



LX-8000/9000 Series User Manual

V1.0.0 March 2017



LX-9131/LX-9331/LX-9731
LX-9171/LX-9371/LX-9771
LX-9181/LX-9381/LX-9781



LX-8131/LX-8331/LX-9771

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1. Introduction

This chapter provides an overview of the LX-8000/9000 and its components, and introduces the fundamental concepts for user familiar with the LX-8000/9000.



The LX-8000/9000 are Linux OS 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 x86 CPU, 1/3/7 I/O expansion slots and a variety of connectives including dual Gigabit Ethernet, VGA , USB port, RS-232 and RS-485 interface. Local I/O slots are available to use our I-9K and I-97K series I/O modules and remote I/O expansions are available to use our Ethernet I/O modules and RS-485 I/O modules.

1.1. Features

The LX-8000/9000 offers the most comprehensive configuration and remote system upgrade solutions to meet specific application requirements. The following list shows the hardware and software features designed to simplify installation, configuration and application.

- Powerful CPU Module
 - x86 CPU(1 GHz, dual-core) for LX-8131/LX-8331/LX-8731
 - E3845 (1.91 GHz, 64-bit quad core) for LX-9181/ LX-9381/ LX-9781
 - E3827 (1.75 GHz, 64-bit dual core) for LX-9171/ LX-9371/ LX-9771

- Linux OS
 - Linux Kernel 3.2 for LX-8x31/9x31 series
 - Linux Kernel 4.4 for LX-9x71/9x81 series

- Memory Size:
 - SDRAM (2 GB DDR3)
 - Flash (32 GB SSD)
 - CF Card (support up to 32 GB)

- 64-bit Hardware Serial Number

- Rich I/O Expansion Ability
 - RS-232/RS-485
 - USB

- Redundant Power Input
- Operating Temperature :
 - -25 °C to +60 °C for LX-9x81 series
 - -25 °C to +75 °C for LX-8x31/9x31/9x71 series

1.2. Specifications

The table below summarizes the specifications of LX-8x31 series.

Models	LX-8131	LX-8331	LX-8731
OS	Linux OS with kernel 3.2		
Embedded Service	SFTP server, Web server, SSH		
SDK Provided	Standard LinPAC SDK for Linux by GNU C language		
CPU Module			
CPU	x86 CPU, 1 GHz, dual-core		
SDRAM	2 GB DDR3		
MRAM, Non-volatile Memory	512 KB (retain memory without battery support)		
Flash	32 GB		
EEPROM	16 KB; Data Retention: 40 years; 1,000,000 erase/write cycles		
CF Card	CF slot with one CF card (support up to 32 GB)		
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)		
Rotary Switch	Yes (0 to 9)		
DIP Switch	Yes (8 bits)		
Programmable LED Indicator	3 (Run, L1 and L2)		
VGA & Communication Ports			
VGA Resolution	1600 x 1200, 1024 x 768, 800 x 600, 640 x 480		
Dual Ethernet Port	RJ-45 x 2, 10/100/1000 Base-T (Auto-negotiating, Auto MDI/MDI-X, LED indicators)		
USB 2.0	4		
ttySA0	Internal communication with high profile I-87K series modules in slots		
Console	RS-232 (Rx/D, Tx/D and GND); non-isolated		
ttyS0	RS-485 (Data+, Data-) with internal self-tuner ASIC; 3000 V _{DC} isolated		

ttyS1	RS-232/RS-485 (RxD, TxD, CTS, RTS and GND for RS-232, Data+ and Data- for RS-485); non-isolated		
ttyS34	RS-232 (RxD, TxD, CTS, RTS, DSR, DTR, CD, RI and GND); non-isolated		
Audio	Microphone-in and Earphone-out		
I/O Expansion Slots			
Number of I/O slots	1	3	7
Supported I/O modules	I-8K and I-87K series I/O Modules		
Mechanical			
Dimensions (W x L x H), unit: mm	169 x 132 x 125	231 x 132 x 125	355 x 132 x 125
Installation	DIN-Rail or Wall Mounting		
Environmental			
Operating Temperature	-25 °C to +75 °C		
Storage Temperature	-30 °C to + 80 °C		
Ambient Relative Humidity	10 % to 90 % RH (non-condensing)		
Power			
Input Range	+10 V _{DC} to +30 V _{DC}		
Redundant Power Inputs	Yes, with one power relay (1 A @ 24 V _{DC}) for alarm		
Isolation	1 kV		
Capacity	3.7 A, 5 V supply to CPU and backplane, 1.3 A, 5 V supply to I/O expansion slots, 25 W in total	3.8 A, 5 V supply to CPU and backplane, 3.2 A, 5 V supply to I/O expansion slots, 30 W in total	4.0 A, 5 V supply to CPU and backplane, 3.0 A, 5 V supply to I/O expansion slots, 35 W in total
Consumption	16.6 W (0.69 A @ 24 VDC)	16.8 W (0.7 A @ 24 VDC)	18 W (0.75 A @ 24 VDC)

The table below summarizes the specifications of LX-9x31 series.

Models	LX-9131	LX-9331	LX-9731
OS	Linux OS with kernel 3.2		
Embedded Service	SFTP server, Web server, SSH		
SDK Provided	Standard LinPAC SDK for Linux by GNU C language		
CPU Module			
CPU	x86 CPU, 1 GHz, dual-core		
SDRAM	2 GB DDR3		
MRAM, Non-volatile Memory	512 KB (retain memory without battery support)		
Flash	32 GB		
EEPROM	16 KB; Data Retention: 40 years; 1,000,000 erase/write cycles		
CF Card	CF slot with one CF card (support up to 32 GB)		
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)		
Rotary Switch	Yes (0 to 9)		
Programmable LED Indicator	3 (Run, L1 and L2)		
VGA & Communication Ports			
VGA Resolution	1600 x 1200, 1024 x 768, 800 x 600, 640 x 480		
Dual Ethernet Port	RJ-45 x 2, 10/100/1000 Base-T (Auto-negotiating, Auto MDI/MDI-X, LED indicators)		
USB 2.0	4		
ttySA0	Internal communication with high profile I-87K series modules in slots		
Console	RS-232 (RxD, TxD and GND); non-isolated		
ttyS0	RS-485 (Data+, Data-) with internal self-tuner ASIC; 3000 V _{DC} isolated		
ttyS1	RS-232/RS-485 (RxD, TxD, CTS, RTS and GND for RS-232, Data+ and Data- for RS-485); non-isolated		
ttyS34	RS-232 (RxD, TxD, CTS, RTS, DSR, DTR, CD, RI and GND); non-isolated		
Audio	Microphone-in and Earphone-out		
I/O Expansion Slots			

Number of I/O slots	1	3	7
Supported I/O modules	I-8K and I-87K series I/O Modules		
Mechanical			
Dimensions (W x L x H), unit: mm	169 x 132 x 125	231 x 132 x 125	355 x 132 x 125
Installation	DIN-Rail or Wall Mounting		
Environmental			
Operating Temperature	-25 °C to +75 °C		
Storage Temperature	-30 °C to + 80 °C		
Ambient Relative Humidity	10 % to 90 % RH (non-condensing)		
Power			
Input Range	+10 V _{DC} to +30 V _{DC}		
Redundant Power Inputs	Yes, with one power relay (1 A @ 24 V _{DC}) for alarm		
Isolation	1 kV		
Capacity	3.7 A, 5 V supply to CPU and backplane, 1.3 A, 5 V supply to I/O expansion slots, 25 W in total	3.8 A, 5 V supply to CPU and backplane, 3.2 A, 5 V supply to I/O expansion slots, 30 W in total	4.0 A, 5 V supply to CPU and backplane, 3.0 A, 5 V supply to I/O expansion slots, 35 W in total
Consumption	16.6 W (0.69 A @ 24 VDC)	16.8 W (0.7 A @ 24 VDC)	18 W (0.75 A @ 24 VDC)

The table below summarizes the specifications of LX-9x81 series.

Models	LX-9181	LX-9381	LX-9781
System Software			
OS	Linux OS with kernel 4.4		
Embedded Service	SFTP server, Web server, SSH		
SDK Provided	Standard LinPAC SDK for Linux by GNU C language		
CPU Module			
CPU	E3845 (1.91 GHz, 64-bit quad core)		
SDRAM	2 GB DDR3		
MRAM	128 KB		
Flash(SSD)	mSATA slot with one 32 GB SSD		
EEPROM	16 KB		
Memory Expansion	CF socket with one 16GB CF card (support up to 32 GB)		
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	3 (Run, L1, L2)		
Rotary Switch	Yes (0 ~ 9)		
VGA & Communication Ports			
VGA Resolution	1280 x 1024 to 1920 x 1080 (16 : 9) /640 x 480 to 1024 x 768 (4 : 3)		
Ethernet Port	RJ-45, 10/100/1000M Base-TX (Auto-negotiating, Auto MDI/MDI-X, LED indicators)		
USB 2.0	4		
ttySA0	Internal communication with the I-97K series modules in slots		
Console	RS-232/485 (RxD, TxD and GND for RS-232; Data+, Data- for RS-485); 3000 V _{DC} isolated		
ttyS0	RS-485 (Data+, Data-); 3000 V _{DC} isolated		
ttyS1	RS-232/485 (RxD, TxD, CTS, RTS and GND for RS-232; Data+, Data- for RS-485); 3000 V _{DC} isolated		
ttyS34	RS-232 (RxD, TxD, CTS, RTS, DSR, DTR, CD, RI and GND); 3000 V _{DC} isolated		

Audio	Mic-in and Earphone-out		
I/O Expansion Slot	1	3	7
Mechanical			
Dimensions (W x H x D, unit: mm)	239 x 164 x 133	300 x 164 x 133	422 x 164 x 133
Installation	Wall mounting / DIN-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	+10 V _{DC} to +30 V _{DC}		
Isolation	1 kV		
Redundant Power Inputs	Yes, with one power relay (1 A @ 24 V _{DC}) for alarm		
Capacity	4.1 A, 5 V supply to CPU and backplane, 2.5 A, 5 V supply to I/O expansion slots, 33 W in total	4.2 A, 5 V supply to CPU and backplane, 2.4 A, 5 V supply to I/O expansion slots, 33 W in total	4.4 A, 5 V supply to CPU and backplane, 2.2 A, 5 V supply to I/O expansion slots, 33 W in total
Consumption	18.5 W (0.77 A @ 24 V _{DC})	18.7 W (0.78 A @ 24 V _{DC})	20.4 W (0.85 A @ 24 V _{DC})

The table below summarizes the specifications of LX-9x71.

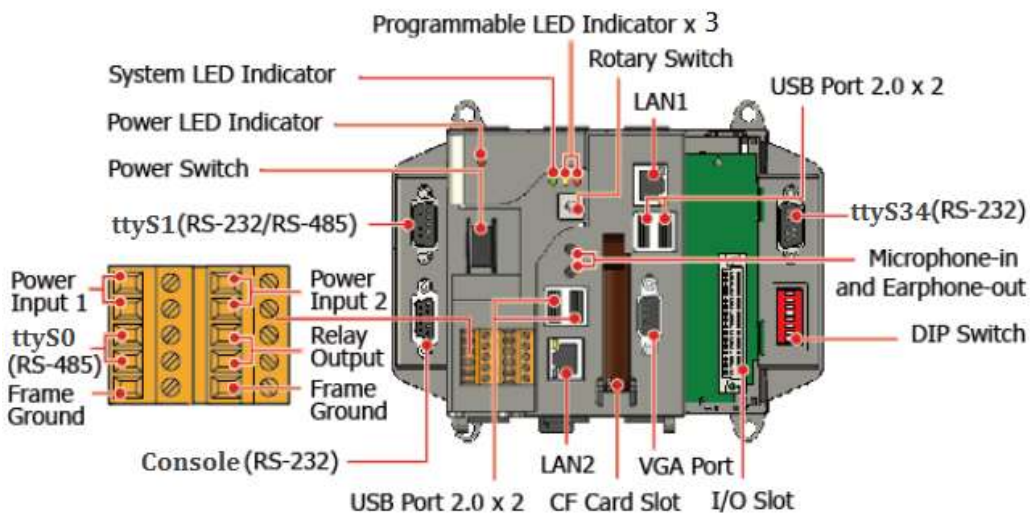
Models	LX-9171	LX-9371	LX-9771
System Software			
OS	Linux OS with kernel 4.4		
Embedded Service	SFTP server, Web server, SSH		
SDK Provided	Standard LinPAC SDK for Linux by GNU C language		
CPU Module			
CPU	E3827 (1.75 GHz, 64-bit dual core)		
SDRAM	2 GB DDR3		
MRAM	128 KB		
Flash(SSD)	mSATA slot with one 32 GB SSD		
EEPROM	16 KB		
Memory Expansion	CF socket with one 16GB CF card (support up to 32 GB)		
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	3 (Run, L1, L2)		
Rotary Switch	Yes (0 ~ 9)		
VGA & Communication Ports			
VGA Resolution	1280 x 1024 to 1920 x 1080 (16 : 9) /640 x 480 to 1024 x 768 (4 : 3)		
Ethernet Port	RJ-45, 10/100/1000M Base-TX (Auto-negotiating, Auto MDI/MDI-X, LED indicators)		
USB 2.0	4		
ttySA0	Internal communication with the I-97K series modules in slots		
Console	RS-232/485 (RxD, TxD and GND for RS-232; Data+, Data- for RS-485); 3000 V _{DC} isolated		
ttyS0	RS-485 (Data+, Data-); 3000 V _{DC} isolated		
ttyS1	RS-232/485 (RxD, TxD, CTS, RTS and GND for RS-232; Data+, Data- for RS-485); 3000 V _{DC} isolated		
ttyS34	RS-232 (RxD, TxD, CTS, RTS, DSR, DTR, CD, RI and GND); 3000 V _{DC} isolated		

Audio	Mic-in and Earphone-out		
I/O Expansion Slot	1	3	7
Mechanical			
Dimensions (W x H x D, unit: mm)	239 x 164 x 133	300 x 164 x 133	422 x 164 x 133
Installation	Wall mounting /DIN-rail mounting		
Environmental			
Operating Temperature	-25 °C to +75 °C		
Storage Temperature	-30 °C to +80 °C		
Ambient Relative Humidity	10 % to 90 % RH (non-condensing)		
Power			
Input Range	+10 V _{DC} to +30 V _{DC}		
Isolation	1 kV		
Redundant Power Inputs	Yes, with one power relay (1 A @ 24 V _{DC}) for alarm		
Capacity	3.7 A, 5 V supply to CPU and backplane, 3.3 A, 5 V supply to I/O expansion slots, 35 W in total	3.8 A, 5 V supply to CPU and backplane, 3.2 A, 5 V supply to I/O expansion slots, 35 W in total	4.0 A, 5 V supply to CPU and backplane, 3.0 A, 5 V supply to I/O expansion slots, 35 W in total
Consumption	16.6 W (0.69 A @ 24 V _{DC})	16.8 W (0.7 A @ 24 V _{DC})	18 W (0.75 A @ 24 V _{DC})

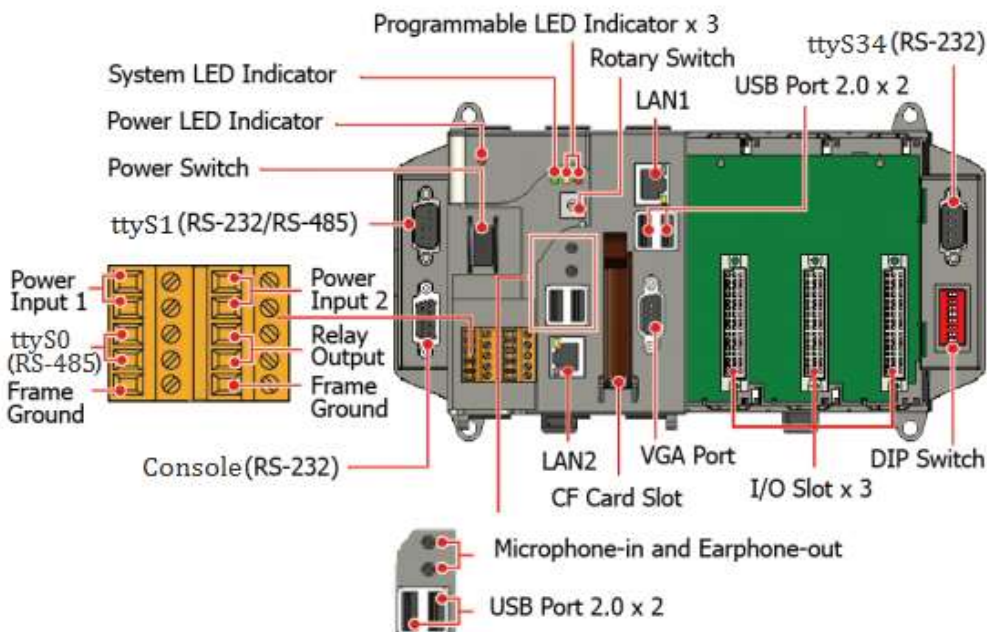
1.3. Overview

The LX-8000/9000 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.

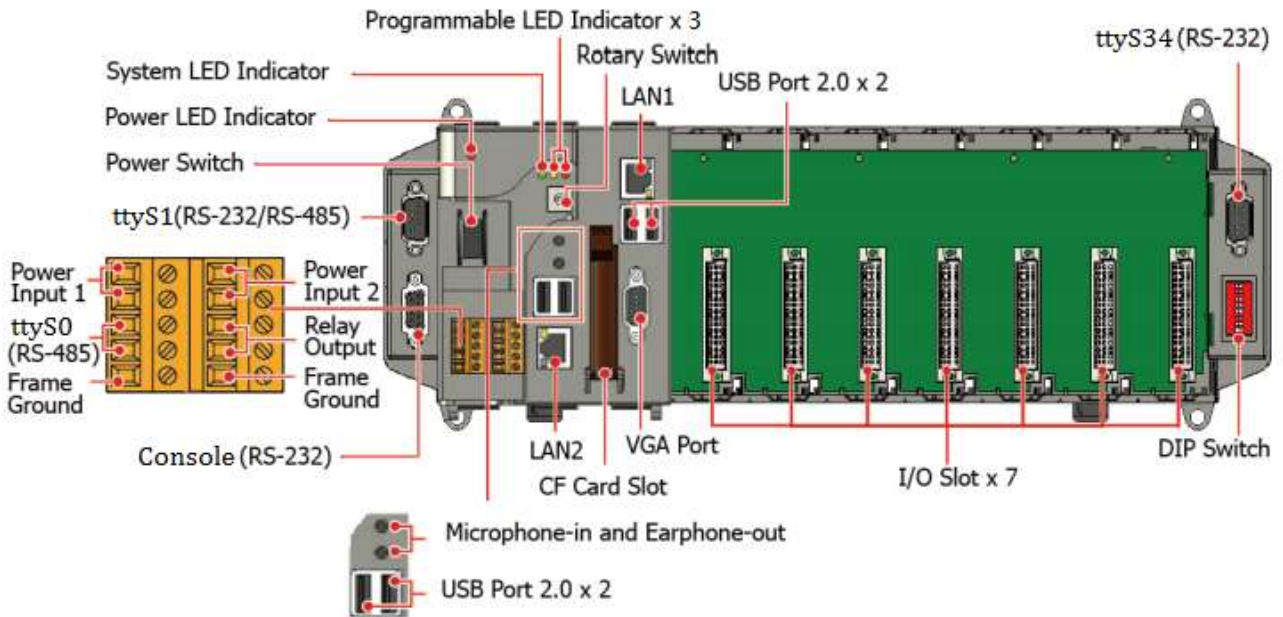
LX-8131



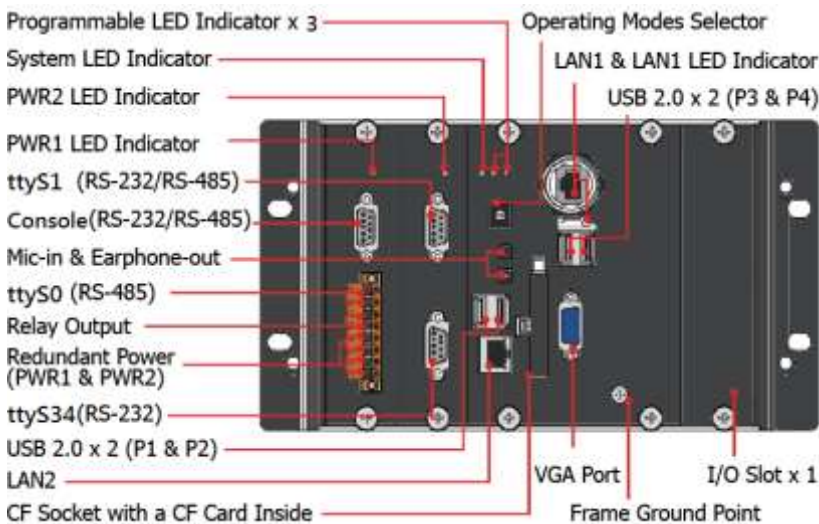
LX-8331



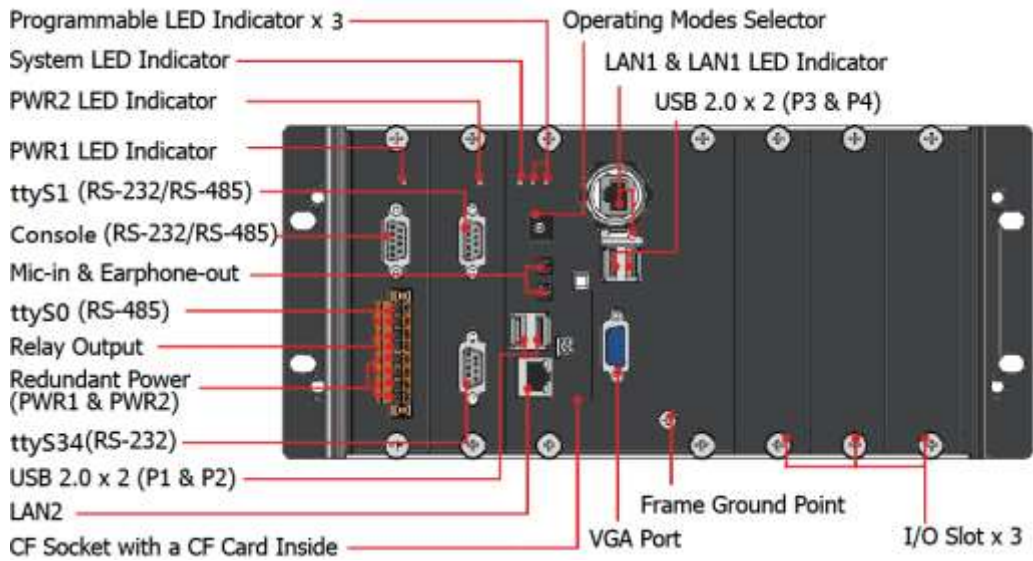
LX-8731



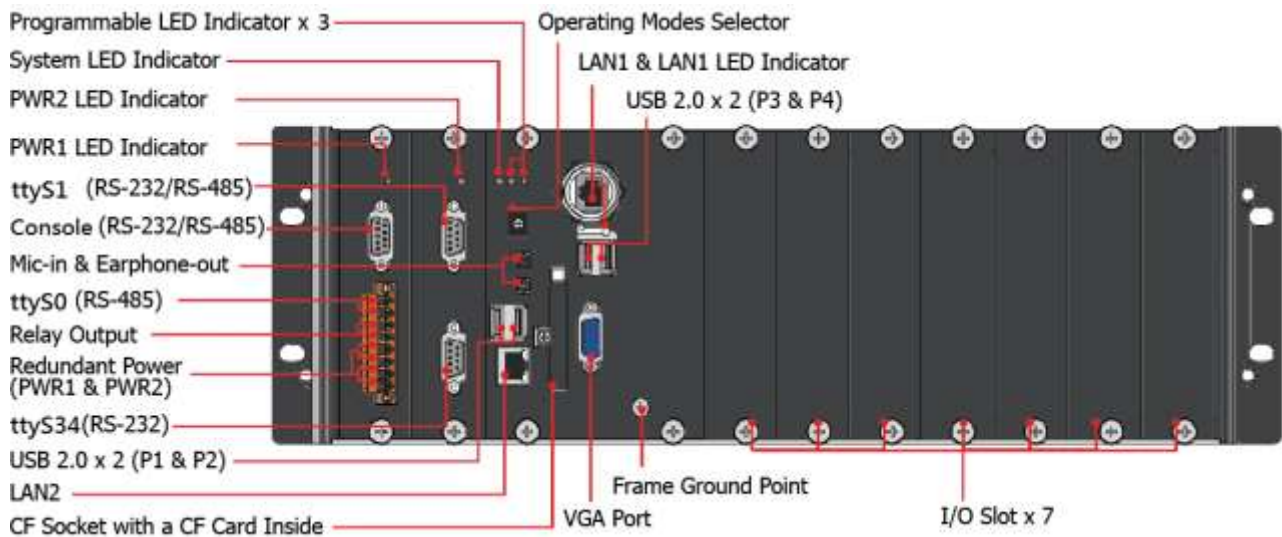
LX-9131/LX-9171/LX-9181



LX-9331/LX-9371/LX-9381



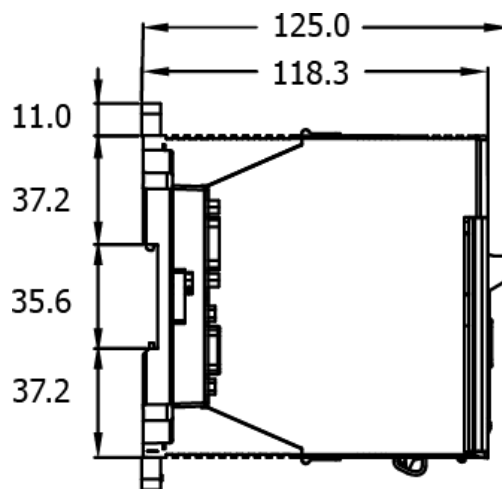
LX-9731/LX-9771/LX-9781



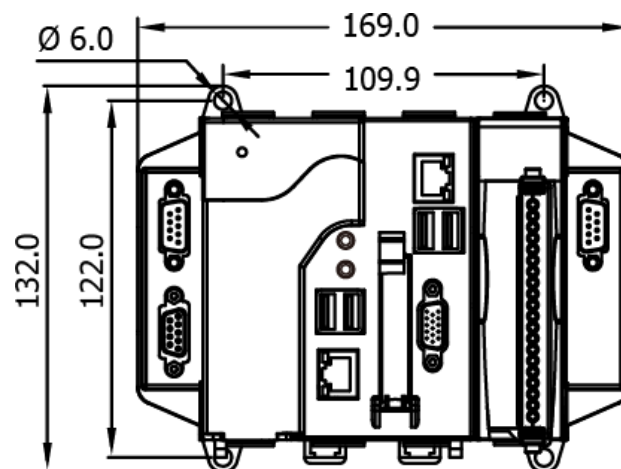
1.4. LX-8x31 Series Dimensions

The diagrams below provide the dimensions of the LX-8x31 to use in defining your enclosure specifications. Remember to leave room for potential expansion if you are using other components in your system.

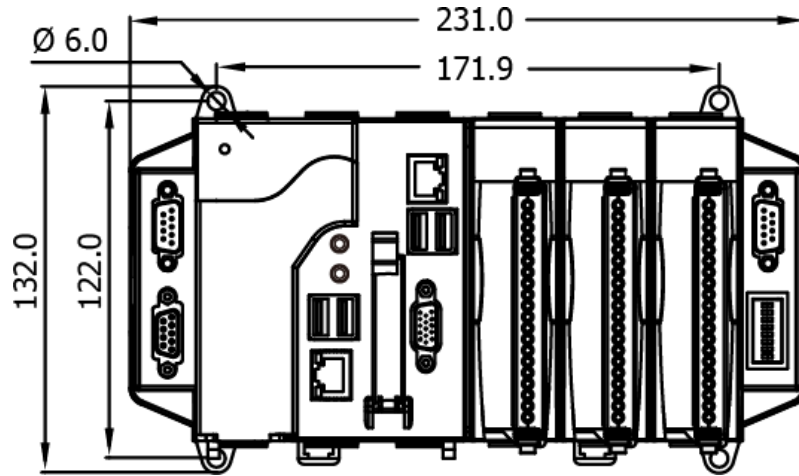
The height dimension is the same for all LX-8x31. The width depending on your choose of I/O expansion slots. All dimensions are in millimeters.



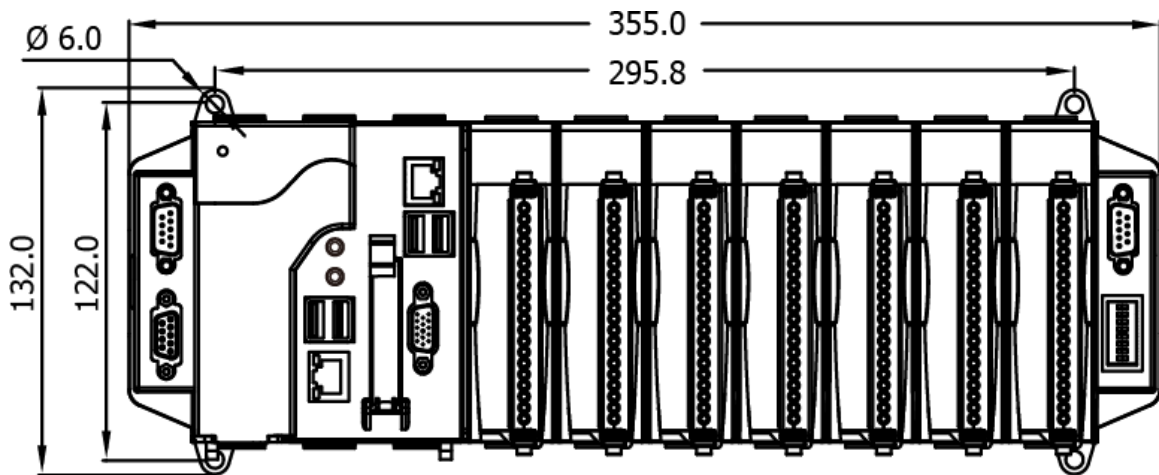
LX-8131



LX-8331



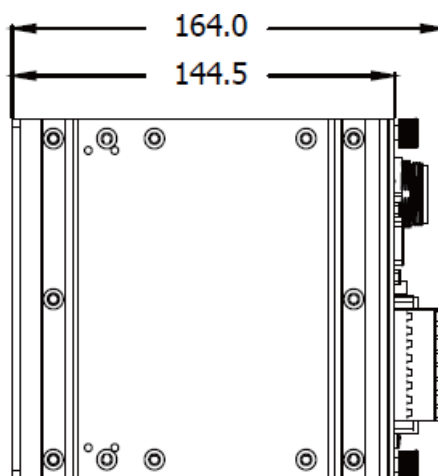
LX-8731



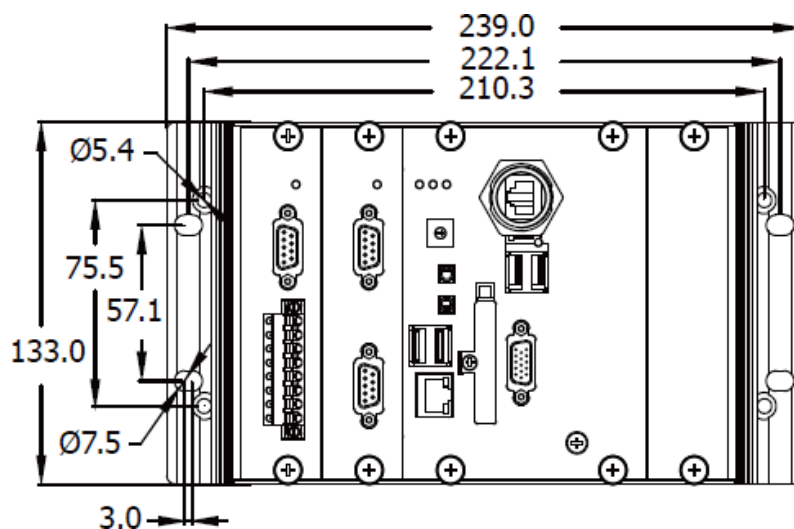
1.5. LX-9000 Series Dimensions

The diagrams below provide the dimensions of the LX-8000/9000 to use in defining your enclosure specifications. Remember to leave room for potential expansion if you are using other components in your system.

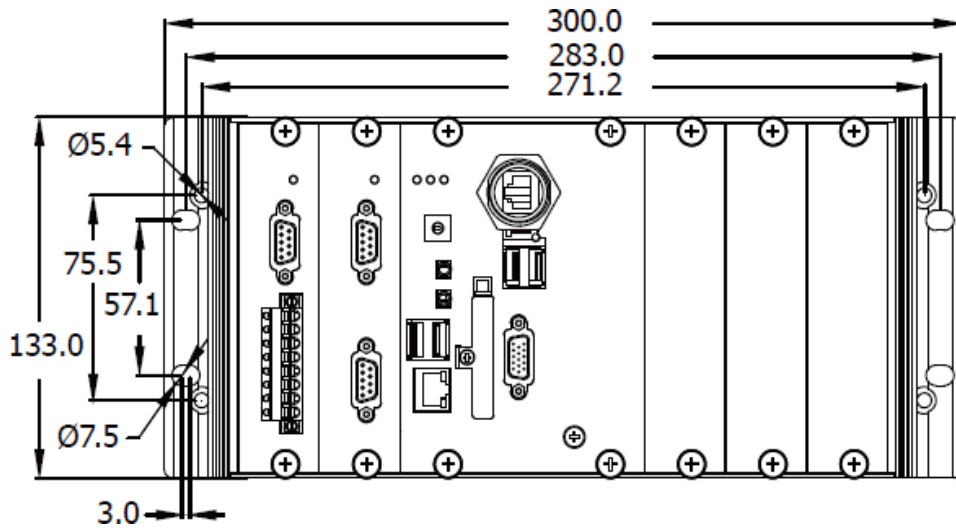
The height dimension is the same for all LX-9000. The width depending on your choose of I/O expansion slots. All dimensions are in millimeters.



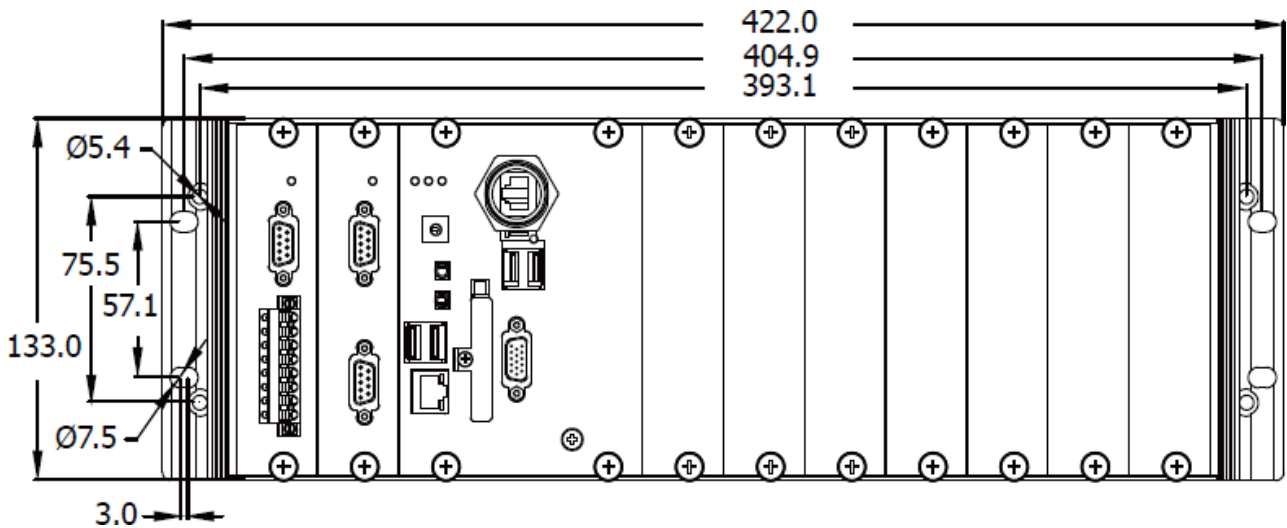
LX-9131/LX-9171/LX-9181



LX-9331/LX-9371/LX-9381



LX-9731/LX-9771/LX-9781



2. LX-8000/9000 Getting Started

This chapter provides a guided tour of the LX-8000/9000 installation and configuration that describes the steps needed to download, install, configure, and run the basic procedures for user working with the LX-8000/9000 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.

■ LX-8000 Series



LX-8000



CF Card



**Screw Driver
(1C016) 2.4 mm**



**Quick Start
(This Document)**

■ LX-9x31/LX-9x71/LX-9x81 Series



LX-9000



CF Card



**44 mm DIN-Rail
Clip x 2**



**Quick Start
(This Document)**



**RJ-45
WaterProof Connector**



**Screw Driver
(1C016) 2.4 mm**



M3x6L Screw * 8

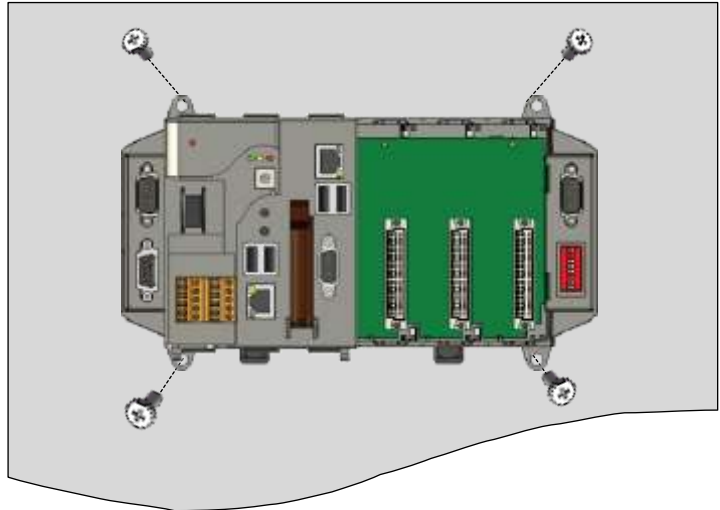
2.1. Mounting the LX-8000

The LX-8000 can be mounted either directly to a wall/panel, or onto a standard 35mm DIN rail.

Wall/Panel mounting

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

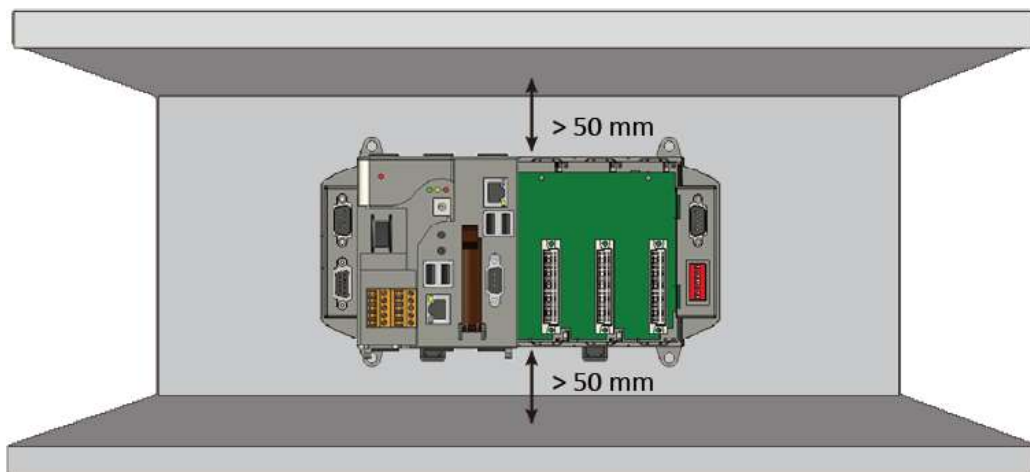
Step 2: Fasten the screws securely



Tips & Warnings



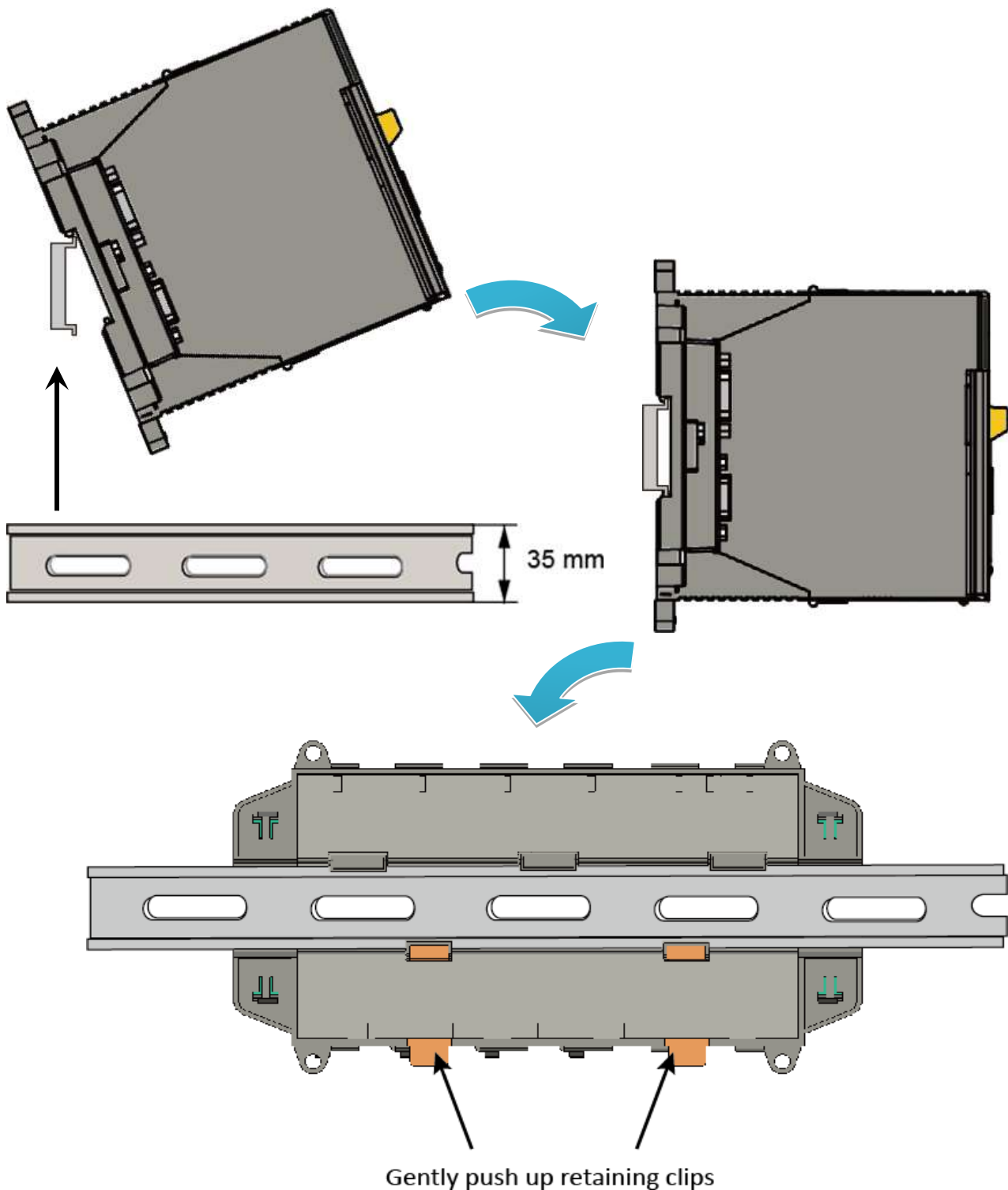
There must be a minimum clearance of 50mm between the LX-8000 and the top and bottom side of the enclosure panel.



DIN Rail mounting

Step 1: Hook upper tab over upper flange of DIN rail

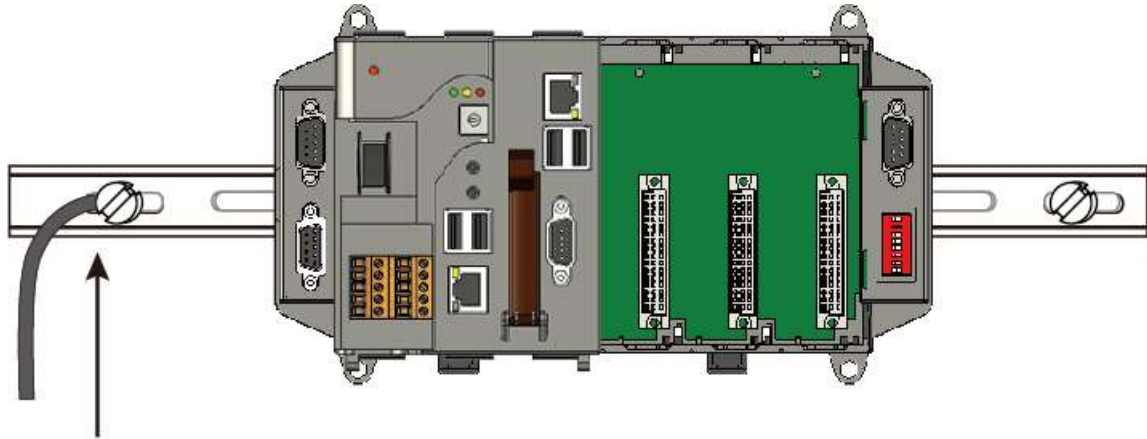
Step 2: Tilt the module toward DIN rail until it snaps securely to DIN rail



Tips & Warnings



A good common ground reference (earth ground) is essential for proper operation of the XP-8000. 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.



Connect the ground lead to the ground screw

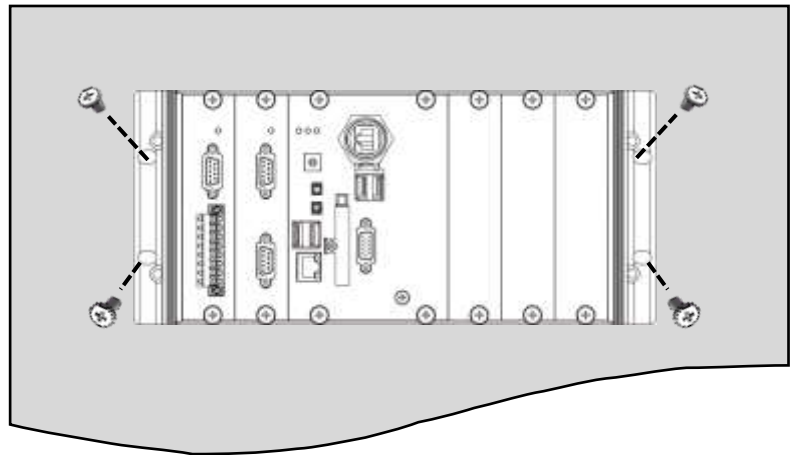
2.2. Mounting the LX-9000

The LX-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

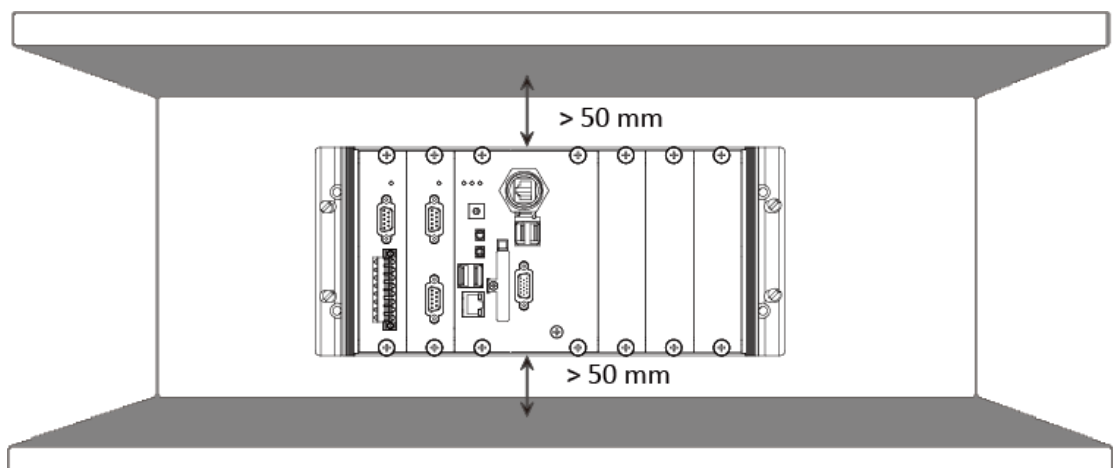
Step 2: Fasten the screws securely



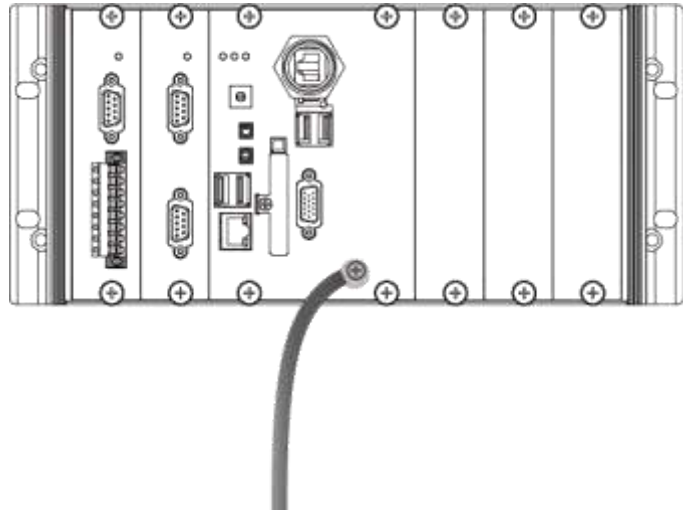
Tips & Warnings



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



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



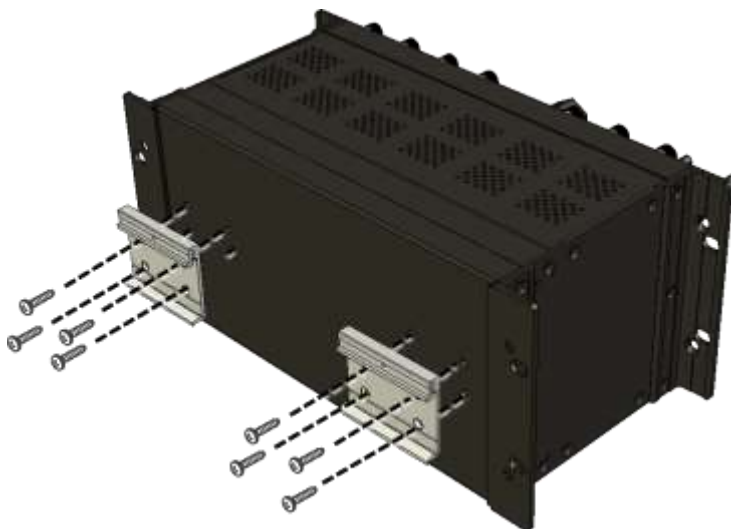
Tips & Warnings



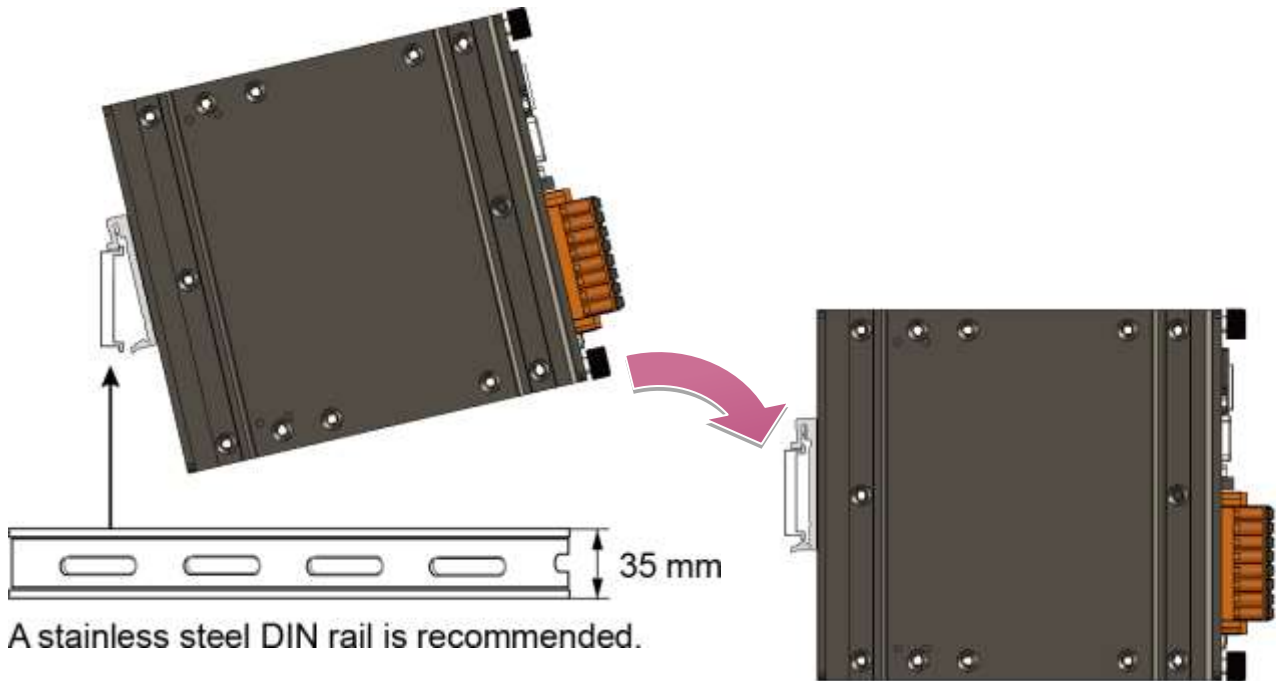
A good common ground reference (earth ground) is essential for proper operation of the LX-9000. One side of all control circuits, power circuits and the ground lead must be properly connected to earth ground by either installing a ground rod in close proximity to the enclosure or by connecting to the 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.

DIN Rail mounting

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



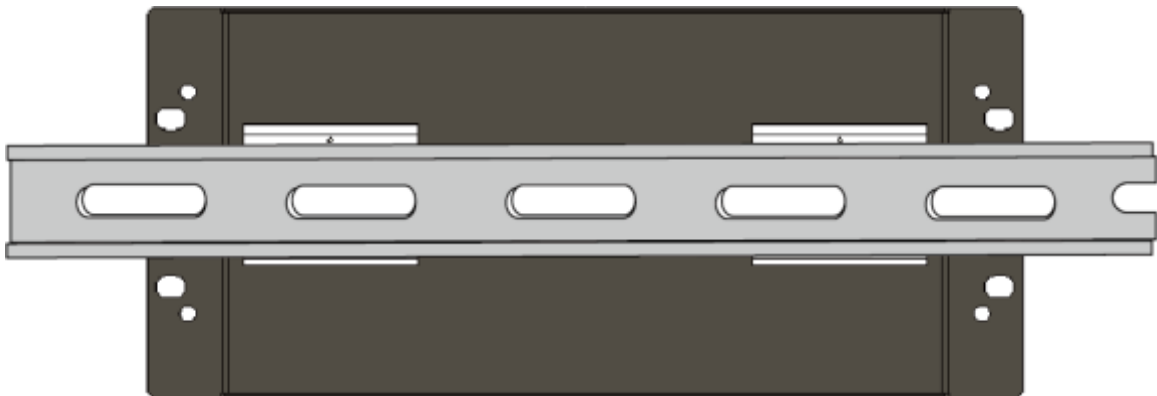
Step 2: Clip the device onto a stainless DIN rail



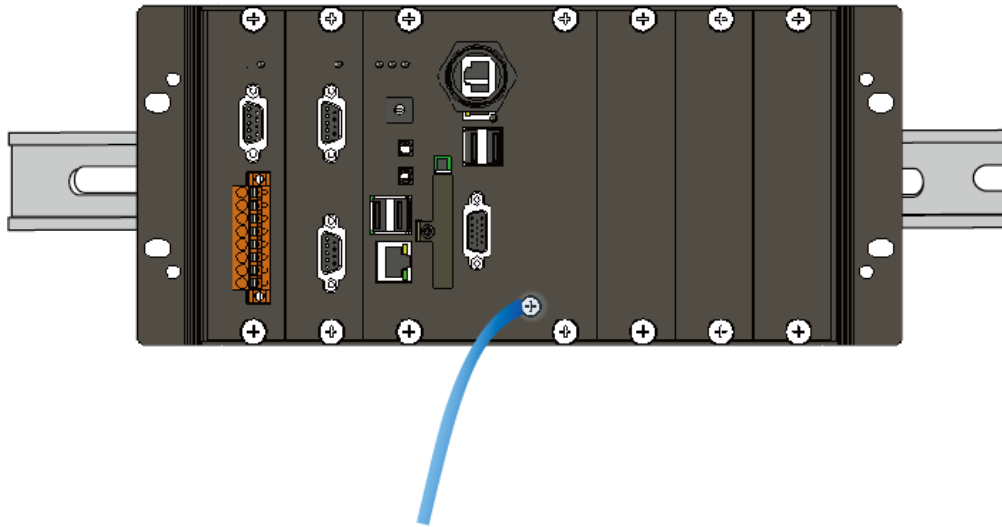
Tips & Warnings



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



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 LX-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.

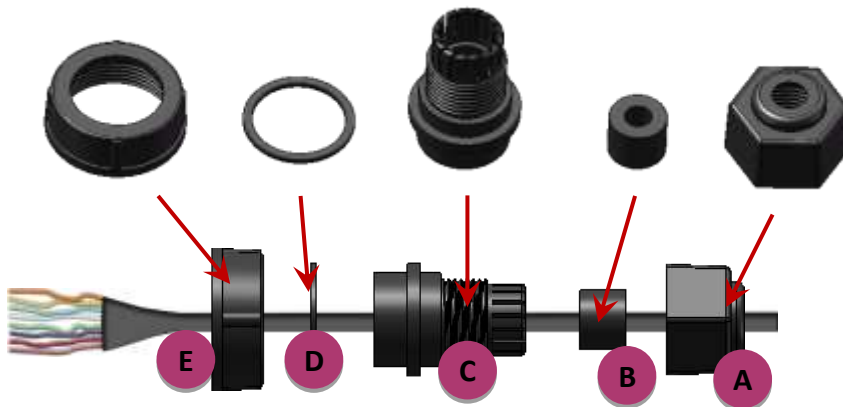
2.3. Installing the RJ-45 waterproof connector assembly

The LX-9000 series is equipped with an RJ-45 waterproof connector to withstand contaminant in dusty environment.

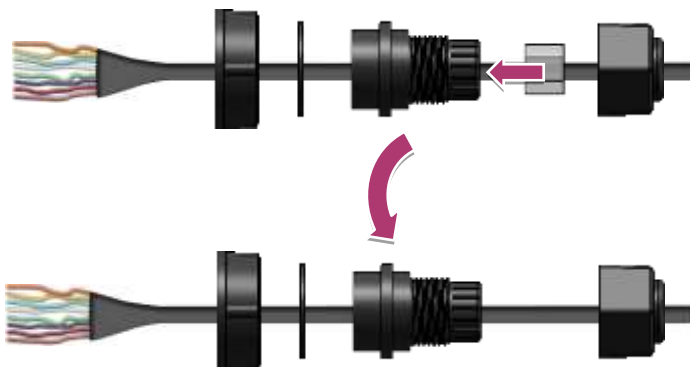
Step 1: Remove the RJ-45 connector from the RJ-45 cable



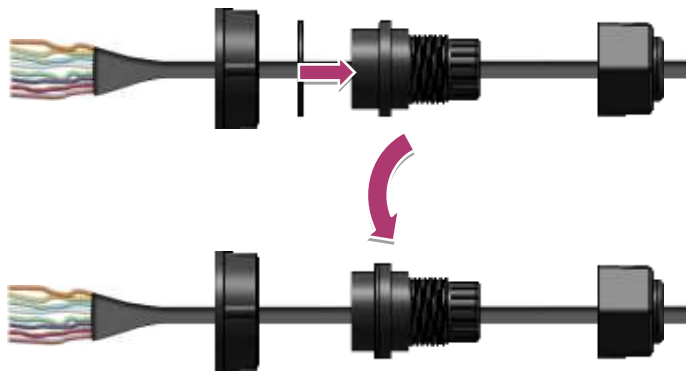
Step 2: Feed the end of the RJ-45 cable through the (A) sealing nut, (B) rubber sealing insert, (C) clamping ring, (D) panel gasket and (E) cable gland base



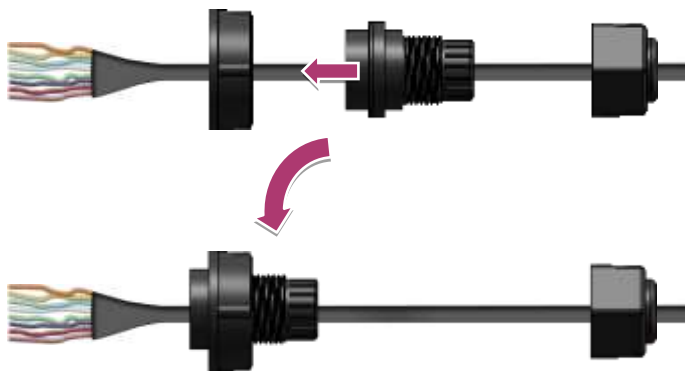
Step 3: Wrap the (C) clamping ring around the (B) rubber sealing insert



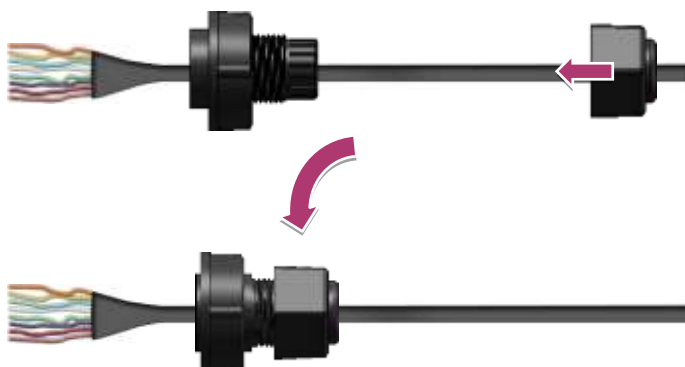
Step 4: Insert the (D) panel gasket into the (C) clamping ring



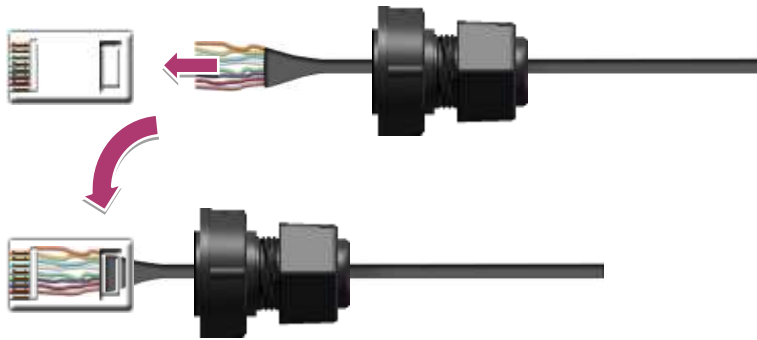
Step 5: Seat the (C) clamping ring and (D) panel gasket in the (E) cable gland base



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



Step 8: Push the RJ-45 waterproof connector assembly forward



2.4. Deploying a Basic LX-8000/9000 System

The LX-8000/9000 provides a variety of communication interface to suit a range of application. Here is a simple application for using the LX-8000/9000.

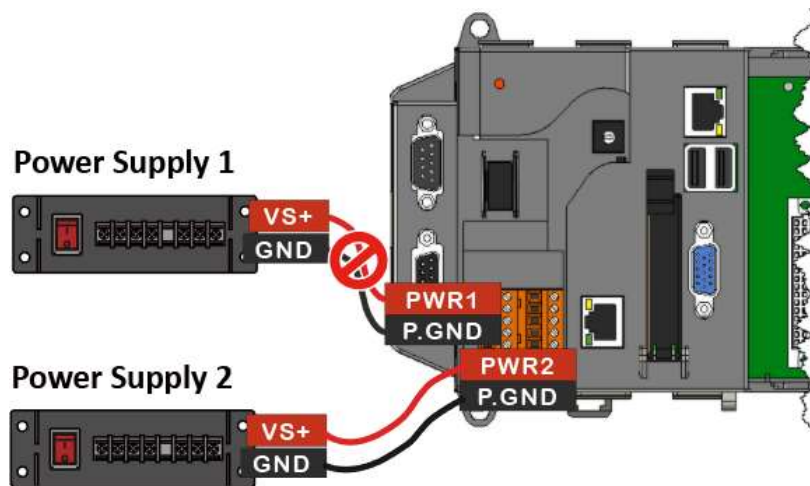
Step 1: Connect the positive terminal (+) of the power supply to the terminal PWR1/2 and the negative terminal (-) of the power supply to the P.GND

Tips & Warnings

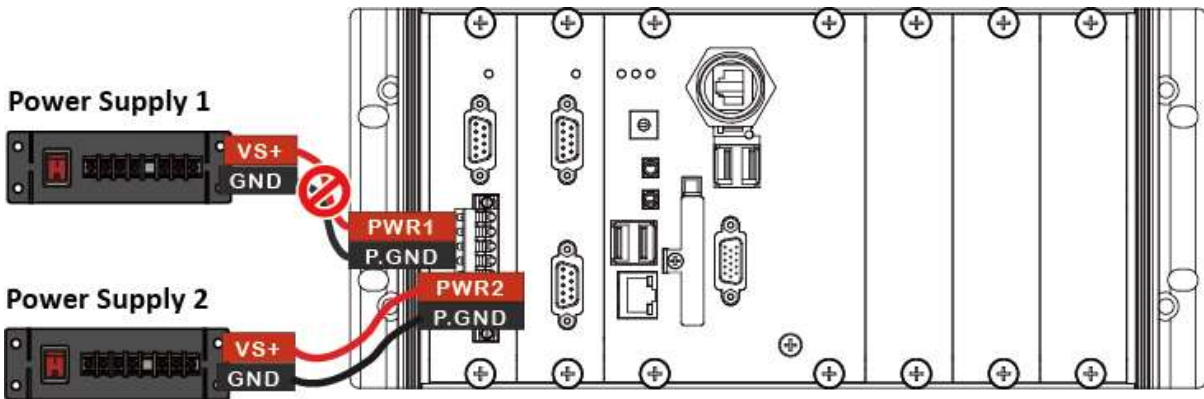


1. The input range of power supply is +10 to +30 V_{DC}.
2. The LX-8000/9000 have two power inputs that can be connected simultaneously to the two independent power sources. If one power source fails, the other source takes over automatically. Redundant power input help assure non-stop operation of the LX-8000/9000.

■ LX-8000



■ LX-9000

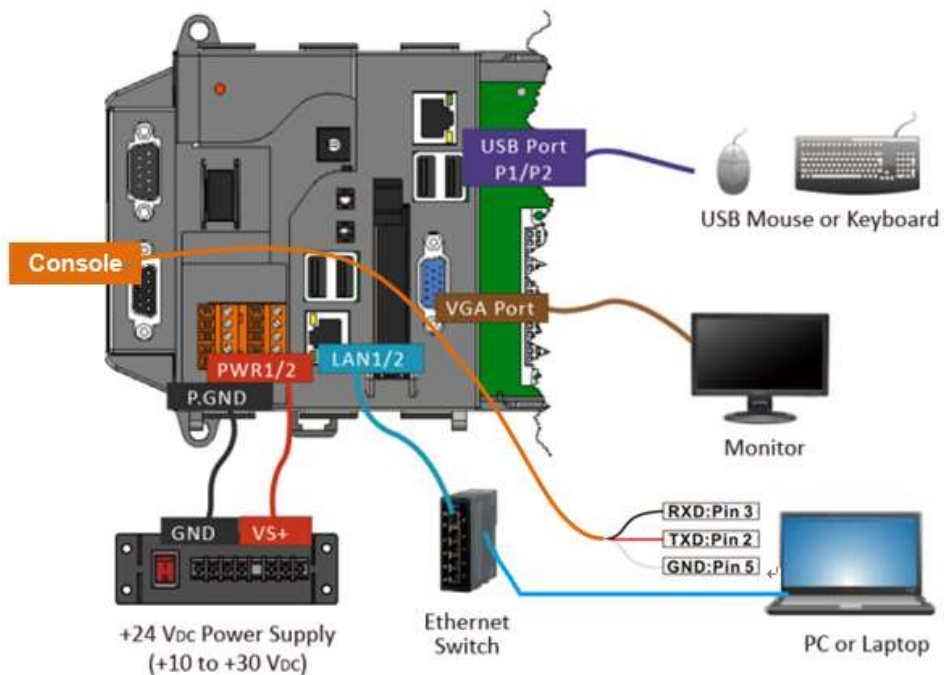


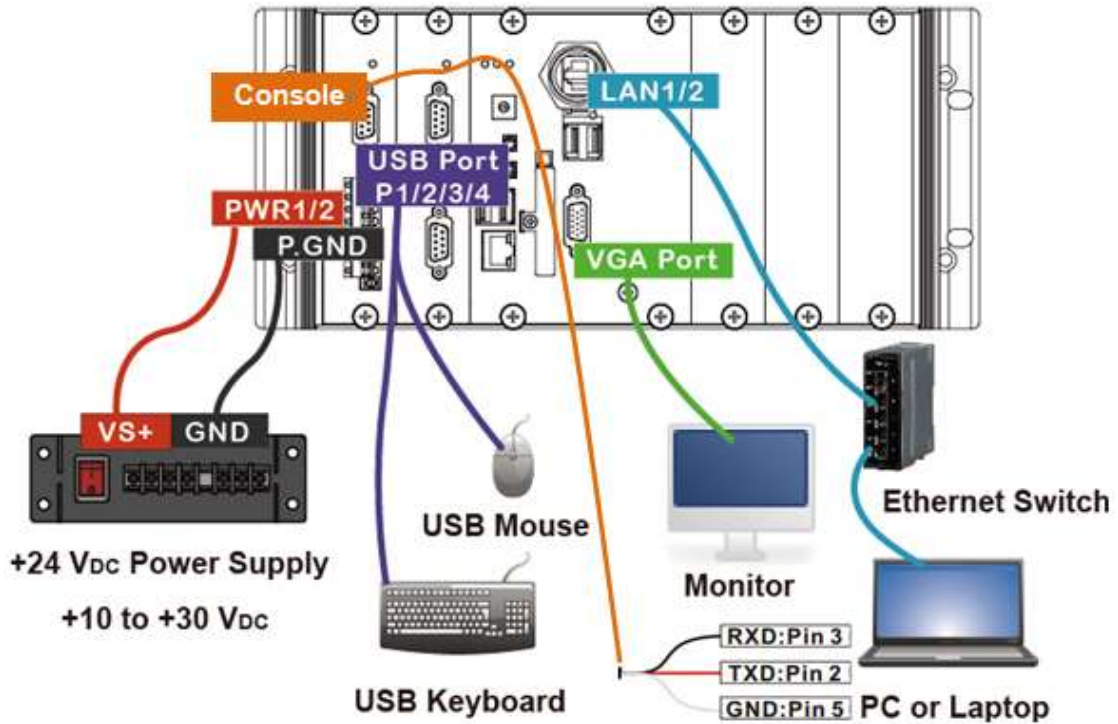
Step 2: Connect the USB mouse or the USB keyboard to the USB port

Step 3: Connect the monitor to the VGA port

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

■ LX-8000





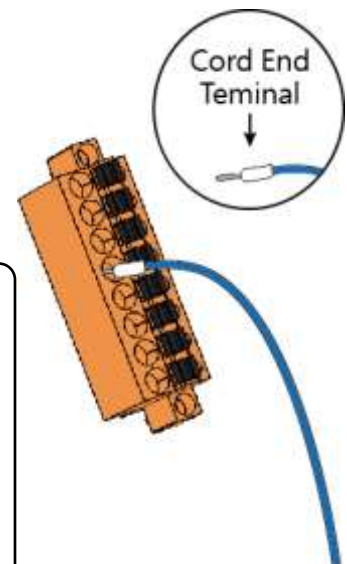
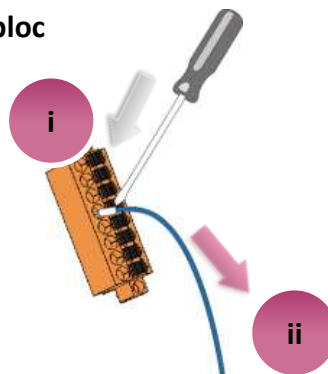
Tips & Warnings



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

Remove the wiring from the terminal bloc

- i. Use the screwdriver to push the black clip in
- ii. Remove the wiring

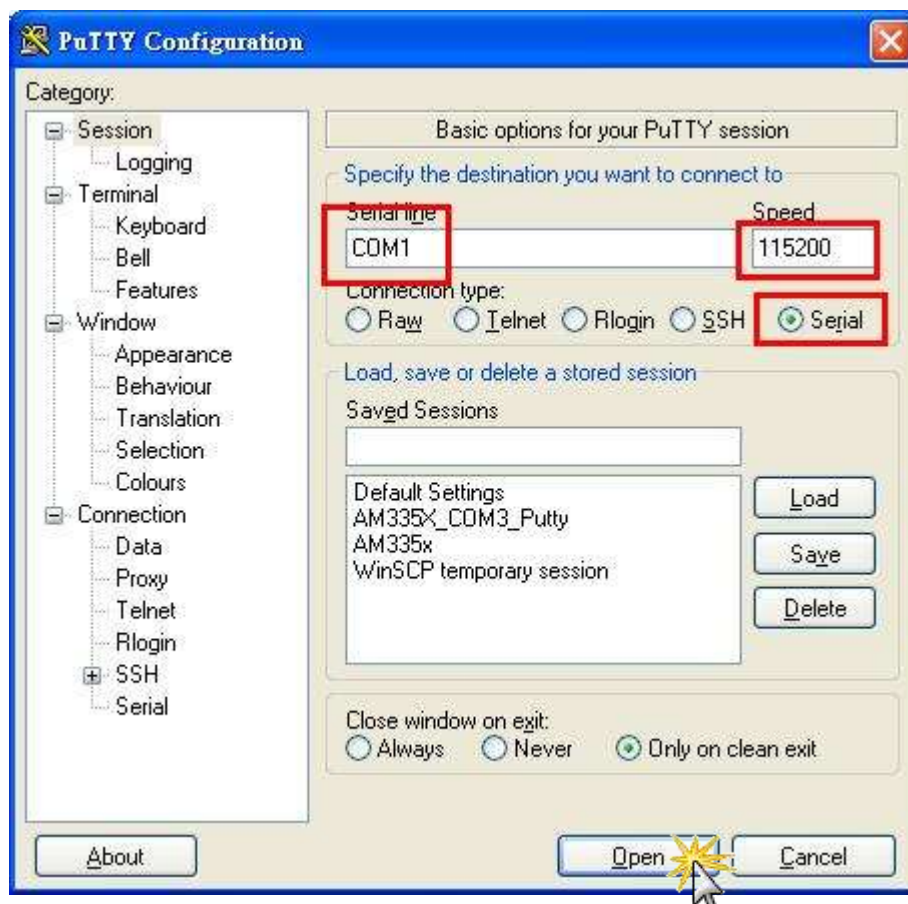


2.5. Console Port Connection

The LX-8000/9000 support remote connection from the “Console” port. The user can follow below steps to connect to the LX-8000/9000.

Step 1: User can choose the software(Putty or others) through the “Console” to connect the LX-8000/9000.

Step 2: If user chose the “Console”, user can set the baud rate “115200” to connect the device.



Step 3: After user connect to the LX-8000/9000 from the “Console” port, user can input default ID “root” and password “icpdas” to login.

2.6. LAN1/LAN2 Network Configuration

If user follow the “2.5 Console Port Connection” to login into the LX-8000/9000 successfully. User can use “ifconfig” command to get the IP address of LAN1/LAN2. The LAN 1/2 of factory setting use DHCP. If user want to set the static IP address, user can refer to below steps:

Step 1: Using the linux command “vi” to modify the file “/etc/network/interfaces”.

Step2: Using the ‘#’ to mark the default configuration.

```
# loopback network interface
auto lo
iface lo inet loopback

# primary network interface
auto eth0 eth1
#iface eth0 inet dhcp
iface eth0 inet static
address 192.168.0.1
netmask 255.255.255.0

#iface eth1 inet dhcp
iface eth1 inet static
address 192.168.0.2
netmask 255.255.255.0
```

Using '#' to mark the eth0/eth1's factory setting "dhcp"

Step3: After user save the file and use “reboot” command to reset device, user can use the new network configuration on LX-8000/9000.

2.7. LAN1/LAN2 Network Connection

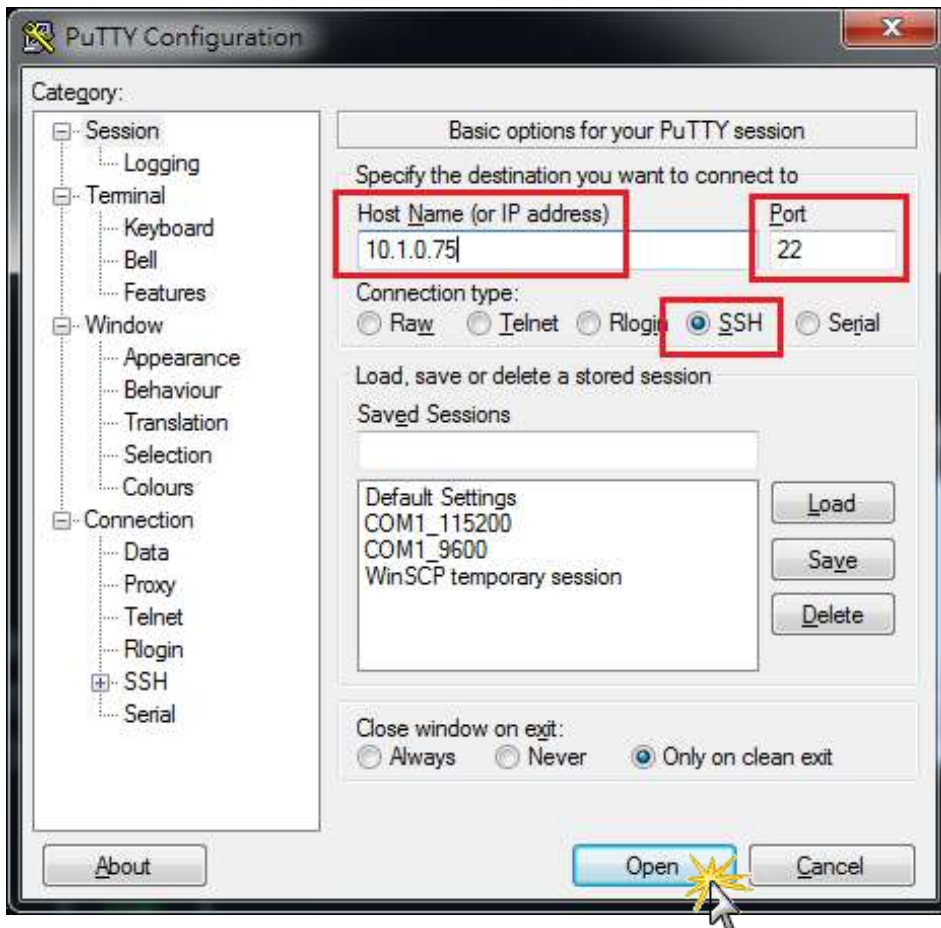
If user follow the “2.5 Console Port Connection” to login into the LX-8000/9000 successfully. The user can use “ifconfig” command to get the IP address of LAN1/LAN2 and the ssh client software(Putty or others) to connect the LX-8000/9000.

Step 1: Using “ifconfig” to check the IP address of LAN1/2.

```
root@icpdas:~# ifconfig
eth0      Link encap:Ethernet  HWaddr 00:0d:e0:6e:08:16
          inet addr:10.1.0.75  Bcast:10.1.255.255  Mask:255.255.0.0
          inet6 addr: fe80::20d:e0ff:fe6e:816/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:593929 errors:0 dropped:0 overruns:0 frame:0
          TX packets:8928 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:39831066 (39.8 MB)  TX bytes:5713563 (5.7 MB)
          Interrupt:17 Memory:febe0000-fec00000

eth1      Link encap:Ethernet  HWaddr 00:0d:e0:b0:97:0b
          inet addr:10.1.0.62  Bcast:10.1.255.255  Mask:255.255.0.0
          inet6 addr: fe80::20d:e0ff:feb0:970b/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:587861 errors:0 dropped:1 overruns:0 frame:0
          TX packets:36 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:28616065 (28.6 MB)  TX bytes:7795 (7.7 KB)
```

Step 2: User can use ssh client software(Putty or others) to connect the LX-8000/9000.



2.8. Inserting the I/O Modules

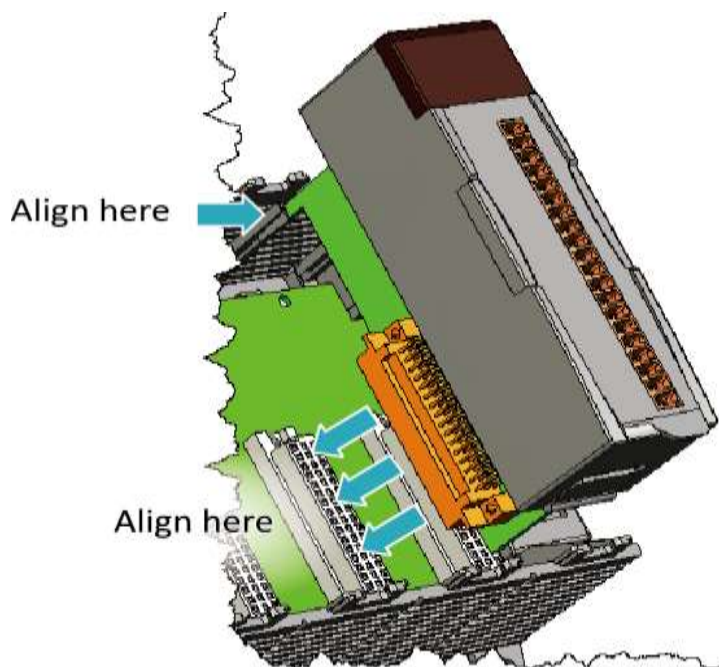
LX-9000 has 1/3/7 I/O expansion slots to support I-9K and I-97K series I/O modules. LX-8x31 also has 1/3/7 I/O expansion slots to support I-8K and I-87K series I/O modules.

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 LX-8000/9000, please refer to:

http://www.icpdas.com/products/PAC/winpac/io_support_list.htm

■ LX-8x31 Series

Step 1: Align circuit card with slot and press firmly to seat module into connector

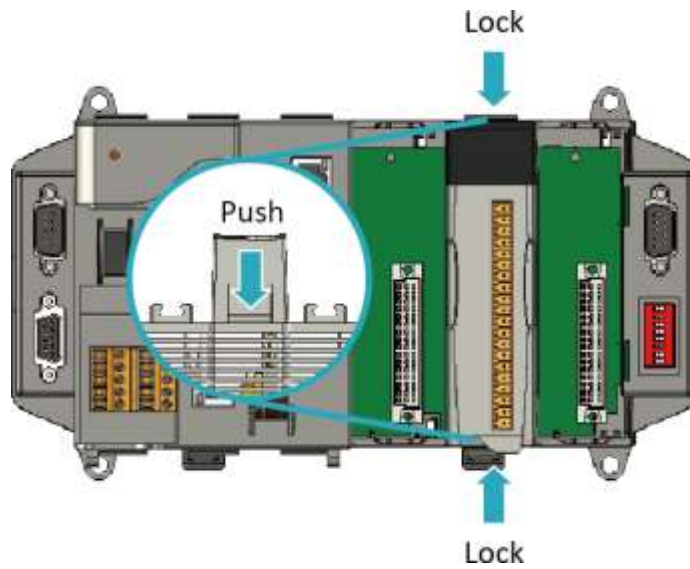


Tips & Warnings



It is recommended that the power to the LX-8000 is switched off when wiring the I/O module which are plugging in the LX-8000 slots.

Step 2: Pull top and bottom locking tabs toward module face. Click indicates lock is engaged

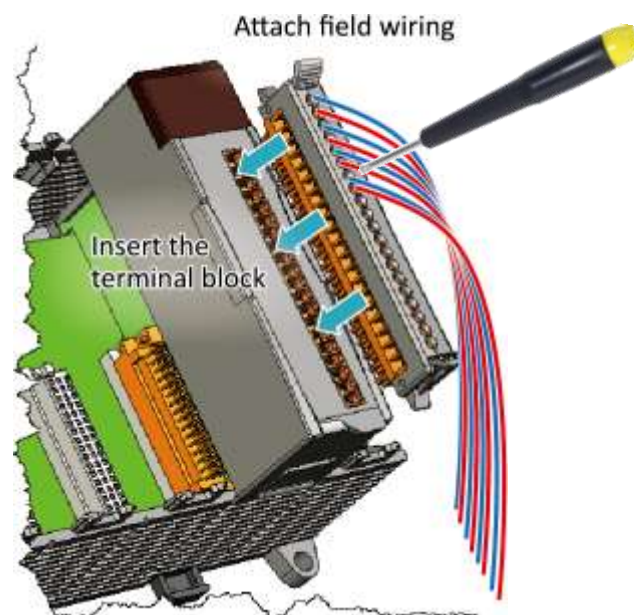


Step 3: Attach field wiring using the terminal block, and then insert the terminal block

All I/O Web Page include the I/O module specifications, pin assignments and wiring connections.

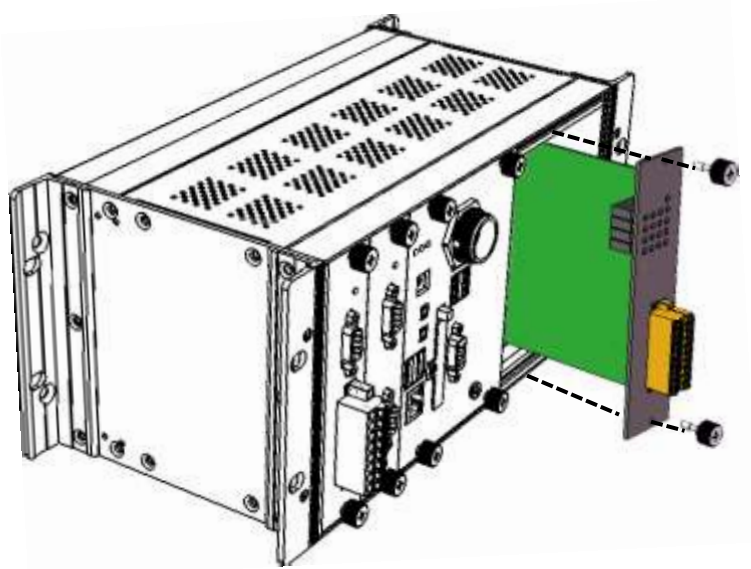
For example, Pin Assignments and Wiring connections for the I-87054W module are as follows:

http://www.icpdas.com/root/product/solutions/remote_io/rs-485/i-8k_i-87k/i-87054w.html



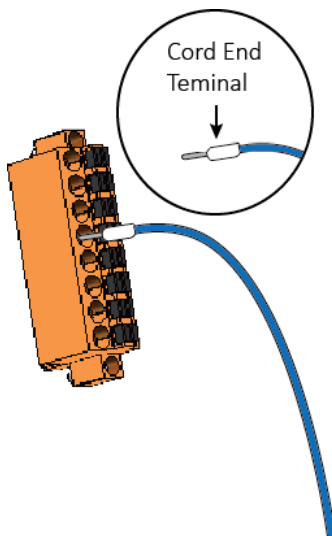
■ LX-9000 Series

Step 1: Insert the I/O module

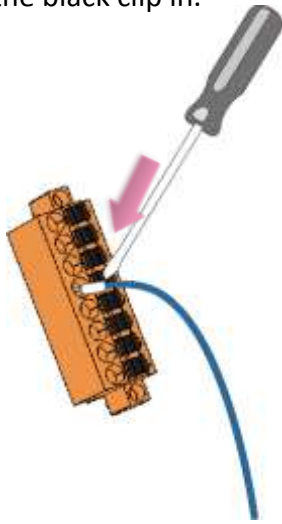


Step 2: Wiring connection

The metal part of the cord end terminal on the wire can be direct wired to the terminal of XP-9000-WES7.

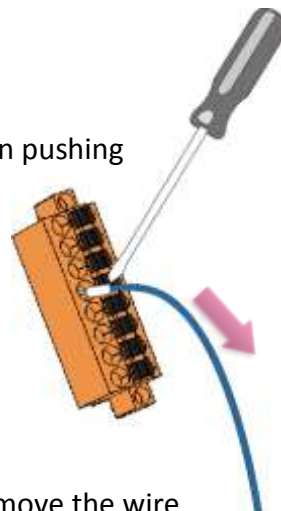


1. Use screwdriver to push the black clip in.



2. Remove the wiring from the terminal block

Keep on pushing



Remove the wire

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.

2.9. Recovering factory OS from CF Card to Flash

If user want to recover factory OS for LX-8000/9000, please using below steps to recover flash's Linux OS:

Step 1: Boot up LX-8000/9000 with CF card OS. Please refer to below command to check the recovery directory in “/root” directory

■ LX-8x31/9x31

```
root@icpdas:~# ls
Desktop OS-install_8x3x_9x3x
root@icpdas:~#
```

■ LX-9x71/9x81

```
root@icpdas:~# ls
Desktop OS-install_9x7x_9x8x
root@icpdas:~#
```

Step 2: Executing the command “setup-control.sh” and choose option ‘1’ to recover the factory Linux OS to flash disk in LX-8000/9000.

■ LX-8x31/9x31

```
root@icpdas:~# setup-control.sh
1.Recover to FLASH (default /dev/sdb1)
2.Recover to CF card (default /dev/sdc1)
3.Recover to FLASH and CF card
1
Recover to FLASH
Fdisk /dev/sdb [ OK ]
Format /dev/sdb1 [ OK ]
Install root file system to /dev/sdb1 [ OK ]
Change root to /dev/sdb1
Set LAN2 MAC use SN-MAC.
update-initramfs /dev/sdb [ OK ]
Setup Boot loader /dev/sdb [ OK ]
Modify /dev/sdb fstab [ OK ]
root@icpdas:~# █
```

■ LX-9x71/9x81

```
root@icpdas:~# setup-control.sh
1.Recover to FLASH (default /dev/sda1)
2.Recover to CF card (default /dev/sdc1)
3.Recover to FLASH and CF card
1
Recover to FLASH
Fdisk /dev/sda [ OK ]
Format /dev/sda1 [ OK ]
Install root file system to /dev/sda1 [ OK ]
Change root to /dev/sda1
update-initramfs /dev/sda [ OK ]
Setup Boot loader /dev/sda [ OK ]
Modify /dev/sda fstab [ OK ]
```

3. Instructions for LX-8000/9000

This chapter provides a brief introduction of the LX-8000/9000 service tools and its benefits.

There are several tools and utilities built-in and designed for use with LX-8000/9000. Some of these are pre-installed on LX-8000/9000 and can work directly on LX-8000/9000, and some of these are supporting tools and can help you to manage the LX-8000/9000 remotely on a PC.

3.1. Basic Linux Command

The Linux basic command can be used to set Linux OS or get system information in the LX-8000/9000.

```
bzcmp          gzip          ntfs-3g.usermap  systemd-ask-password
bzdiff         hciconfig     ntfs-cat         systemd-escape
bzegrep        hostname     ntfscluster     systemd-hwdb
bzfgrep        ip           ntfs-cmp        systemd-inhibit
bzgrep         journalctl   ntfs-fallocate  systemd-machine-id-setup
bzip2          kbd_mode     ntfs-fix        systemd-notify
bzip2recover  kill         ntfs-info       systemd-tmpfiles
bzless         kmod         ntfs-ls         systemd-tty-ask-password-agent
bzmore         less         ntfs-move       tailf
cat            lessecho    ntfs-truncate   tar
chacl         lessfile     ntfs-wipe       tempfile
chgrp         lesskey     open            touch
chmod         lesspipe    openvt          true
```

3.1.1. Linux Command “ls”

ls : list the file information — > (like dir in DOS)

Parameter :

(1) -l : list detailed information of file

```
root@icpdas:/# ls -l
```

```
total 100
```

```
drwxr-xr-x  2  root root 4096   Mar 21 03:56 bin
drwxr-xr-x  3  root root 4096   Apr  8 08:41 boot
drwxrwxr-x  2  root root 4096   Jan  5 09:02 cdrom
drwxr-xr-x 19  root root 6640   Apr 10 18:05 dev
drwxr-xr-x 136 root root 12288  Apr 10 14:13 etc
drwxr-xr-x  3  root root 4096   Apr 13 2016 home
```

```
...ignore below message ....
```

```
root@icpdas:/#
```

(2) -a : list all files including hidden files

```
root@icpdas:/# ls -a
```

```
.   boot  etc      lib      mnt      root     tmp
..  cdrom home    lost+found  opt      run      srv      usr
bin devinitrd.imgmedia  proc      sbin     sys      var
```

```
root@icpdas:/#
```


3.1.2. Linux Command “cd”

cd directory : Change directory — > (like cd in DOS)

Parameter :

(1) .. : move to the upper directory

```
root@icpdas:/tmp# cd ..  
root@icpdas:/#
```

(2) ~ : move back to the root directory

```
root@icpdas:/# cd ~  
root@icpdas:~#
```

(3) / : divided sign

```
root@icpdas:~# cd /tmp  
root@icpdas:/tmp#
```

3.1.3. Linux Command “mkdir”

mkdir : create the subdirectory – > (like md in DOS)

mkdir –parameter subdirectory

```
root@icpdas:/tmp# mkdir mytest
```

```
root@icpdas:/tmp# ls mytest
```

```
mytest
```

```
root@icpdas:/tmp#
```

3.1.4. Linux Command “rm”

rm : delete file or directory —> (like del or deltree in DOS)

rm -parameter file (or directory)

Parameter :

(1) i : it will show the warning message when deleting

```
root@icpdas:/tmp# rm -i test.log
rm: remove regular file 'test.log'? y
root@icpdas:/tmp#
```

(2) r : delete directory despite that it isn't empty

```
root@icpdas:/tmp# rm -r mytest/
root@icpdas:/tmp#
```

(3) f : it will not show a warning message when deleting (Example : rm -f test.exe)

```
root@icpdas:/tmp# rm -f test.log
root@icpdas:/tmp#
```

3.1.5. Linux Command “cp”

cp : copy file —> (like copy in DOS)

cp -parameter source destination

```
root@icpdas:/tmp# cp /root/test.log /tmp/test.log
root@icpdas:/tmp# ls test.log
test.log
root@icpdas:/tmp#
```

3.1.6. Linux Command “mv”

mv : move or rename file or directory — > (like move or ren in DOS)

mv -parameter source file (or directory) destination file (or directory)

```
root@icpdas:/tmp# mv /root/test.log /tmp/mytest.log
root@icpdas:/tmp# ls mytest.log
mytest.log
root@icpdas:/tmp#
```

3.1.7. Linux Command “pwd”

pwd : show the current path

```
root@icpdas:/tmp# pwd
/tmp
root@icpdas:/tmp#
```

3.1.8. Linux Command “chmod”

chmod : change authority of file

chmod ??? file -> ??? means owner : group : all users

For example :

7 5 4 -> 111(read, write, execute) 101(read, write, execute) 100(read, write, execute)

The first number 7 : **owner** can read and write and execute files

The second number 5 : **group** can only read and execute files

The third number 4 : **all users** can only read files

```
root@icpdas:/tmp# chmod 754 test.log
```

```
root@icpdas:/tmp# ls -al test.log
```

```
-rwxr-xr-- 1 root root 7 Apr 11 10:34 test.log
```

```
root@icpdas:/tmp#
```

3.1.9. Linux Command “uname”

uname : show the version of Linux kernel

```
root@icpdas:/tmp# uname -a  
Linux icpdas 4.4.39-rt50 #3 SMP PREEMPT RT Sun Mar 19 23:08:15 PDT 2017 i686 i686  
i686 GNU/Linux  
root@icpdas:/tmp#
```


3.1.10. Linux Command “ps”

ps : show the procedures that execute now

```
root@icpdas:/tmp# ps -a
```

PID	TTY	STAT	TIME	COMMAND
1346	ttySX4	Ss+	0:00	/sbin/agetty 115200 ttySX4 vt220
1347	tty1	Ss+	0:00	/sbin/agetty --noclear 115200 tty1 linux
1607	pts/3	Ss	0:01	-bash
3655	pts/4	Ss	0:00	-bash
4134	pts/5	Ss	0:00	-bash
4442	pts/4	S+	0:00	vim slot.c
5052	pts/3	S+	0:00	vim test.c
5159	pts/5	R+	0:00	ps a

...ignore below message

```
root@icpdas:/#
```

3.1.11. Linux Command “date”

date : show date and time

```
root@icpdas:/tmp# date
```

```
Tue Apr 11 10:49:24 CST 2017
```

```
root@icpdas:/tmp#
```

3.1.12. Linux Command “netstat”

netstat : show the state of network

Parameter [-a] : list all states

```
root@icpdas:/tmp# netstat -a
Active Internet connections (servers and established)
Proto Recv-Q Send-Q Local Address           Foreign Address         State
tcp        0      0 localhost:gpsd         *.*                     LISTEN
tcp        0      0 localhost:mysql        *.*                     LISTEN
tcp        0      0 *:ssh                  *.*                     LISTEN
tcp        0      0 10.1.0.26:ssh          10.1.0.3:3874          ESTABLISHED
...ignore below message ...

root@icpdas:/#
```

3.1.13. Linux Command “ifconfig”

ifconfig : show the ip and network mask (like ipconfig in DOS)

```
root@icpdas:/tmp# ifconfig
eth0      Link encap:Ethernet  HWaddr 00:90:fb:5b:58:7f
          inet addr:10.1.0.7  Bcast:10.1.255.255  Mask:255.255.0.0
          inet6 addr: fe80::290:fbff:fe5b:587f/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:1413820 errors:0 dropped:0 overruns:0 frame:0
          TX packets:18223 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:139319074 (139.3 MB)  TX bytes:2141346 (2.1 MB)
          Memory:b0600000-b067ffff

eth1      Link encap:Ethernet  HWaddr 00:00:00:00:00:03
          inet addr:10.1.0.26  Bcast:10.1.255.255  Mask:255.255.0.0
          inet6 addr: fe80::200:ff:fe00:3/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:1383704 errors:0 dropped:0 overruns:0 frame:0
          TX packets:122 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:108598342 (108.5 MB)  TX bytes:15709 (15.7 KB)
          Interrupt:17 Memory:b0700000-b0720000

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:7 errors:0 dropped:0 overruns:0 frame:0
          TX packets:7 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1
          RX bytes:387 (387.0 B)  TX bytes:387 (387.0 B)

root@icpdas:/tmp#
```

3.1.14. Linux Command “wget”

wget : get the file from the web link.

```
root@icpdas:/tmp# wget http://ftp.icpdas.com/pub/cd/linpac/napdos/lx-series/sdk/linpac_x86_sdk.tgz
--2017-04-11 10:54:27-- http://ftp.icpdas.com/pub/cd/linpac/napdos/lx-series/sdk/linpac_x86_sdk.tgz
Resolving ftp.icpdas.com (ftp.icpdas.com)... xx.xx.xx.xx
Connecting to ftp.icpdas.com (ftp.icpdas.com)|xx.xx.xx.xx|:xx... connected.
HTTP request sent, awaiting response... 200 OK
Length: 248598 (243K) [application/pdf]
Saving to: 'linpac_x86_sdk.tgz'

linpac_x86_sdk.tgz 100%[=====>] 242.77K  --.-KB/s  in 0.02s

2017-04-11 10:54:27 (10.8 MB/s) - 'linpac_x86_sdk.tgz' saved [248598/248598]

root@icpdas:/tmp#
```

3.1.15. Linux Command “ping”

ping : check to see if the host in the network is alive

ping IPAddress (Example : ping 192.168.0.1)

```
root@icpdas:/tmp# ping www.google.com
```

```
PING www.google.com (216.58.200.36) 56(84) bytes of data.
```

```
64 bytes from tsa01s08-in-f4.1e100.net (216.58.200.36): icmp_seq=6 ttl=53 time=8.89 ms
```

```
64 bytes from tsa01s08-in-f4.1e100.net (216.58.200.36): icmp_seq=7 ttl=53 time=8.69 ms
```

```
64 bytes from tsa01s08-in-f4.1e100.net (216.58.200.36): icmp_seq=8 ttl=53 time=8.54 ms
```

```
64 bytes from tsa01s08-in-f4.1e100.net (216.58.200.36): icmp_seq=9 ttl=53 time=18.6 ms
```

```
64 bytes from tsa01s08-in-f4.1e100.net (216.58.200.36): icmp_seq=10 ttl=53 time=8.46 ms
```

```
64 bytes from tsa01s08-in-f4.1e100.net (216.58.200.36): icmp_seq=11 ttl=53 time=18.6 ms
```

```
^C
```

```
--- www.google.com ping statistics ---
```

```
11 packets transmitted, 6 received, 45% packet loss, time 10046ms
```

```
rtt min/avg/max/mdev = 8.465/11.973/18.632/4.705 ms
```

```
root@icpdas:/tmp#
```

3.1.16. Linux Command “clear”

clear : clear the screen

```
root@icpdas:/tmp# ping www.google.com
PING www.google.com (216.58.200.36) 56(84) bytes of data.
64 bytes from tsa01s08-in-f4.1e100.net (216.58.200.36): icmp_seq=6 ttl=53 time=8.89 ms
64 bytes from tsa01s08-in-f4.1e100.net (216.58.200.36): icmp_seq=7 ttl=53 time=8.69 ms
64 bytes from tsa01s08-in-f4.1e100.net (216.58.200.36): icmp_seq=8 ttl=53 time=8.54 ms
64 bytes from tsa01s08-in-f4.1e100.net (216.58.200.36): icmp_seq=9 ttl=53 time=18.6 ms
64 bytes from tsa01s08-in-f4.1e100.net (216.58.200.36): icmp_seq=10 ttl=53 time=8.46 ms
64 bytes from tsa01s08-in-f4.1e100.net (216.58.200.36): icmp_seq=11 ttl=53 time=18.6 ms
^C
--- www.google.com ping statistics ---
11 packets transmitted, 6 received, 45% packet loss, time 10046ms
rtt min/avg/max/mdev = 8.465/11.973/18.632/4.705 ms
root@icpdas:/tmp#clear
```

3.1.17. Linux Command “passwd”

passwd : change the password

passwd ??? — > ??? means the users that you want to change password

```
root@icpdas:/tmp# passwd root
```

```
Enter new UNIX password:
```

```
Retype new UNIX password:
```

```
passwd: password updated successfully
```

```
root@icpdas:/tmp#
```


3.1.18. Linux Command “update-rc.d”

update-rc.d : install and remove System-V style init script links

(1)update-rc.d [-n] name defaults(Example : update-rc.d hello defaults)

```
root@icpdas:~# update-rc.d hello defaults
```

(2)update-rc.d [-n] [-f] name remove(Example : update-rc.d -f hello remove)

```
root@icpdas:~# update-rc.d -f hello remove
```

3.1.19. Linux Command “reboot”

reboot : reboot the LinPAC

```
root@icpdas:~# reboot
```

3.2. i-Talk Utility

The **i-Talk utility** can make the convenient for users to access the modules and hardware in the LX-8000/9000.

Instruction	Function Description
getlist	List all module name in the LX-8000/9000
setdo	Set digital output value to 8k module
setao	Set analog output value to 8k module
getdi	Get digital input value from 8k module
getai	Get analog input value from 8k module
setexdo	Set digital output value to 7k/87k module
setexao	Set analog output value to 7k/87k module
getexdi	Get digital input value from 7k/87k module
getexai	Get analog input value from 7k/87k module
setport	Set port value by offset to a module
getport	Get port value by offset from a module
setsend	Send string from LinPAC COM port
getreceive	Receive string from LinPAC COM port
getsendreceive	Send/Receive string from LinPAC COM port
read_sn	Get Hardware Serial Number of LX-8000/9000
Rotary_id	Get Rotary Switch ID of LX-8000/9000
ttyS1-config	Set ttyS1 communication mode

(LX-8x31/9x31 only)	
iztconfig	Zigbee protocol communicate, Use ZT-USBC commute with ZT-2000 series device

■ ZT-USBC introduce

http://www.icpdas.com/root/product/solutions/industrial_wireless_communication/wireless_solutions/zst-usb.html

■ ZT-2000 series introduce

http://www.icpdas.com/root/product/solutions/industrial_wireless_communication/wireless_solutions/wireless_selection.html

Below Table lists the demos that show how to use the I-talk utility. In the demo, the **I-8024** (AO Module) 、 **I-8017H** (AI Module) and **I-8055** (DIO Module) are all used and they are plugged into the slots 1 、 2 and 3 of the LinPAC separately.

Instruction	Demo
getlist	Command: getlist → getlist Description: List all module names in the LX-8000/9000 Series.
setdo	Command: setdo [slot] [data] → setdo 3 3 Description: Set i-8055 channel 1 and 2 on.
setao	Command: setao [slot] [channel] [data] → setao 1 0 2.2

	<p>Description: Set the i-8024 channel 0 output 2.2V.</p>
getdi	<p>Command: getdi [slot] [type] → getdi 3 8</p> <p>Description: Get the 8 bits DI value from i-8055.</p>
getai	<p>Command: getai [slot] [channel] [gain] [mode] → getai 2 0 0 0</p> <p>Description: Get the AI value from i-8017HW.</p>
setexdo	<p>Command: (1) setexdo [slot] 1 [data] → setexdo 2 1 55 (2) setexdo [slot] [comport] [data] [baudrate] [address] → setexdo 0 3 55 9600 2</p> <p>Description: (1)Set the dec digital output value to the module at slot 2 at COM1. (2)Set the dec digital output value to the module at slot 0 at COM3.</p>
setexao	<p>Command: (1) setexao [slot] 1 [value] [channel] → setexao 2 1 6.7 5 (2)setexao [slot] [comport] [value] [channel] [baudrate] [address] → setexao 0 3 6.7 5 9600 2</p> <p>Description: (1)Set channel 5 analog value 6.7 to the module at slot 2. (2)Set channel 5 analog value 6.7 to the module at COM3.</p>

getexdi	<p>Command: (1)getexdi [slot] 1 → getexdi 2 1 (2)getexdi [slot] [comport] [baudrate] [address] → getexdi 0 3 9600 2</p> <p>Description: (1)Get the dec digital input value from the module at slot 2. (2)Get the dec digital input value from the module at COM3.</p>
getexai	<p>Command: (1)getexai [slot] 1 [channel] → getexai 2 1 5 (2)getexai [slot] [comport] [channel] [baudrate] [address] → getexai 0 3 5 9600 2</p> <p>Description: (1)Get channel 5 analog value from the module at slot 2. (2)Get channel 5 analog value from the module at COM3.</p>
read_sn	<p>Command: read_sn → read_sn</p> <p>Description: Show the serial number.</p>
rotary_id	<p>Command: rotary_id → rotary_id</p> <p>Description: Read rotary switch ID of LX-8000/9000</p>
ttyS1-config (LX-8x31/9x31 only)	<p>Command: ttyS1-config → ttyS1-config</p> <p>Description:</p>

	Setting the serial port ttyS1(RS232 or RS485) of LX-8x31/9x31
iztconfig	<p>Command: iztconfig → iztconfig</p> <p>Description: Using ZT-USBC communicate with ZT-2000 series</p> <ol style="list-style-type: none"> 1.Loaded ftdi_sio driver first #modprobe ftdi_sio 2.Add ZT-USBC device id # echo "1b5c 0210" > /sys/bus/usb-serial/drivers/ftdi_sio/new_id

3.3. LX-8000/9000 SDK

LX-8000/9000 SDK consists of the following major items.

- LinPAC SDK library files
- LinPAC SDK include files
- Demo files

From <http://ftp.icpdas.com/pub/cd/linpac/napdos/lx-series/sdk>, you can download the latest version of LX-8000/9000 SDK. And then follows the below steps in order to get the development toolkit which has been provided by ICP DAS for the easy application of the LX-8000/9000 embedded controller platform.

(1) User can connect to LX-8000/9000 through communication port (**Console, LAN1, LAN2**) by using “**putty**” software (refer to “CH2.LX-8000/9000 Getting Started”).

(2) After connecting to LX-8000/9000, user could type command “wget”

“http://ftp.icpdas.com/pub/cd/linpac/napdos/lx-series/sdk/linpac_x86_sdk.tgz” to get the latest version of LX-8000/9000 SDK.

Tips & Warnings



Please check the network can connect to the ICP DAS official website.

(2) To type “tar xzf LinPAC_X86_SDK.tar.gz” to decompress tar file and type “make” to compile demo code.

```
root@icpdas:~# tar xzf LinPAC_X86_SDK.tgz
root@icpdas:~# ls LinPAC_X86_SDK
LinPAC_X86_SDK
root@icpdas:~# cd LinPAC_X86_SDK/
root@icpdas:~/LinPAC_X86_SDK# make
```


Once user decompresses the SDK file, user can find the files for the library and demo in the following paths.

The libPAC_x86.a path is “**LinPAC_X86_SDK/lib**”.

The include files path is “**LinPAC_X86_SDK/include**”.

The LX-8000/9000 demo path is “**LinPAC_X86_SDK/examples/lx-series**”.

The LP-8x81/8x81-Atom demo path is “**LinPAC_X86_SDK/examples/lp-8x81**”.

4. Your First LX-8000/9000 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 LX-8000/9000. The default LX-8000/9000 support below development tools:

Default Development Tools

Linux OS is a mature embedded operating system which supports rapid development. Standard development tools are list as follows which are highly integrated, with comprehensive support for developing applications of LX-8000/9000.

- Scripts Language (shell script, perl, python and php)
- Standard C language and GNU gcc compiler

LX-8000/9000 SDKs

The x86 LinPAC SDK is a Software Development Kit (SDK) that contains C header files, C libraries. The LX-8000/9000 SDK are classified by development tools that can be downloaded from the web link "http://ftp.icpdas.com/pub/cd/linpac/napdos/lx-series/sdk/linpac_x86_sdk.tgz" to get the latest version of LX-8000/9000 SDK.

4.1. Your First LX-8000/9000 Program with C Language

In this section, we will introduce how to compile the helloworld.c to helloworld and executes this file on the LX-8000/9000 Series. In this example, no ICP DAS modules are used. To create a demo program with C that includes the following main steps:

1. Find demo "helloworld.c" in SDK
2. Compile and Execute the demo on LX-8000/9000
3. Execute the application on LX-8000/9000 at boot time

All main steps will be described in the following subsection.

4.1.1. Find Demo “helloworld.c” in SDK

The x86 LinPAC SDK had added the demo “helloworld.c”. User can follow below steps to find the demo in SDK.

1. Download SDK

Please refer to “CH3.3 LX-8000/9000 SDK” steps to get SDK

2. Find the demo in SDK

Using “cd” command to go into the demo’s directory.

3. Use “vi” command to modify/create demo “helloworld.c” in SDK

```
root@icpdas:~# cd LinPAC_X86_SDK/examples/lx-series/common/
root@icpdas:/tmp/LinPAC_X86_SDK/examples/lx-series/common# ls helloworld*
helloworld  helloworld.c
root@icpdas:/tmp/LinPAC_X86_SDK/examples/lx-series/common# vi helloworld.c
```

4.1.2. Compile/Execute Demo “helloworld”

User can refer to below steps to compile and execute demo “helloworld”.

1. Add script to SDK Makefile

User can refer to the SDK Makefile(LinPAC_X86_SDK/examples/lx-series/common/Makefile) that we had added the script for demo “helloworld.c”.

2.Type “make helloworld” command to compile demo “helloworld.c”

3. Execute binary file “helloworld”

```
root@icpdas:/tmp/LinPAC_X86_SDK/examples/lx-series/common# make helloworld
gcc -I. -I../../include -c -o helloworld.o helloworld.c
gcc -I. -I../../include -o helloworld helloworld.o ../../lib/libPAC_x86.a -lm
rm -f helloworld.o
root@icpdas:/tmp/LinPAC_X86_SDK/examples/lx-series/common# ./helloworld
Hi ~ Welcome to x86 LinPAC
root@icpdas:/tmp/LinPAC_X86_SDK/examples/lx-series/common#
```


4.1.3. Execute Demo at Boot Time

User can refer to below steps to auto-execute demo “helloworld” at boot time in LX-8000/9000.

1. Create script file in “/etc/init.d”

User can use “vi” command to create the script file in “/etc/init.d” and add below script language to the file.

```
root@icpdas:~# vi /etc/init.d/hello
```

```
#!/bin/sh

### BEGIN INIT INFO
# Provides: ICP DAS
# Required-Start:
# Required-Stop:
# Should-Start:
# Should-Stop:
# Default-Start: 2 3 4 5
# Default-Stop: 0 1 6
# Short-Description: Start and stop hello
# Description: hello
### END INIT INFO

helloworld > /tmp/test.log
```

2. Use “update-rc.d” command to add the script “hello” automatically.

```
root@icpdas:~# chmod +x /etc/init.d/hello
root@icpdas:~# update-rc.d hello defaults
```

3. After setting the file, the LX-8000/9000 will execute binary “helloworld” at boot time

5. Application for LX-8000/9000

In this chapter, ICP DAS provides extra module supported and instructions to enhance LX-8000/9000 functionality and affinity.

5.1.1. Advanced Package Tool

“apt-get” command is a management system for software packages on the Linux OS of LX-8000/9000.

- To install a package run the following commands:

```
apt-get update  
apt-get install <package>
```

- To search available package run the following commands:

```
apt-cache search <package name>
```

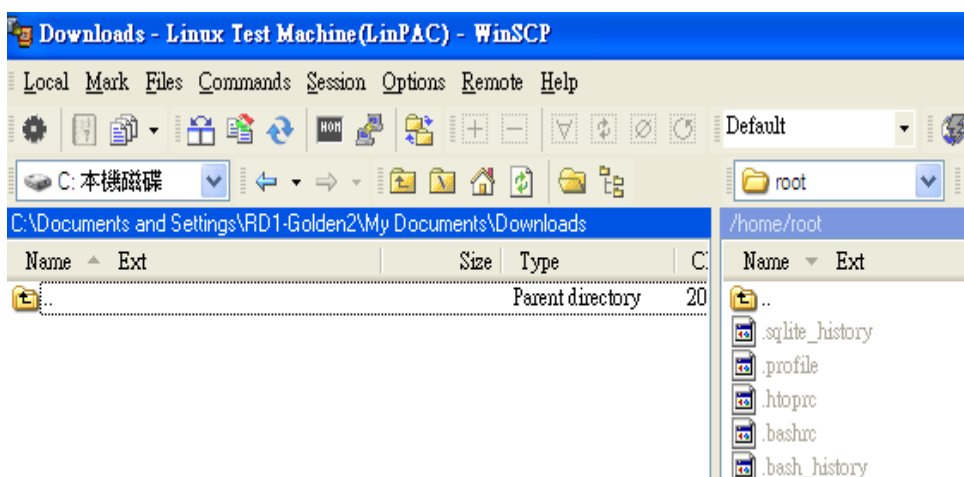
5.1.2. SFTP(secure file transfer program)

The LX-8000/9000 series had supported SFTP(or SCP), user can transfer the file from Windows(or Linux). For examples, using Windows Program “WinSCP” to access the device over network, please follow below steps:

1. Choosing the “SFTP” or “SCP” protocol and type IP address , default ID(root) and password(icpdas) to login

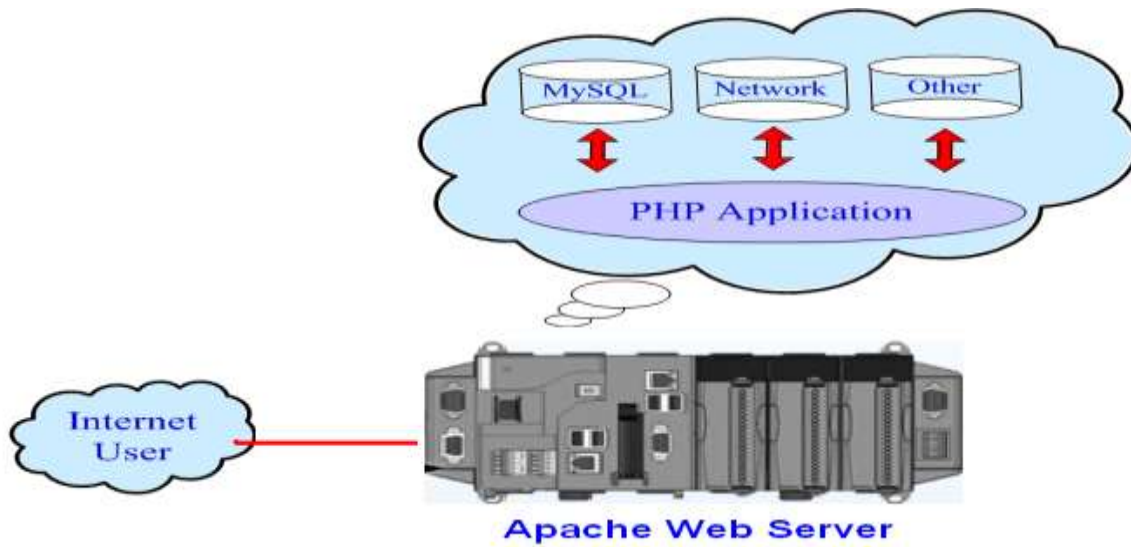


2. Drag and drop file



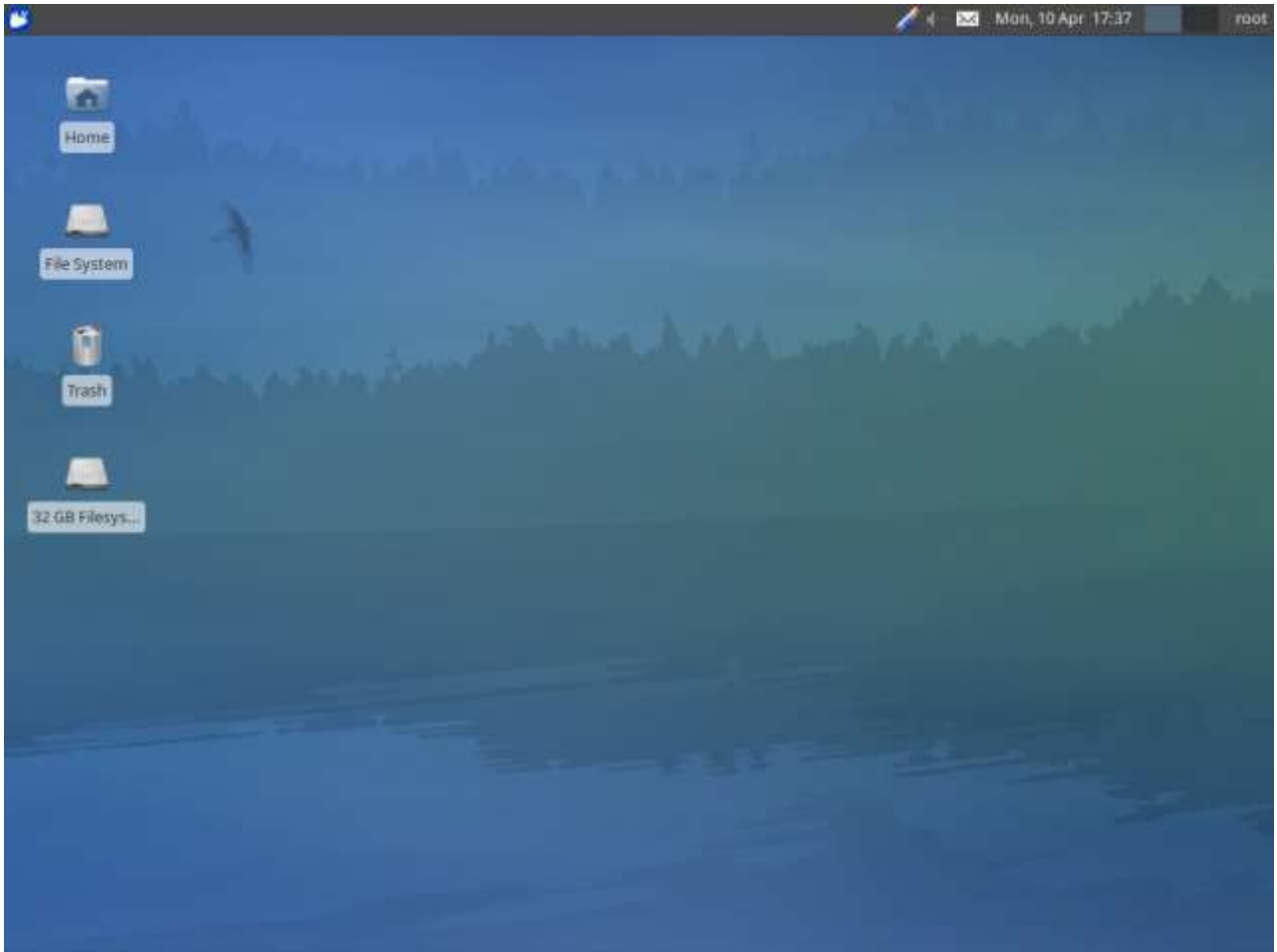
5.1.3. LAMP

The LAMP(Linux + Apache + PHP + MySQL) server has been built in the Linux OS of LX-8000/9000. As a solution stack, LAMP is suitable for building dynamic web sites and web applications.



5.1.4. XFCE(secure file transfer program)

XFCE is a lightweight desktop environment for UNIX-like operating systems. It aims to be fast and low on system resources, while still being visually appealing and user friendly. The LX-8000/9000 series support the XFCE package, after user type “root” and password “icpdas” to login, the local terminal would execute the XFCE Desktop.



6. LX-8000/9000 Internet Service

The [internet service](#) provided by ICP DAS will be satisfied and it includes [Technical Support](#), [Driver Update](#), [OS_Image](#), [LinPAC_SDK](#) and [User's Manual Download](#) etc. Users can refer to the following web site to get more information:

1. ICP DAS Web Site :

<http://www.icpdas.com/>

2. LX-8x31/9x31/9x71/9x81 Product Page:

<http://www.icpdas.com/root/product/solutions/pac/linpac/lx-8x3x.html>

<http://www.icpdas.com/root/product/solutions/pac/linpac/lx-9x3x.html>

<http://www.icpdas.com/root/product/solutions/pac/linpac/lx-9x7x.html>

<http://www.icpdas.com/root/product/solutions/pac/linpac/lx-9x8x.html>

3. E-mail for Technical Support : service@icpdas.com

Appendix

A. I-8K Modules and I-87K Modules

This chapter provides a brief overview of the different between the I-8K series modules and I-87K series modules.

I-8K and I-87K modules provide the option to expand the local I/O to expansion I/O slots and the bus type for the modules can be either parallel (high profile I-8K series) or serial (high profile I-87K series).

The differences between the I-8K series modules and I-87K series modules are as follows.

Item	I-8K Series	I-87K Series
Microprocessor	No	Yes (8051)
Communication Interface	Parallel Bus	Serial Bus
Communication Speed	Fast	Slow
Latched DI Function	No	Yes
Counter Input (for digital input modules)	No	Yes (100 Hz)
Power-on Value	No	Yes
Safe Value	No	Yes
Programmable Slew-Rate for AO modules	No	Yes

B. 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 LX-9000. One is high communication speed I-9K series modules with parallel interface; the other is I-97K series modules with serial interface. The differences between the two series are listed as follows:

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

C. Revision History

This chapter provides revision history information to this document.

The table below shows the revision history.

Revision	Date	Description
V1.0.0	April 2017	Initial issue