & Warnings

A good common ground reference (earth ground) is essential for proper operation of the EMP-9000. One side of all control circuits, power circuits and the ground lead must be properly connected to earth ground by either installing a ground rod in close proximity to the enclosure or by connecting to the incoming power system ground. There must be a single-point ground (i.e. copper bus bar) for all devices in the enclosure that require an earth ground.

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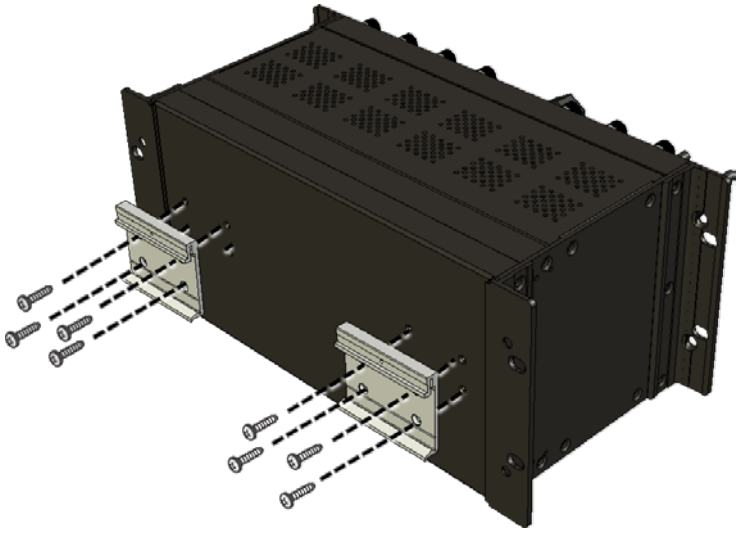
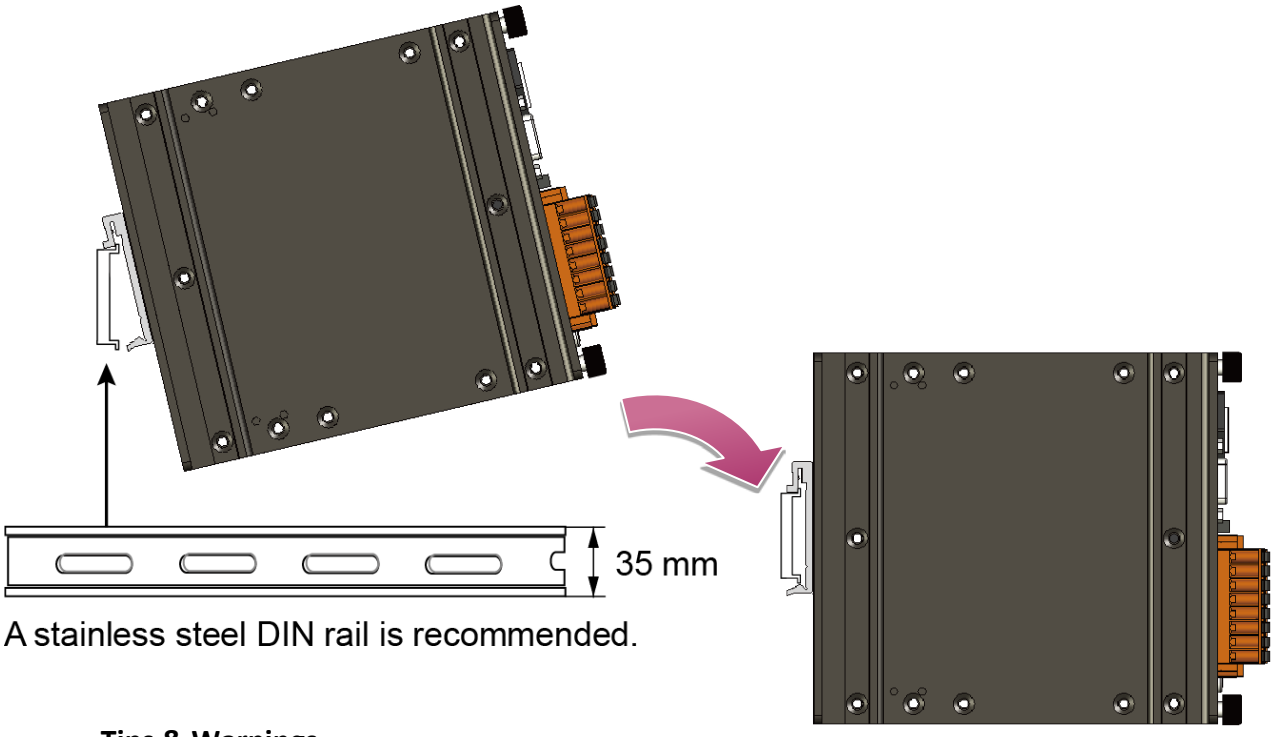
DIN Rail mounting

Step 1: Fasten the DIN rail clip to the EMP-9000



Step 2: Clip the device onto a stainless DIN rail



Tips & Warnings

For DIN rail mounting, it is strongly recommended that only a stainless steel DIN rail be used to support the weight of EMP-9000 system, providing stability and preventing EMP-9000 from leaning

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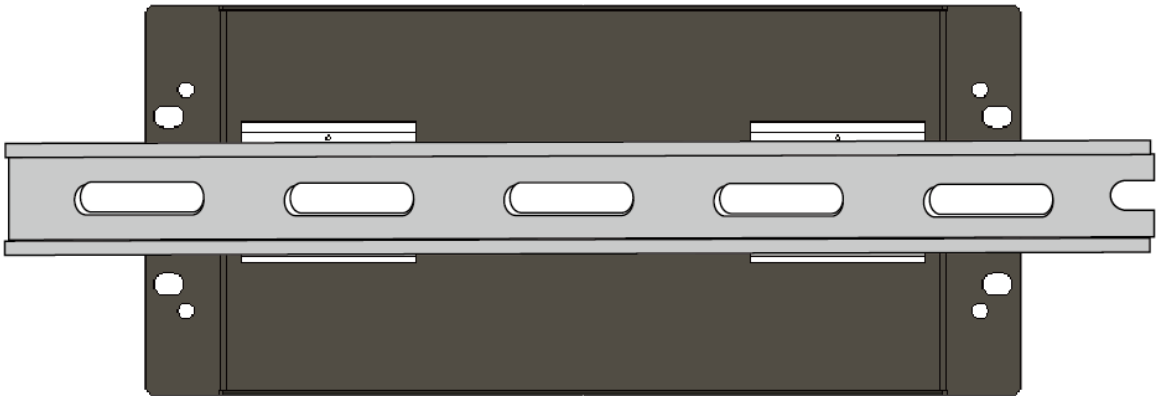

Step 3: Connect the ground lead to the frame ground point

Tips & Warnings

A good common ground reference (earth ground) is essential for proper operation of the EMP-9000. One side of all control circuits, power circuits and the ground lead must be properly connected to earth ground by either installing a ground rod in close proximity to the enclosure or by connecting to the incoming power system ground. There must be a single-point ground (i.e. copper bus bar) for all devices in the enclosure that require an earth ground.

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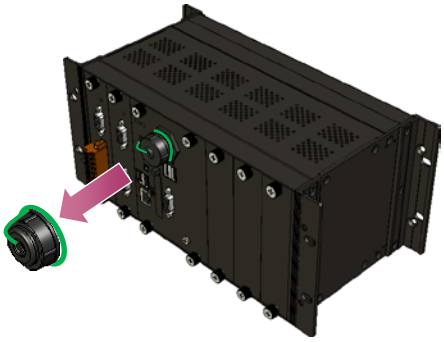
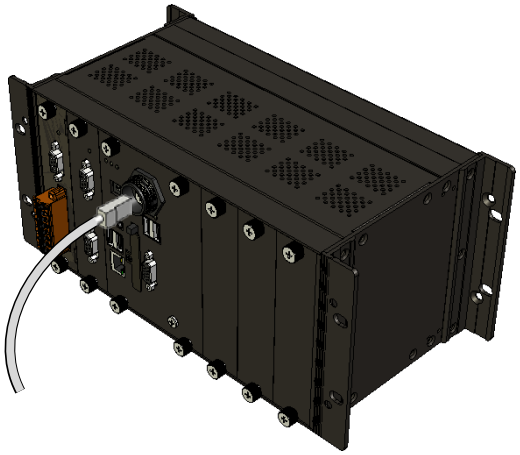
2.2. Installing the RJ-45 waterproof connector assembly

The EMP-9000 is equipped with an RJ-45 waterproof connector to protect the connection in vibrate environment.

The RJ-45 waterproof connector is optional for use with LAN1 port. If you do not need the RJ-45 waterproof connector, you can remove the cap and just plug in a regular Ethernet cable.





If you want to use the RJ-45 waterproof connector for protecting the connection, follow the instructions below.

Step 1: Remove the RJ-45 connector from the RJ-45 cable

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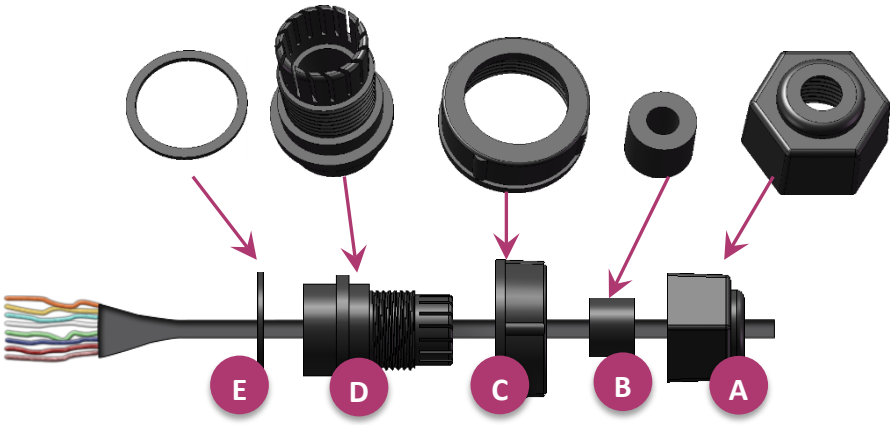
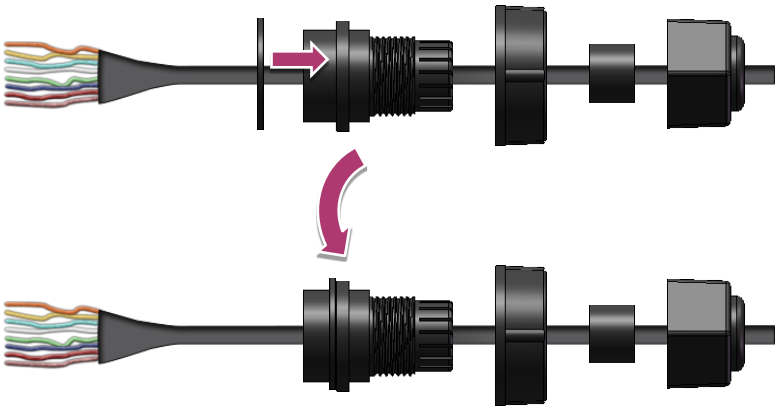
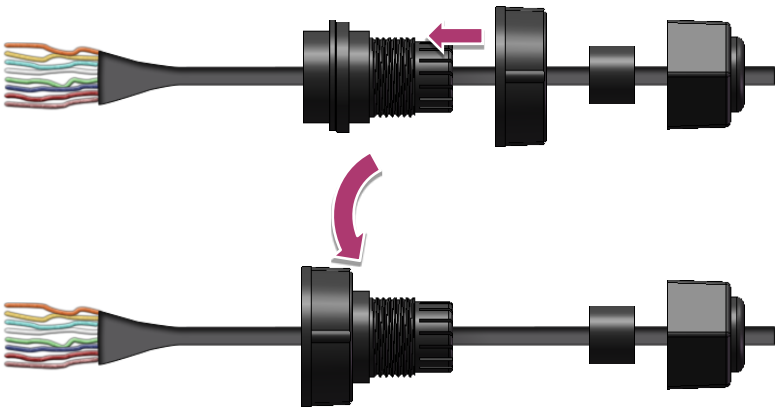
Step 2: Feed the end of the RJ-45 cable through the (A) sealing nut, (B) rubber sealing insert, (C) cable gland base, (D) clamping ring and (E) panel gasket



Step 3: Wrap the (E) panel gasket around the (D) clamping ring



Step 4: Wrap the (C) cable gland base around the (D) clamping ring



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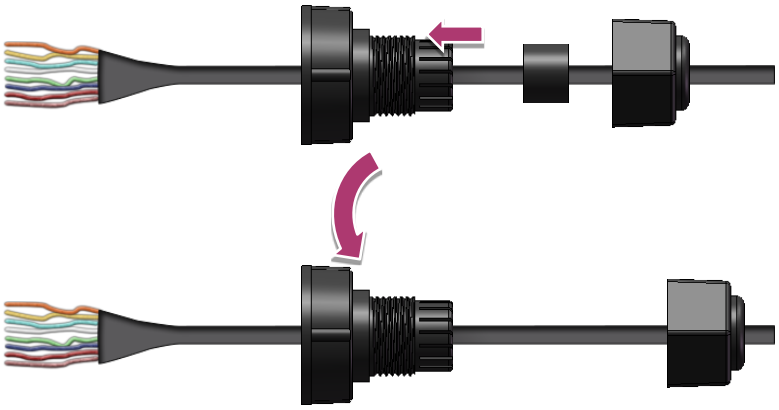
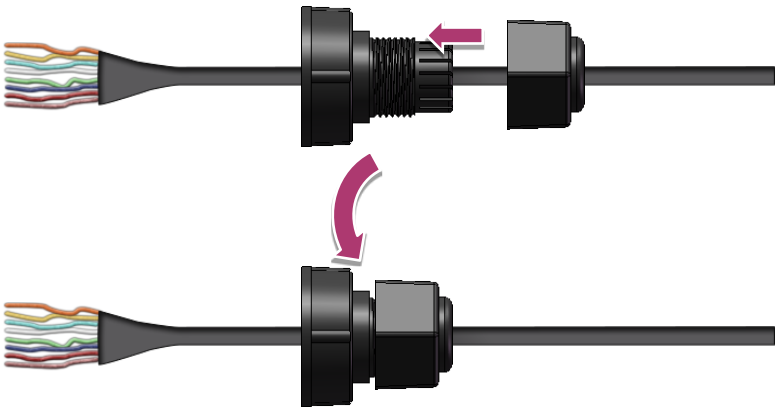
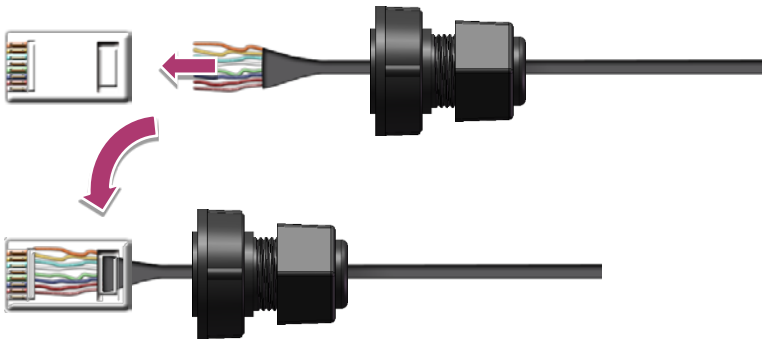
Step 5: Insert the (B) rubber sealing insert into the (D) clamping ring



Step 6: Push the (E) sealing nut forward and Hand-tighten it to seal the assembly



Step 7: Insert the RJ-45 cable into the RJ-45 connector



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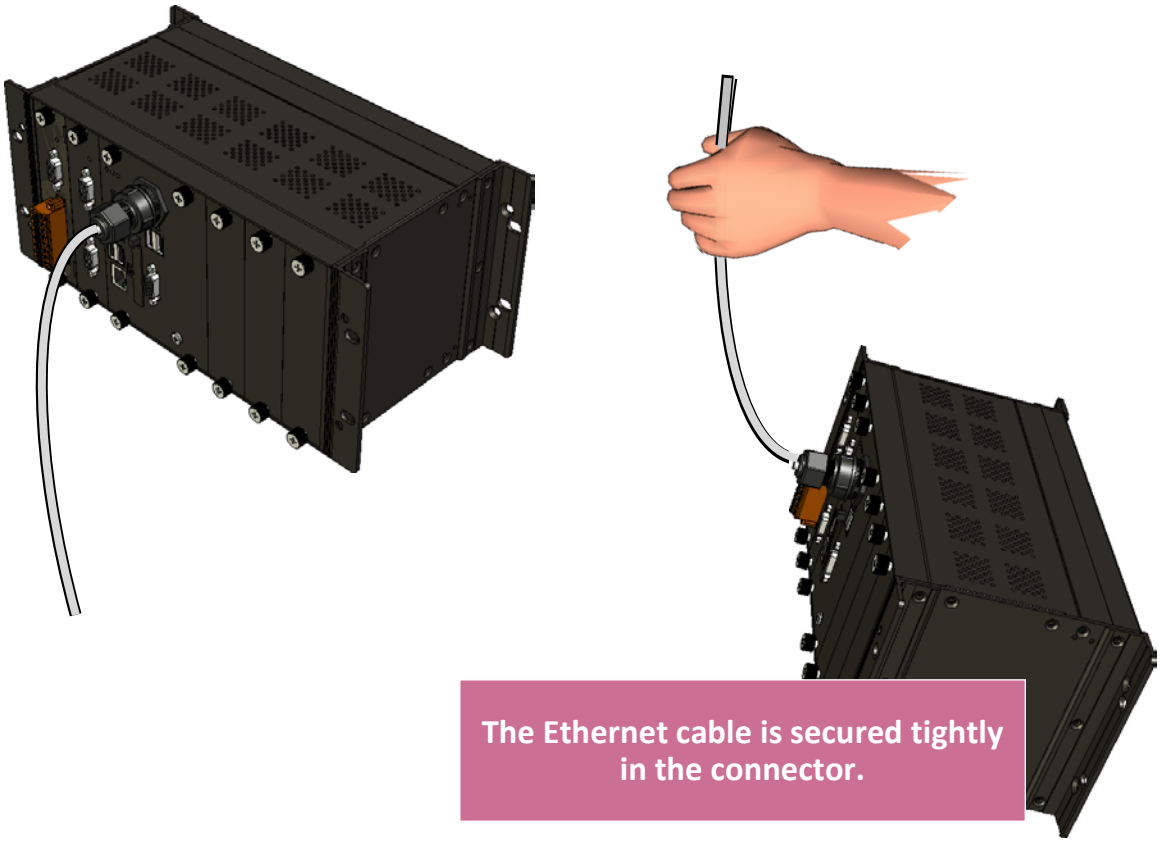
Step 8: Push the RJ-45 waterproof connector ass grabembly forward

Step 9: Insert the Ethernet cable and screw the RJ-45 waterproof into the receptacle



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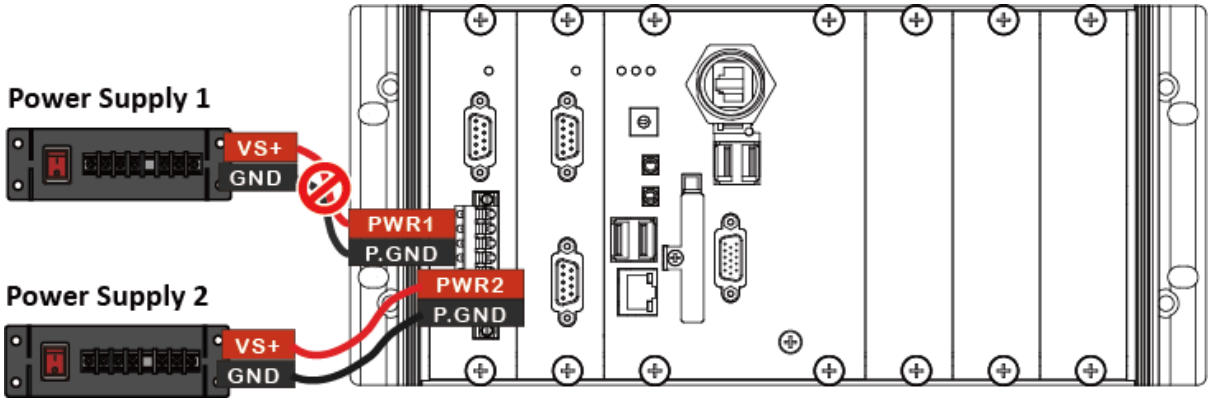
2.3. Deploying a Basic EMP-9000 System

The EMP-9000 provides a variety of communication interface to suit a range of application. Here is a simple application for using the EMP-9000.

Step 1: Connect the positive terminal (+) of the power supply to the terminal PWR1/2 and the negative terminal (-) of the power supply to the P.GND

Tips & Warnings

1. The input range of power supply is +10 to +30 V_{DC}.
2. The EMP-9000 have two power inputs that can be connected simultaneously to the two independent power sources. If one power source fails, the other source takes over automatically. Redundant power input help assure non-stop operation of the EMP-9000.



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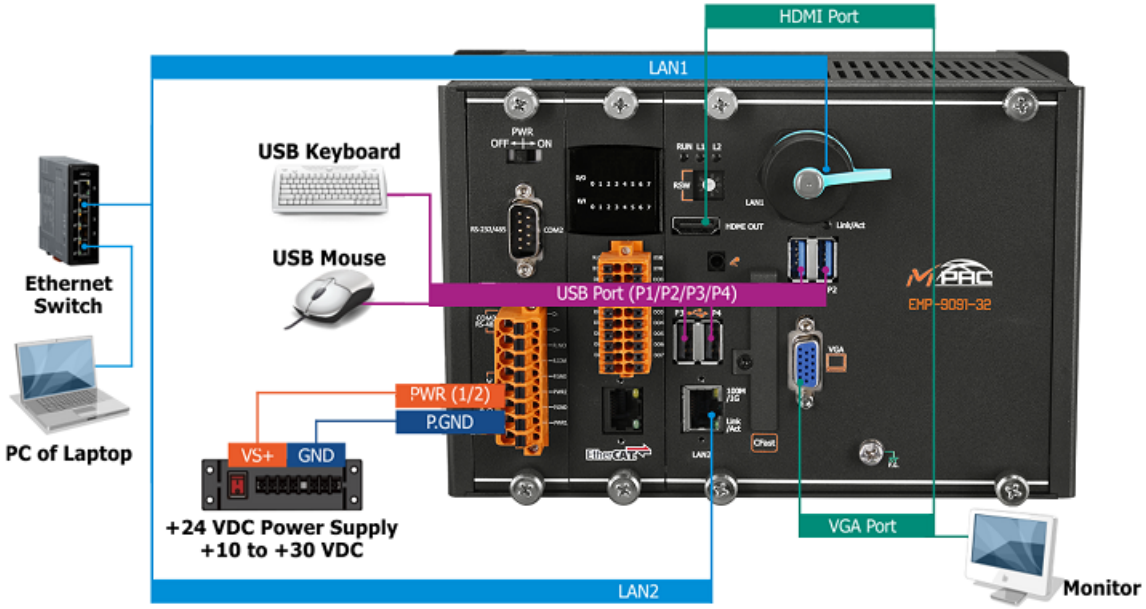
Step 2: Connect the USB mouse or the USB keyboard to the USB port

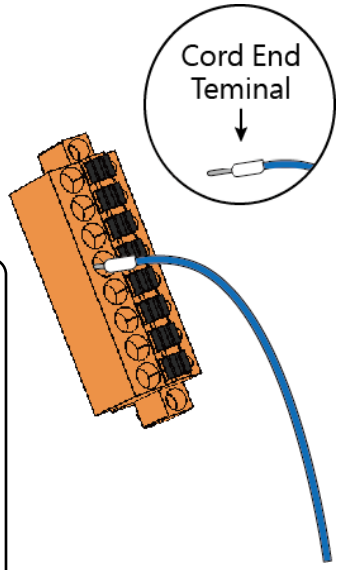
Step 3: Connect the monitor to the VGA or HDMI port

Step 4: Connect to PC or the laptop to the LAN port via an Ethernet switch



Tips & Warnings

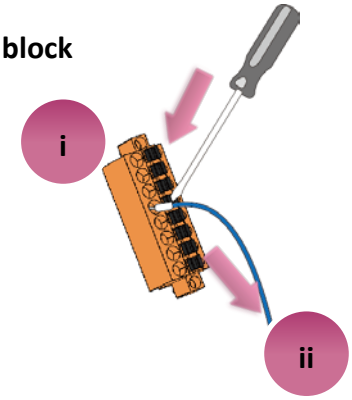
The metal part of the cord end terminal on the wire can be direct wired to the terminal.



Remove the wiring from the terminal block

i. Use the screwdriver to push the black clip in

ii. Remove the wiring



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2.4. Inserting the I/O Modules

EMP-9000 has 2/6 I/O expansion slots to support I-9K and I-97K series I/O modules.

EMP-9000 also has 1 e-Bus I/O slots to support e-9K series I/O expansion modules.

Before choosing the right I/O modules, you first need to know the I/O expansion capacities in order to choose the best expansion module for achieving maximal efficiency. For more information about the I/O expansion modules that are compatible with the EMP-9000, please refer to:

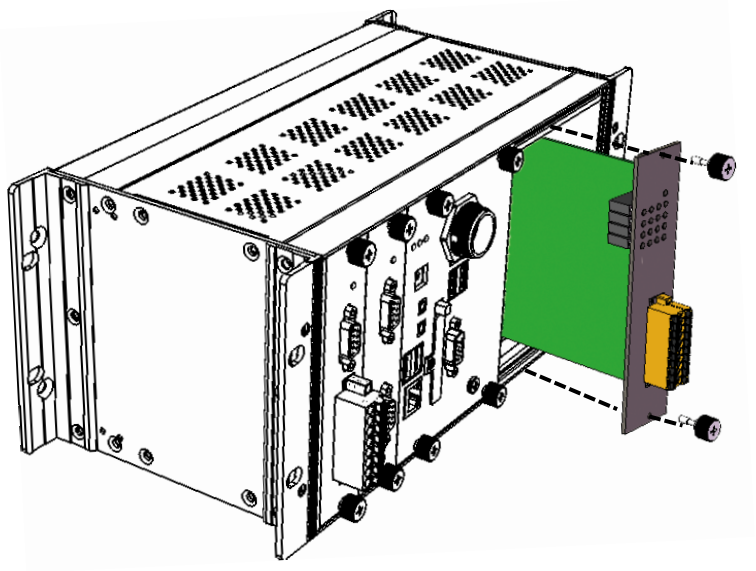
I-9K and I-97K series

https://www.icpdas.com/en/product/guide+Remote_I_O_Module_and_Unit+PAC_%EF%BC%86amp;_Local_I_O_Modules+I-9K_I-97K_Series

e-9K series

https://www.icpdas.com/en/product/guide+Remote_I_O_Module_and_Unit+PAC_%EF%BC%86amp;_Local_I_O_Modules+e-9k_Series#384

Step 1: Insert the I/O module



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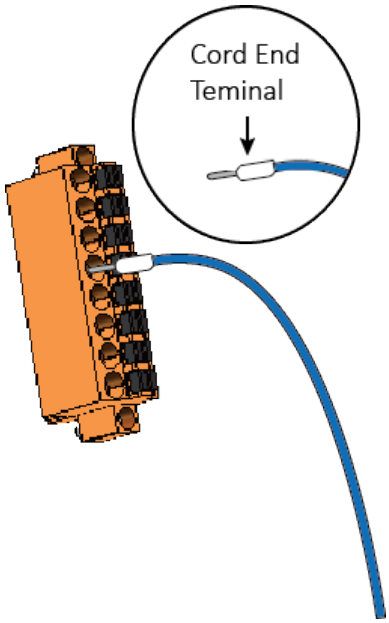
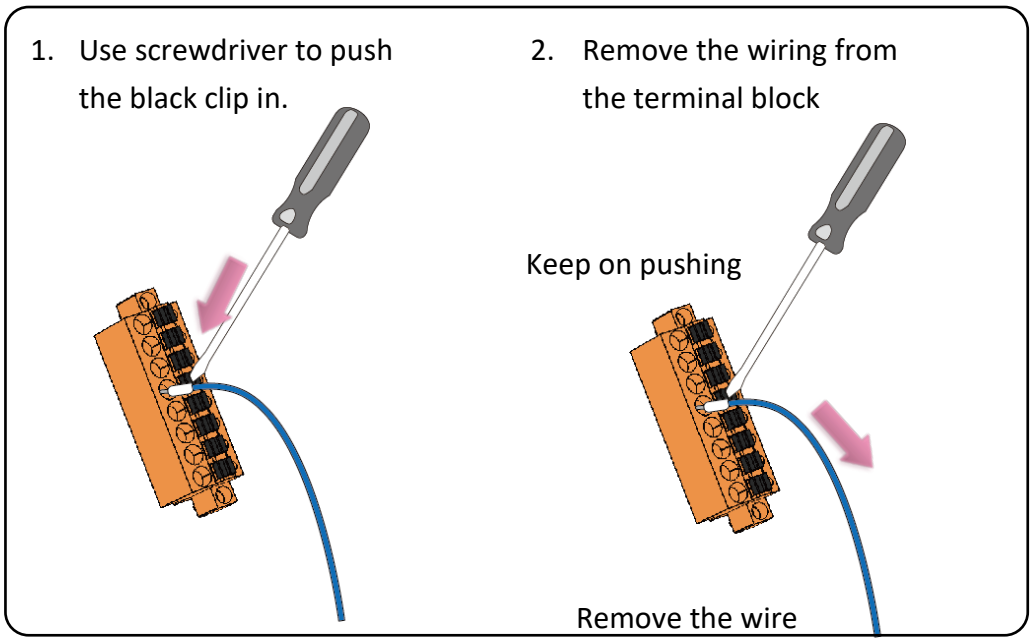
Step 2: Wiring connection

The metal part of the cord end terminal on the wire can be direct wired to the terminal of EMP-9000.





Tips & Warnings

If you do not expand the I/O module full, please keep the top case of the unused slot to protect the backplane from dirt, dust and damage from foreign objects.

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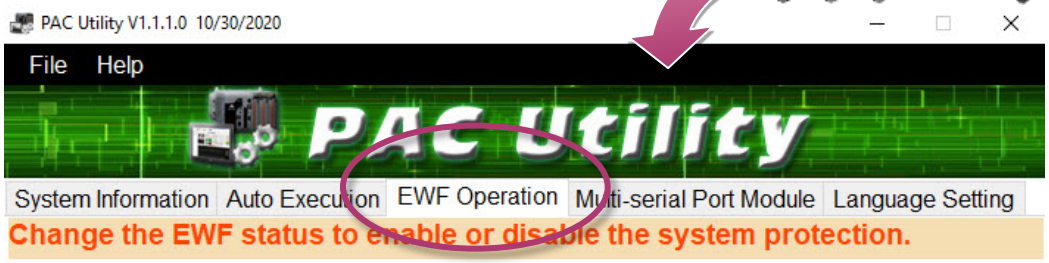
2.5. Disable UWF to Allow Settings to Be Saved

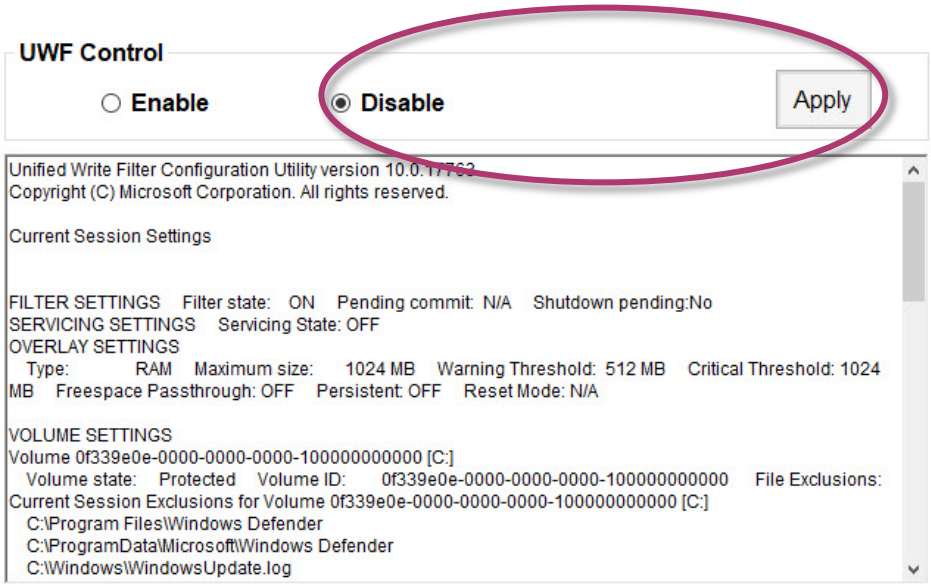
The UWF is a safety mechanism that provides the ability to control write protection of the EMP-9000 system built in C: drive. Any changes made to the system are lost when the start restarts while UWF is enabled, unless they are committed to the system.

For more details about the UWF, please refer to section 3.4. Configuring the UWF Manager.

1. Click the PAC Utility shortcut on the desktop

2. Click the UWF Operation tab, select the Commit check box, and then click Apply button





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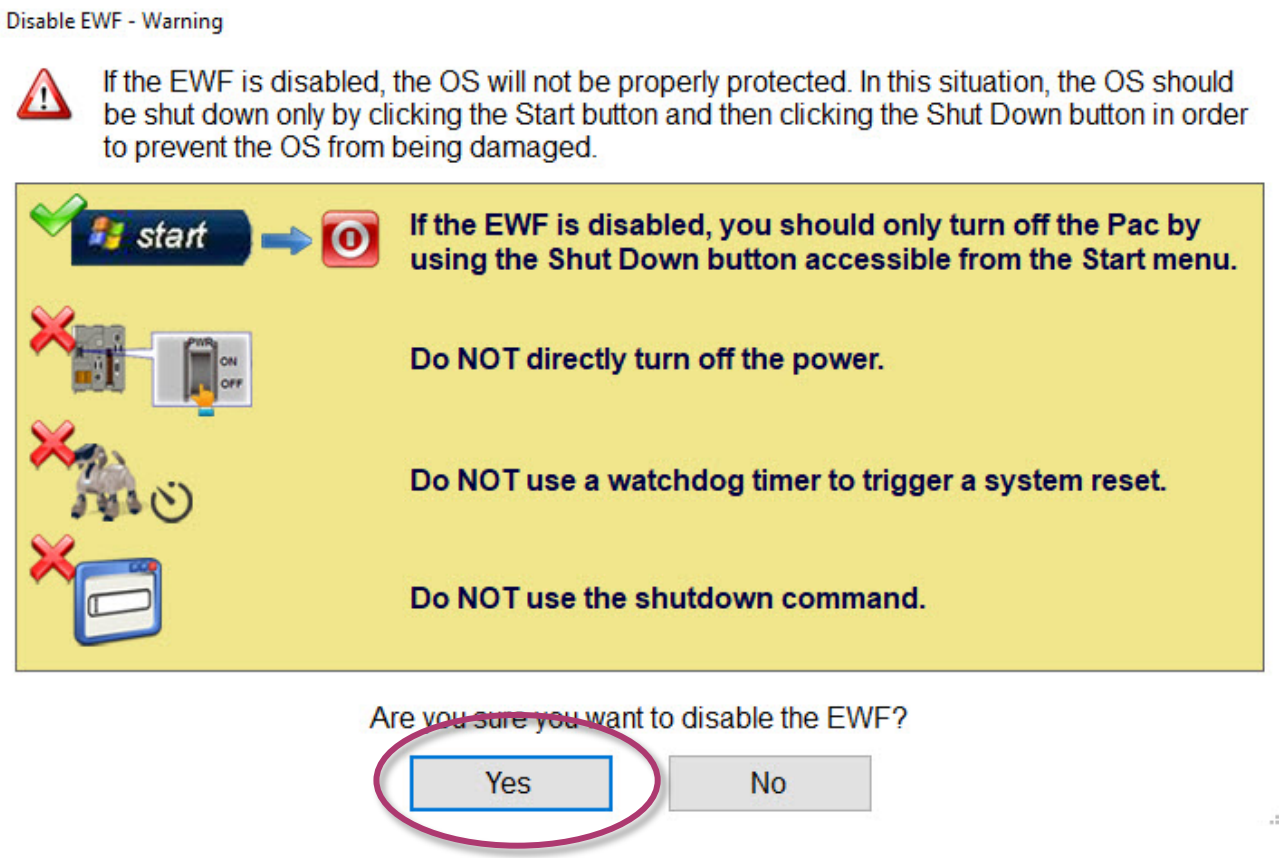
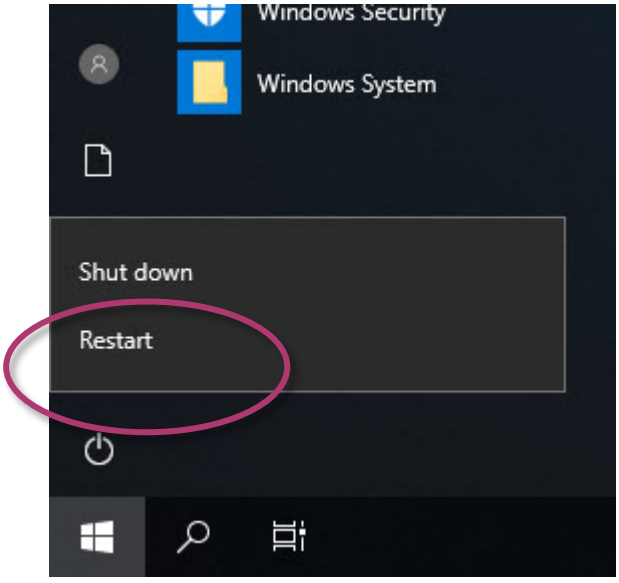
3. Click Yes button In the pop-up dialog box



4. Click the Start button , click the power button , and then click Restart for changes to take effect.



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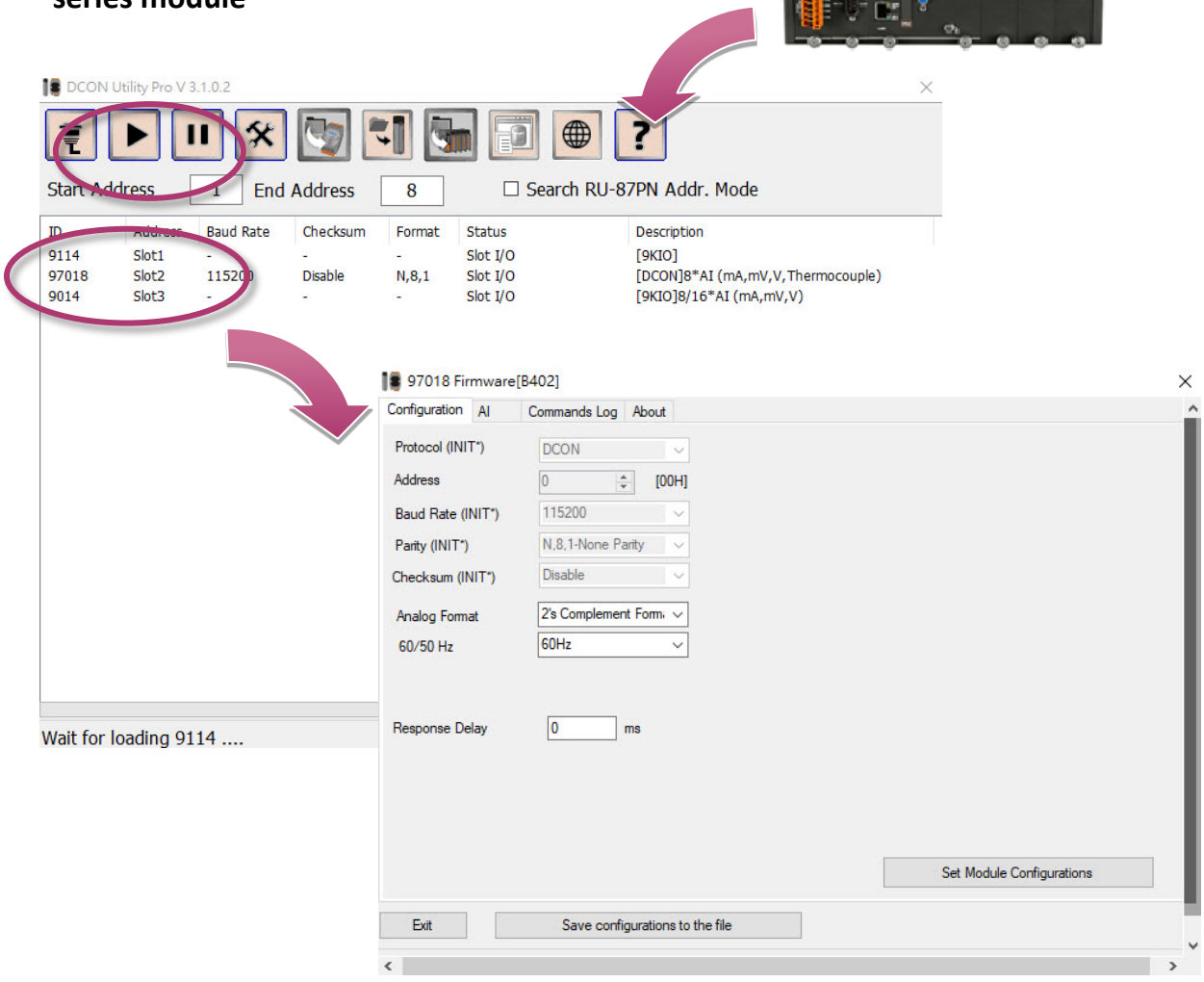
2.6. Using DCON Utility Pro to Configure I/O Modules

DCON Utility Pro is a tool kit designed to quickly control and manage I-97K series expansion I/O modules.

1. Click the DCON Utility Pro shortcut on the desktop

2. Click the Search button

3. Click the module name to configure the I-97K series module



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3. Security and Risk

This chapter provides information of technological security risks and solutions associated with the EMP-9000 services.

Security is important for EMP-9000. Based on Windows 10 IoT, EMP-9000 can avoid many security vulnerabilities. The following provides some security policy that you should consider before you develop your EMP-9000.

- Windows Firewall
- UWF (Unified Write Filter)

The following table provides the default settings of the EMP-9000 security policy.

Security Item	Default Settings	User Name	Password
Firewall	Enable	N/A	N/A
UWF	Enable	N/A	N/A

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3.1. Creating and Managing User Accounts

Based on Windows 10 IoT, EMP-9000 includes several components for managing user account names, groups, and passwords.

- The Administrator Account component allows you to specify the password for the local Administrator account. You can only include one Administrator Account component in your configuration.
- The User Account component allows you to specify the user name, group, and password for a local user account. You must add a separate User Account component for each user in your configuration.
- Additional components are required if you want to provide end-user access to account settings, passwords, and display names in User Accounts in Control Panel.

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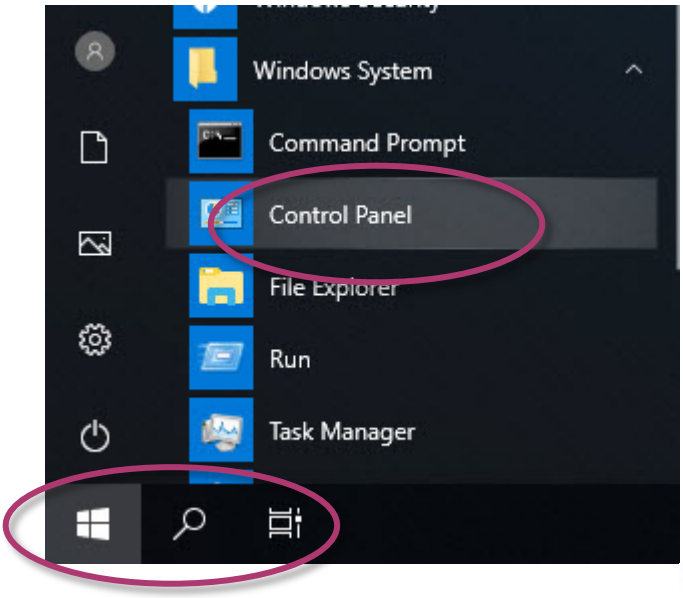
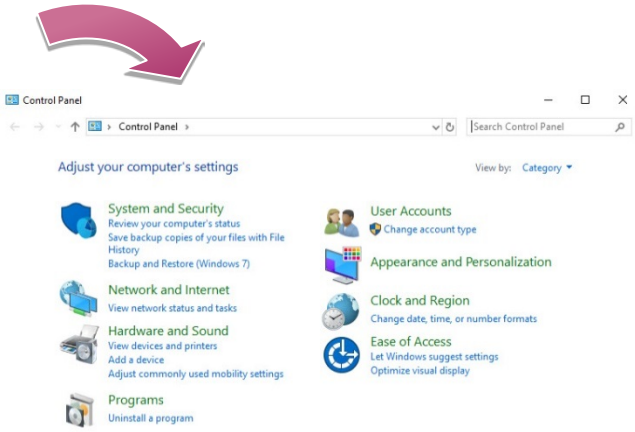
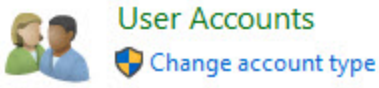
To open the user accounts tool

1. Click the Start button , find Control Panel then click it.





2. Click the User Accounts and Family Safety



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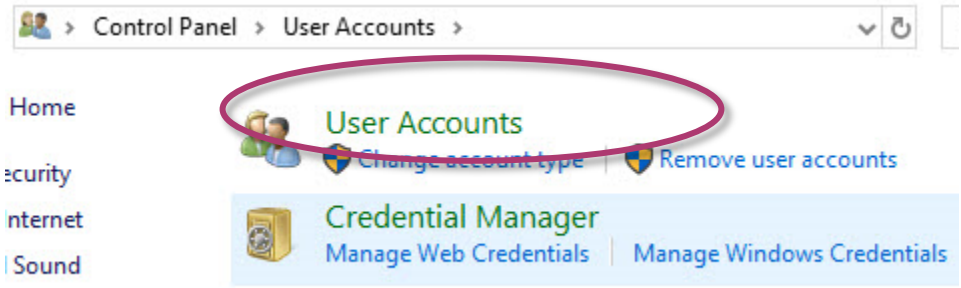
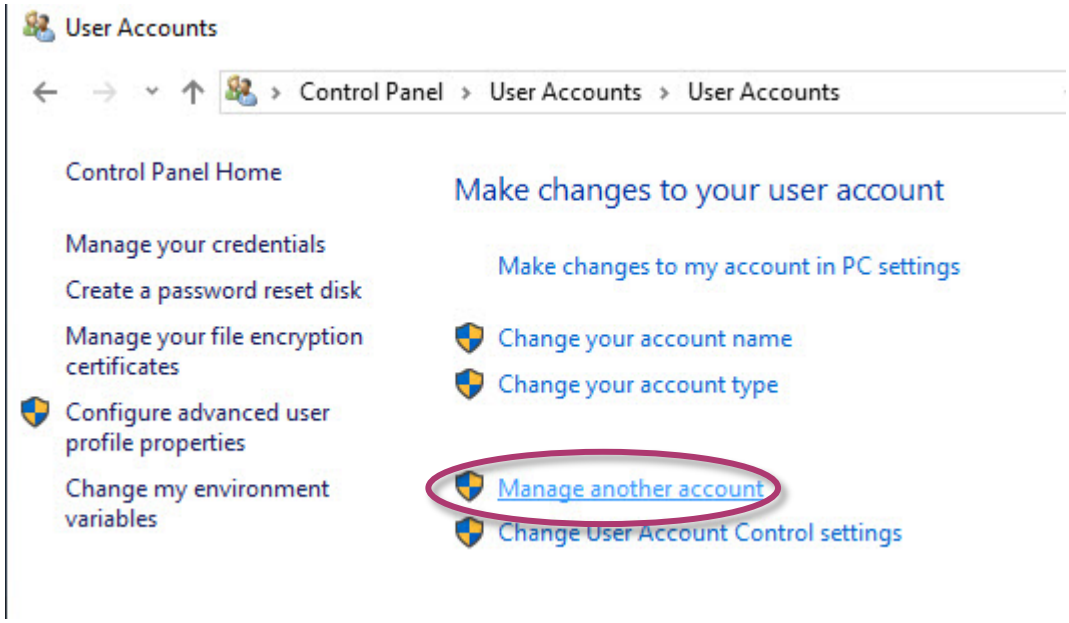
To create a new use account

1. Click user accounts



2. Click the Manage another account



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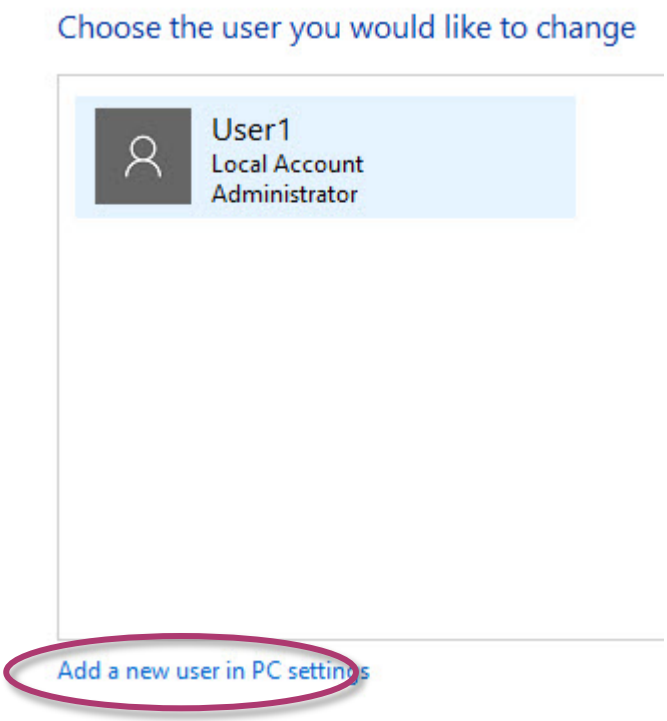
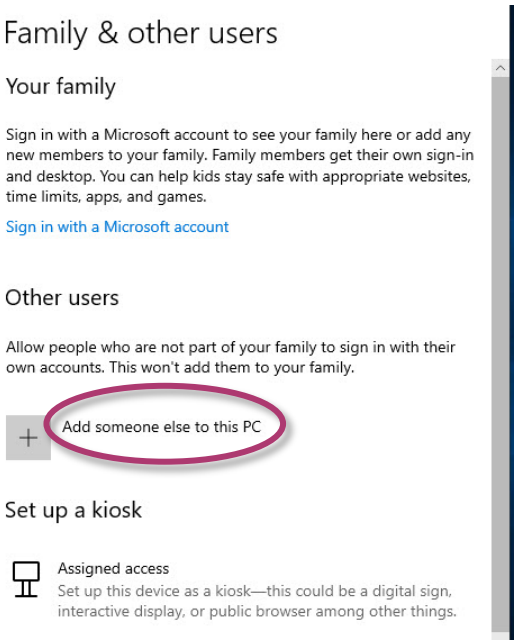
3. Click Add a user in PC settings



4. Click Add someone else to this PC



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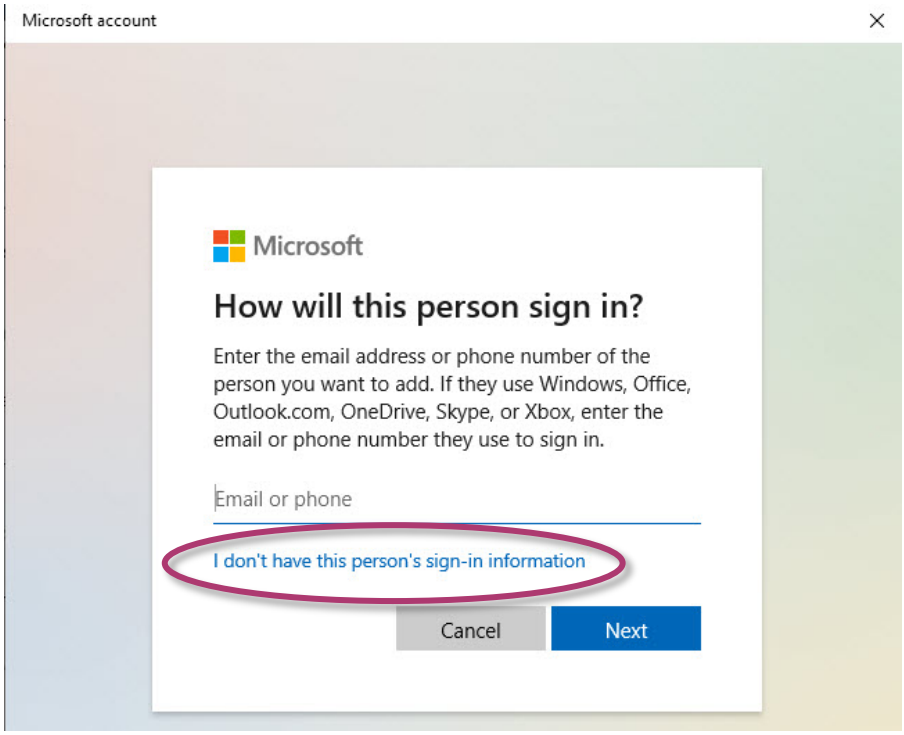
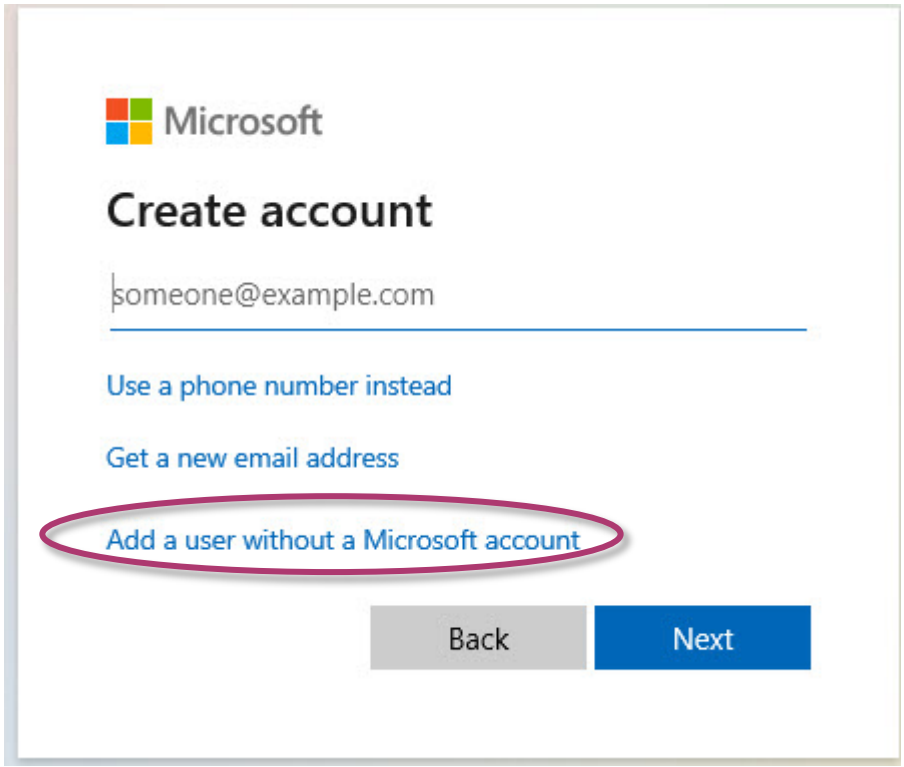
5. Click I don't have this person's sign-in information



6. Click Add a user without a Microsoft account



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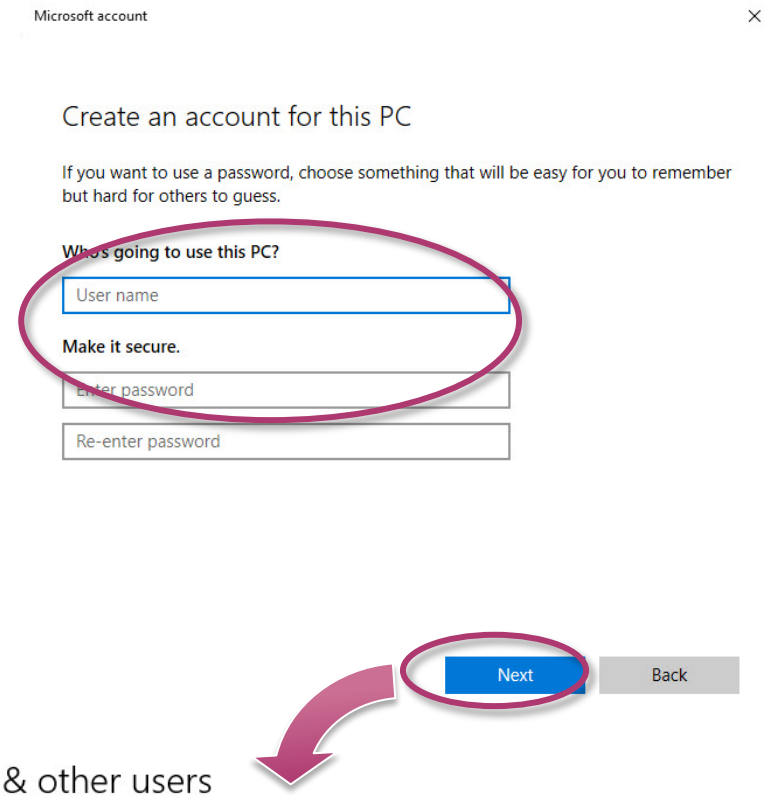
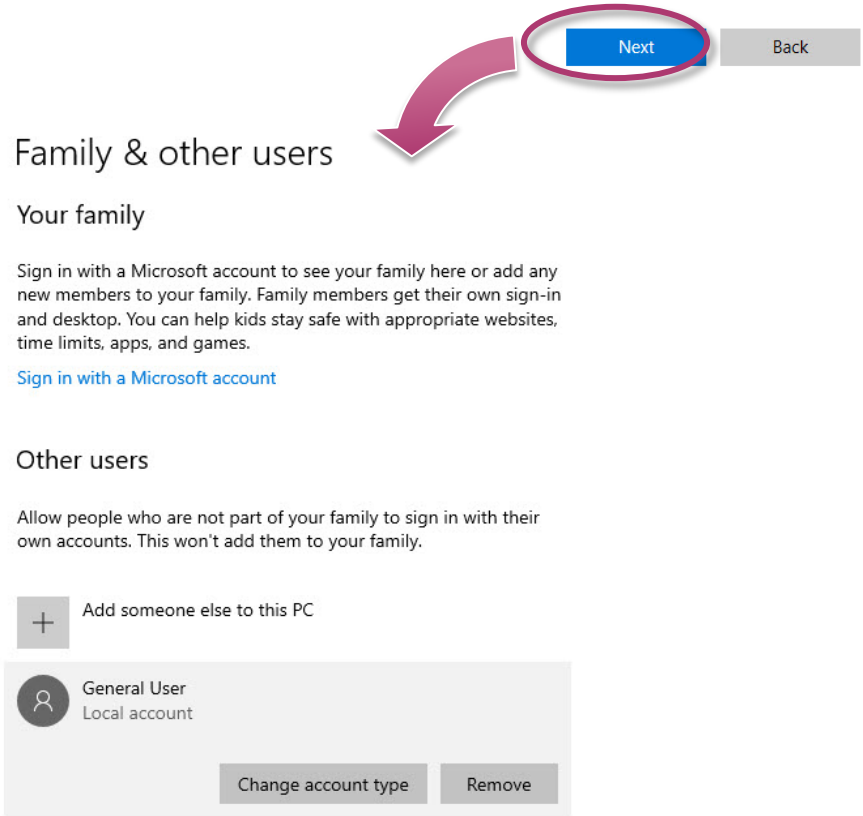
7. Type the name that you want to use for the account, if you want to set password, please enter it then click next.





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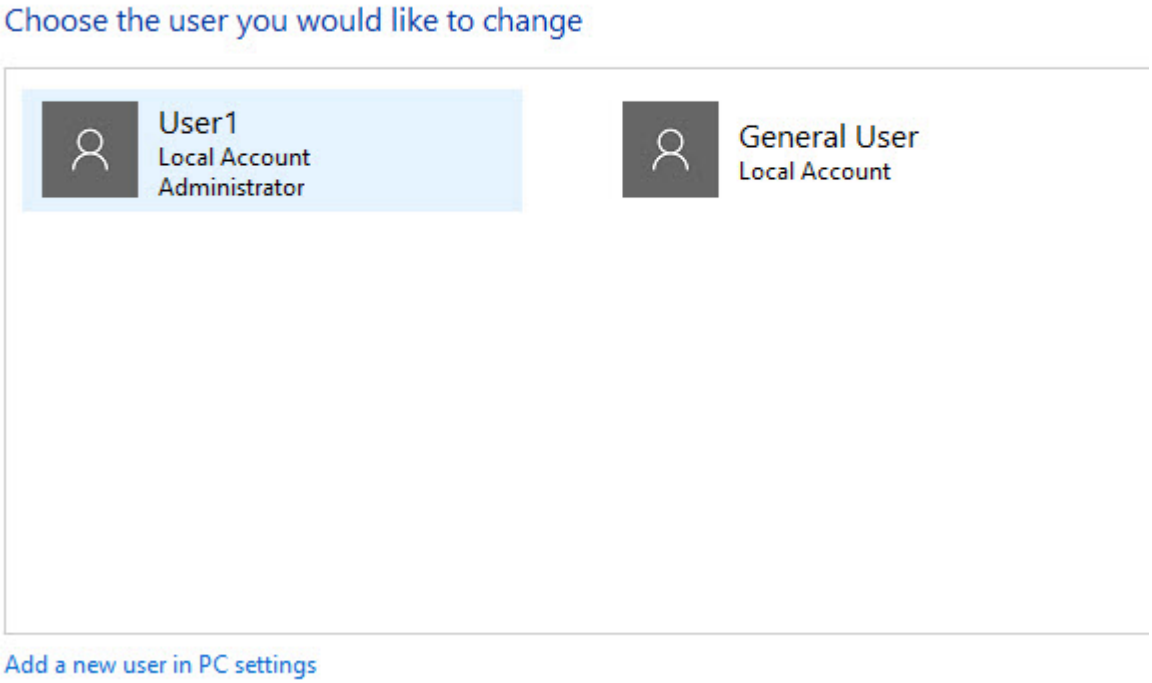
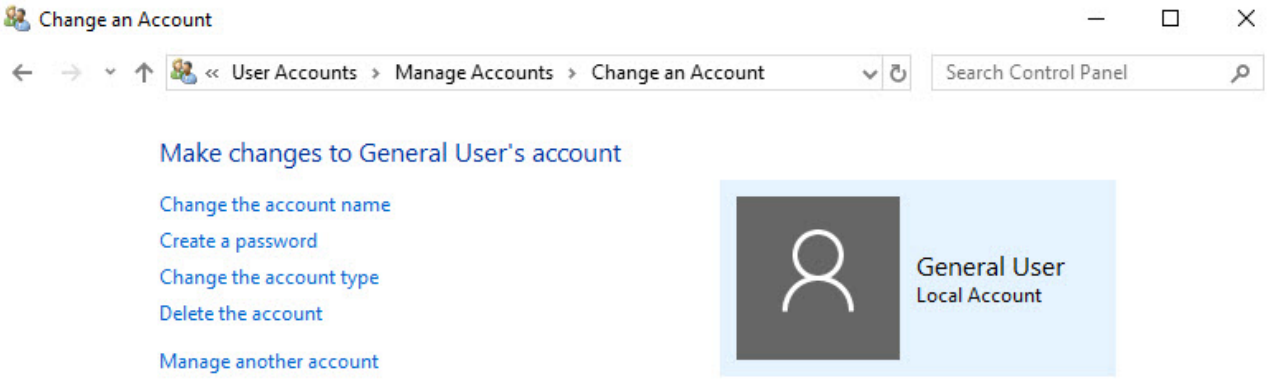
To Make Changes to an Account

1. Back to Manage Accounts, click the account that you want to change.



2. Select the item that you would like to change:



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- Click the **Change the account name** to change the name that appears on the Welcome screen for the account.
- Click the **Create/change a password** to create or change the password for the user and create or change the password hint.
- Click the **Change the account type** to change the account type to increase or decrease the user's rights on the computer.
- Click the **Delete the account** to delete the user account from the computer. When you delete the account, you are given the option to save the user's files on the computer.
- Click the **Manage another account** to manage another account.

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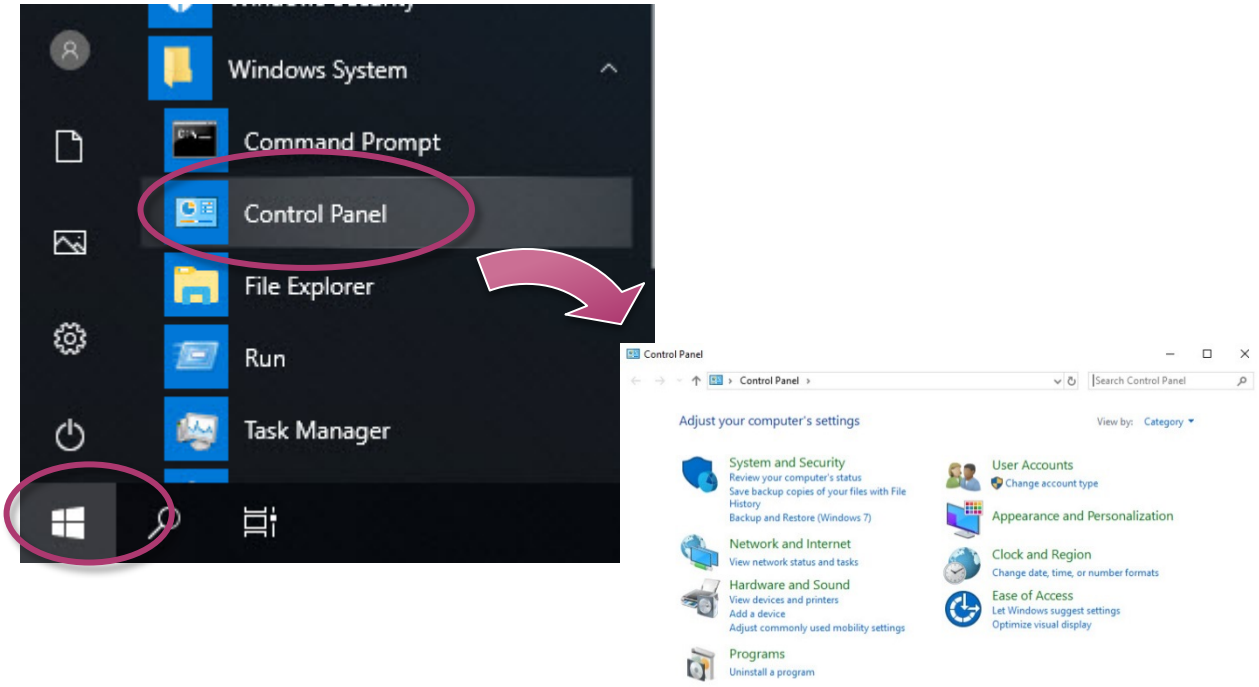
3.2. Turning Firewall On or Off

Based on Windows 10 IoT, EMP-9000 Firewall with Advanced Security and the related firewall technologies documented here enable user to share Internet connections, protect connections using a firewall, and provide Network Address Translation (NAT).

To open the Windows Firewall tool

1. Click the Start button , find Control Panel then click it.



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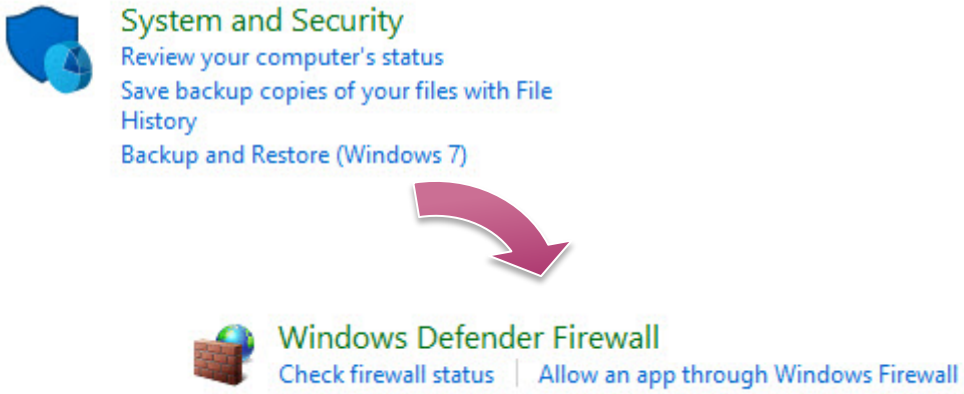
2. Click the System and Security, and then click Windows Defender Firewall



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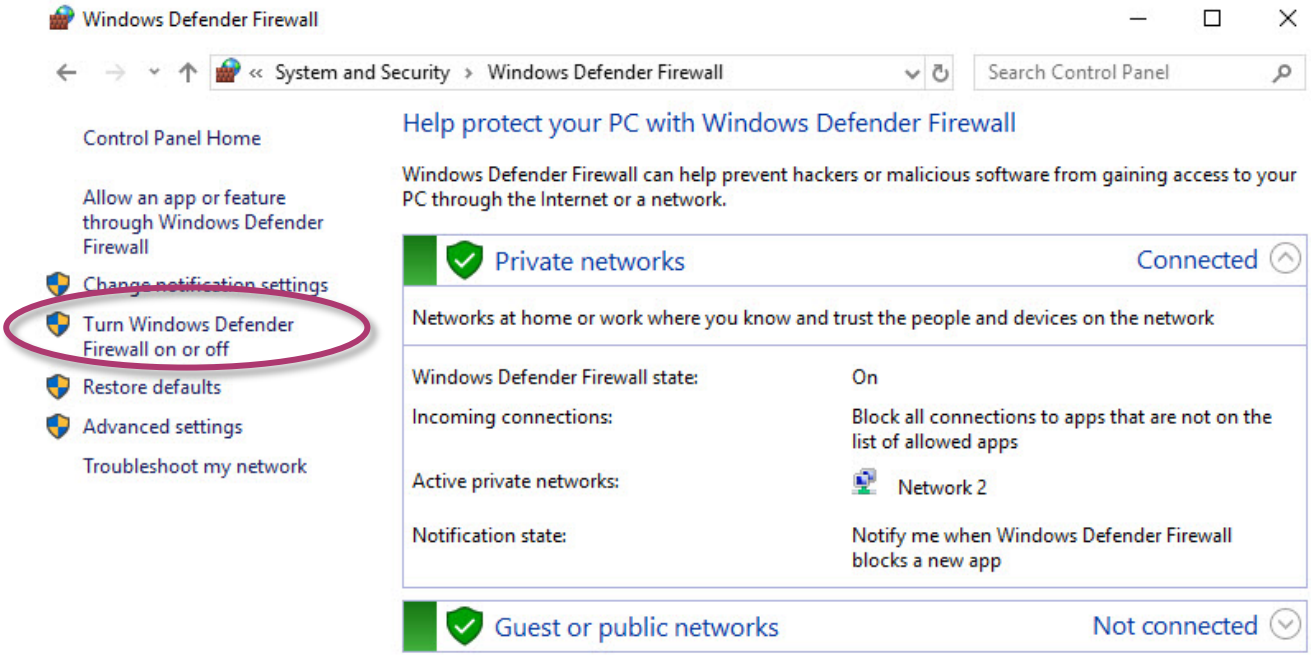
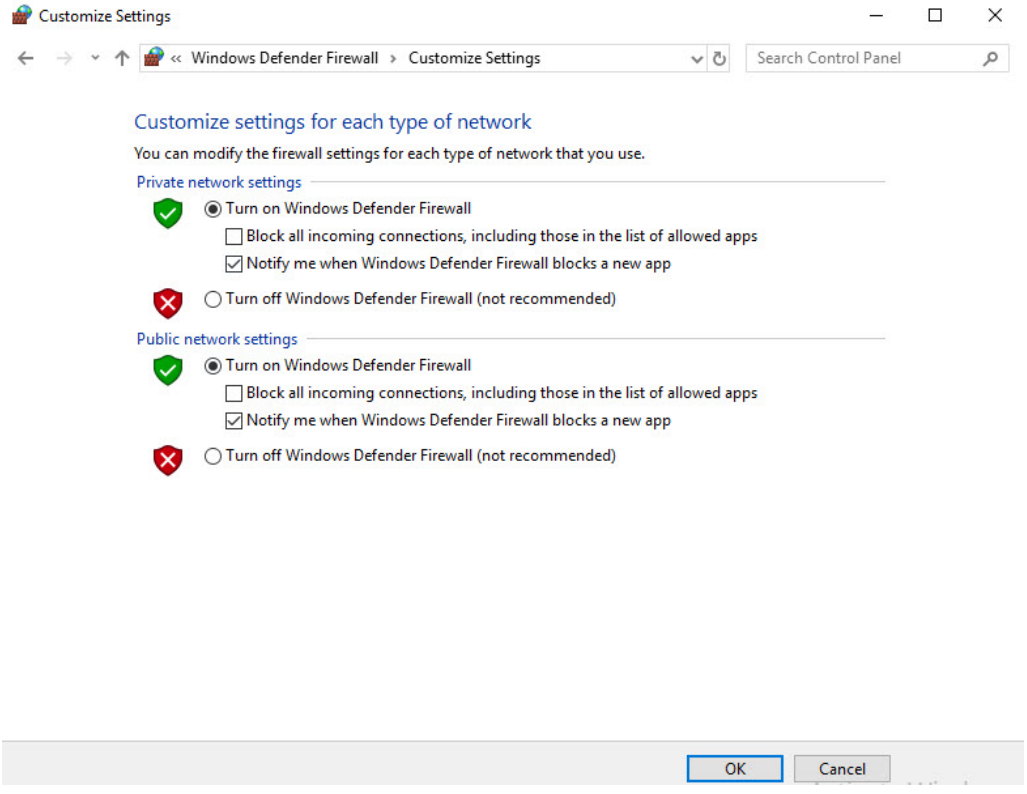
To turn on/off Windows Firewall

1. Click the Turn Windows Firewall on or off in the left panel



2. Select the settings for your home/work (private) or public network, and then OK



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3.3. Configuring the UWF Manager

UWF provides a means for protecting a volume from writes. All writes to an UWF-protected volume are redirected to an overlay. These writes are stored in the overlay and made available as part of the volume. In this way, it feels like that the volume is writeable. The overlay may exist either on disk or in RAM. If desired, the data stored in the overlay may be committed to the protected volume. The following figure is an overview of UWF.

For more detailed information about Unified Write Filter (UWF), please refer to
https://docs.microsoft.com/en-us/windows-hardware/customize/enterprise/unified-write-filter

On EMP-9000, only the C drive that OS resides can be protected.

In cases of maintenance, the disk must be updated to your desired changes.
There is one way to use contains three steps: (1) disabling UWF, (2) updating, and (3) re-enabling UWF.

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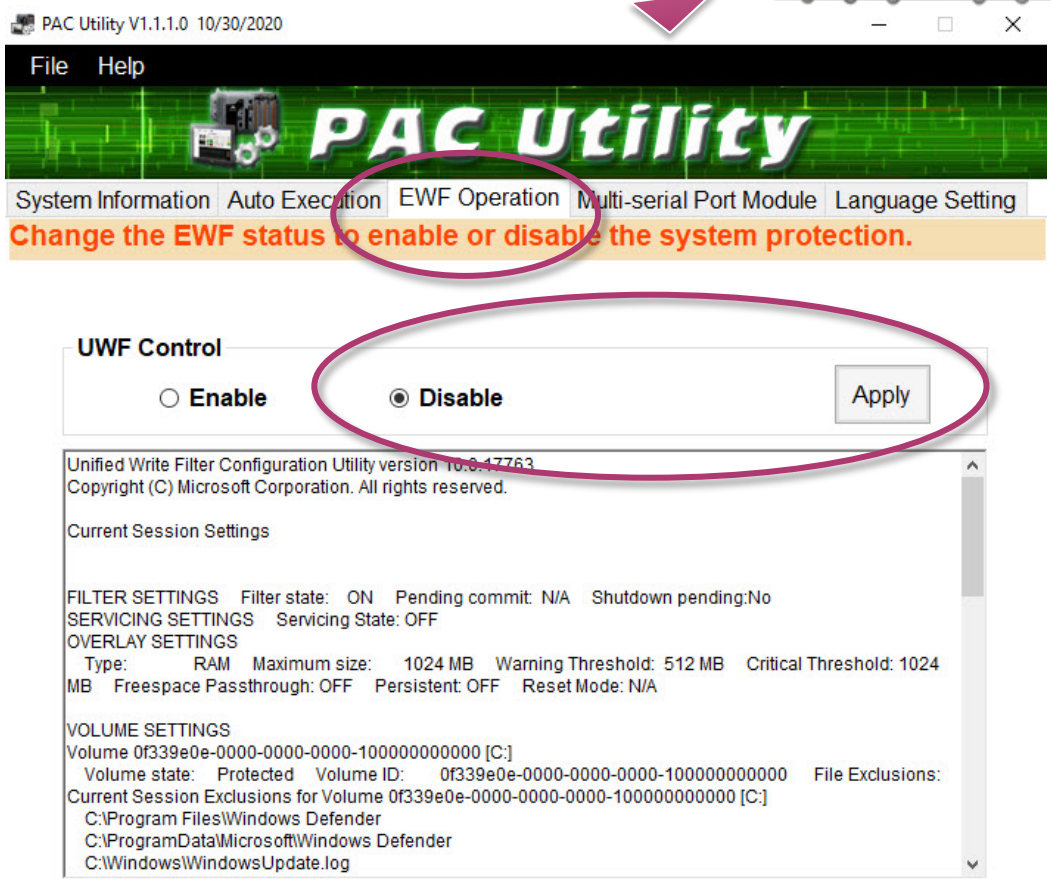
To disable the UWF

1. Click the PAC Utility shortcut on the desktop

2. Click the UWF Operation tab, select the Disable check box, and then click Apply button



Tips & Warnings

If UWF is disabled and XP-9000-IoT/AXP-9000-IoT/EMP-9000 suffers sudden power off, the operating system of XP-9000-IoT/AXP-9000-IoT/ EMP-9000 may be damaged or incomplete.

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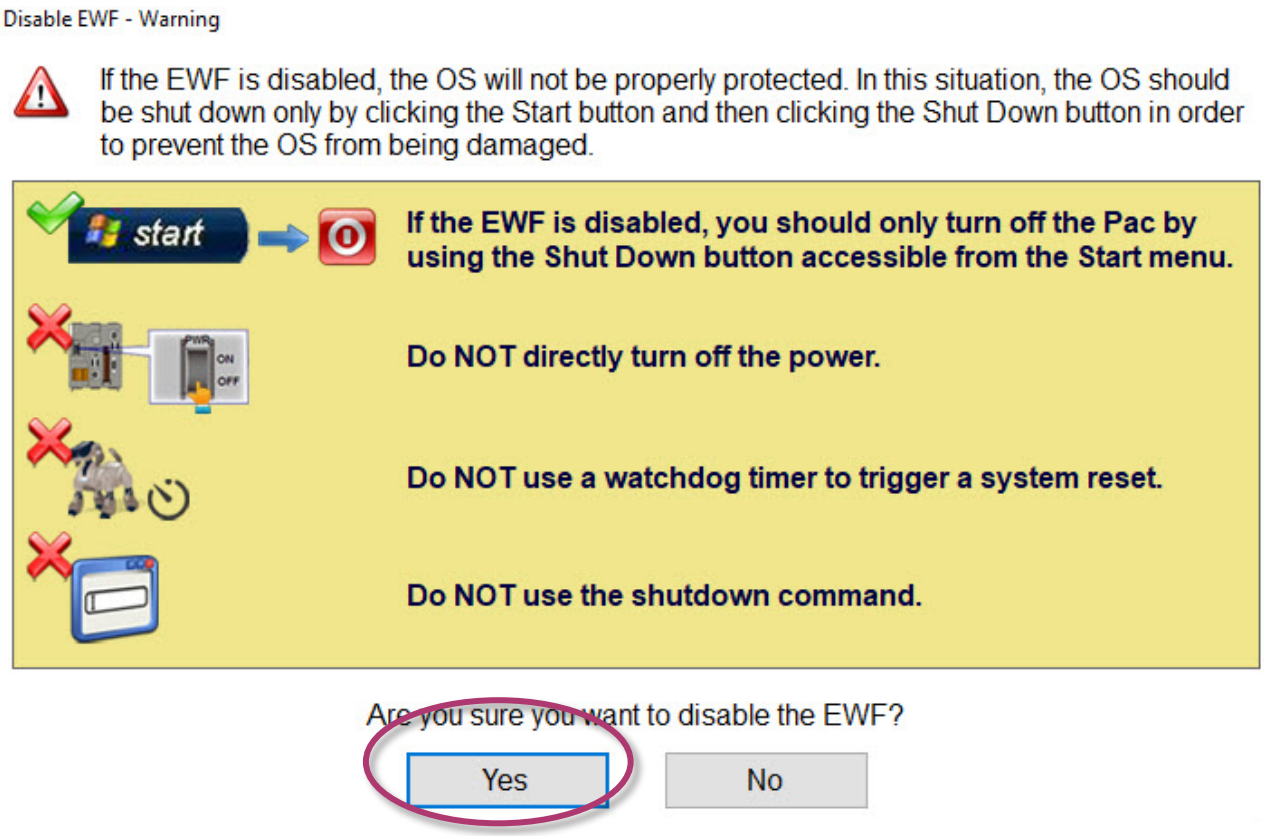
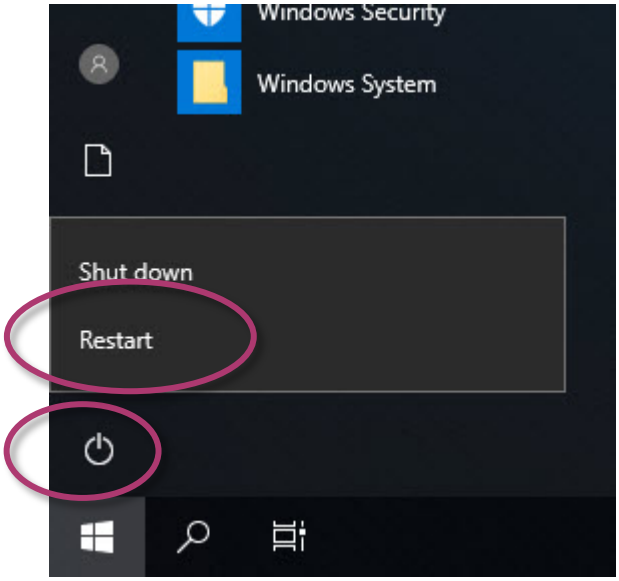
3. In the pop-up dialog box, click Yes button



4. Click the Start button , click the power button , and then click Restart for changes to take effect.



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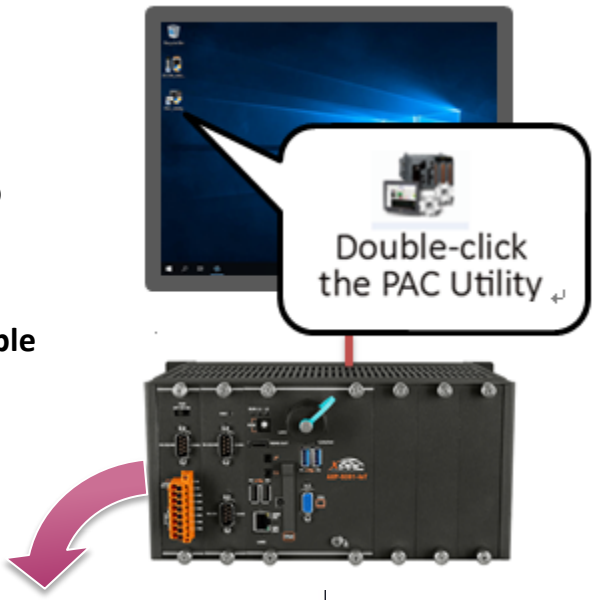
To enable the UWF

1. Click the PAC Utility shortcut on the desktop



2. Click the UWF Operation tab, select the Enable check box, and then click Apply button

Tips & Warnings

UWF only takes effect on hard drive C (where the operating system resides), it is recommended to download your programs to Compact Flash or USB-HDD. It'll prevent operating system from damages of illegal writing or sudden power off.

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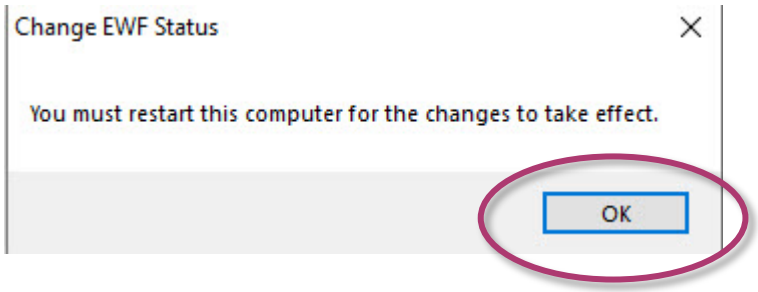
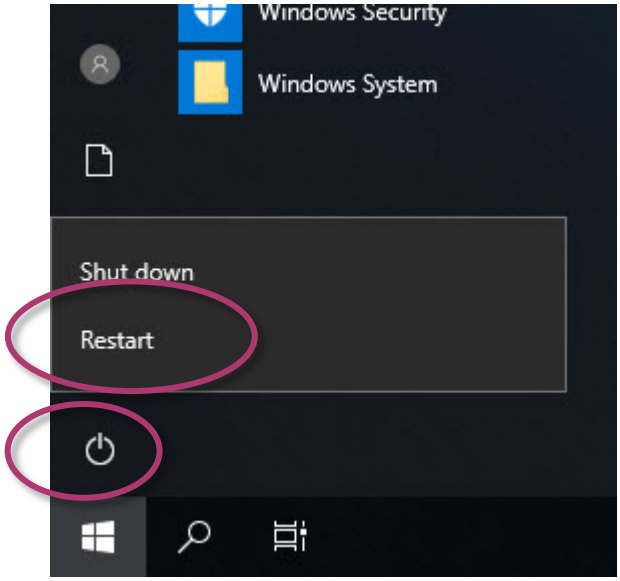
3. In the pop-up dialog box, click OK button



4. Click the Start button , click the power button , and then click Restart for changes to take effect.



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How to use the UWF console application command-line tool

To control the status of UWF, use the UWF Manager Command "UWFMGR".

Windows 10 IoT includes the Unified Write Filter (UWF) console application command-line tool, Uwfmgr.exe.

- Enable the UWF:
  uwfmgr filter enable (it is effective after rebooting.)
- Disable UWF:
  uwfmgr filter disable

For more information about using UWF Manager Commands, please refer to **Manager Commands**
https://docs.microsoft.com/en-us/windows-hardware/customize/enterprise/uwfmgrexe

Tips & Warnings

Only the disk drive (usually, c:\) that OS resides can use the feature of UWF

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4. Tools and Tasks

This chapter provides a brief introduction of the EMP-9000 service tools and its benefits.

There are several tools and utilities built-in and designed for use with EMP-9000. Some of these are pre-installed on EMP-9000 and can work directly on EMP-9000, and some of these are supporting tools and can help you to manage the EMP-9000 remotely on a PC.

Tools for working with PC can be found separately by downloading the latest version from ICP DAS web site.

https://www.icpdas.com/en/download/index.php?model=EMP-9051-16

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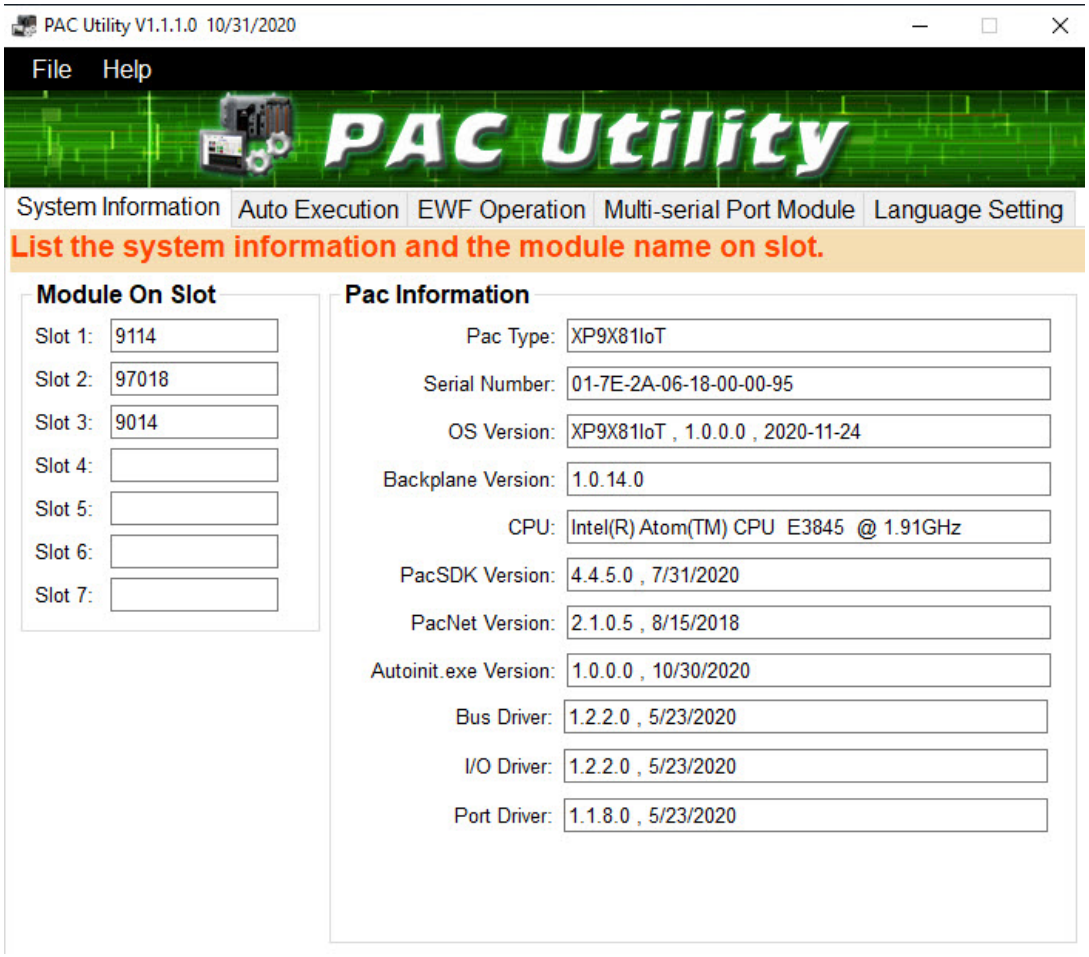
4.1. PAC Utility

PAC Utility is a collection of software applications that enable management and configuration of EMP-9000 system and features.

4.1.1. System Information

The System Information tab provides functions to monitor necessary device information of EMP-9000. The system information is the most important note of version control for upgrading system.



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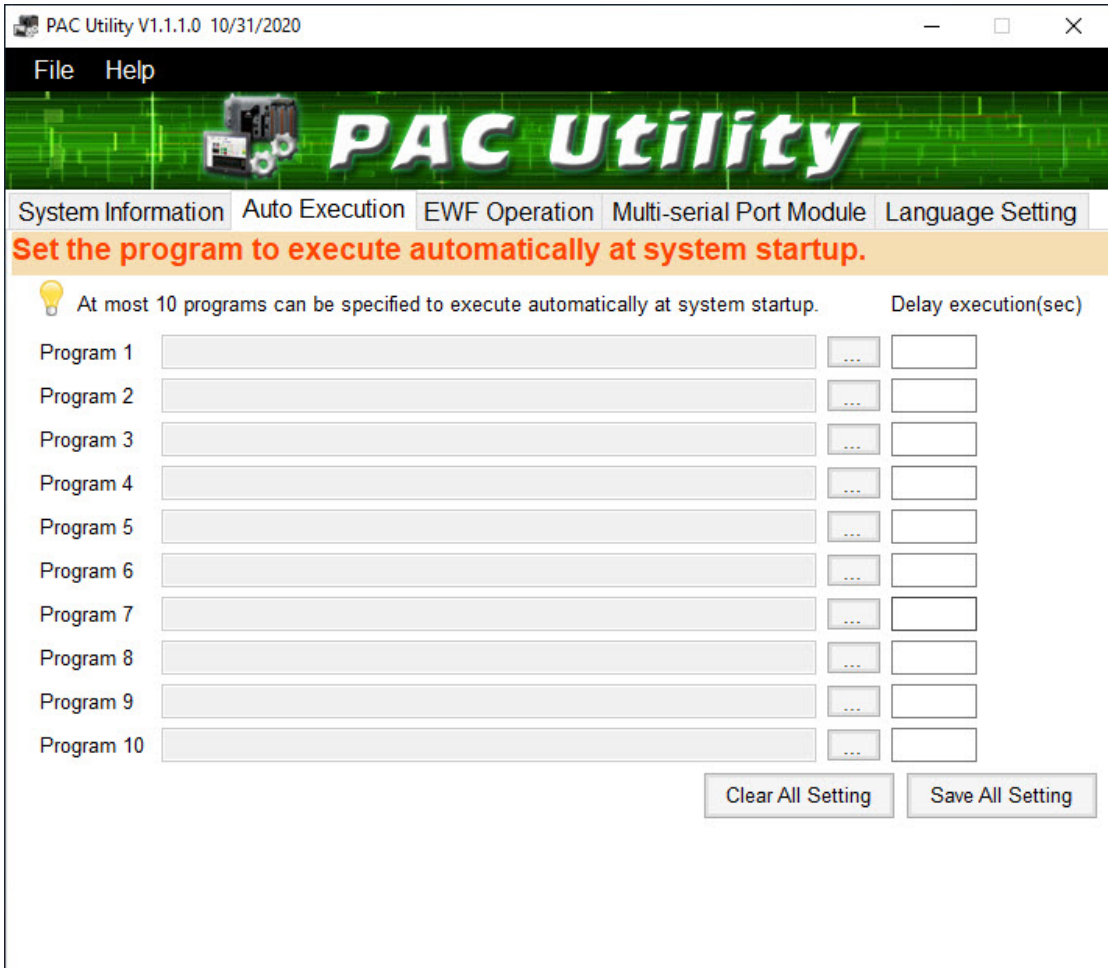
4.1.2. Auto Execution

The Auto Execution tab provides functions to configure programs running at EMP-9000 startup, it allows users to configure ten execute files at most.



Tips & Warnings

The allowed file types are .exe and .bat, and they are executed in order of program 1, program 2, etc.

The tab use to	How to use
Configure programs running at startup	Click on the Browse button and select the execute file which you want, and then click the **Save All Setting** button.

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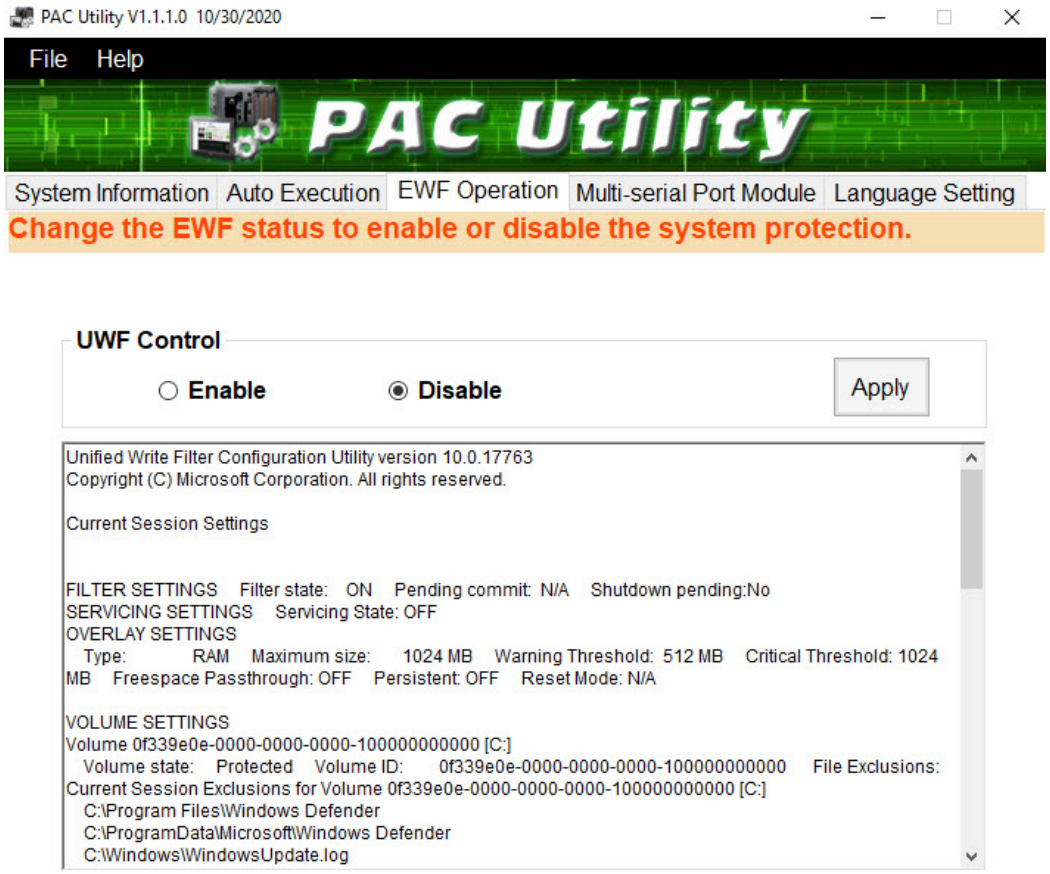
4.1.3. UWF Operation

The UWF Operation tab provides functions to configure UWF.



The tab use to	How to use
Enable/disable the UWF function	**Enable the UWF function:** Select the **Enable** option, and then click the **Apply** button. **Disable the UWF function:** Select the **Disable** option, and then click the **Apply** button.

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4.1.4. Multi-serial Port Module

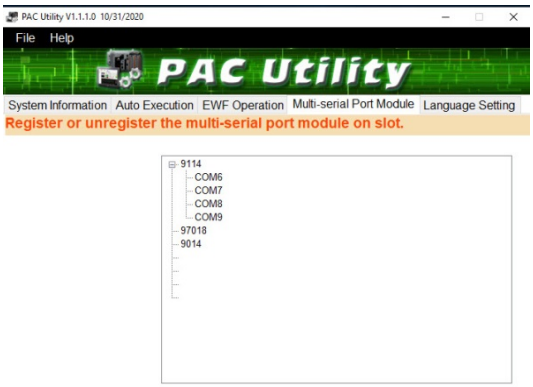
The Multi-serial port provides functions for installation of the RS-232/RS-422/RS-485 communication module driver.

The table below shows the expansion RS-232/RS-422/RS-485 communication modules that are compatible with the EMP-9000.

Item	RS-232	RS-422/RS-485	Isolation	Connector
I-9114	4	4	2500 Vrms	DB-37 (Female) x 1
I-9144	-	4	2500 Vrms	Terminator block x 1

The EMP-9000 can be expanded to support up to 16 I/O modules.

For more detailed information about these support modules, please refer to https://www.icpdas.com/en/product/guide+Remote_I_O_Module_and_Unit+PAC_%EF%BC%86amp;_Local_I_O_Modules+I-9K_I-97K_Series



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4.2. DCON Utility Pro

The DCON Utility Pro is a toolkit that help user to search the network, easily to configure and test the I/O modules via the serial port (RS-232/485) or Ethernet port (using virtual com port).

For more information on how to use DCON Utility Pro to configure I/O modules, please refer to section 2.7. Using DCON Utility Pro to Configure I/O Modules.

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5. Your First EMP-9000 Program

This chapter provides a guided tour that describes the steps needed to set-up a development environment, download, install, configure for user programming with the EMP-9000.

Before writing your first program, ensure that you have the necessary development tool and the corresponding EMP-9000 SDKs are installed on your system.

Development Tools

EMP-9000 is a Windows 10 IoT based unit. Windows 10 IoT is a mature embedded operating system which supports rapid development. Three standard development tools are list as follows which are highly integrated, with comprehensive support for developing applications of Windows 10 IoT based EMP-9000.

- Visual Basic.net
- Visual C#
- Visual C++

EMP-9000 SDKs

The PAC SDK is a Software Development Kit (SDK) that contains C header files, C libraries and documents.

The EMP-9000 SDK are classified by development tools that can be obtained by downloading the latest version from ICP DAS web site.

https://www.icpdas.com/en/download/index.php?model=EMP-9051-16

	FILE NAME	DESCRIPTION	MODEL	LAST UPDATE
	Windows PACs/iPPCs	SDK	EMP-9051-16	2022-10-20

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5.1. Your First EMP-9000 Program in VB.NET

The best way to learn programming with EMP-9000 is to actually create an EMP-9000 program.

The example below will guide you through creating this simple program in VB.net and running them on EMP-9000.

To create a demo program with VB.NET that includes the following main steps:

1. Create a new project
2. Specify the path of the PAC reference
3. Add the control to the form
4. Add the event handling for the control
5. Upload the application to EMP-9000
6. Execute the application on EMP-9000

All main steps will be described in the following subsection.

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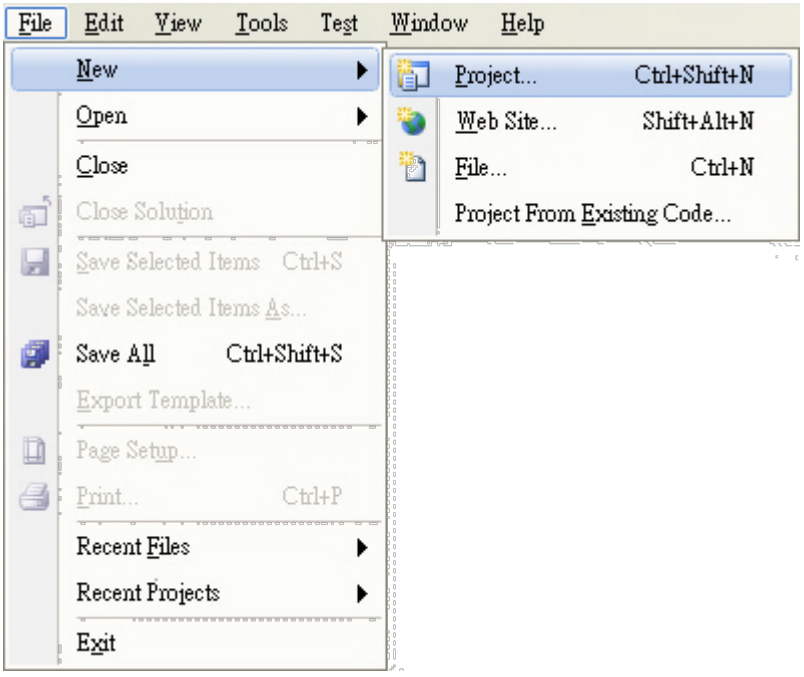
5.1.1. Create a New Project

The Visual VB.net project template is a composite control that you use in this example creates a new project with this user control.

1. Run the Visual Studio 2008

Visual Studio 2008

2. On the File menu, point to New, and then click Project



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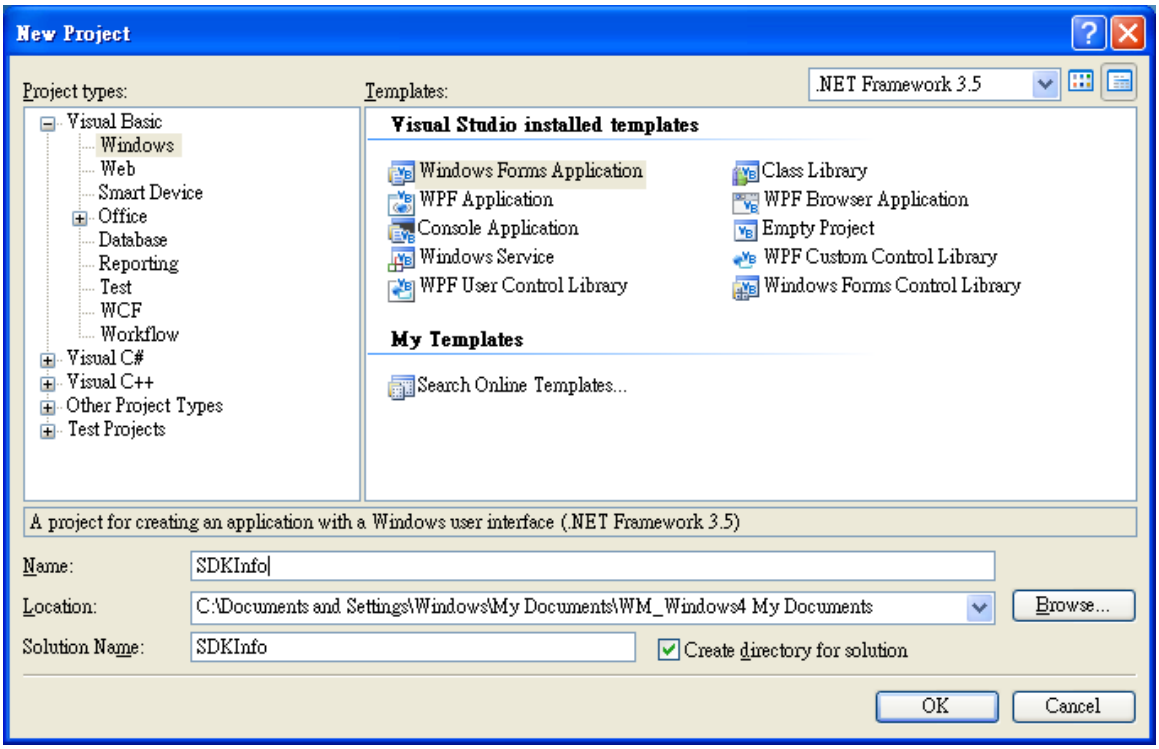
3. In the Project types pane, expand Visual Basic, and then click Windows

4. In the Templates pane, click Windows Forms Application

5. Type a name in the Name field, and then click OK button

Here we will enter the name “SDKInfo” and a different location for the project if you wish



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5.1.2. Specify the Path of PAC Reference

The PAC SDK provides a complete solution to integrate with EMP-9000 and it's compatible with Visual C#, Visual Basic .net and C++. In order to use a component in your application, you must first add a reference to it.

1.1 Get the PACNET.dll and copy it to the project folder

The PACNET.dll can be obtained separately by downloading the latest version from ICP DAS web site.

https://www.icpdas.com/en/download/index.php?model=EMP-9051-16

1.2 Get the UniDAQ.vb and copy it to the project folder (Only uses for e-9K module.)

The UniDAQ.vb can be obtained separately by downloading the latest version from ICP DAS web site.

https://www.icpdas.com/en/download/index.php?model=EMP-9051-16

PACSDK_WES7_IoT_Vxxx_YYYYMMDD.zip

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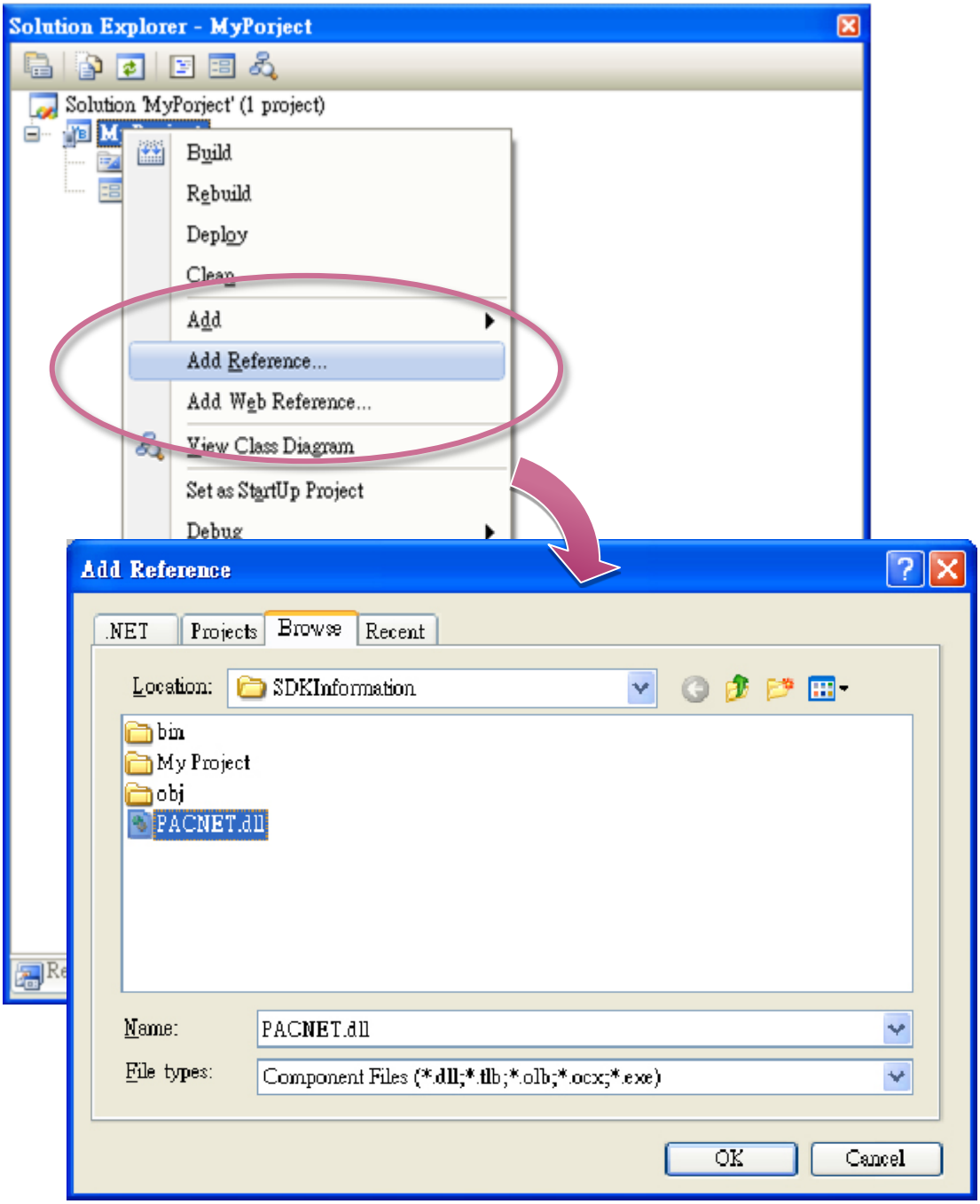
2. In the Solution Explorer, right-click the References node, and then click Add Reference…

3.1. Click the Browse tab, and then select the PACNET.dll



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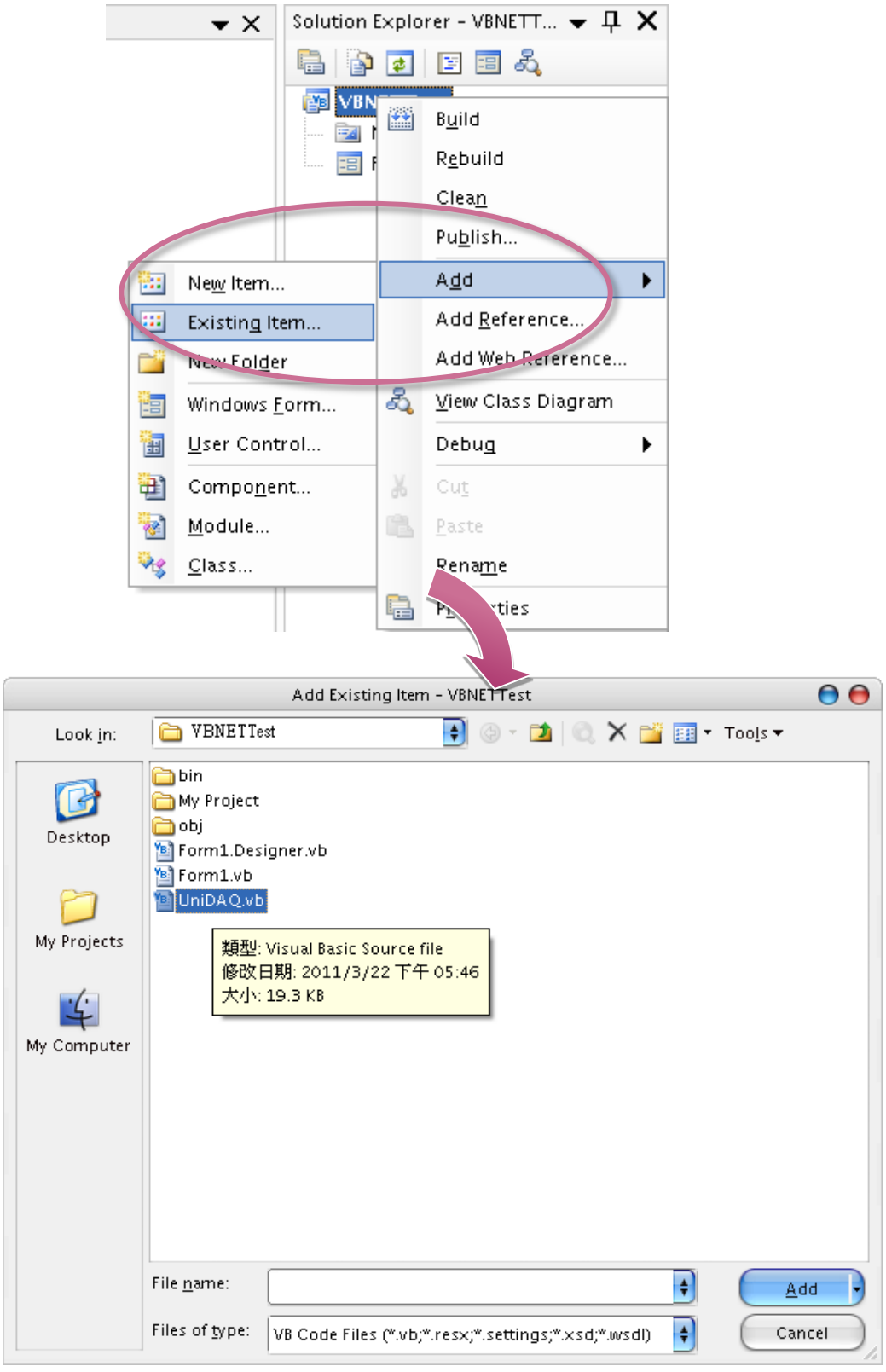
3.2. Add the UniDAQ.vb declaration file by clicking the name of the file and then clicking the Add button. (Only uses for e-9K module.)



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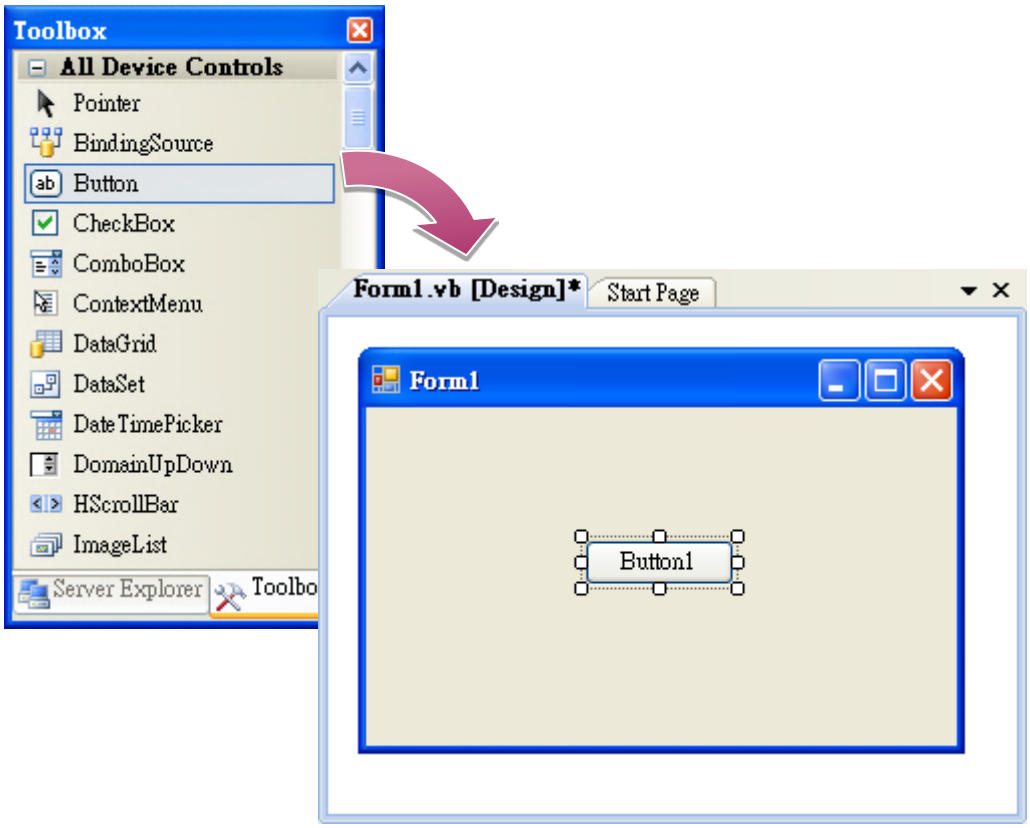
5.1.3. Add the Control to the Form

You can drag various controls from the Toolbox onto the form. These controls are not really "live"; they are just images that are convenient to move around on the form into a precise location.

After you add a control to your form, you can use the Properties window to set its properties, such as background color and default text. The values that you specify in the Properties window are the initial values that will be assigned to that property when the control is created at run time.

1. From the Toolbox, drag a Button control onto the form



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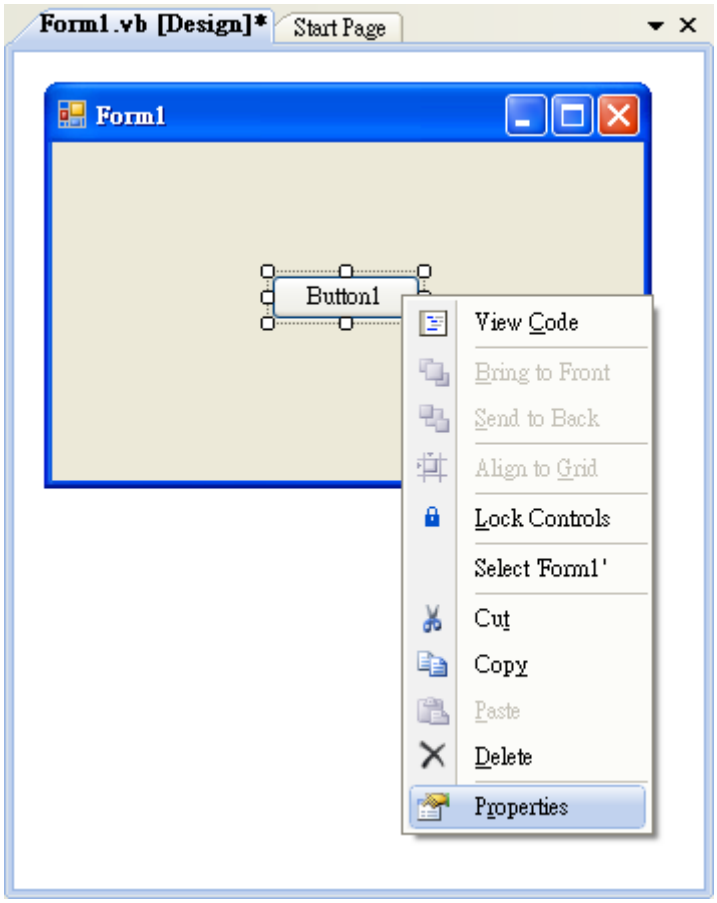
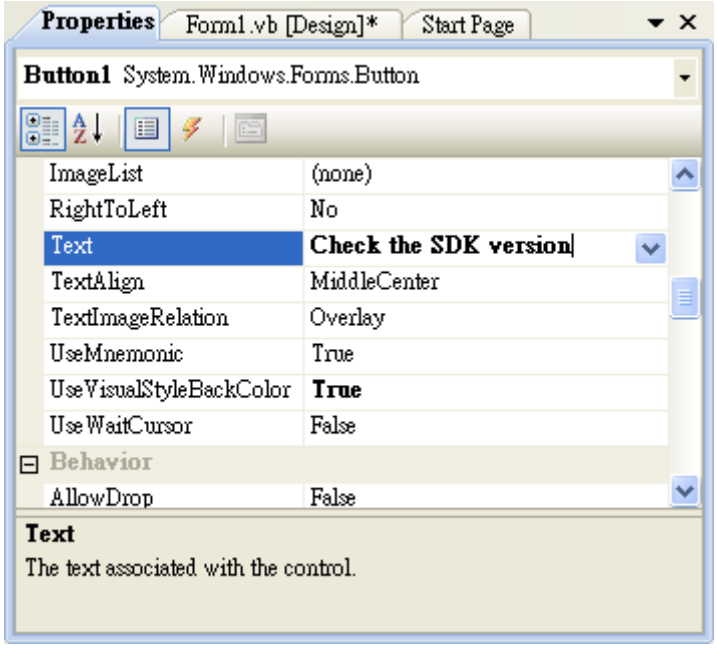
2. Right-click the Button control, and then click Properties



3. In the Properties window, type Check the SDK version in the Text item, and press ENTER



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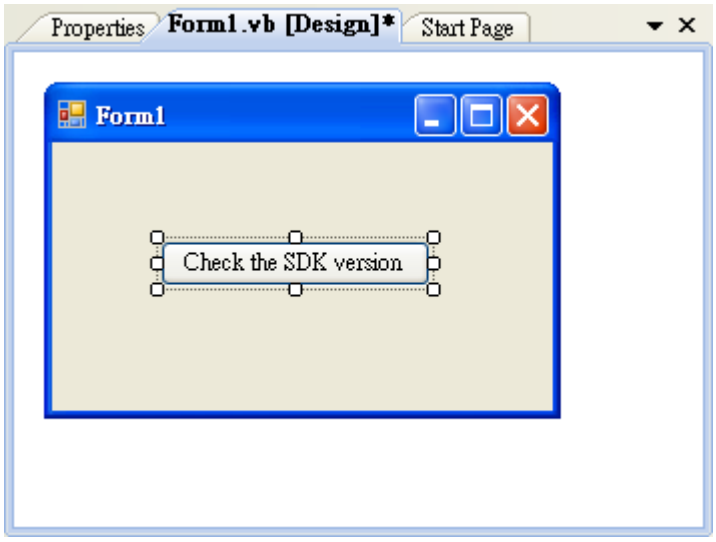
5.1.4. Add the Event Handling for the Control

You have finished the design stage of your application and are at the point when you can start adding some code to provide the program's functionality.

1. Double-click the button on the form



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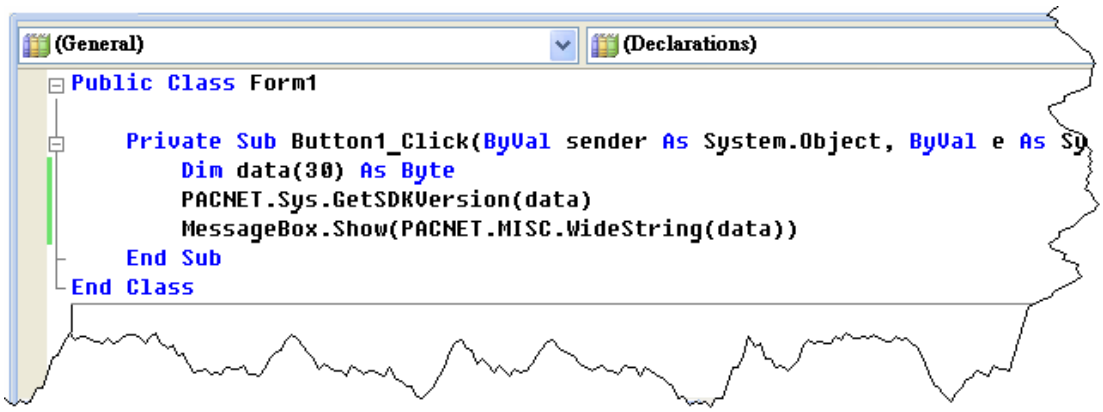
2. Inserting the following code

Dim data(30) As Byte
PACNET.Sys.GetSDKVersion(data)
MessageBox.Show(PACNET.MISC.WideString(data))



Tips & Warnings

The “PACNET” of “using PACNET” is case- sensitive.

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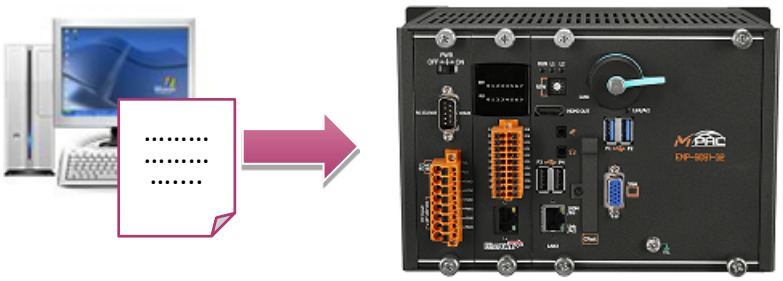
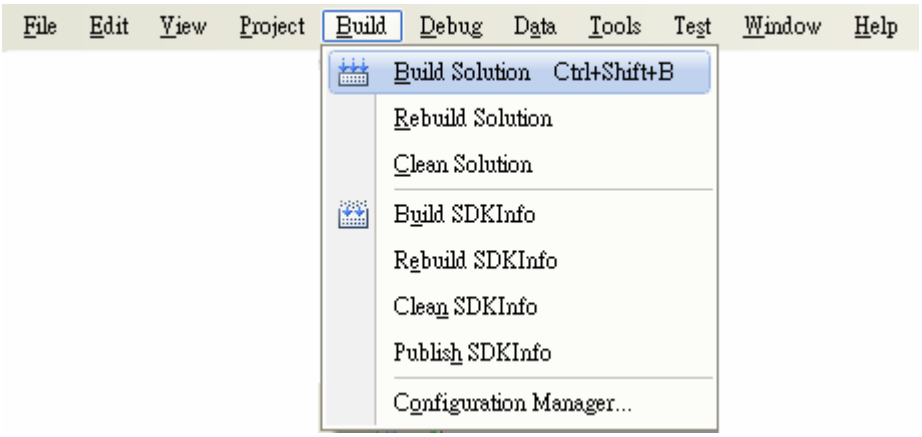
5.1.5. Upload the Application to EMP-9000

EMP-9000 supports FTP server service. You can upload files to EMP-9000 or download files from a public FTP server.



1. On the Build menu, click Build Solution



2. Open the browser and type the IP address of EMP-9000

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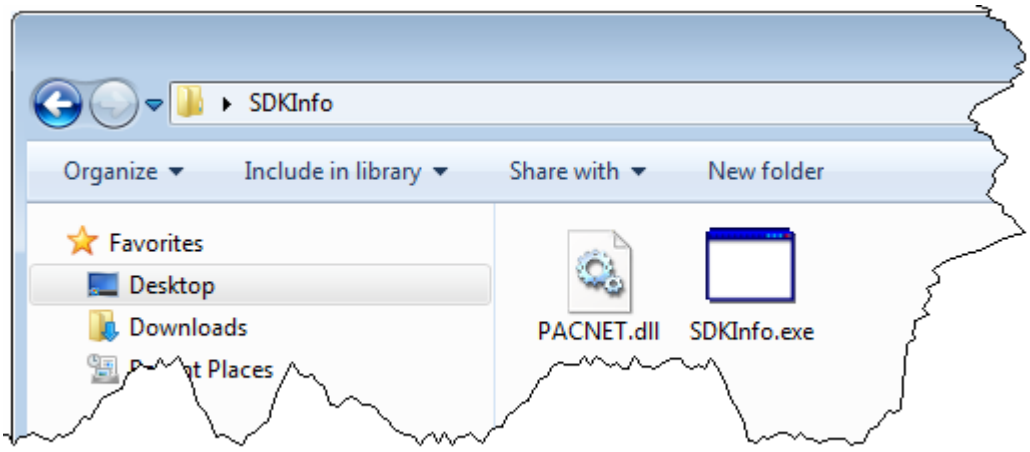
3. Upload the SDKInfo.exe application and the corresponding PACNET.dll files to EMP-9000

Tips & Warnings

For applications programming in C# and VB.net with .net compact framework, when executing these application on EMP-9000, the corresponding PACNET.dll must be in the same directory as the .exe file.



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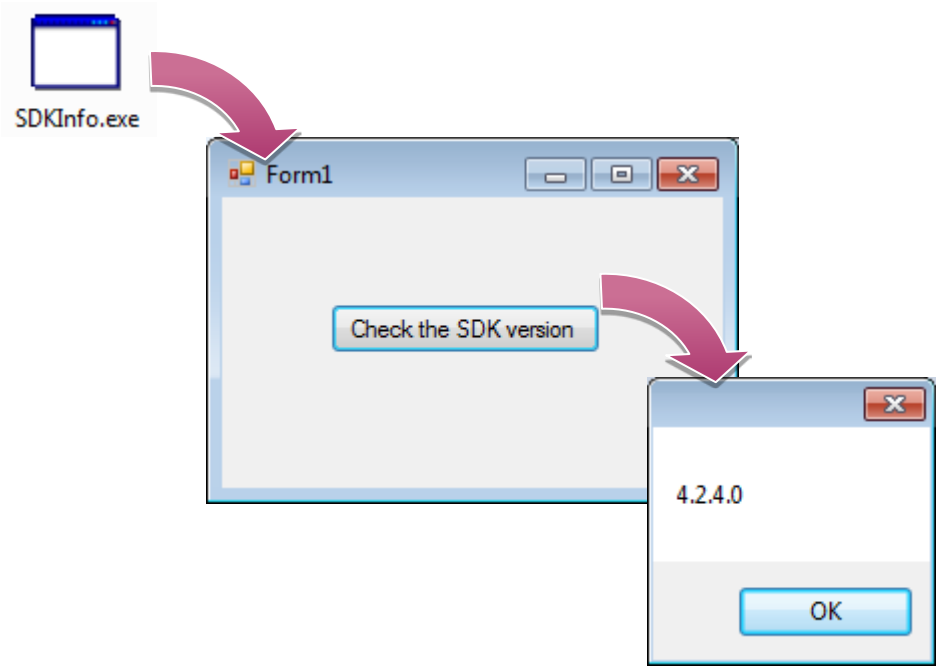
5.1.6. Execute the Application on EMP-9000

After uploading the application to EMP-9000, you can just double-click it to execute it.



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5.2. Your First EMP-9000 Program in C#

The best way to learn programming with EMP-9000 is to actually create an EMP-9000 program.

The example below will guide you through creating this simple program in C# and running them on EMP-9000.

To create a demo program with C# that includes the following main steps:

1. Create a new project
2. Specify the path of the PAC reference
3. Add the control to the form
4. Add the event handling for the control
5. Upload the application to EMP-9000
6. Execute the application on EMP-9000

All main steps will be described in the following subsection.

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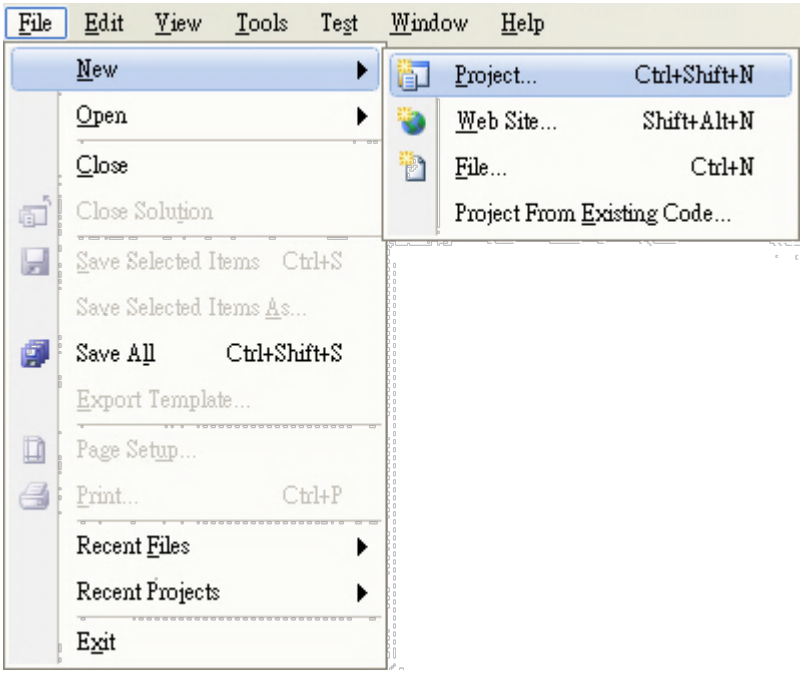
5.2.1. Create a New Project

The C# project template is a composite control that you use in this example creates a new project with this user control.

1. Run the Visual Studio 2008

Visual Studio 2008

2. On the File menu, point to New, and then click Project



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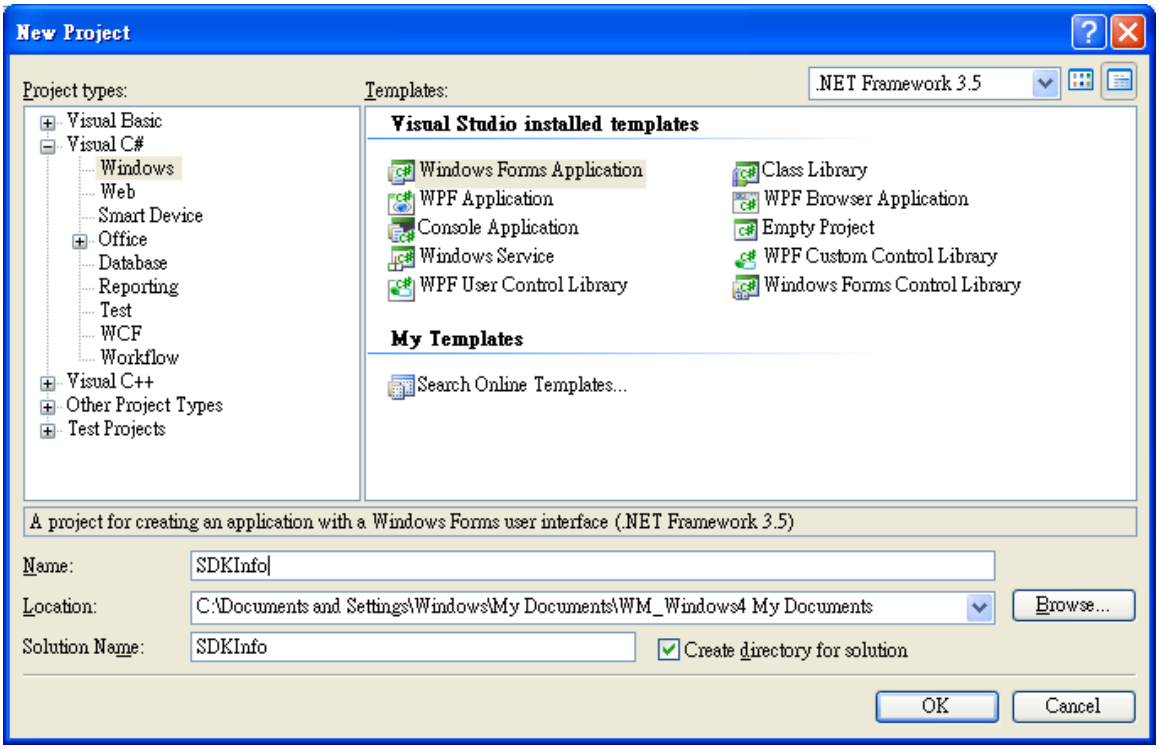
3. In the Project types pane, expand Visual C#, and then click Windows

4. In the Templates pane, click Windows Forms Application

5. Type a name in the Name field, and then click OK button

Here we will enter the name “SDKInfo” and a different location for the project if you wish



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5.2.2. Specify the Path of PAC Reference

The PAC SDK provides a complete solution to integrate with EMP-9000 and it's compatible with Visual C#, Visual Basic .net and C++. In order to use a component in your application, you must first add a reference to it.

1.1 Get the PACNET.dll and copy it to the project folder

The PACNET.dll can be obtained separately by downloading the latest version from ICP DAS web site.

https://www.icpdas.com/en/download/index.php?model=EMP-9051-16

1.2 Get the UniDAQ.cs and copy it to the project folder (Only uses for e-9K module.)

The UniDAQ.vb can be obtained separately by downloading the latest version from ICP DAS web site.

https://www.icpdas.com/en/download/index.php?model=EMP-9051-16

PACSDK_WES7_IoT_Vxxx_YYYYMMDD.zip

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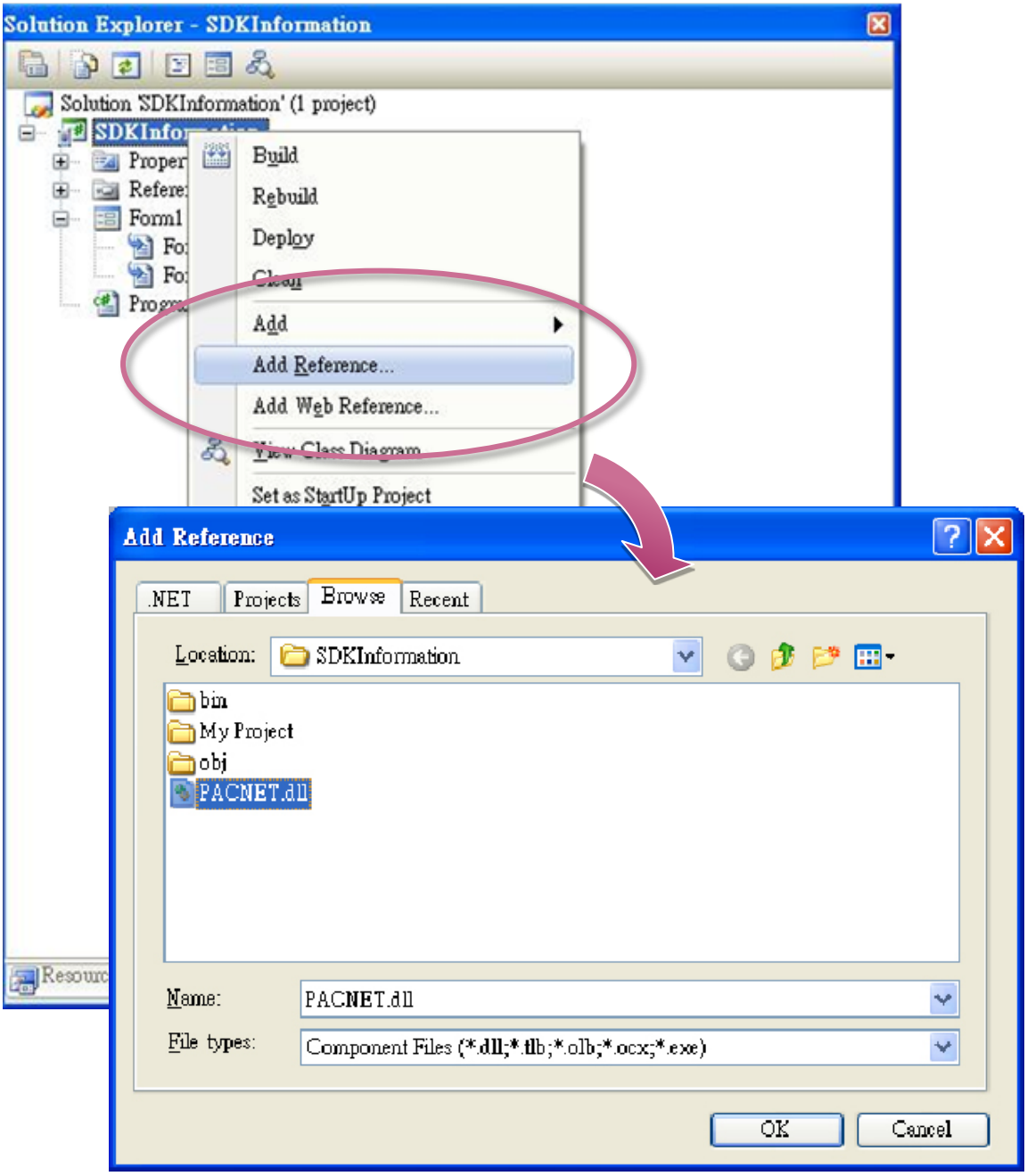
2. In Solution Explorer, right-click the References node, and then click Add Reference…

3.1. Select Browse tab and add the PACNET.dll



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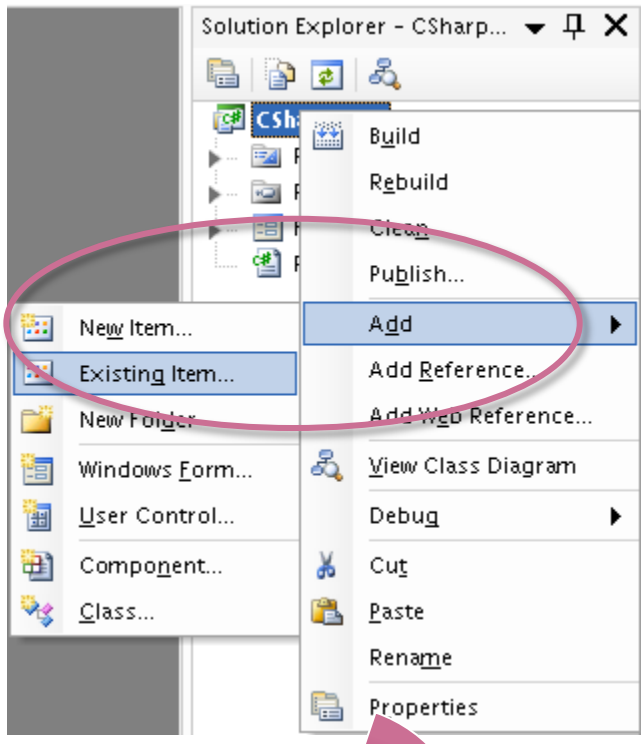
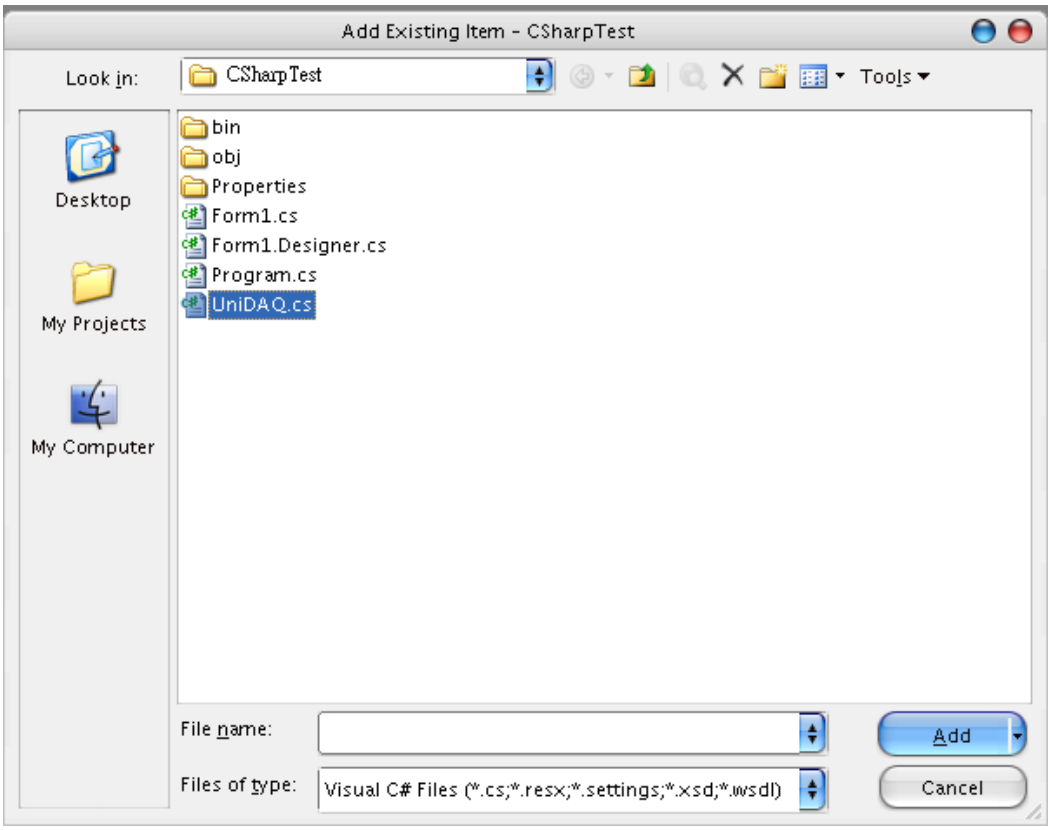
3.2. Add the UniDAQ.cs declaration file by clicking the name of the file and then clicking the Add button. (Only uses for e-9K module.)





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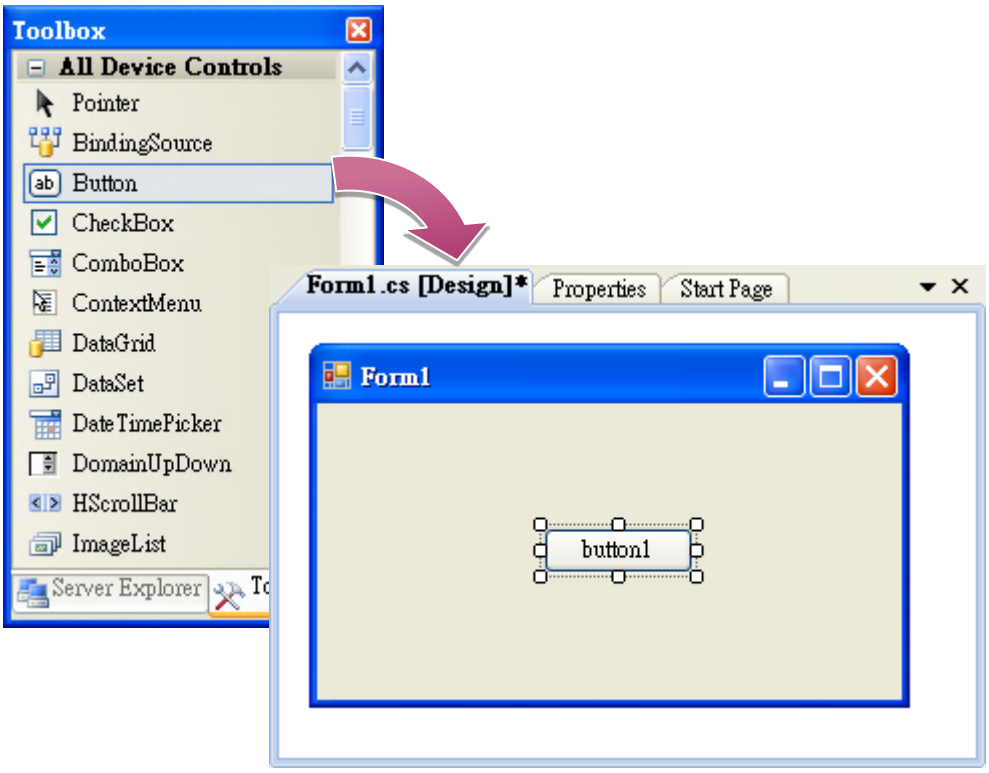
5.2.3. Add the Control to the Form

You can drag various controls from the Toolbox onto the form. These controls are not really "live"; they are just images that are convenient to move around on the form into a precise location.

After you add a control to your form, you can use the Properties window to set its properties, such as background color and default text. The values that you specify in the Properties window are the initial values that will be assigned to that property when the control is created at run time.

1. From the Toolbox, drag a Button control onto the form



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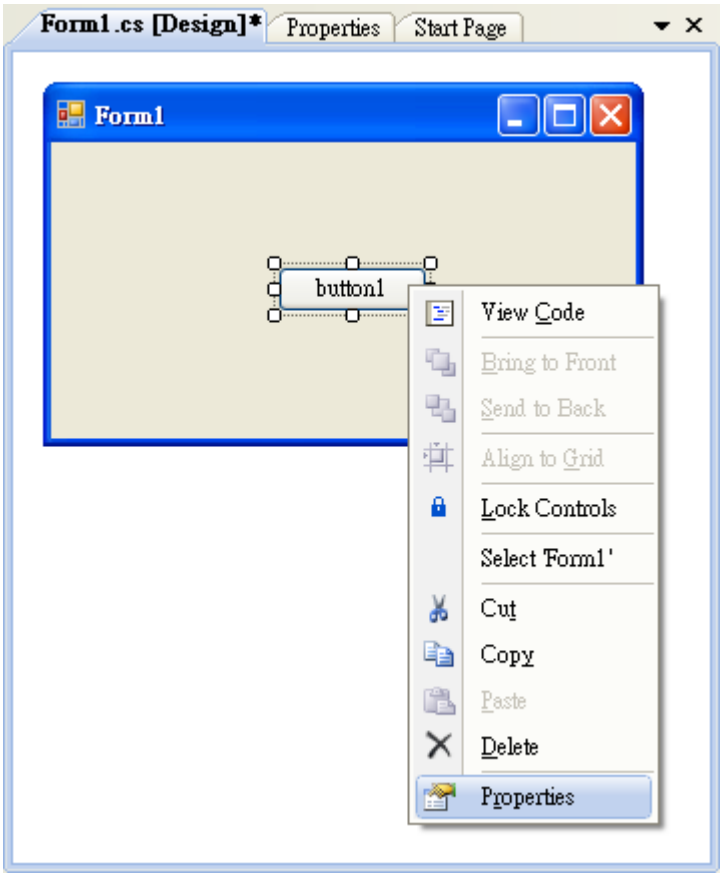
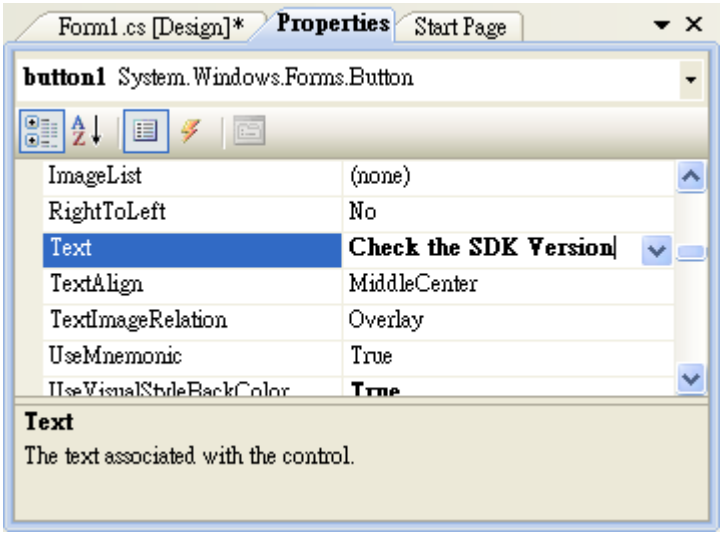
2. Right-click the Button control, and then click Properties



3. In the Properties window, type Check the SDK version in the Text item, and press ENTER



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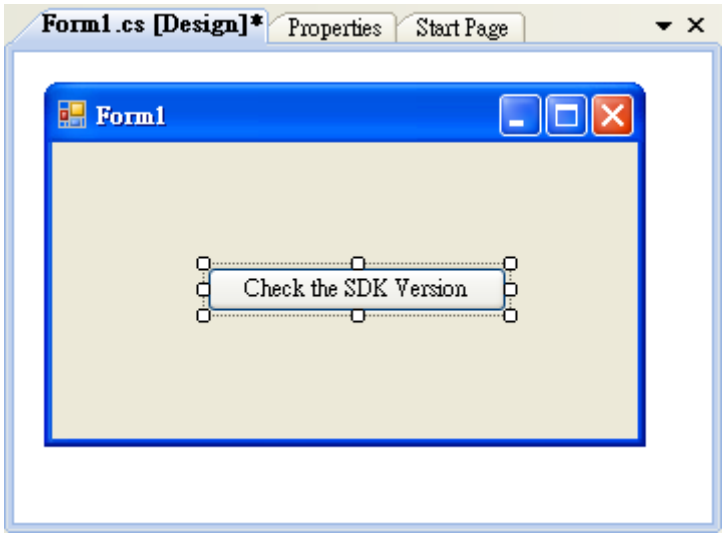
5.2.4. Add the Event Handling for the Control

You have finished the design stage of your application and are at the point when you can start adding some code to provide the program's functionality.

1. Double-click the button on the form



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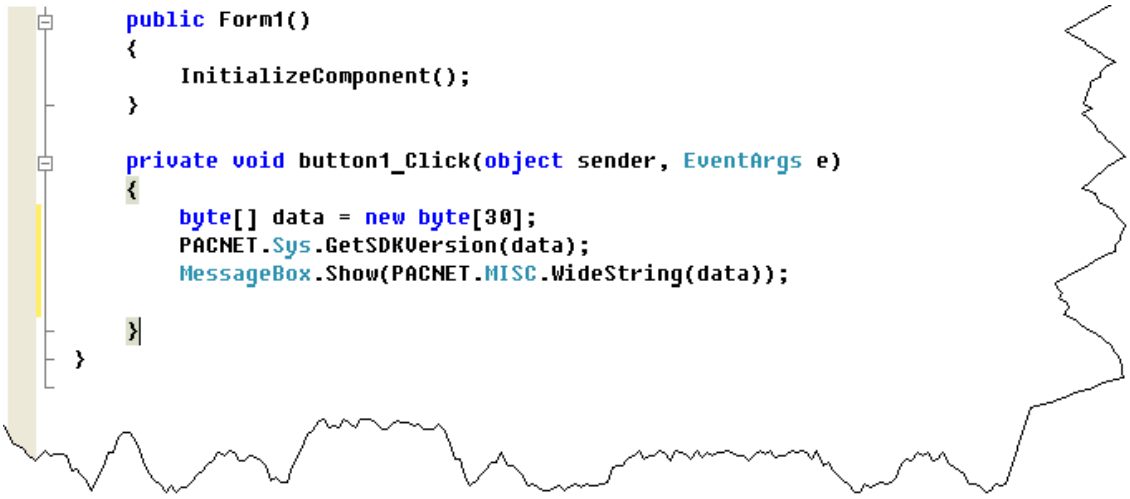
2. Inserting the following code

byte []data = new byte[30];
PACNET.Sys.GetSDKVersion(data);
MessageBox.Show(PACNET.MISC.WideString(data));



```
        public Form1()
        {
            InitializeComponent();
        }

        private void button1_Click(object sender, EventArgs e)
        {
            byte[] data = new byte[30];
            PACNET.Sys.GetSDKVersion(data);
            MessageBox.Show(PACNET.MISC.WideString(data));

        }
    }
```

Tips & Warnings

The “PACNET” of “using PACNET” is case- sensitive.

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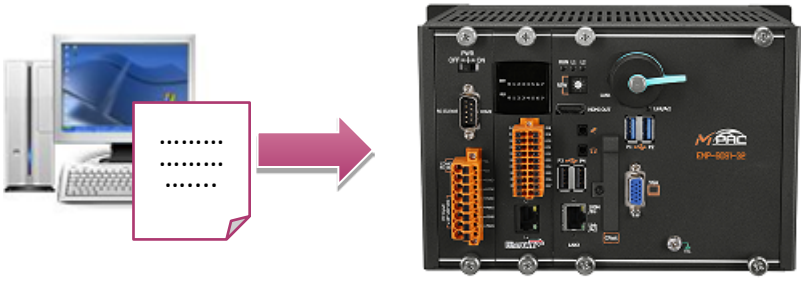
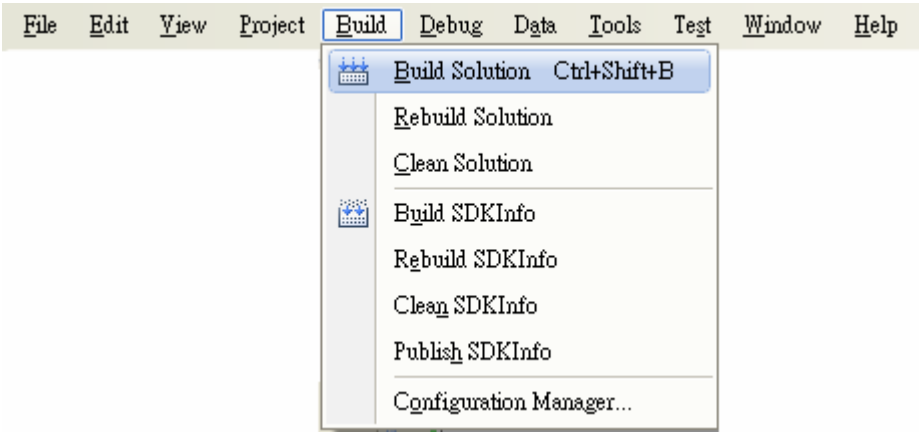
5.2.5. Upload the Application to EMP-9000

EMP-9000 supports FTP server service. You can upload files to EMP-9000 or download files from a public FTP server.



1. On the Build menu, click Build Solution



2. Open the browser and type the IP address of EMP-9000

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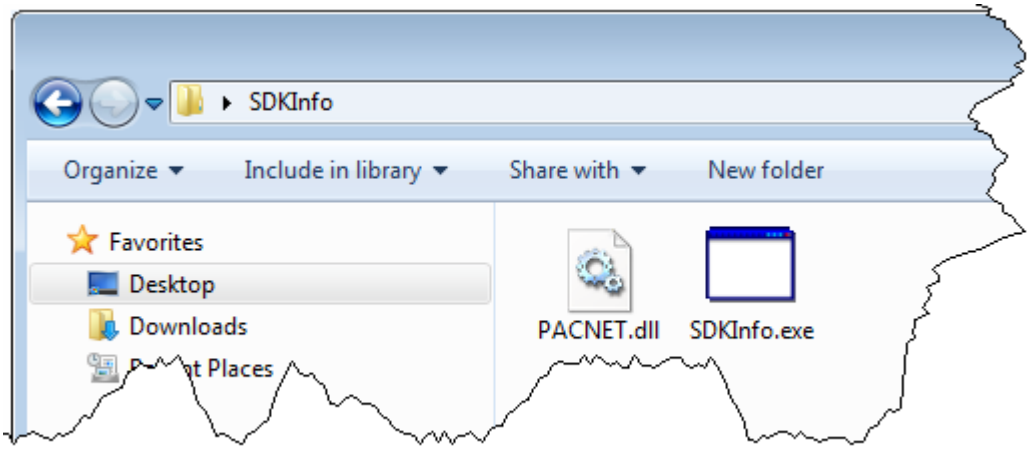
3. Upload the SDKInfo.exe application and the corresponding PACNET.dll files to EMP-9000

Tips & Warnings

For applications programming in C# and VB.net with .net compact framework, when executing these application on EMP-9000, the corresponding PACNET.dll must be in the same directory as the .exe file.



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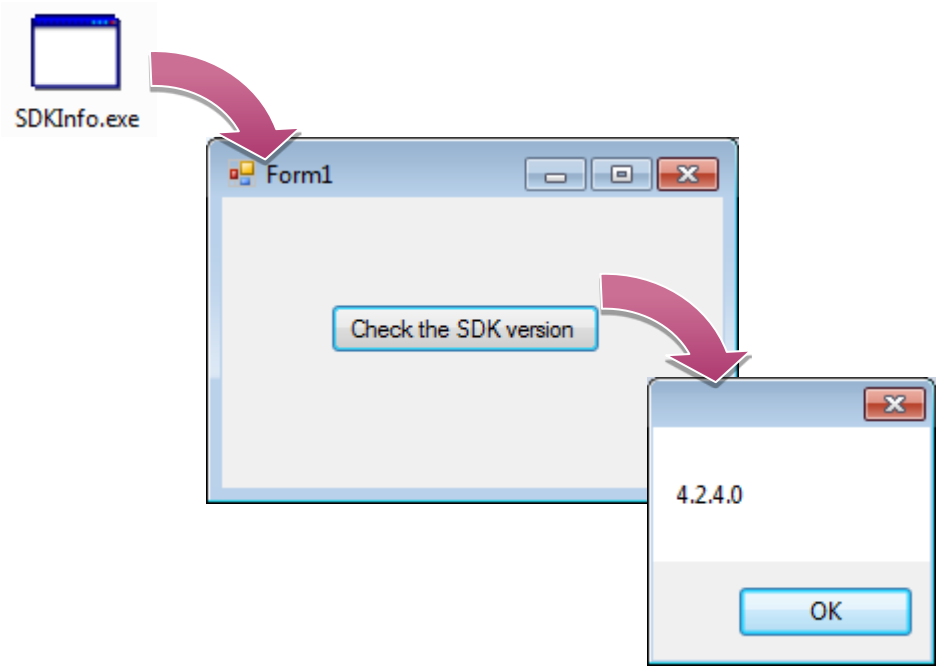
5.2.6. Execute the Application on EMP-9000

After uploading the application to EMP-9000, you can just double-click it to execute it.



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5.3. Your First EMP-9000 Program in Visual C++

The best way to learn programming with EMP-9000 is to actually create a EMP-9000 program.

The example below will guide you through creating this simple program in Visual C++ and running them on EMP-9000.

To create a demo program with Visual C++ that includes the following main steps:

1. Create a new project
2. Specify the path of the EMP-9000 reference
3. Add the control to the form
4. Add the event handling for the control
5. Upload the application to EMP-9000
6. Execute the application on EMP-9000

All main steps will be described in the following subsection.

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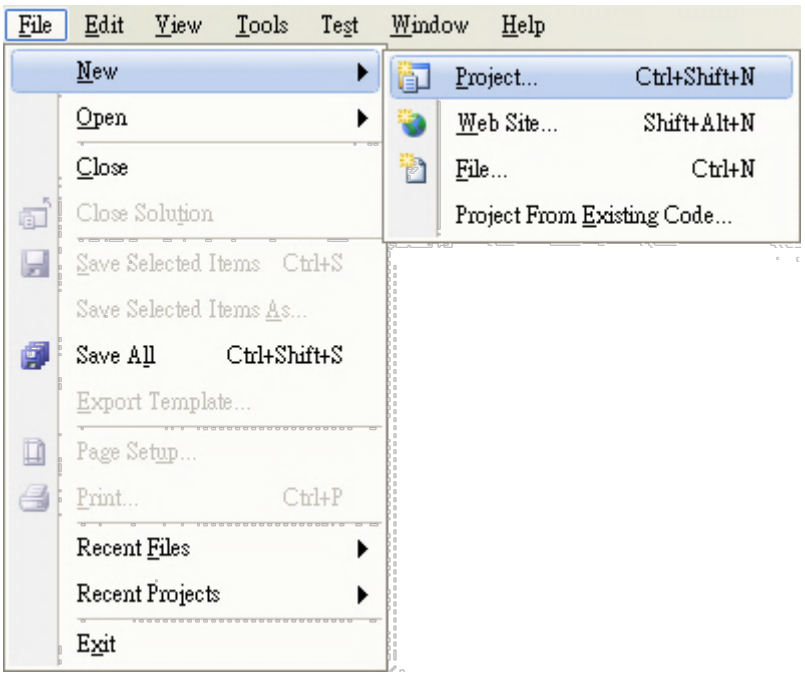
5.3.1. Create a New Project

The Visual C++ project template is a composite control that you use in this example creates a new project with this user control.

1. Run the Visual Studio 2008

Visual Studio 2008

2. On the File menu, point to New, and then click Project



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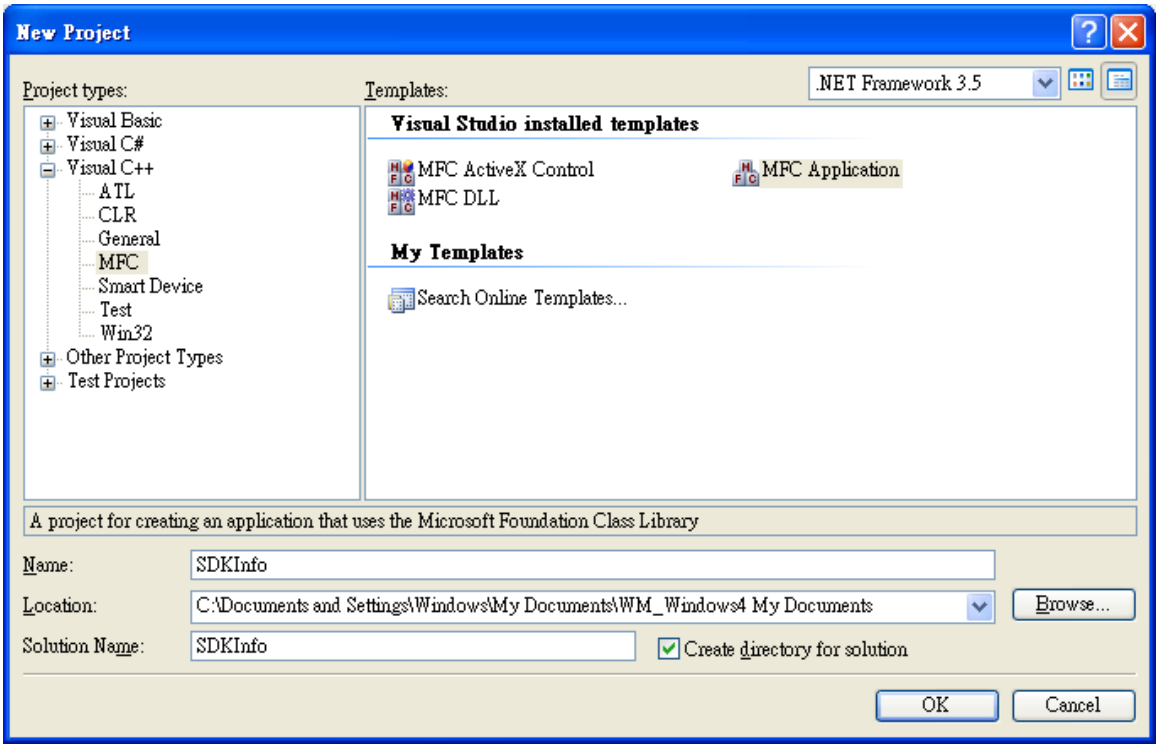
3. In the Project types pane, expand Visual C++, and then click MFC

4. In the Templates pane, click MFC Application

5. Type a name in the Name field, and then click OK

Here we will enter the name “SDKInfo” and a different location for the project if you wish



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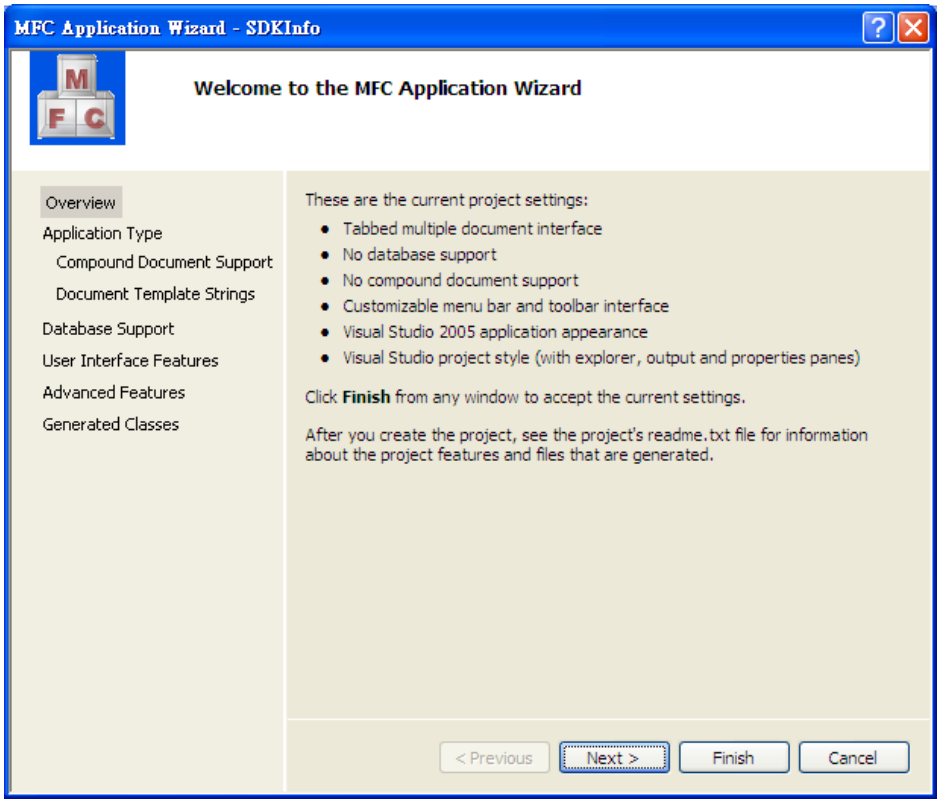
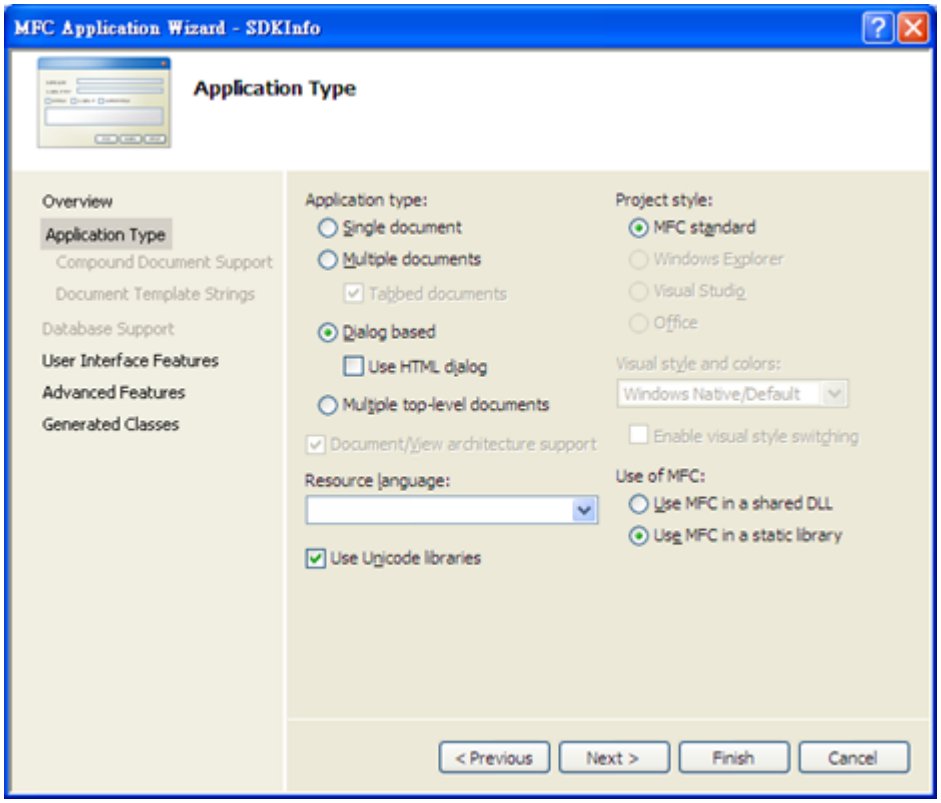
6. On the first page of the wizard, click Next >



7. On the next page of the wizard, select Dialog based, select Use MFC in a static library, and then click Finish



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5.3.2. Specify the Path of the PAC Reference

The PAC SDK provides a complete solution to integrate with EMP-9000 and it's compatible with Visual C#, Visual Basic .net and C++. In order to use a component in your application, you must first add a reference to it.

1.1 Get the PACSDK.H and PACSDK.lib, and copy them to the project folder

The PACSDK.H and PACSDK.lib can be obtained separately by downloading the latest version from ICP DAS web site.

https://www.icpdas.com/en/download/index.php?model=EMP-9051-16

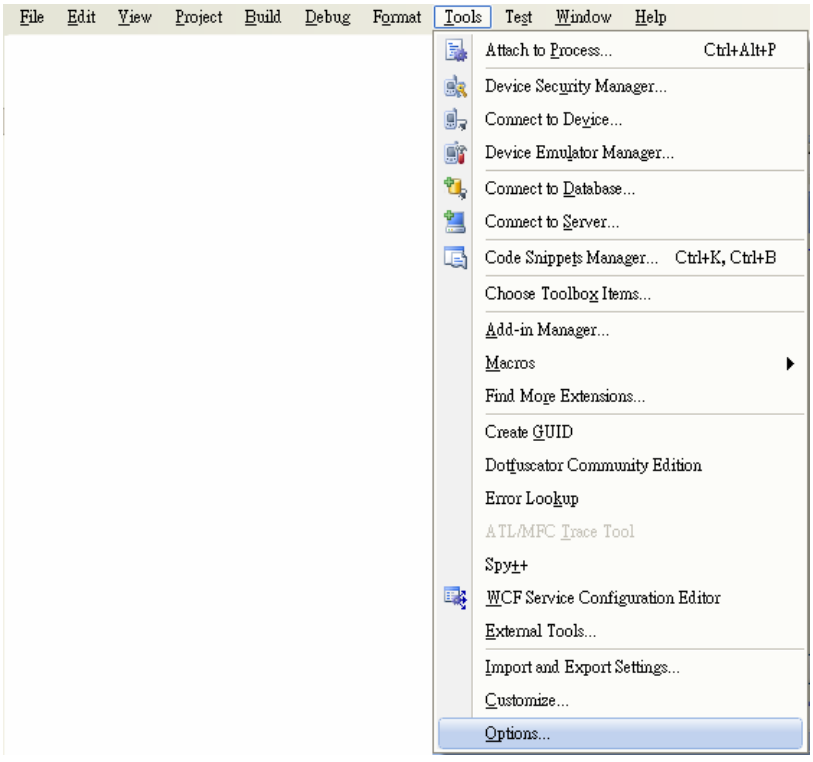
1.2 Get the UniDAQ.h and UniDAQ.lib, and copy them to the project folder (Only uses for e-9K module.)

The UniDAQ.h and UniDAQ.lib can be obtained separately by downloading the latest version from ICP DAS web site.

https://www.icpdas.com/en/download/index.php?model=EMP-9051-16

PACSDK_WES7_IoT_Vxxx_YYYYMMDD.zip

2. On the Tools menu, and then click Options



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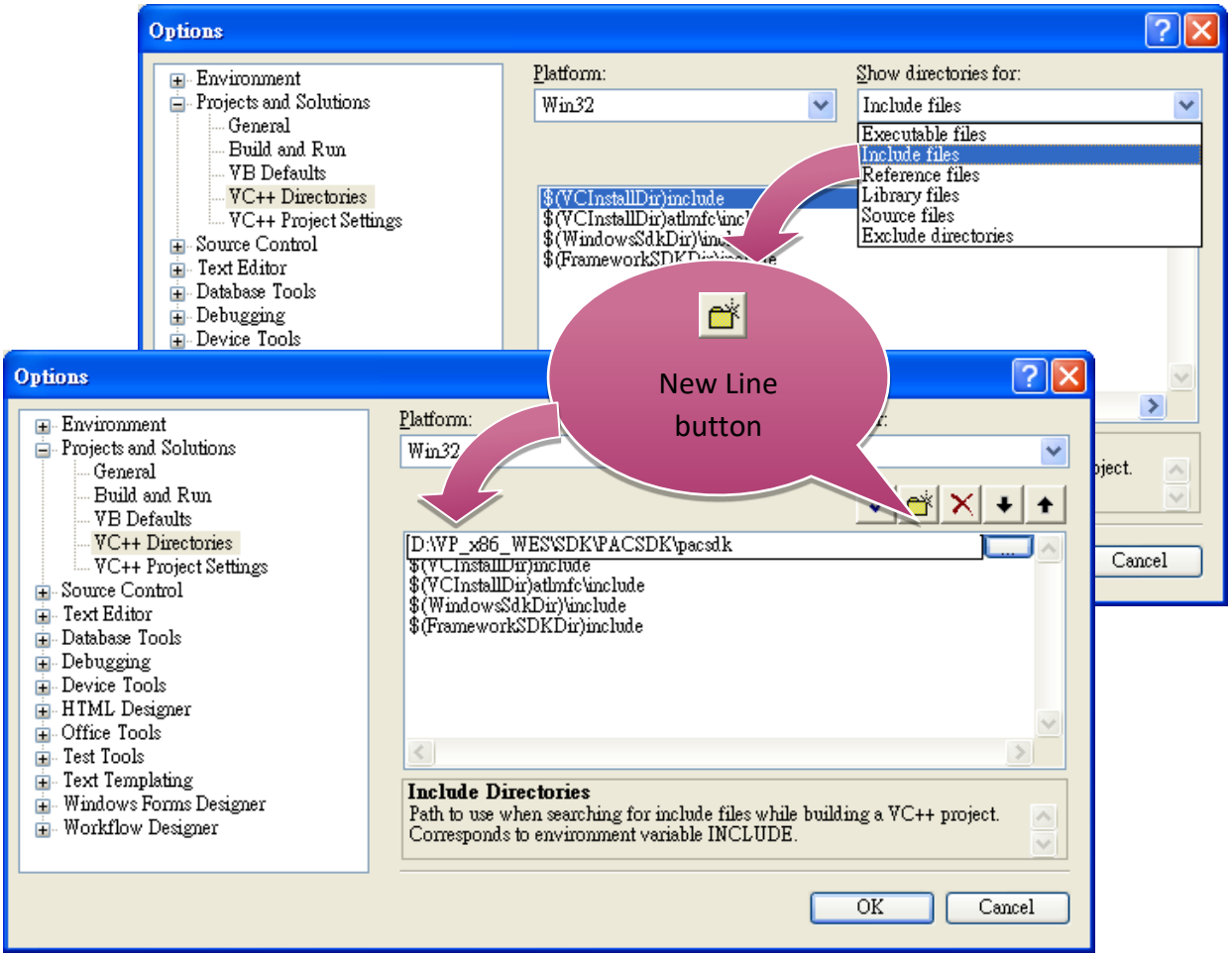
3. In the left pane, expand Projects and Solutions, and then click the VC++ Directories

4. Select Include files in the Show directories for drop down box, and then click the New Line button

5. Add a new line to the list of directories. Browse to the directory that contains the PACSDK.H file.



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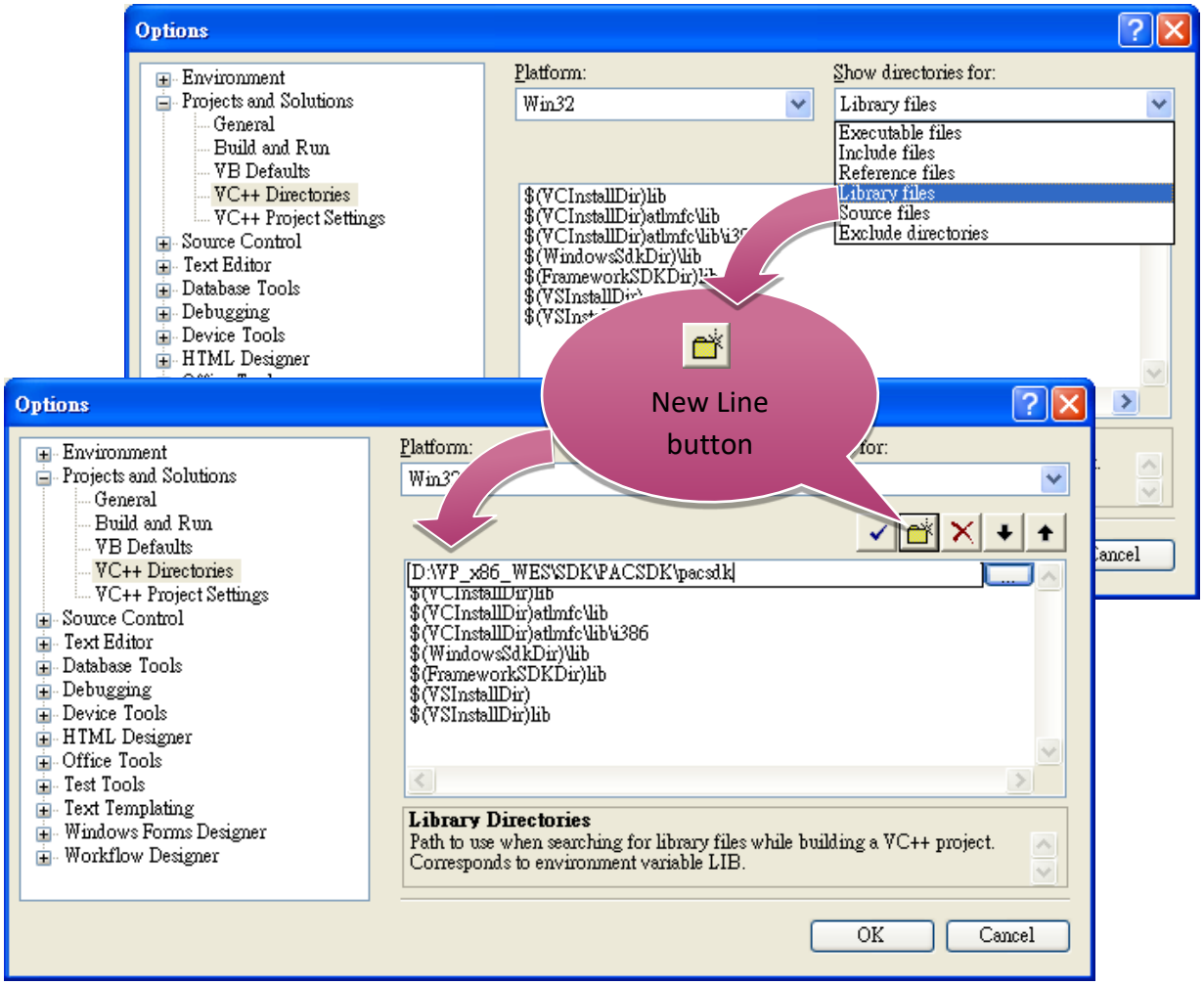
6. Select Library files in the Show directories for drop down box, and then click the New Line button

7. Add a new line to the list of directories. Browse to the directory that contains the PACSDK.lib file, and then click OK button



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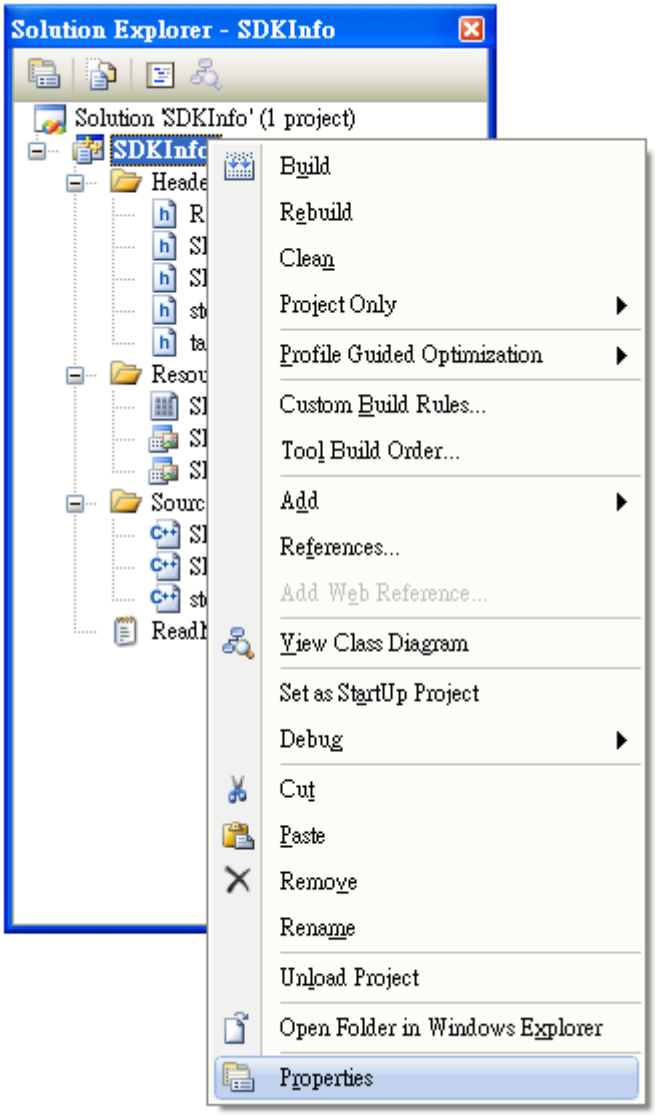
8. In the Solution Explorer windows, right-click the project name, and then click Properties



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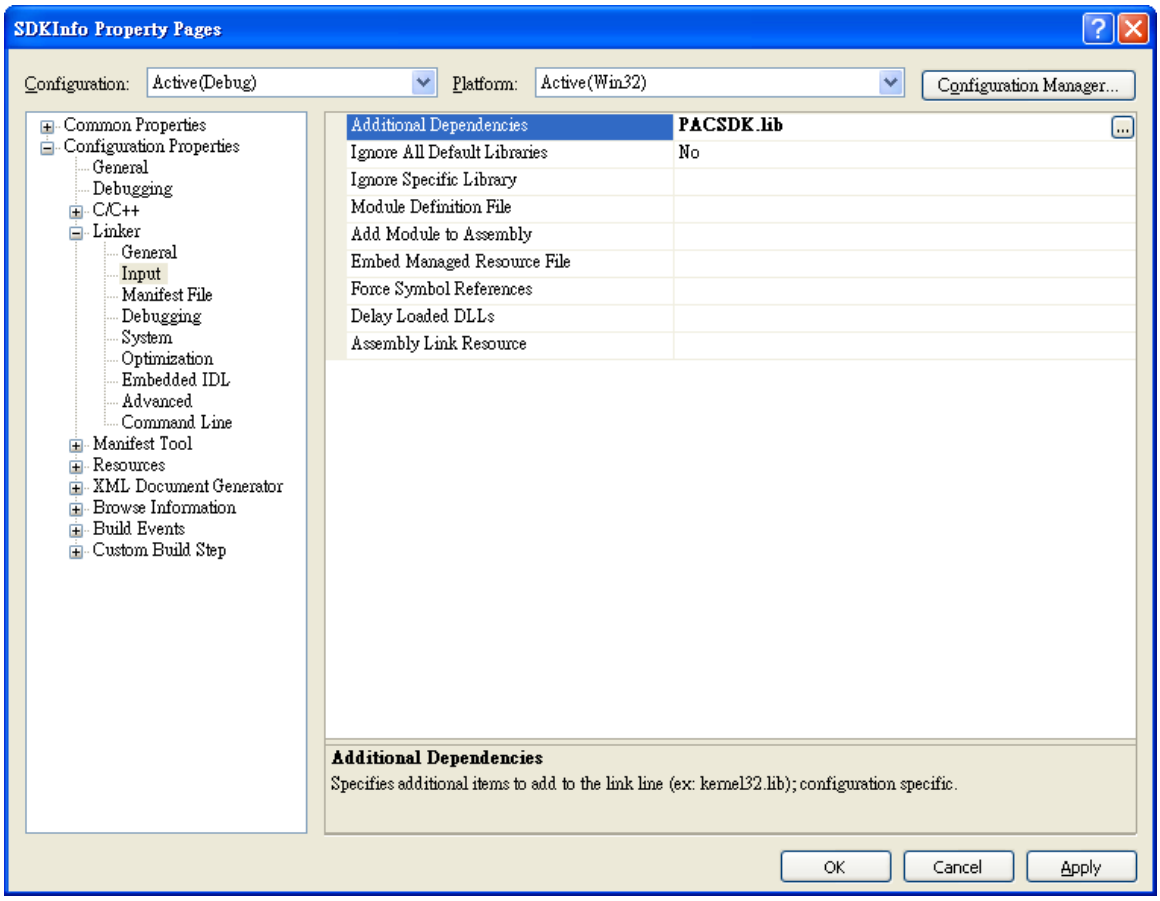
9. In the left pane, expand Configuration Properties, and then click the Link

10. In the right pane, type the PACSDK.lib in the Additional Dependencies item, click Apply button, and then click the OK button



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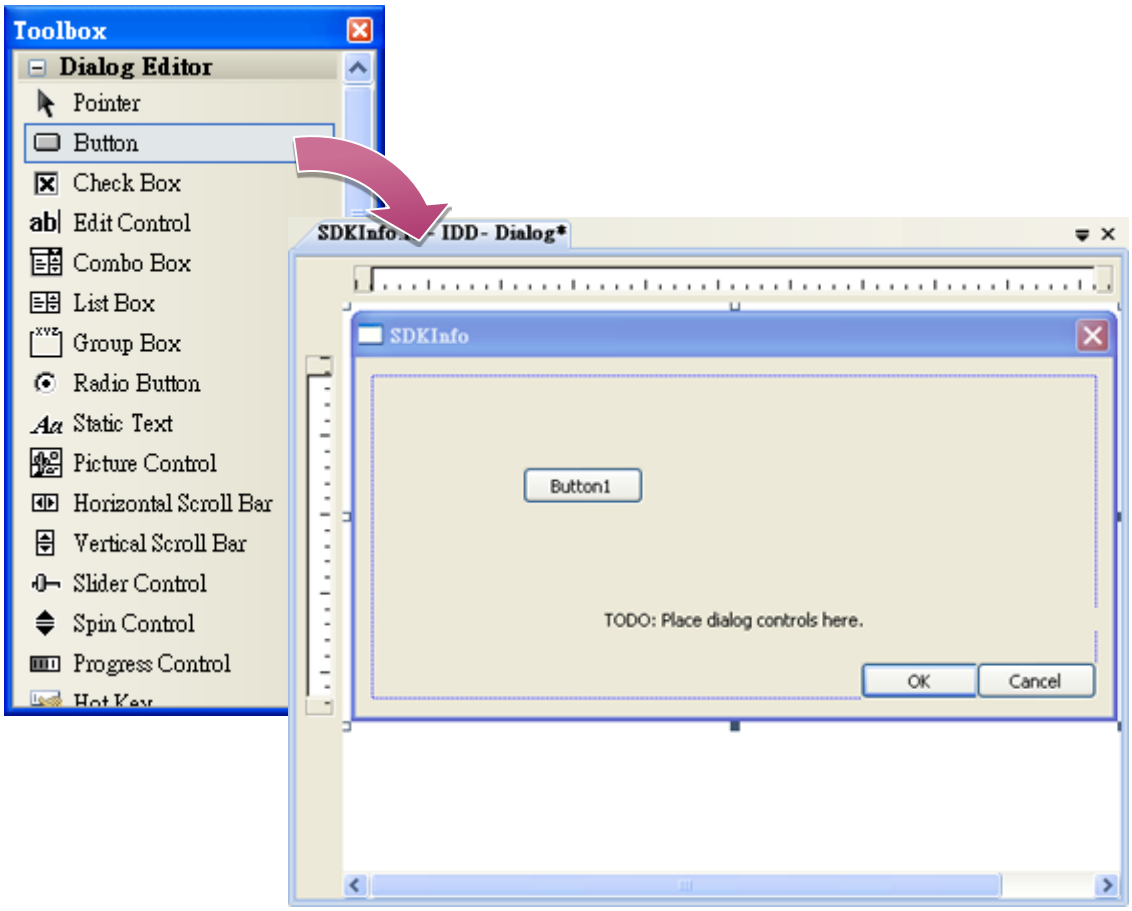
5.3.3. Add the Control to the Form

You can drag various controls from the Toolbox onto the form. These controls are not really "live"; they are just images that are convenient to move around on the form into a precise location.

After you add a control to your form, you can use the Properties window to set its properties, such as background color and default text. The values that you specify in the Properties window are the initial values that will be assigned to that property when the control is created at run time.

1. From the Toolbox, drag a Button control onto the form



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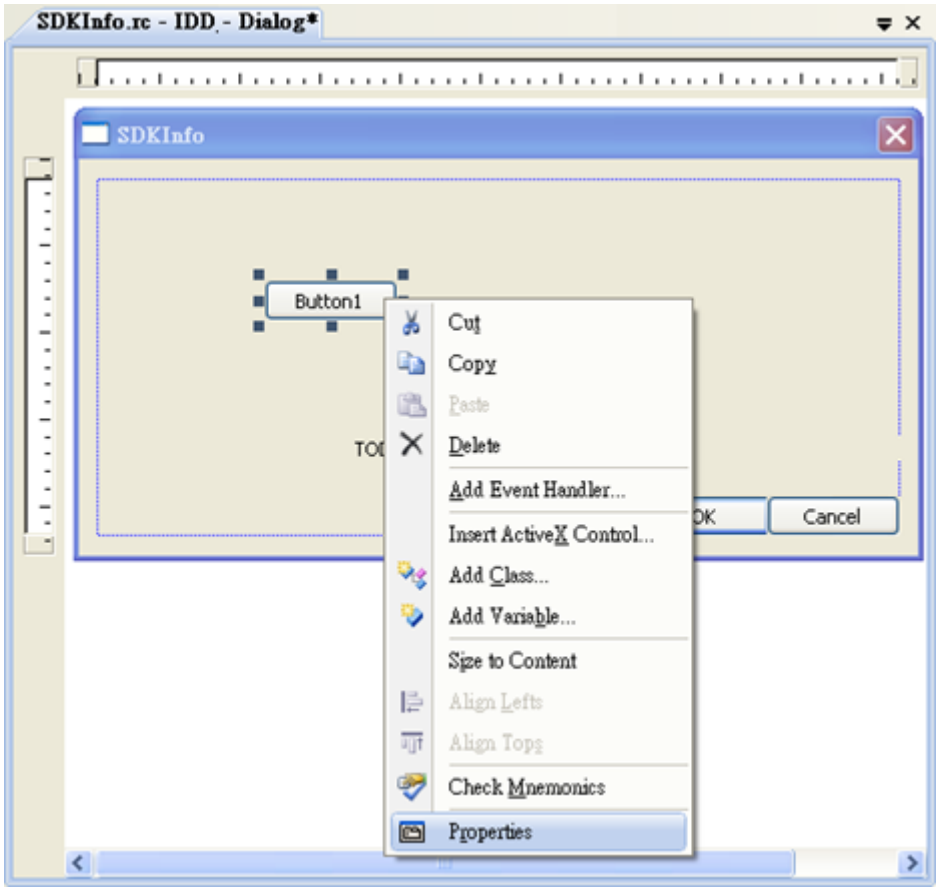
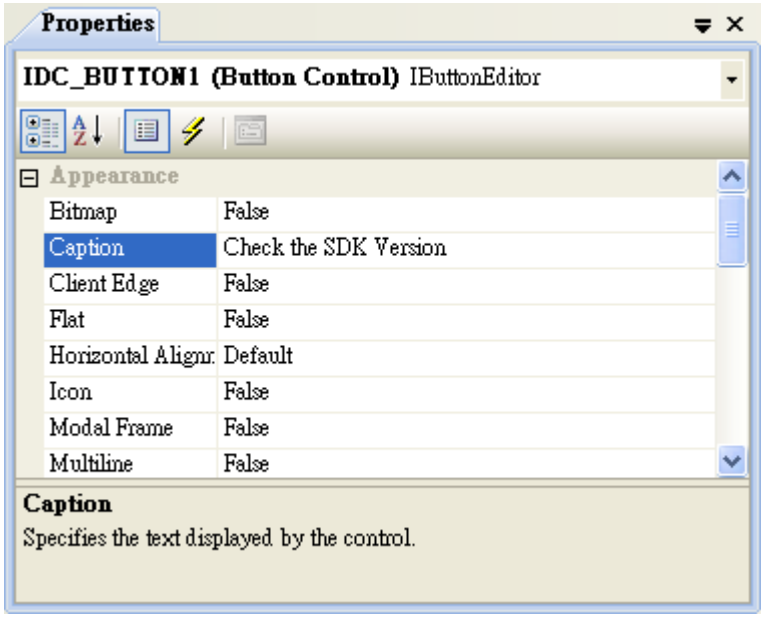
2. Right-click the Button control, and then click Properties



3. In the Properties window, type Check the SDK version in the Caption item, and press ENTER



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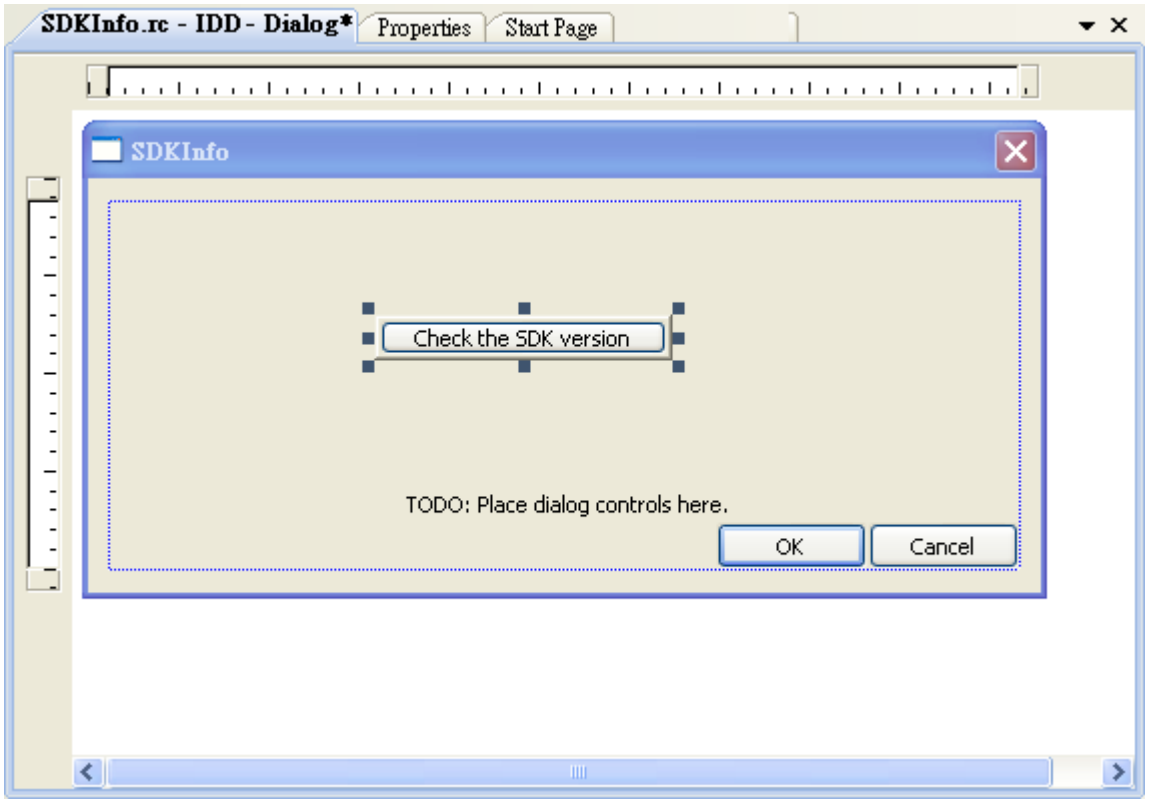
5.3.4. Add the Event Handling for the Control

You have finished the design stage of your application and are at the point when you can start adding some code to provide the program's functionality.

1. Double-click the button on the form



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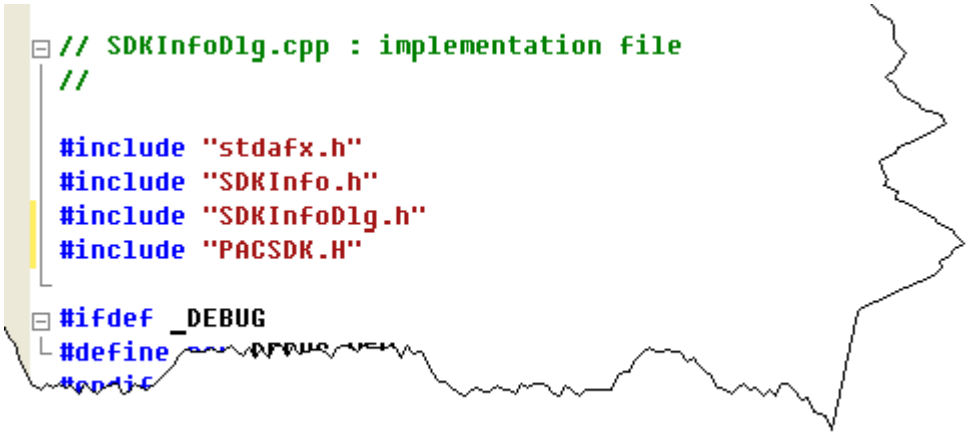
2. Inserting the following code

```
char sdk_version[32];
TCHAR buf[32];
pac_GetSDKVersion(sdk_version);
pac_AnsiToWideString(sdk_version, buf);
MessageBox(buf,0,MB_OK);
```

3.1. Inserting the following code into the header area

#include “PACSDK.H”



3.2. Inserting the following code into the header area (Only uses for e-9K module.)

```
#include "UniDAQ.h"
#pragma comment(lib,"UniDAQ.lib")
```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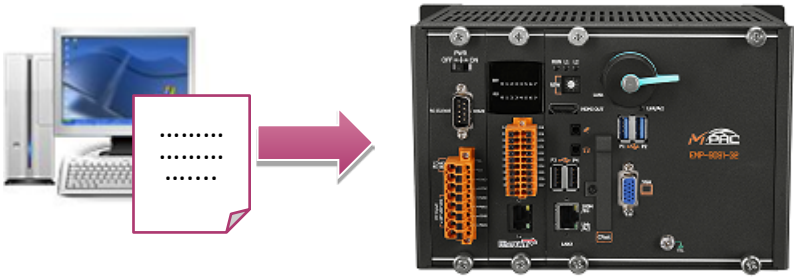
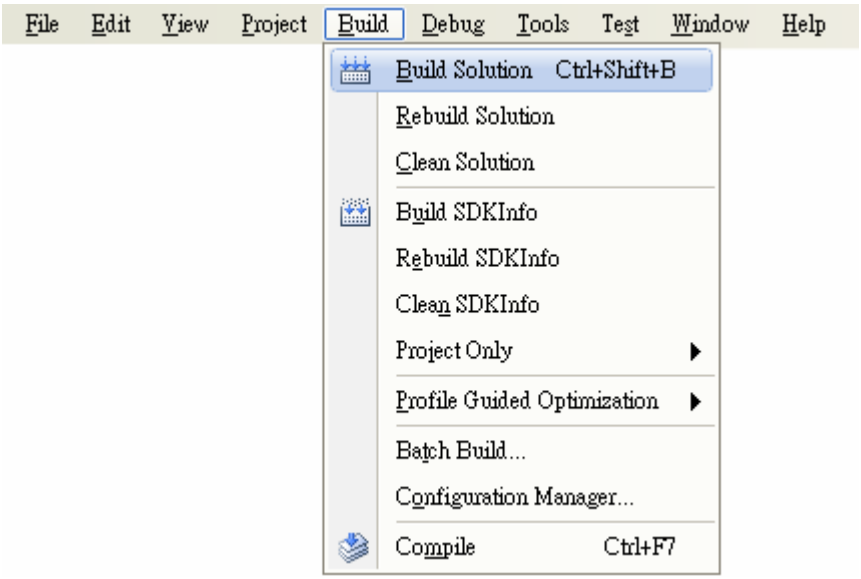
5.3.5. Upload the Application to EMP-9000

EMP-9000 supports FTP server service. You can upload files to EMP-9000 or download files from a public FTP server.



1. On the Build menu, click Build Solution



2. Open the browser and type the IP address of EMP-9000

3. Upload the SDKInfo.exe application to EMP-9000

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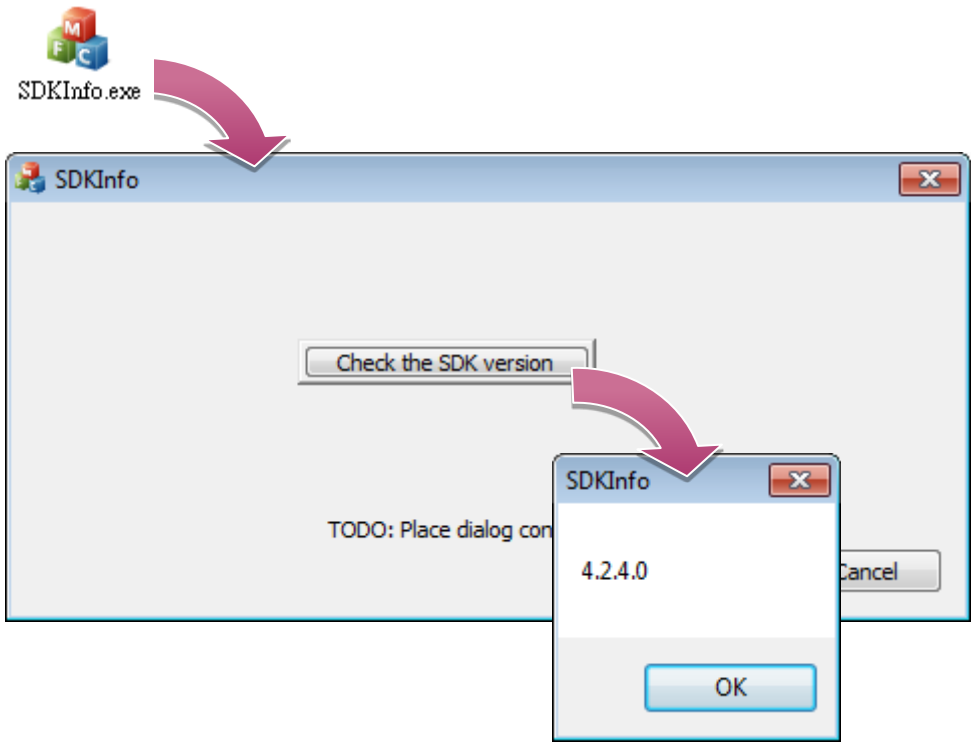
5.3.6. Execute the Application on EMP-9000

After uploading the application to EMP-9000, you can just double-click it to execute it.



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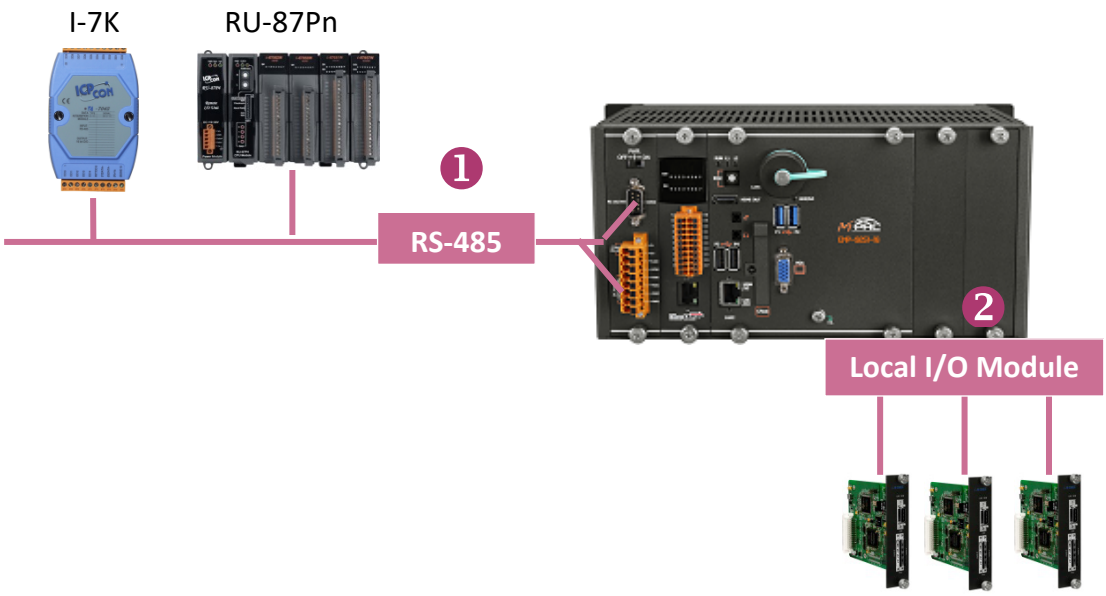
6. I/O Modules and SDK Selection

This chapter describes how to select a suitable expansion I/O module and the corresponding SDK library to be used for developing programs on EMP-9000.

EMP-9000 provides the following I/O expansion buses:



e-9K/I-9K/I-97K series I/O modules

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1. RS-485 (I-7000 series and M-7000 series)

I-7000, RU-87Pn and high profile I-87K series modules connect to EMP-9000 via a twisted-pair, multi-drop, 2-wire RS-485 network.

➢ I-7000 series I/O modules

Module	Native SDK	.NET CF SDK
I-7000 series	PACSDK.dll	PACNET.dll
I-7000 series with I-7088 (D)	PACSDK_PWM.dll	PACNET.dll

➢ RU-87Pn + I-87K series I/O modules

Module	Native SDK	.NET CF SDK
RU-87Pn+I-87K series	PACSDK.dll	PACNET.dll

➢ Other Specified I/O

Module	Native SDK	.NET CF SDK
Others	PACSDK.dll	PACNET.dll

For full details regarding I-7K series I/O modules and its demos, please refer to:

https://www.icpdas.com/en/download/show.php?num=2540&model=EMP-9051-16

xpac_iot_wes7_sdk_demo.zip

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2. Local I/O Module (I-9K/I-97K series、e-9K series)

There are three types of I/O modules that can be inserted into local bus of a EMP-9000, Parallel\Serial and Ebus. **Parallel modules** (I-9K Series) are high-speed modules and only support an MCU (Main Control Unit). **Serial modules** (I-97K Series) can support either an MCU or an I/O expansion unit. **Ebus modules** (e-9K Series) can support either an MCU or an I/O expansion unit.

The following table shows the appropriate SDK library to be used for I/O modules.

- **I-9K series I/O modules**

Module	Native SDK	.NET CF SDK
I-9014 (C)	pac_i9014W.dll	pac_i9014Wnet.dll
I-9017(C)-15	pac_i9017W.dll	pac_i9017Wnet.dll
I-9028U	pac_i9028W.dll	pac_i9028Wnet.dll
I-9093	pac_i9093W.dll	pac_i9093Wnet.dll
I-9172	pac_i9172W.dll	pac_i9172Wnet.dll
Other I-9K series	PACSDK.dll	PACNET.dll

- **I-97K series I/O modules**

Module	Native SDK	.NET CF SDK
I-97K series	PACSDK.dll	PACNET.dll

- **e-9K series I/O modules**

Module	Native SDK	.NET CF SDK
e-9K series	UniDAQ.DLL	UniDAQ.cs

For full details regarding I-9K/I-97K/e-9K series I/O modules and its demos, please refer to:

https://www.icpdas.com/en/download/show.php?num=2540&model=EMP-9051-16

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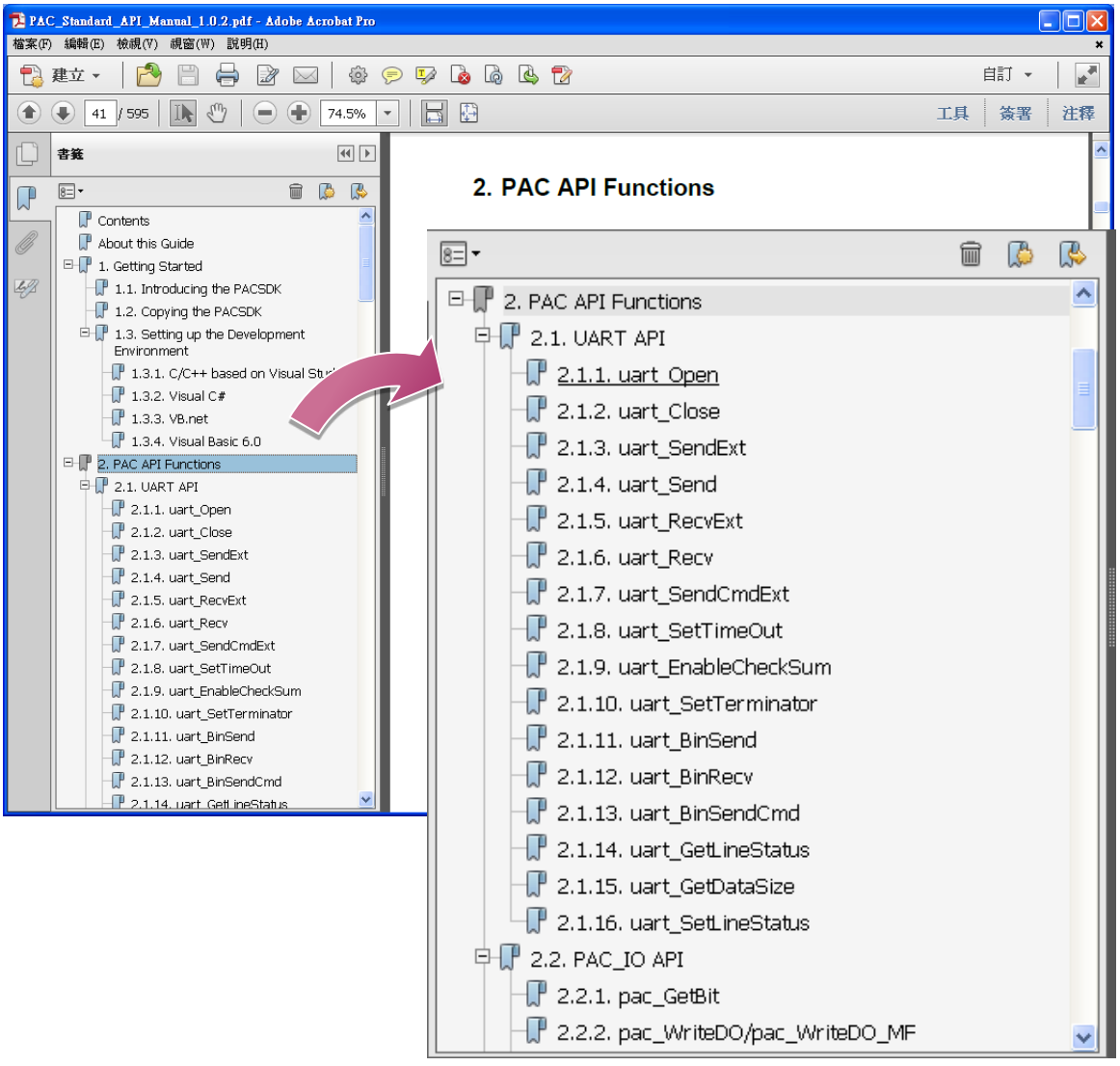
7. APIs and Demo Programs

This chapter provides a brief overview of PAC APIs and demo programs that have been designed for EMP-9000.

ICP DAS provides a set of demo programs in different programming languages. You can examine the demo codes, which includes numerous comments, to familiarize yourself with the PAC APIs. This will allow developing your own applications quickly by modifying these demo programs.

For full usage information regarding the description, prototype and the arguments of the functions, please refer to the “PAC Standard API Manual”



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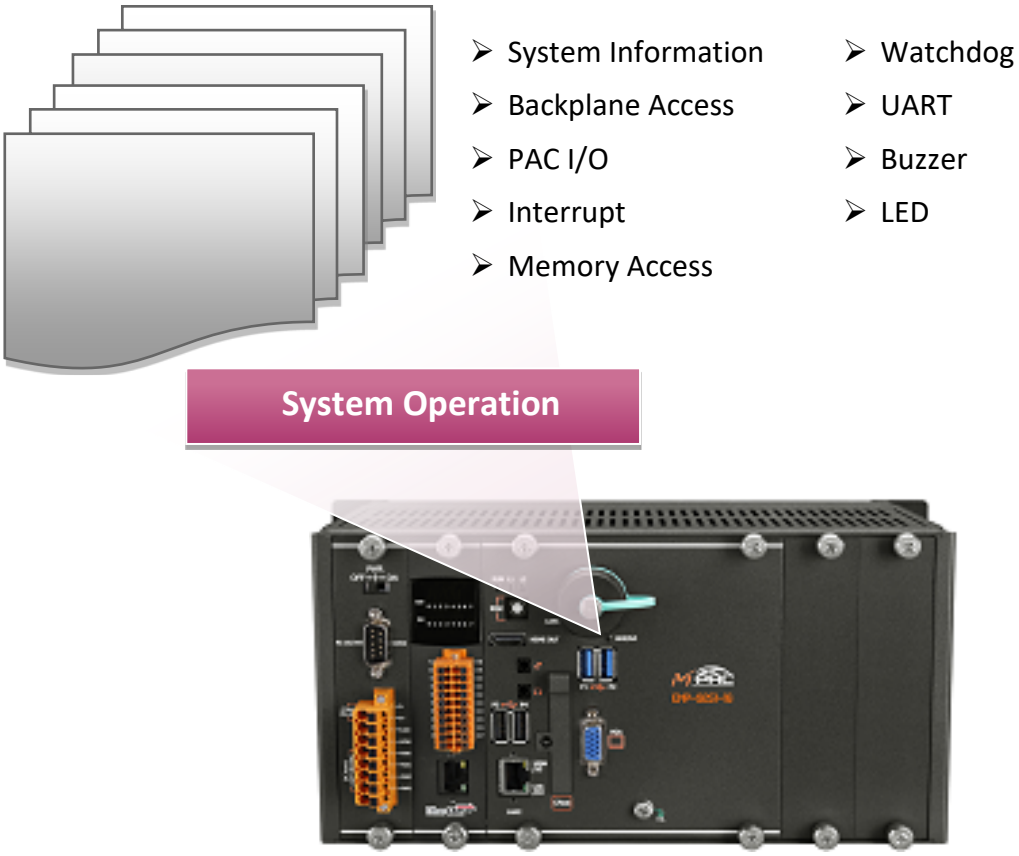
7.1. PAC Standard APIs

The diagram below shows the set of each system operation API provided in the PACSDK.



PAC Standard API Manual (EN)

https://www.icpdas.com/en/download/show.php?num=2527

VB.NET Demo Programs for PAC Standard APIs

The PAC SDK includes the following demo programs that demonstrate the use of the PAC Standard APIs in a VB.NET language environment. The following demo programs can be found by downloading the latest version from ICP DAS web site.

For VB.NET applications, these demo programs can be obtained from:

https://www.icpdas.com/en/download/show.php?num=2540&model=EMP-9051-16

xpac_iot_wes7_sdk_demo.zip

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C# Demo Programs for PAC Standard APIs

The PAC SDK includes the following demo programs that demonstrate the use of the PAC Standard APIs in a C# language environment. The following demo programs can be found by downloading the latest version from ICP DAS web site.

For C# applications, these demo programs can be obtained from:

https://www.icpdas.com/en/download/show.php?num=2540&model=EMP-9051-16

xpac_iot_wes7_sdk_demo.zip

Visual C++ Demo Programs for PAC Standard APIs

The PAC SDK includes the following demo programs that demonstrate the use of the PAC Standard APIs in a Visual C++ language environment. The following demo programs can be found by downloading the latest version from ICP DAS web site.

For Visual C++ applications, these demo programs can be obtained from:

https://www.icpdas.com/en/download/show.php?num=2540&model=EMP-9051-16

xpac_iot_wes7_sdk_demo.zip

Folder	Demo	Explanation
diagnostic	diagnostic	Retrieves information about the slot count and the module inserted in the backplane.
dip	dip	Retrieves information about the status of the DIP switch.
getdeviceinformation	getdeviceinformation	Retrieves information about the OS version, the CPU version and the SDK version, etc.
GetRotaryID	GetRotaryID	Retrieves information about the status of the rotary switch.
Memory	readmemory	Shows how to read date values from EEPROM.
	writememory	Shows how to write date values to EEPROM.
uart_sendcmd	uart_sendcmd	Shows how to read the name of local I/O modules via UART
WatchDog	WatchDog	Displays information about how to operate the watchdog

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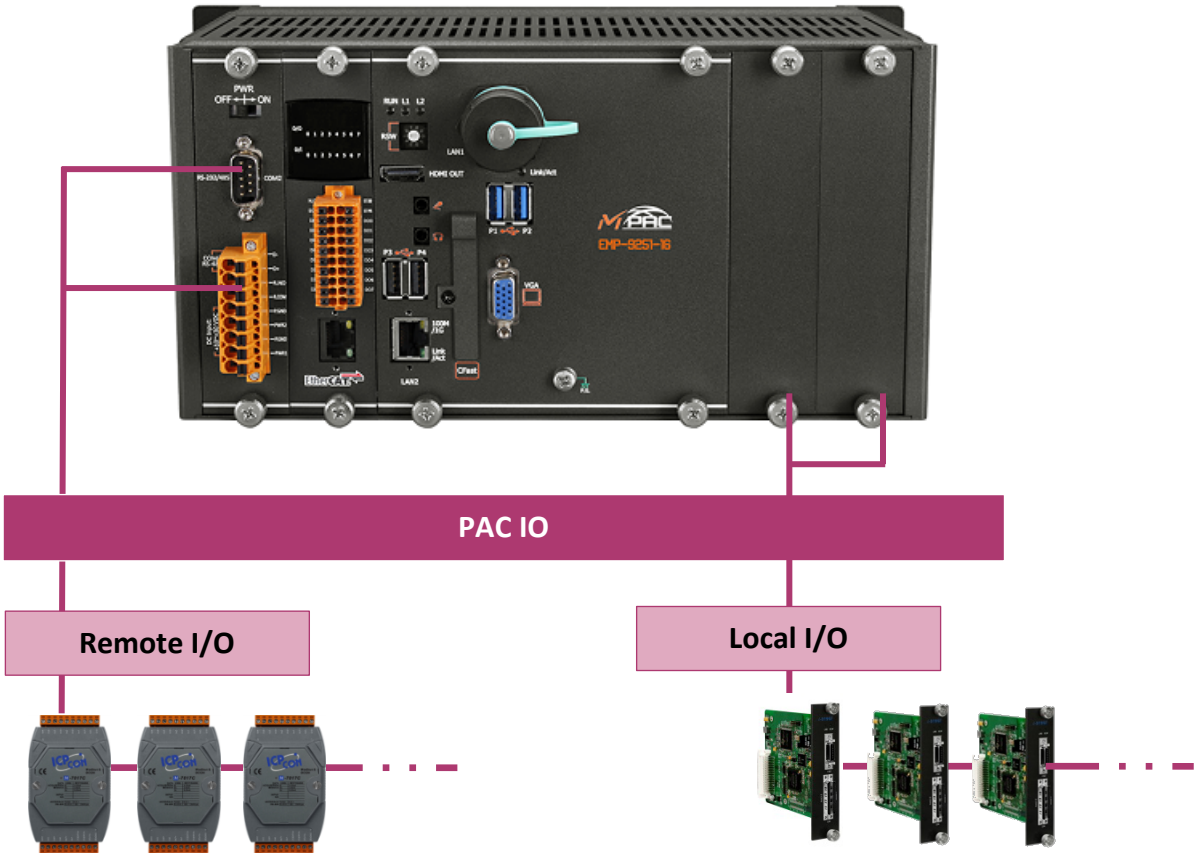
7.2. PAC Local IO APIs

The diagram below shows the types of the PAC IO APIs provided in the PACSDK or the specified SDK.

For more information about the APIs and demo programs provided by the expansion I/O modules, please refer to chapter 6. I/O Modules and SDK Selection



PAC Standard API Manual (EN)

https://www.icpdas.com/en/download/show.php?num=2527

e-9K API - UniDAQ DLL User Manual

https://www.icpdas.com/en/download/show.php?num=1010

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VB.NET Demo Programs for PAC Local IO APIs

The PAC SDK includes the following demo programs that demonstrate the use of the PAC IO APIs in a VB.NET language environment. The following demo programs can be found by downloading the latest version from ICP DAS web site.

For VB.NET applications, these demo programs can be obtained from:

https://www.icpdas.com/en/download/show.php?num=2540&model=EMP-9051-16

xpac_iot_wes7_sdk_demo.zip

C# Demo Programs for PAC Local IO APIs

The PAC SDK includes the following demo programs that demonstrate the use of the PAC IO APIs in a C# language environment. The following demo programs can be found by downloading the latest version from ICP DAS web site.

For C# applications, these demo programs can be obtained from:

https://www.icpdas.com/en/download/show.php?num=2540&model=EMP-9051-16

xpac_iot_wes7_sdk_demo.zip

Visual C++ Demo Programs for PAC Local IO APIs

The PAC SDK includes the following demo programs that demonstrate the use of the PAC IO APIs in a Visual C++ language environment. The following demo programs can be found by downloading the latest version from ICP DAS web site.

For Visual C++ applications, these demo programs can be obtained from:

https://www.icpdas.com/en/download/show.php?num=2540&model=EMP-9051-16

xpac_iot_wes7_sdk_demo.zip

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Folder	Demo	Explanation
Local	87K_ai	https://www.icpdas.com/en/download/show.php?num=2775&model=I-9014#aio **I-97K (PAC I/O) User Manual**
	87K_ao	
	87k_ao_poweron_safe	
	87k_basic	
	87k_count	
	87k_di(mf)	
	87k_di_cnt(mf)	
	87k_di_latch	
	87k_dio(mf)	
	87k_dio_latch	
	87k_do(mf)	
	87k_do_poweron_safe(mf)	
	87k_pwm	
	8k_87k_di(mf)	
	8k_87k_dio(mf)	
	8k_87k_do(mf)	
	8k_di	https://www.icpdas.com/en/download/show.php?num=2775&model=I-9014#aio **I-9K (PAC I/O) User Manual**
	8k_dio	
	8k_do	
	pac_i8014w_demo	https://www.icpdas.com/en/download/show.php?num=2775&model=I-9014#aio https://www.icpdas.com/en/download/show.php?num=2775&model=I-9014#dio https://www.icpdas.com/en/download/show.php?num=2775&model=I-9014#motion
	pac_i8017hwdemo	
	pac_i8024wdemo	
	pac_i8026w_demo	
	pac_i8084wdemo	
	pac_i8088wdemo	
	pac_i8093demo	

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	pac_i8172wdemo	

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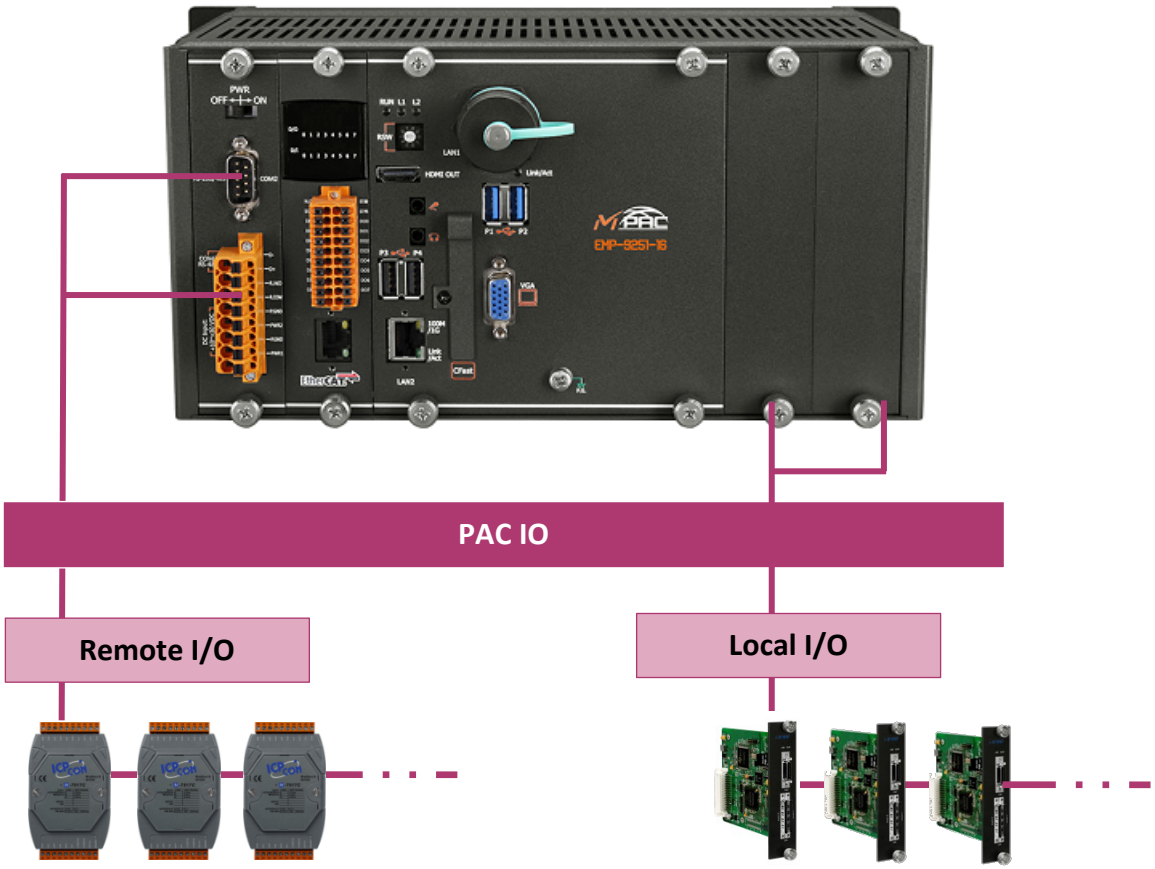
7.3. PAC Remote IO APIs

The diagram below shows the types of the PAC IO APIs provided in the PACSDK or the specified SDK.

For more information about the APIs and demo programs provided by the expansion I/O modules, please refer to chapter 6. I/O Modules and SDK Selection



VB.NET Demo Programs for PAC Remote IO APIs

The PAC SDK includes the following demo programs that demonstrate the use of the PAC IO APIs in a VB.NET language environment. The following demo programs can be found by downloading the latest version from ICP DAS web site.

For VB.NET applications, these demo programs can be obtained from:

https://www.icpdas.com/en/download/show.php?num=2540&model=EMP-9051-16

xpac_iot_wes7_sdk_demo.zip

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C# Demo Programs for PAC Remote IO APIs

The PAC SDK includes the following demo programs that demonstrate the use of the PAC IO APIs in a C# language environment. The following demo programs can be found by downloading the latest version from ICP DAS web site.

For C# applications, these demo programs can be obtained from:

https://www.icpdas.com/en/download/show.php?num=2540&model=EMP-9051-16

xpac_iot_wes7_sdk_demo.zip

Visual C++ Demo Programs for PAC Remote IO APIs

The PAC SDK includes the following demo programs that demonstrate the use of the PAC IO APIs in a Visual C++ language environment. The following demo programs can be found by downloading the latest version from ICP DAS web site.

For Visual C++ applications, these demo programs can be obtained from:

https://www.icpdas.com/en/download/show.php?num=2540&model=EMP-9051-16

xpac_iot_wes7_sdk_demo.zip

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Folder	Demo	Explanation
Remote	7k87k_basic	Shows how to send/receive a command/response application. This demo program is used by 7K, 97K series AI modules which connected through a COM port.
	7k87k_ai	Shows how to read the AI values of AI module. This demo program is used by 7K, 97K series AI modules which connected through a COM port.
	7k87k_ao	Shows how to write the AO values to AO module. This demo program is used by 7K, 97K series AI modules which connected through a COM port.
	7k87k_di	Shows how to read the DI values of DI module. This demo program is used by 7K, 97K series AI modules which connected through a COM port.
	7k87k_do	Shows how to write the DO values to DO module. This demo program is used by 7K, 97K series AI modules which connected through a COM port.
	7k87k_dio	Shows how to read the DI and the DO values of the DIO module. This demo program is used by 7K, 97K series AI modules which connected through a COM port.

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8. Restore and Recovery

This chapter provides information of the EMP-9000 restore and recovery, and a guided tour that describes the steps needed to restore and recovery the EMP-9000.

The EMP-9000 come with a rescue CFast card that can be used to not only boot the EMP-9000 when the OS fails to load, but also recover files.

The recovery file of the rescue CFast card can be found separately by downloading the latest version from ICP DAS web site.

EMP-9x5x:
https://www.icpdas.com/en/download/index.php?model=EMP-9051-16
EMP-9x9x:
https://www.icpdas.com/en/download/index.php?model=EMP-9091-16

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8.1. Recovering the EMP-9000

The EMP-9000 comes with a rescue CFast card that can be used to restore the EMP-9000 to factory default settings by reinstalling the EMP-9000 OS image.

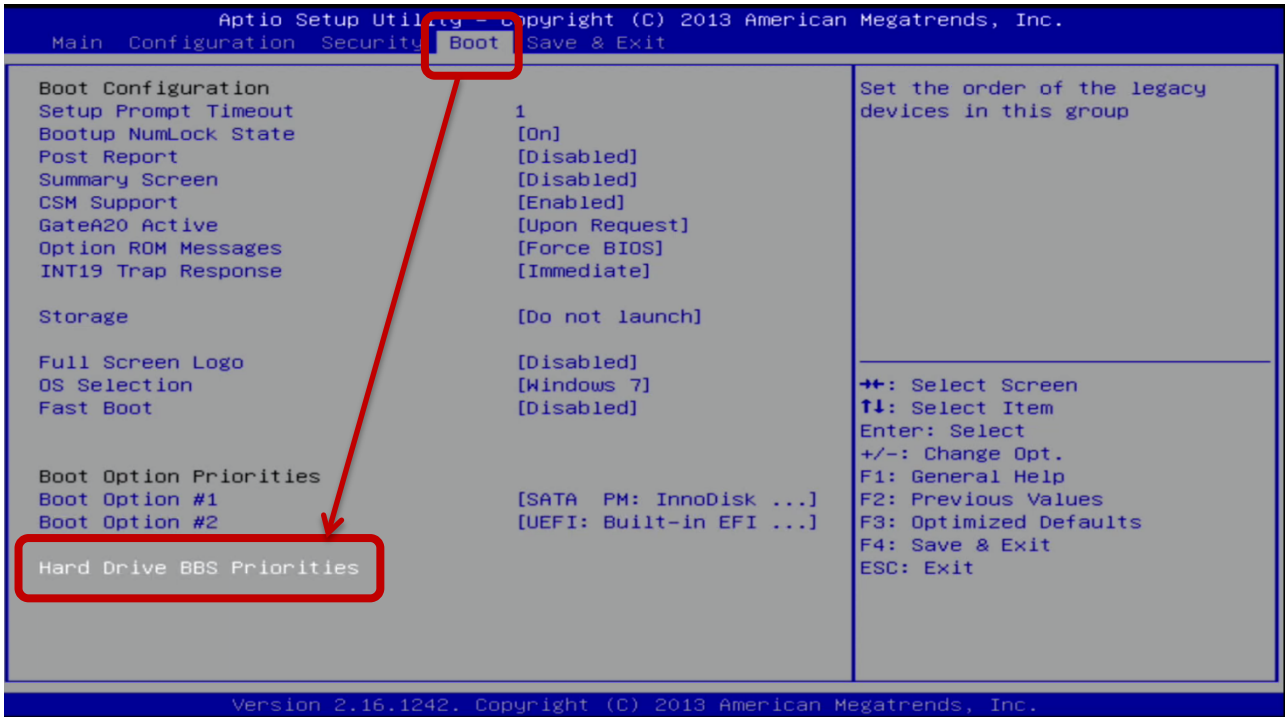
If the EMP-9000 crashes and won't start up, you can use the rescue CFast card to start up the EMP-9000 and then fix the problem that caused the crash.

To restore the EMP-9000 OS

1. Plug the Rescue CFast card into CFast slot (EMP-9000)

2. Restart the EMP-9000, and then enter the BIOS by pressing Delete key

3. Press the → key to highlight the Boot tab, and then press ↓ key to select [Hard Drive BBS Priorities]



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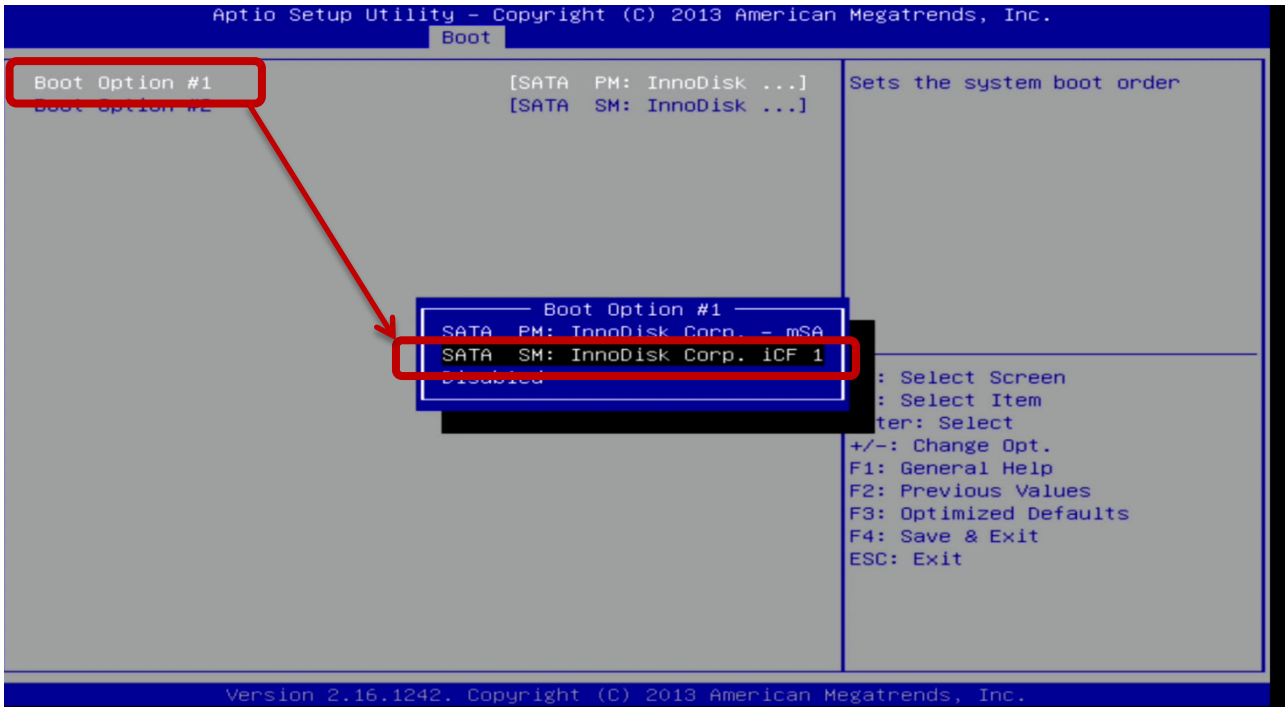
4. Press Enter on Boot Option #1, and select [CFast card name]



5. Press the F4 key, and then select Yes to save settings and exit the utility.

The EMP-9000 will restart and then enter to the EMP-9000 PAC Recovery Utility.

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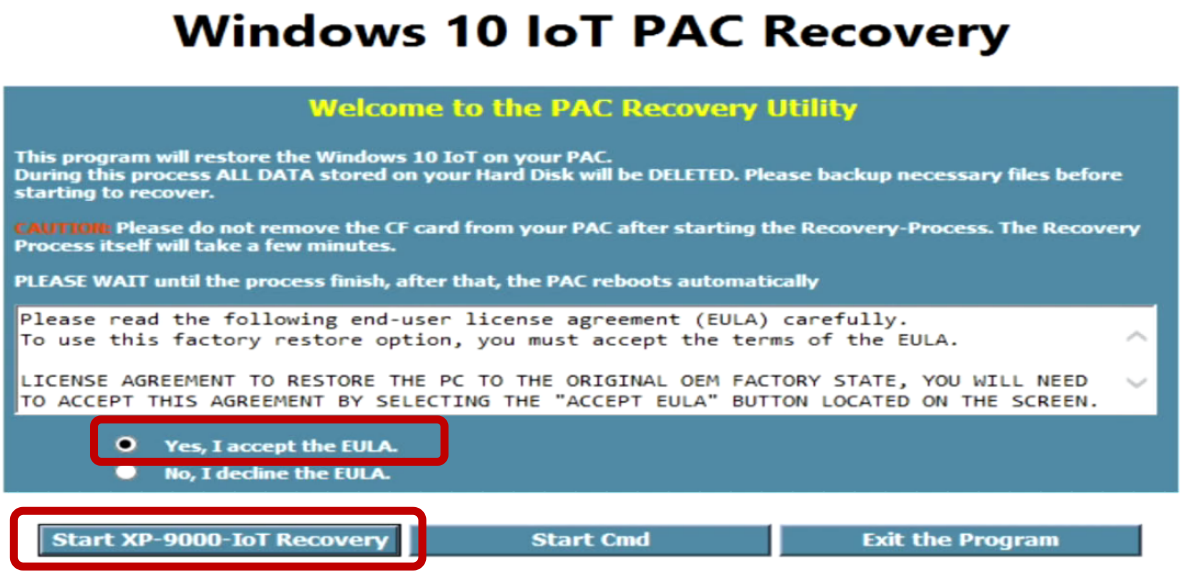
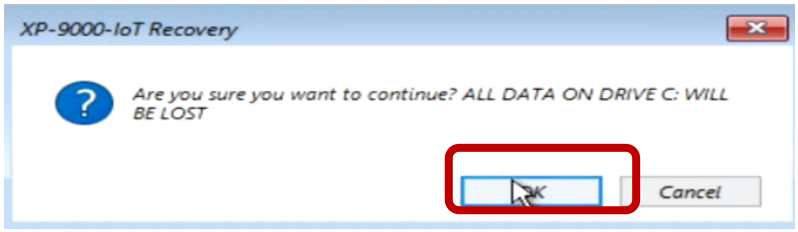
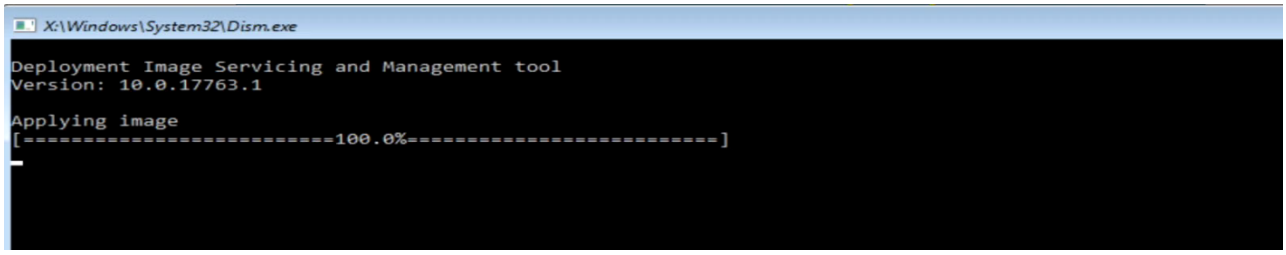
6. Check Yes and click Start EMP-9000 Recovery button for start the recovery process.

The process will take a few minutes until this utility is displayed again.







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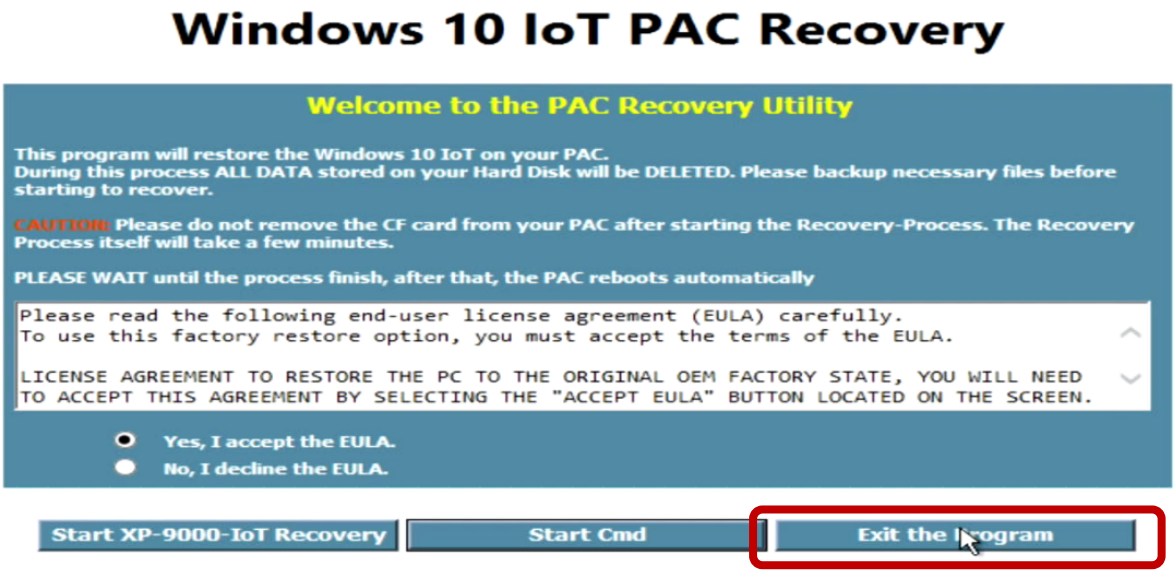
7. Click the Exit And Restart button, and then repeat the step 2 to step 5. In step 4, the [SATA PM: InnoDisk Corp. –mSA] option need be selected for using the restored disk as a boot drive. After completing the configuration process, restart the EMP-9000.



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8.2. Restoring the Rescue CFast Card

The rescue CFast card is rescue equipment that allows you to perform some maintenance tasks on your system in case of failure.
Once the rescue CFast card are partitioned or formatted, you must restore the rescue CFast card.

Requirements

For restoring the Rescue CFast card, you should prepare Clonezilla, which you could obtain by contacting Symantec (http://www.symantec.com)

In this article, we will use Symantec Norton Ghost32 V.11 (The Symantec Norton Ghost V.11 or above version are recommend) to restore the rescue CFast card.

To restore the rescue CFast card

1. Get the rescue ghost file, rescue.gho

The rescue.gho file can be found by downloading the latest version from ICP DAS web site.
EMP-9000:
https://www.icpdas.com/en/download/index.php?model=EMP-9051-16

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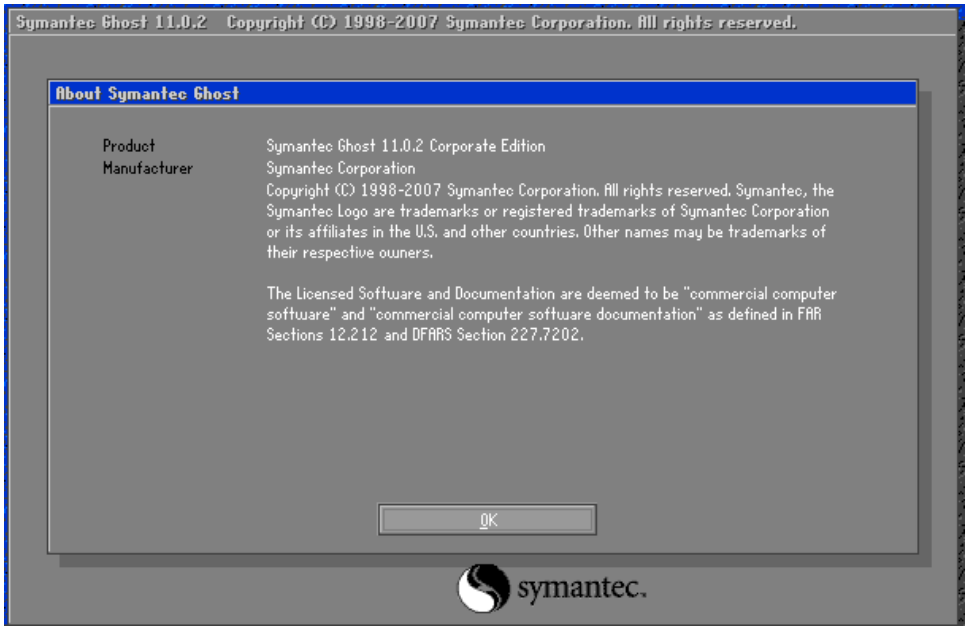
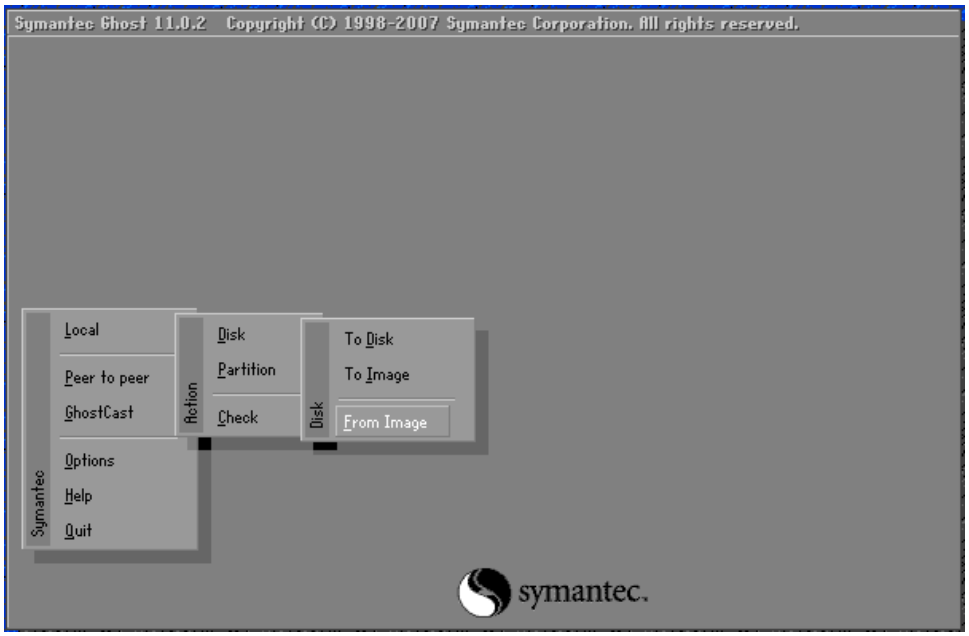
2. Run the Symantec Ghost32, and then click OK button



3. Click Function Menu, point to Local, point to Disk, and then click From Image



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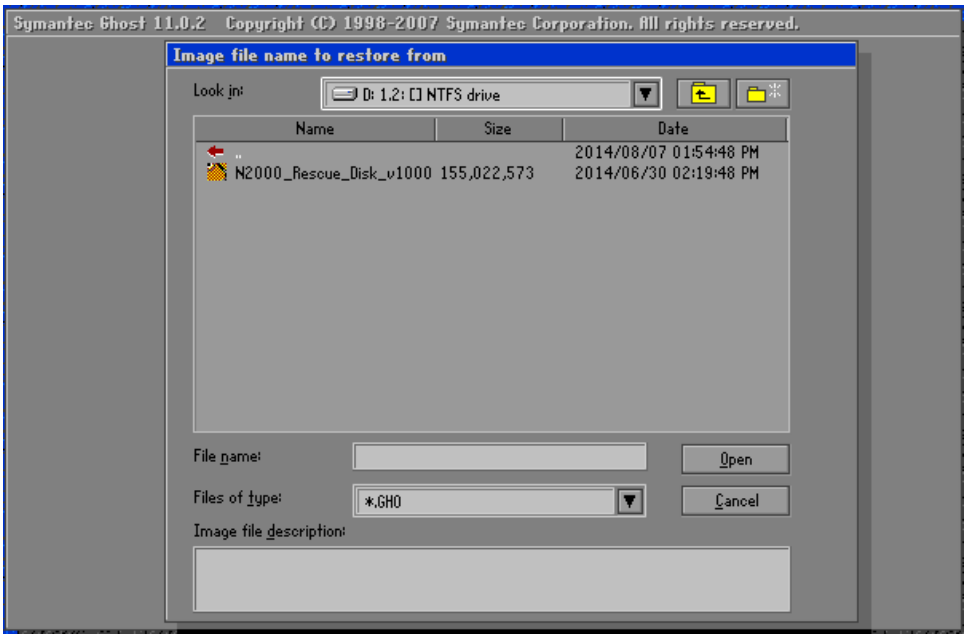
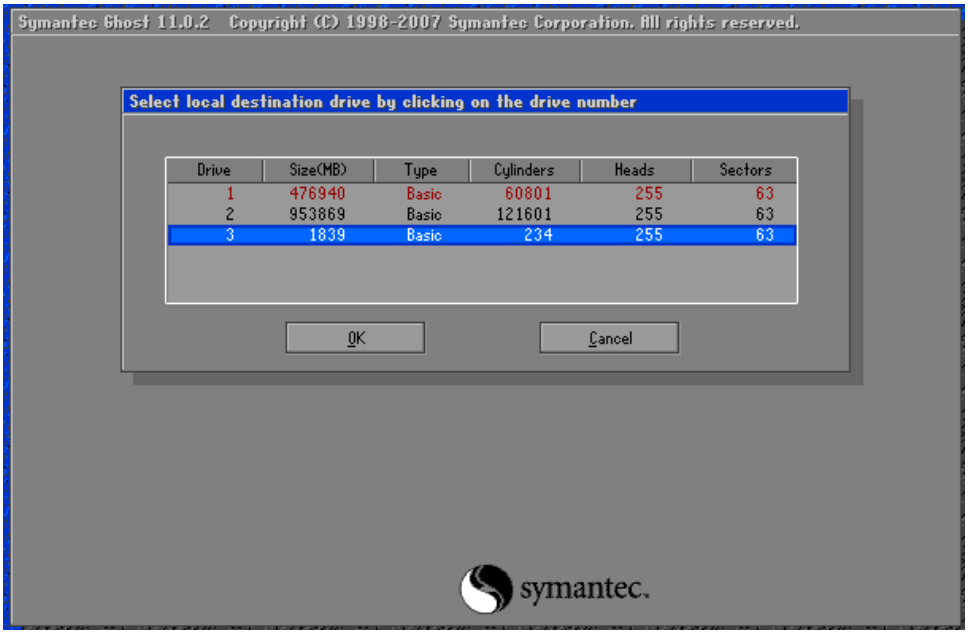
4. Select the rescue ghost file, rescue.gho, that you saved and then click Open



5. Select the destination to CFast card and click then OK



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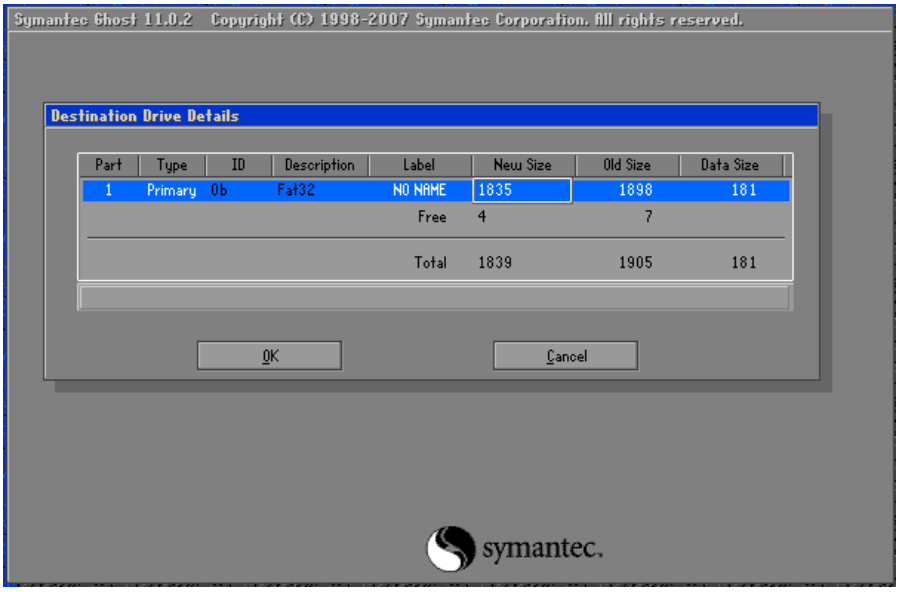
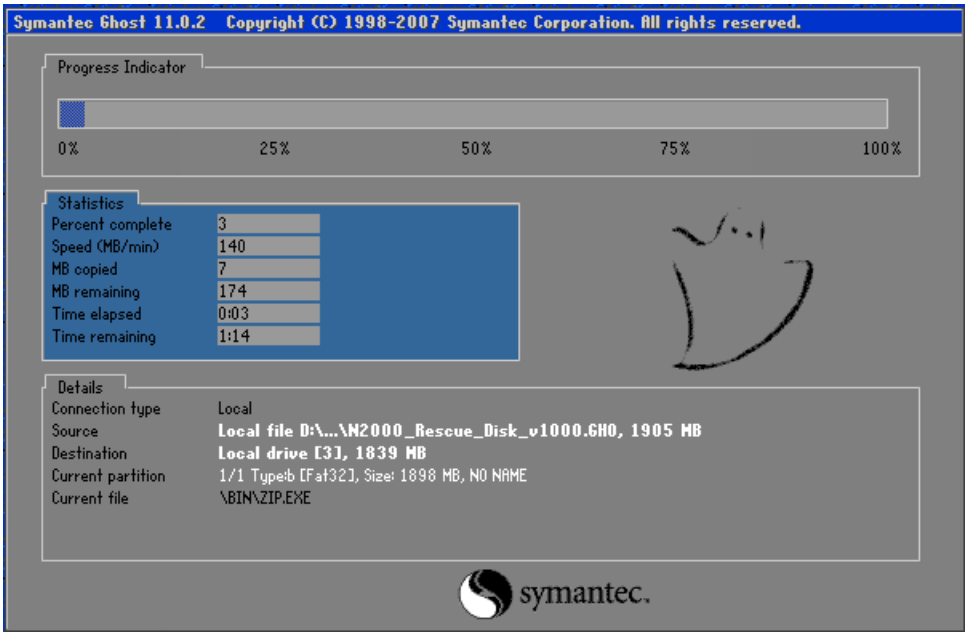
6. Recovery the rescue ghost file, rescue.gho, into CFast card and then click OK



7. The rescue CFast card has been done



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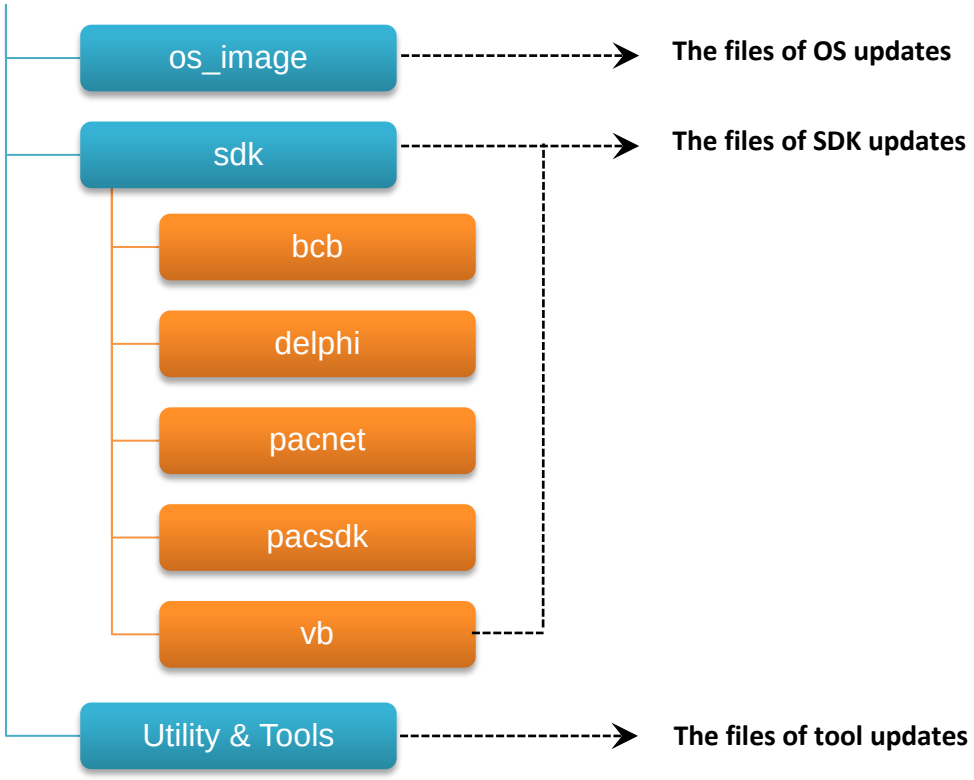
9. EMP-9000 Updates

This chapter provides information of the EMP-9000 OS, SDKs and tools, and a guided tour that demonstrates the steps needed to update the EMP-9000 OS, SDKs and tools.

ICP DAS will continue to add additional features to EMP-9000 OS, SDKs and tools in the future, so we advise you to periodically check the ICP DAS web site for the latest updates.

The files of OS updates, SDK updates and tool updates can be found on the CD that was provided with the package or by downloading the latest version from ICP DAS web site.

https://www.icpdas.com/en/download/index.php?model=AXP-9051-IoT/



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9.1. Updating the EMP-9000 OS

ICP DAS will continue to add additional features and improve performances to EMP-9000 OS in the future, so we advise you to periodically check the ICP DAS web site for the latest updates.

The information can be obtained from:
EMP-9000:
https://www.icpdas.com/en/download/index.php?model=EMP-9051-16

Free feel to contact us to get the latest version of OS image.
E-mail: service@icpdas.com

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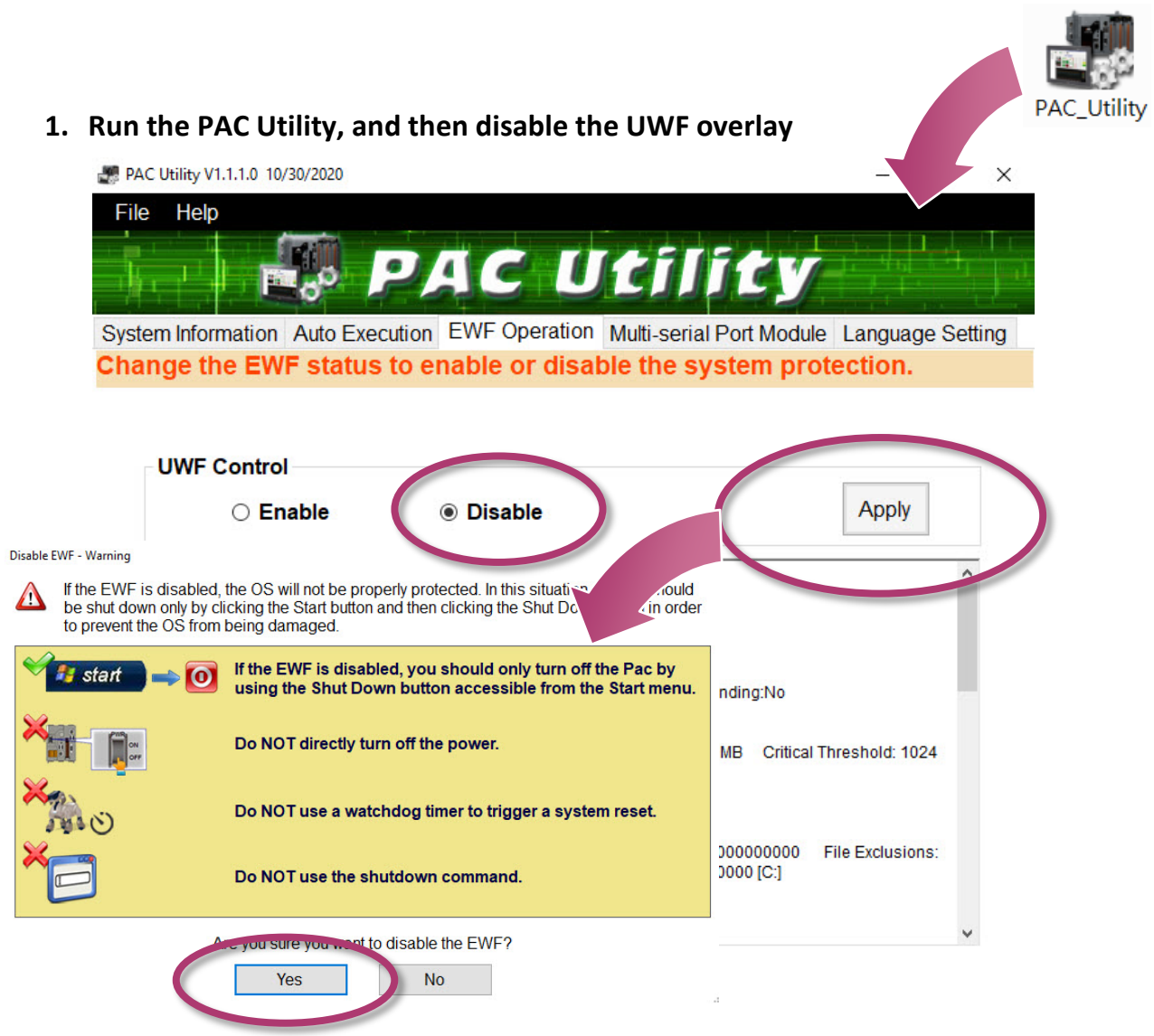
9.2. Updating the EMP-9000 SDK

ICP DAS will continue to include more functionality and API calls to EMP-9000 SDK in the future, so we advise you to periodically check the ICP DAS web site for the latest updates.

To update the EMP-9000 SDK

1. **Run the PAC Utility, and then disable the UWF overlay**



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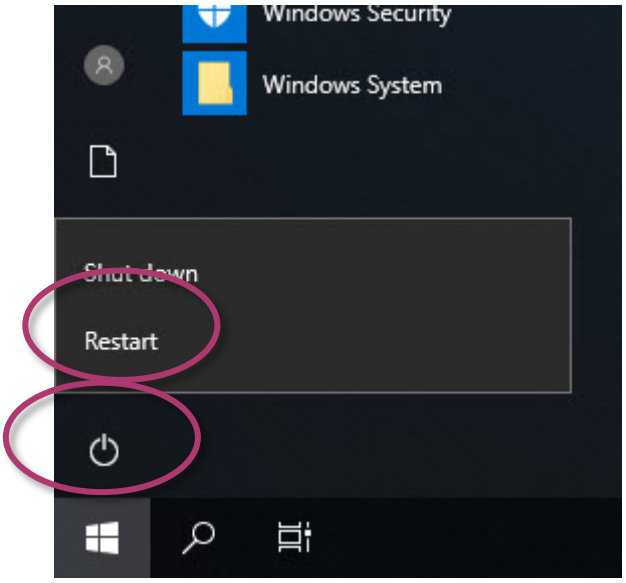
2. **Click the Start button , click the power button , and then click Restart for changes to take effect.**



3. **Download the latest version of the pacsdk.dll file**

The latest version of the pacsdk.dll file can be obtained from ICP DAS web site.
https://www.icpdas.com/en/download/show.php?num=2540&model=EMP-9051-16

Copy the downloaded file, pacsdk.dll into the C:\Windows\System32\ folder.
This will overwrite the existing pacsdk.dll file

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9.3. Updating the EMP-9000 Tools

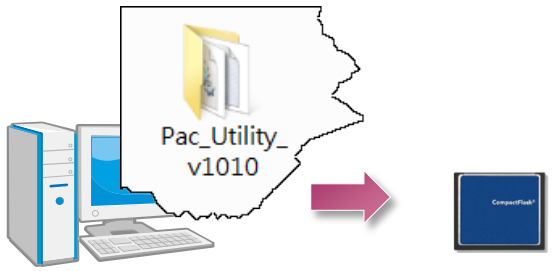
ICP DAS will continue to add more functionality and support to the PAC utility in the future, so we advise you to periodically check the ICP DAS web site for the latest updates.

To update the PAC Utility

1. **To update the PAC Utility Download the latest version of the PAC utility file in PC or a laptop**

   The latest version of the PAC utility file can be obtained from ICP DAS web site.
   https://www.icpdas.com/en/download/show.php?num=2531&model=EMP-9091-16

2. **Extract the downloaded file, and then copy the file folder to the CFast card**



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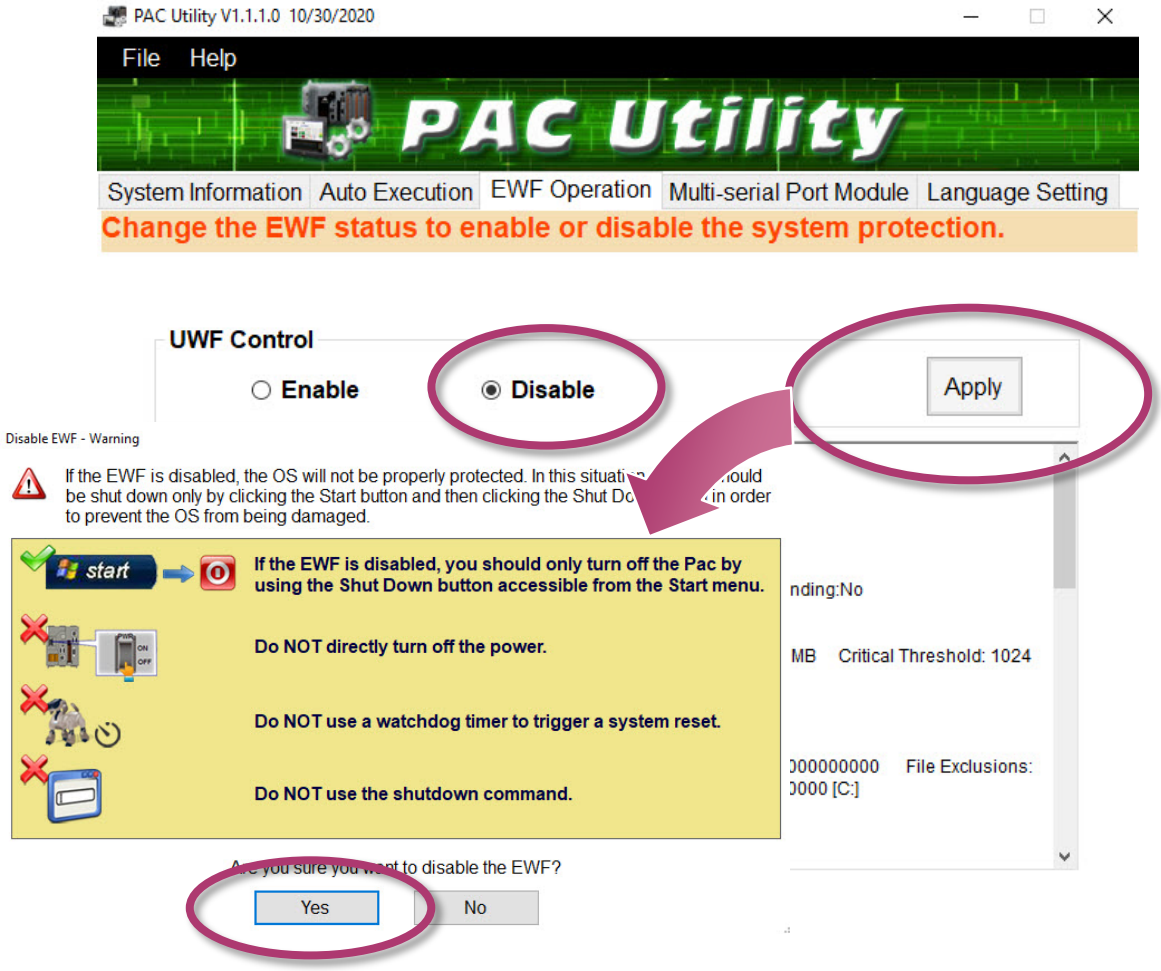
3. Plug the Rescue CFast card into CFast socket of EMP-9000

4. Run the PAC Utility, and then disable the UWF overlay



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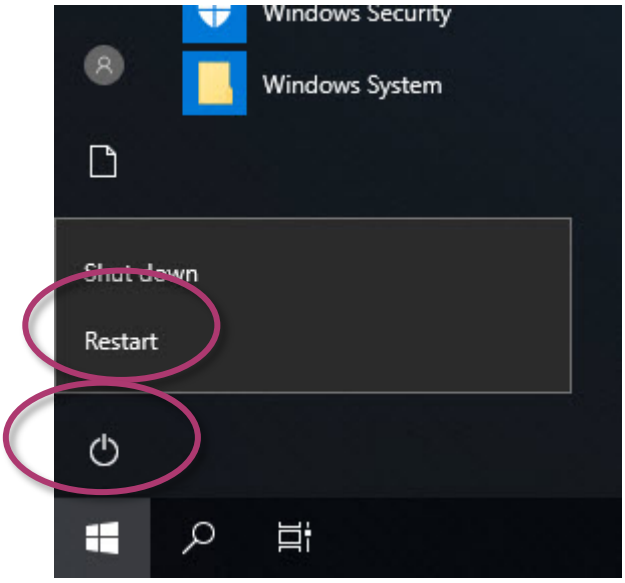
5. **Click the Start button , click the power button , and then click Restart for changes to take effect.**



6. **Copy the file folder into C:\icpdas\, and then delete the older, existing file folder**

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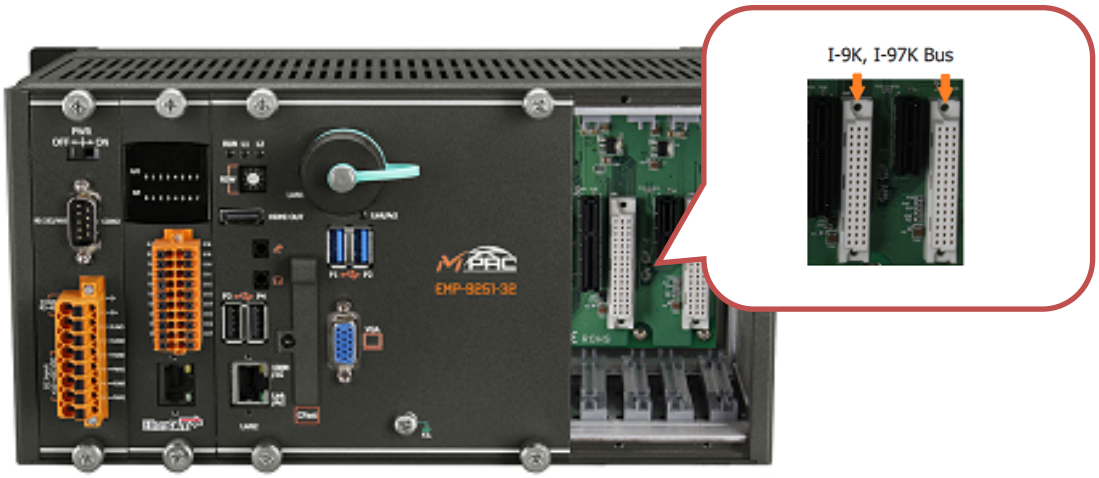
Appendix

A. I-9K Modules and I-97K Modules

This chapter provides a brief overview of the different between the I-9K series modules and I-97K series modules.

There are two types of I/O modules provided for supporting EMP-9000. One is high communication speed I-9K series modules with parallel interface; the other is I-97K series modules with serial interface.



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The differences between the I-9K and I-97K series I/O modules are as follows.

Item	I-9K Series	I-97K Series
Communication Interface	Parallel Bus	Serial Bus
Protocol	-	DCON
Communication Speed	Fast	Slow
DI with latched function	-	Y
DI with counter input	-	Y (100 Hz)
Power on value	-	Y
Safe Value	-	Y
Programmable slew-rate for AO module	-	Y

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B. e-9K Modules

e-9K series modules are provided for combining a variety of I/O functions within the EMP-9000, AXP-9000 and ALX-9000 programmable automation controllers (PAC). e-9k series is based on a high-speed bus interface (e-Bus) with speeds up to 2GB/s (e-Bus x4) and 500MB/s(e-Bus x1), and also supports DMA (Direct memory access) data transfer without the need for a central Processing unit intervention. e-Bus new generation high-speed bus interface.

ICP DAS fully supports the new generation of high-speed bus interface (e-Bus) in the new generation flagship controller (EMP/AXP/ALX9000). In addition to the maximum speed of up to 2GB/s (e-Bus x4) and 500MB/s(e-Bus x1), it also supports DMA (Direct memory access) data transmission without the need for the central processing unit to intervene in processing. Under the burden of the processor at the same level, DMA is a fast data transfer method, which can provide a large amount of data transmission and high-speed data comparison of the expansion module, and improve the working efficiency of the controller.

ICP DAS utilizes the powerful performance of the e-Bus bus interface to fully develop a new generation of e-9K I/O expansion modules, and fully demonstrate the performance of e-Bus on the new generation flagship controller (EMP/AXP/ALX9000) to provide customers with the high-cost performance ratio.

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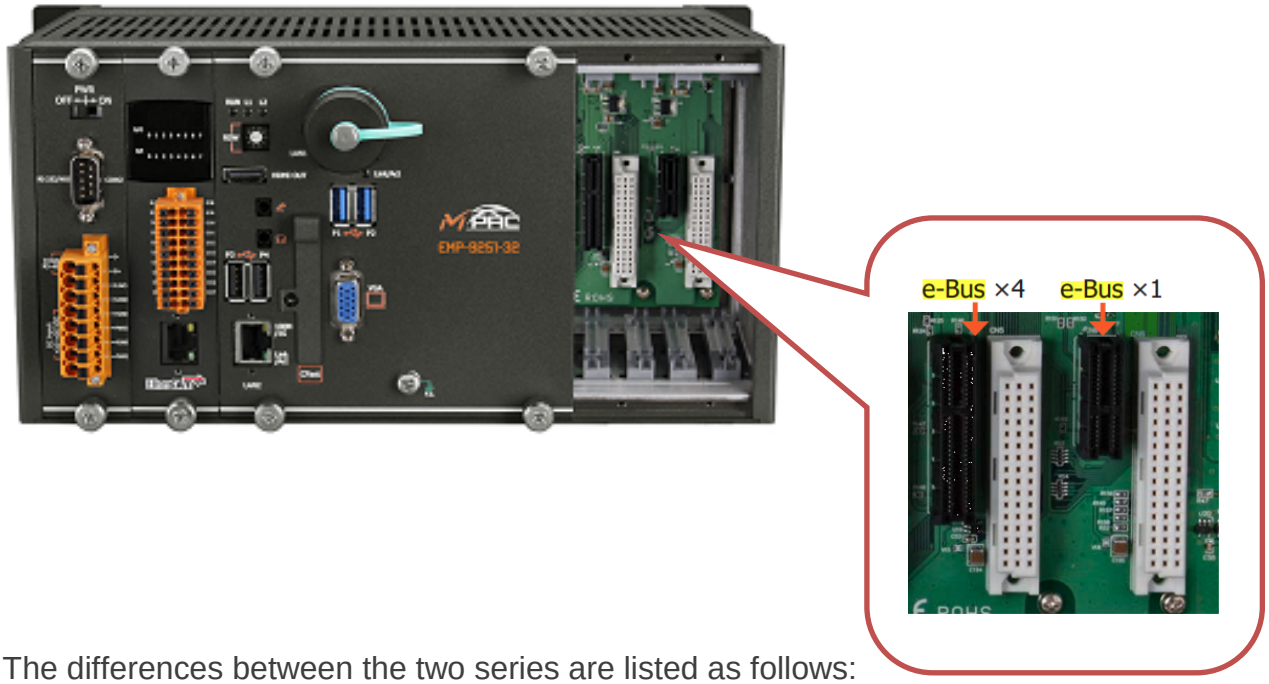

The differences between the two series are listed as follows:

Model	e-9K Series	I-9K Series	I-97K Series
Communication Interface	e-Bus	I-9K Bus (Parallel)	I-97K Bus (Serial)
Protocol	-	-	DCON
Communication Speed	2GB/s (e-Bus x4) 500MB/s(e-Bus x1)	200 ~ 500 KB/s	115 kbit/s
DI with Latched Function		-	Y
DI with Counter Input		-	Y (100 Hz)
Power on Value		Y	Y
Safe Value		Y	Y
Programmable Slew-Rate for AO Module		-	Y

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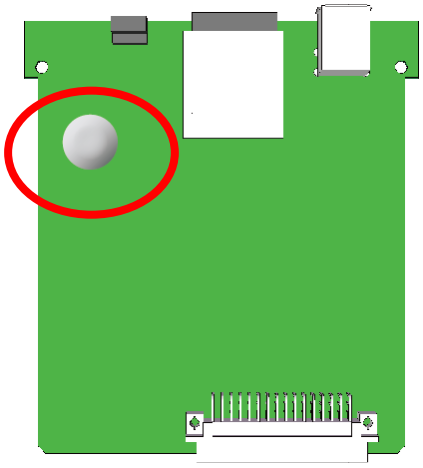
C. How to change the BIOS CMOS battery

The BIOS is retained by a Li-ion battery, which can supply continuous power for 10 years. The battery design has the added function of preventing data from being lost while replacing the battery. The following figures show the location of the battery installed in the CPU board of EMP-9000.

1. **Disconnect the power of the computer**.
2. **Locate your CMOS battery in the CPU board**



3. **Removing the battery**.

   Use your fingers to move the clip up and the other hand to pull the battery out.

   Do not use any kind of metal object to pry the battery.

   (Removing the CMOS battery erases the BIOS settings)

4. **Obtain battery information**

   Replace the battery with the exact same type of coin cell battery.

   (Use BR2032 coin cell battery)

5. **Insert the new battery**

   Ensure to replace with a brand new battery. Do not install a used battery.

Ordering information

Battery type: BR2032

For more detailed information, contact your local sales office or distributor.

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D. Revision History

This chapter provides revision history information to this document.

The table below shows the revision history.

Revision	Date	Created By	Description
V1.1.3	April 2021	Anna	Initial issue
V1.1.4	November 2021	Jeffery	Modified the pictures to AXP version
V1.1.5	March 2022	Jeffery	Remove instructions about IIS
V1.1.6	October 2022	Stan	Modified the pictures to EMP version

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