ioPAC 5500 Hardware User's Manual

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MOXA®

ioPAC 5500 Hardware User's Manual

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Introduction

The following topics are covered in this chapter:

❒ **Overview**
❒ **Package Checklist**

Overview

The ioPAC 5500 standalone controllers use an ARM9 based industrial-grade CPU for the main system, with ARM Cortex™ M4 based CPUs for the I/O channels. The USB bus between the controller CPU and module CPUs transmits data at up to 200 Mbps, and the dual CPU architecture supports a 2 kHz analog input sampling rate and millisecond timestamps. The ioPAC 5500 supports C/C++ programming, rail-level surge and ESD protection, a -40 to 75°C (-30 to 75°C for HSPA models) operating temperature range, UL/cUL Class 1 Division 2 and ATEX Zone 2 certifications, two 10/100 Mbps Ethernet ports with two MACs (Port Trunking ready), and two 3-in-1 serial ports. With Moxa's Active OPC Server and DA-Center, the ioPAC 5500 series provides a comprehensive solution for data acquisition and control applications in harsh environments.

Package Checklist

ioPAC 5500

The ioPAC 5500 is shipped with the following items:

- ioPAC 5500 controller
- Serial console cable
- Documentation and software CD

Optional Accessories (can be purchased separately)

- WK-51-01: Wallmount kit

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Installation

This chapter includes instructions on how to install the ioPAC 5500.

The following topics are covered in this chapter:

❒ **Basic Installation**

➢ DIN Rail Installation Procedure

❒ **Configuring the Power**

➢ Powering on the ioPAC Controller

➢ Grounding the ioPAC

❒ **Installing a microSD Card**

❒ **Installing a SIM card**

❒ **Connecting to the Network**

➢ Ethernet Communication

❒ **Serial Connectivity**

➢ Connecting to a Serial Device

➢ Serial Console (Debug Port)

❒ **Battery**

Basic Installation

DIN Rail Installation Procedure

Installing the ioPAC 5500 on a DIN Rail

The DIN rail attachment plate should already be fixed to the back panel of the ioPAC 5500 when you take it out of the box. To install the ioPAC 5500 on a DIN Rail, follow below steps.

NOTE   A wall mount kit can be purchased separately.

STEP 1: Insert the top of the DIN rail into the slot just below the stiff metal spring.
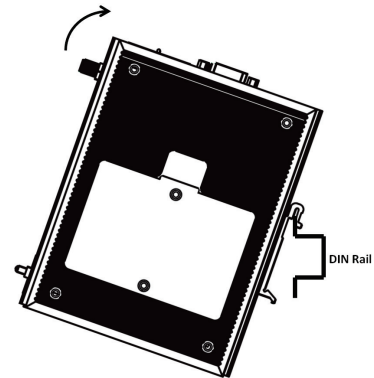
DIN Rail

STEP 2: The DIN-rail attachment unit will snap into place as shown to the right.
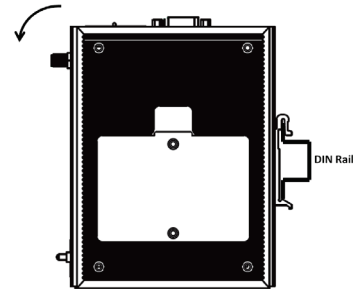
DIN Rail

Removing the ioPAC 5500 from a DIN Rail

To remove the ioLogik unit from the DIN-rail, simply reverse Steps 1 and 2 above.

Configuring the Power

Powering on the ioPAC Controller

The ioPAC controller can receive power from a 9 to 48 VDC power. Input power is applied to the positive (V1+, V2+) and negative (V1-, V2-) terminals on the connector.

- When the input voltage is below the minimum recommended voltage the ioPAC will turn off.
- The ioPAC has reverse protection and power input over-voltage protection, allowing it to resist a maximum voltage of 60 V, and the ioPAC's power input over-current fuse protection specification is 5 A at 25°C.
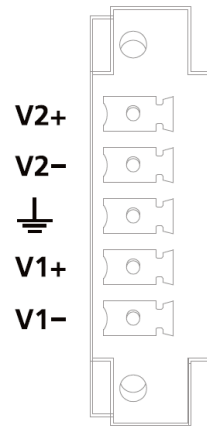
After connecting the Moxa ioPAC controller to the power supply, it will take 30 to 60 seconds for the operating system to boot up. The green Ready LED will not turn on until the operating system is ready.

⚠ ATTENTION

This product is intended to be supplied by a Listed Power Unit with output marked "LPS" and rated for 9-48 VDC (minimum requirements). For railway rolling stock applications, these devices must be supplied by a galvanic isolated power supply with design based on the EN 50155 standard.

Grounding the ioPAC

For most applications, it is desirable to ground the system by connecting the system's power supply common wire to the chassis or panel ground. The negative (−V) side of the DC power input terminal as well as all I/O point terminals labeled GND are connected to chassis ground.
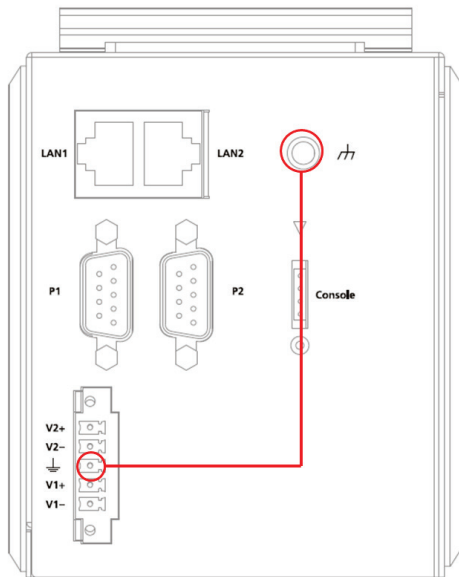
NOTE
1. Use 18 AWG wire for the power ground.
2. We highly recommend connecting the ground screw to the power terminal block's ground.

Installing a microSD Card

The ioPAC is equipped with one slot for microSD cards. The card reader slot is located inside the ioPAC device, so you will need to unscrew and remove the card cover to install your microSD cards. When inserting a microSD card, remember to keep the front edge of the card facing down.

Follow these steps to remove or install a microSD card:

1. Remove the screw holding the card cover in place.
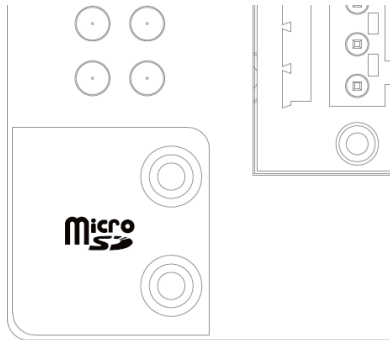
2. (a) Insert the microSD card into the microSD card slot, or
   (b) Remove the microSD card from the microSD card slot.
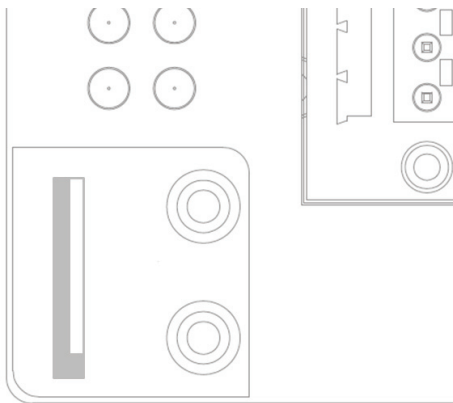
3. Fasten back the screw holding the card cover in place.

Installing a SIM card

ioPAC 5542-HSPA controller supports cellular network function. user can unscrew and remove the SIM card cover to insert the SIM card.
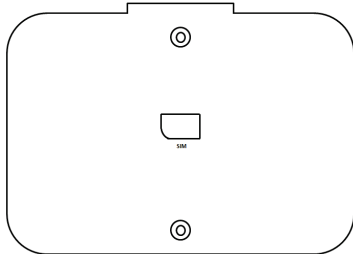
Follow these steps to remove or install a SIM card:

1. Remove the screw holding the card cover in place.

2. (a) Insert the SIM card into the slot, or
   (b) Remove the SIM card from the slot.

Connecting to the Network

Ethernet Communication

Connections to the LAN port are made through an RJ45 or M12 connector on the module. The wiring and pin connections for these connectors are described in separate sections below.

- **TCP/IP Settings:** Dual Speed Functionality: The ioPAC 5500's Ethernet ports auto negotiate with the connected devices and then use the fastest data transmission rate supported by both devices. The following table shows the TCP/IP parameters supported by the LAN port. Default values are set when a Factory Reset is performed on the controller.

Lan Port 1		Lan Port 2	
Parameter	**Supported Values**	**Parameter**	**Supported Values**
IP Address	Default: 192.168.127.254	IP Address	Default: 192.168.126.254
Subnet Mask	Default: 255.255.255.0	Subnet Mask	Default: 255.255.255.0
Gateway	Default: 0.0.0.0	Gateway	Default: 0.0.0.0

IP Address is the IP address of the controller.
Subnet Mask determines the subnet on which the controller is located.
Gateway determines how your controller communicates with devices outside its subnet. Enter the IP address of the gateway.

The IP address, subnet mask, and gateway are static; contact your network administrator to obtain these addresses for the controller.

RJ45 Ethernet Connector

The ideal maximum cable length of a 10/100BaseT connection is 100 m (350 feet), but the actual limit could be longer or shorter depending on the amount of electrical noise in the environment. To minimize the amount of noise, Ethernet cables should not run parallel to power cables or other types of cables that generate electrical noise.

The following diagram and table shows the pin connections for the RJ45 Ethernet connector.

RJ45 Connector Pin Assignment

| Contact	Media Direct Interface Signal
1	Tx + (transmit)
2	Tx - (transmit)
3	Rx + (receive)
4	Not used
5	Not used
6	Rx - (receive)
7	Not used
8	Not used
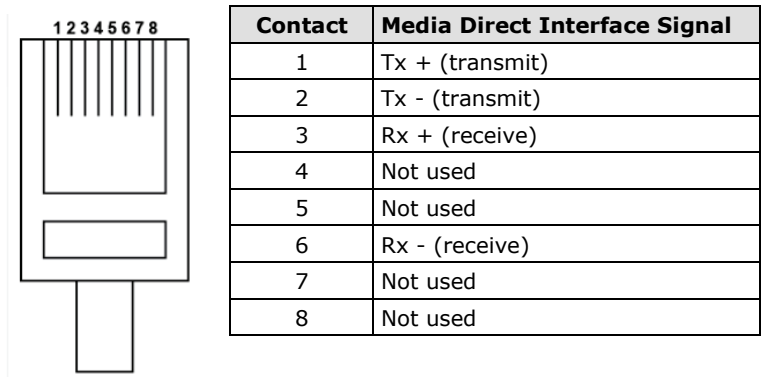
Port Trunking

The ioPAC 5500 RTU controller has a **Port Trunking** function (active backup mode) that can convert two LAN-port IP addresses into one virtual IP address for easy SCADA integration and Ethernet redundancy. In the following diagram, both LAN ports on each ioPAC RTU controller are connected to a managed switch on an Ethernet network running SCADA software. For more details regarding configuration setup, refer to the **ioPAC RTU Software User's Manual.**
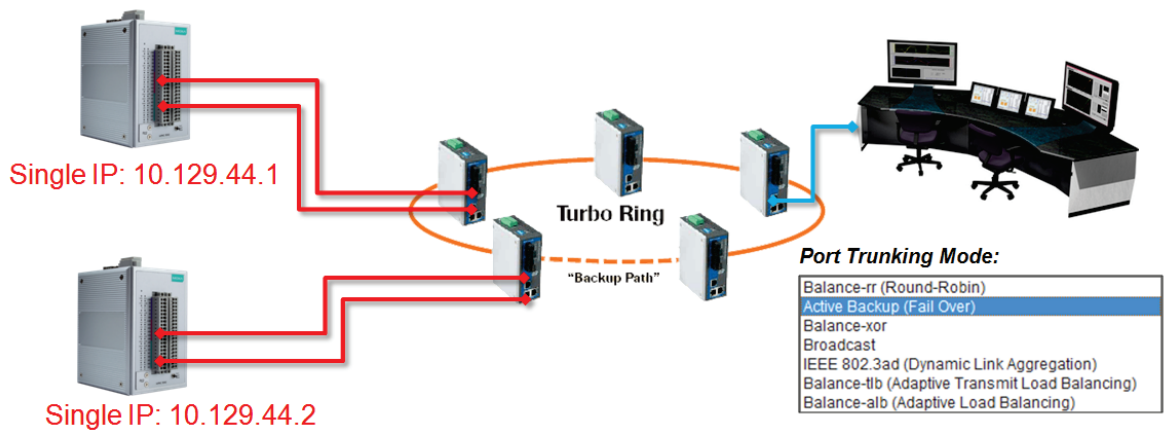
Serial Connectivity

Connecting to a Serial Device

The ioPAC RTU is equipped with two 3-in-1 serial ports that support RS-232/422/485, making it more convenient to connect field serial devices.
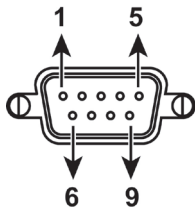
Pin	RS-232	RS-422 and 4-wire RS-485	2-wire RS-485
1	DCD	TxD-(A)	–
2	RXD	TxD+(B)	–
3	TXD	RxD+(B)	Data+(B)
4	DTR	RxD-(A)	Data-(A)
5	GND	GND	GND
6	DSR	–	–
7	RTS	–	–
8	CTS	–	–
9	RI	–	–

Serial Console (Debug Port)

The serial console gives users a convenient way of connecting to the RTU controllers. This method is particularly useful when using the computer for the first time. The serial console is also effective for connecting the Moxa RTU controllers when you do not know target network settings and IP addresses.
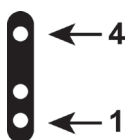
Step 1: To use the serial console, remove the cover from the front/top panel first.

Console Port for the ioPAC Series
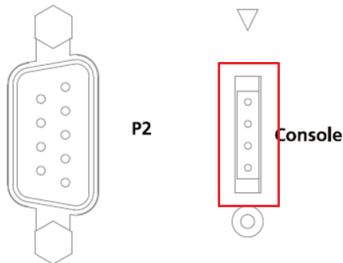
Step 2: Attach the 4-pin serial console cable to the console port. The following diagram shows the 4-pin serial connector and pin connections.

Pin Assignment for the Serial Console Port

Pin	Definition
1	TxD
2	RxD
3	NC
4	GND

Serial Console Default Settings

Parameter	Value
Baudrate	115200 bps
Parity	None
Data bits	8
Stop bits	1
Flow Control	None
Terminal	VT100

We recommend using Moxa PComm Terminal Emulator to connect to the serial console. The following steps describe how to connect the console.

1. Download Moxa PComm Lite from the Moxa website (www.moxa.com) or copy it from the following folder on the Documentation and Software CD: Software\utility\PComm\.

2. Install Moxa PComm Lite to the host Windows PC.

3. Run PComm Lite Terminal Emulator from **Start → Programs → PComm Lite Ver 1.x → Terminal Emulator**.

4. Click **Profile → Open**.
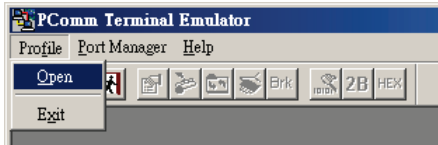
5. Specify which COM port is connecting to the Moxa RTU, and use the following configuration settings: 115, 200, 8, none, 1.
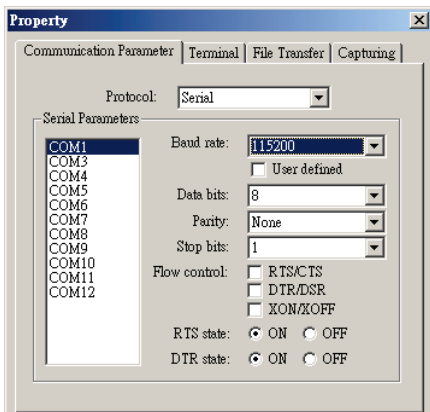
6. Click on the Terminal tab and configure the Terminal Type to VT100. Click **OK** to proceed.
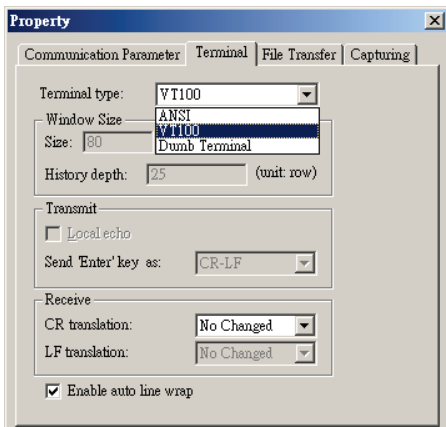
7. The serial console will be displayed on the terminal screen.

Battery

The ioPAC RTU controller is equipped with one built-in, rechargeable VL2020 3V battery for the SRAM and one BR2032 3V non-rechargeable battery for the Real Time Clock (RTC).
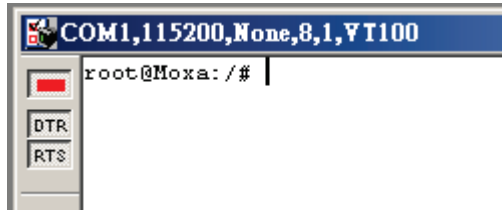
- Rechargeable battery (VL2020) for SRAM
  - ➢ Sustains at least 1 week without power supply
  - ➢ Capacity: 20 mAh
  - ➢ Typical consumption (@ 25°C): 4 µA
  - ➢ 5-year warranty
- Non-rechargeable battery (BR2032) for RTC
  - ➢ Sustains at least 5 years without power supply
  - ➢ Capacity: 195 mAh
  - ➢ Typical consumption (@ 25°C): 2 µA
  - ➢ 5-year warranty

⚠️ **Caution**

Do NOT attempt to replace the battery. Contact your local dealer for replacement assistance.

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ioPAC 5500 Hardware Introduction

This chapter introduces the ioPAC 5500's hardware specifications.

The following topics are covered in this chapter:

❏ **Appearance and Dimensions**
  ➢ Appearance
  ➢ Dimensions

❏ **Hardware Block Diagrams**
  ➢ ioPAC 5500 RTU Controller Block Diagram

❏ **Product Hardware Specifications**
  ➢ Product Selection Guide
  ➢ Product Specifications

❏ **ioPAC 5500 LED Indicators**
  ➢ System LEDs
  ➢ Communication LEDs
  ➢ Cellular
  ➢ User-Defined LEDs: LED1 and LED2
  ➢ I/O LEDs

❏ **Toggle Switch: Mode 1 and Mode 2**

❏ **Toggle Switch: Factory Reset Process**

❏ **Pin assignment and I/O wiring guide**
  ➢ Pin Assignment
  ➢ Digital Input
  ➢ Digital Output
  ➢ Analog Input (Voltage)
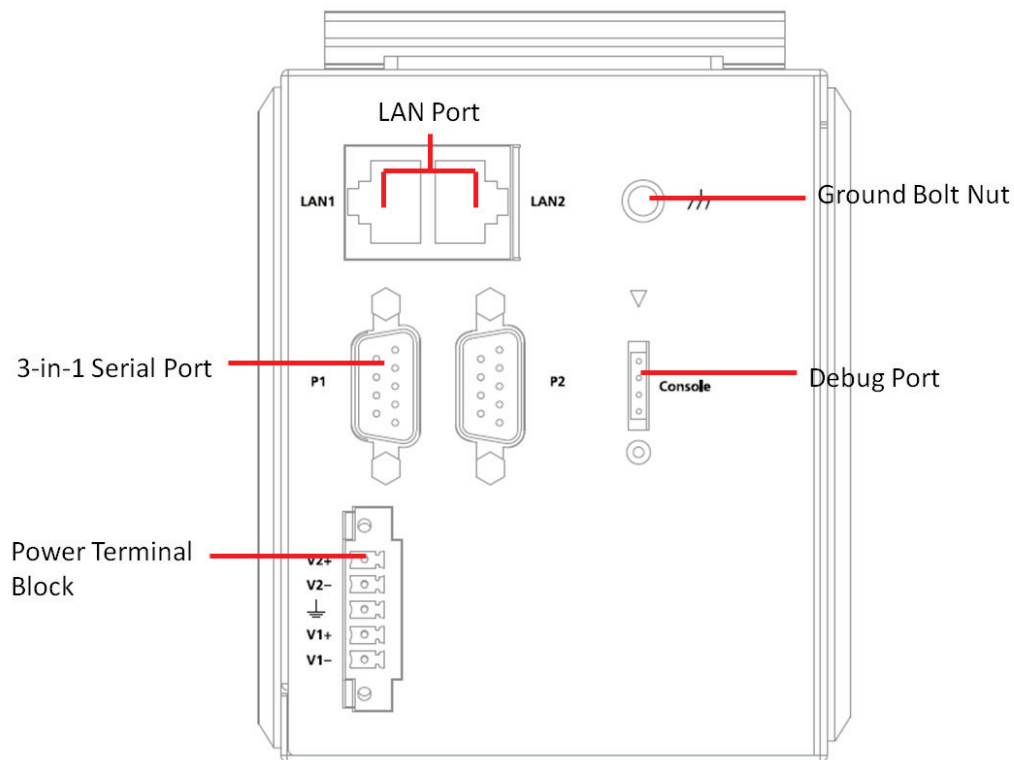 ➢ Analog Input (Current)

Appearance and Dimensions

Appearance

The following figures depict ioPAC 5500 RTU controller.
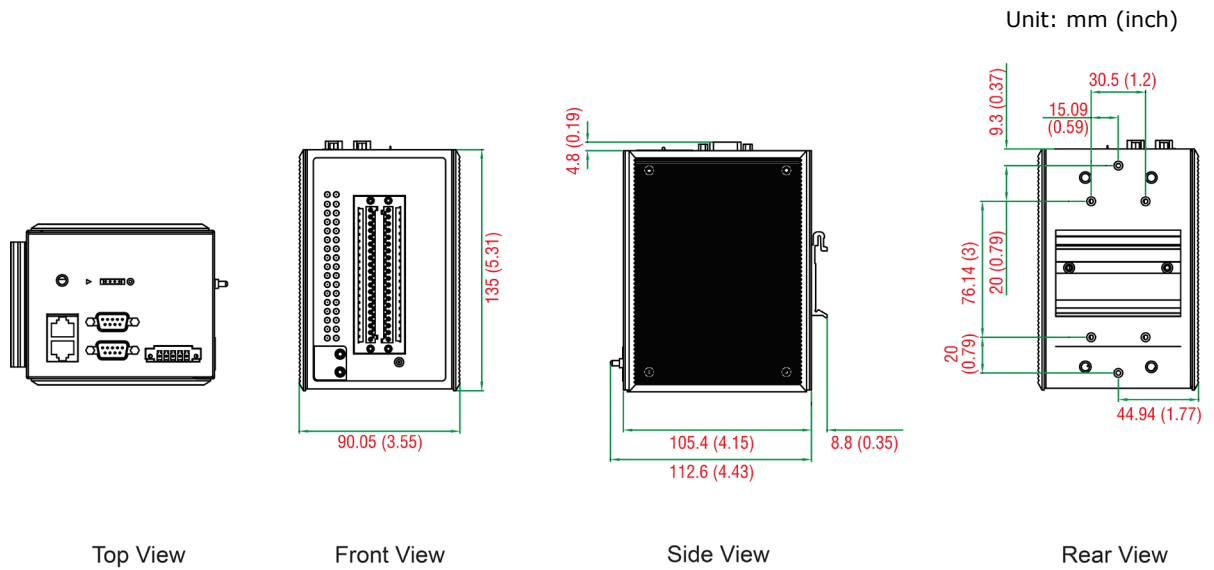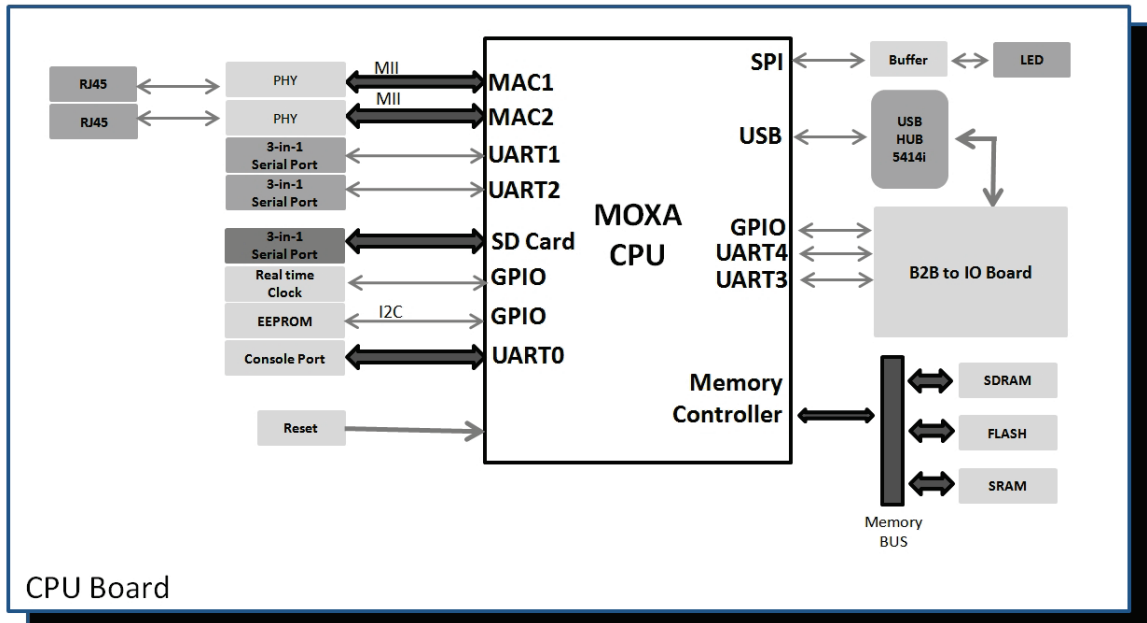
Front View

Top View

Dimensions

Unit: mm (inch)

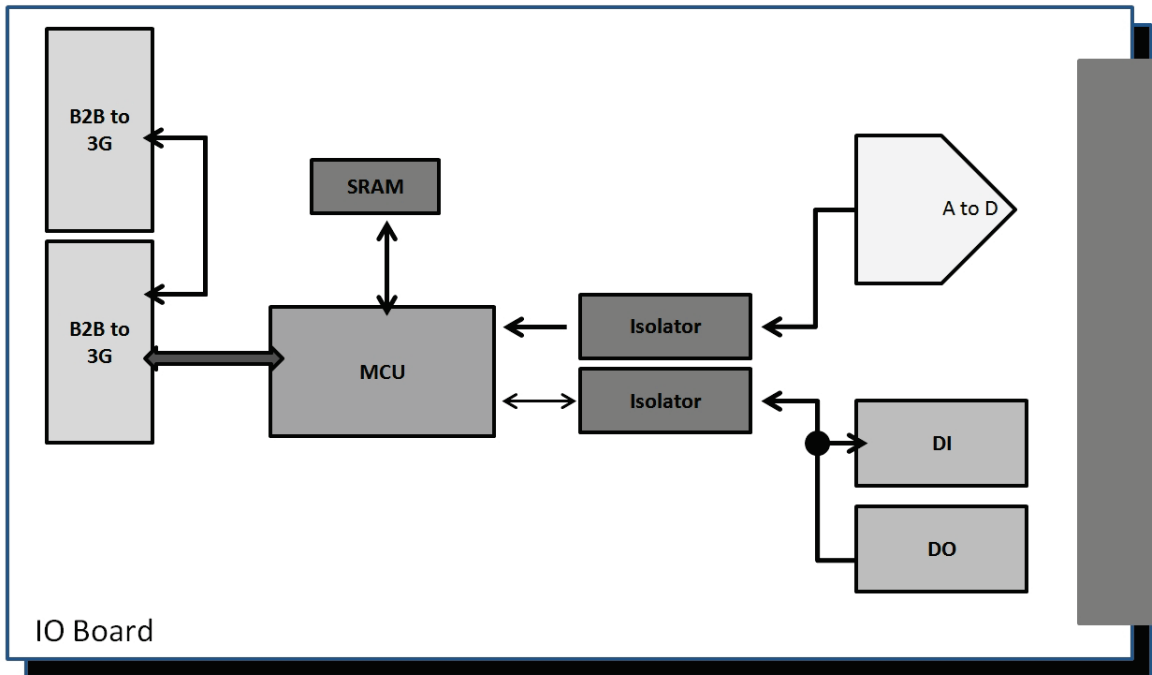Top View   Front View   Side View   Rear View

Hardware Block Diagrams

ioPAC 5500 RTU Controller Block Diagram

CPU Board

I/O Board

3G Board
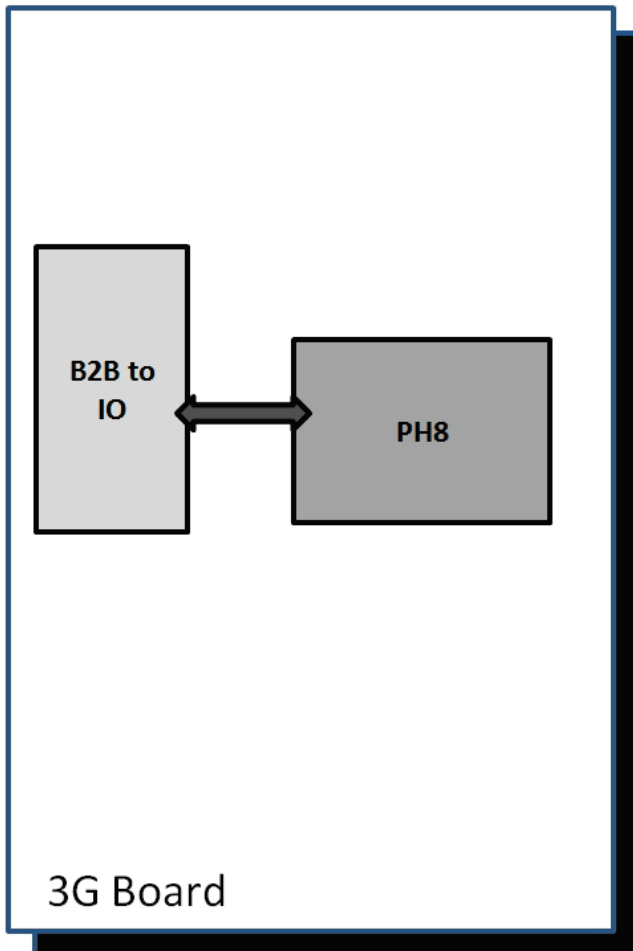
Product Hardware Specifications

Product Selection Guide

Model Name	Description
ioPAC 5542-C-T	RTU controller, 8AIs, 8 DIs, 8DIOs, C/C++, -40 to 75°C operating temperature
ioPAC 5542-HSPA-C-T	RTU controller with HSPA module, 8AIs, 8 DIs, 8DIOs, C/C++, -30 to 75°C operating temperature

NOTE   Conformal coating available on request.

Product Specifications

Computer
Main CPU: 32-bit ARM9 192 MHz CPU
I/O CPU: 32-bit ARM Cortex M4 80 MHz CPU
OS: Linux
Clock: Real-time clock with battery backup
Memory:
• SDRAM: 64 MB
• Flash: 32 MB
• SRAM: 256 KB (battery backup lasts for 1 week)
• microSD™ Slot: Up to 32 GB (SD 2.0 compatible)
Note: For units operating in extreme temperatures, industrial grade, wide-temperature microSD cards are required.

Cellular (for the ioPAC 5542-HSPA Series)
Network:
• Quad-band GSM/GPRS/EDGE 850/900/1800/1900 MHz
• Tri-band UMTS/HSPA 850/1900/2100 MHz
Internet:
HSPA:
• Up to 5.76 Mbps upload speed
• Up to 14.4 Mbps download speed
UMTS:
• Up to 384 kbps upload/download speed
EDGE Class 12:
• Up to 237 kbps upload/download speed
GPPRS Class 12:
• Up to 85.6 kbps upload/download speed
SMS: Point-to-Point Text/PDU mode
SIM Control Voltage: 3/1.8 V

Ethernet Interface
LAN: 2 x 10/100 Mbps, 2 MACs (IPs), RJ45
Protection: 1.5 kV magnetic isolation

Serial Communication
Interface:
• 2 RS-232/422/485 ports, software selectable (DB9 male)
• 1 RS-232 debug port (4-pin connector)
Serial Line Protection: 15 kV ESD for all signals

Serial Communication Parameters

Parity: None, Even, Odd

Data Bits: 7, 8

Stop Bits: 1, 2

Flow Control: RTS/CTS, XON/XOFF

Baudrate: 300 bps to 921.6 Kbps

Serial Signals

RS-232: TxD, RxD, DTR, DSR, RTS, CTS, DCD, GND, RI

RS-422: Tx+, Tx-, Rx+, Rx-, GND

RS-485-4w: Tx+, Tx-, Rx+, Rx-, GND

RS-485-2w: Data+, Data-, GND

Inputs and Outputs

Analog Inputs: 8 channels

Digital Inputs: 8 channels

Configurable DIOs: 8 channels

Isolation: 3K VDC or 2K Vrms

Analog Input

Type: Differential Input

Resolution: 16 bits

I/O Mode: Voltage / Current

Input Range: 0 to 10 VDC, -10 to 10 VDC, 0 to 20 mA, 4 to 20 mA (wire off)

Accuracy:

±0.1% FSR @ 25°C

±0.3% FSR @ -40 and 75°C

Sampling Rate:

• All channels: 2000 samples/sec

• Per channel: 250 samples/sec

Input Impedance: 2M ohms (min.)

Built-in Resistor for Current Input: 120 ohms

Digital Input

Sensor Type: Wet Contact (NPN or PNP), Dry Contact

I/O Mode: DI or Event Counter

Dry Contact:

• On: short to GND

• Off: open

Wet Contact:

NPN (DI to GND):

• On: 0 to 3 VDC

• Off: 10 to 30 VDC

PNP (DI to GND):

• Off: 0 to 3 VDC

• On: 10 to 30 VDC

Common Type: 4 points per COM

Counter Frequency: 1 kHz

Digital Filtering Time Interval: Software selectable (in 0.1 ms increments)

Digital Output

Type: Sink

I/O Mode: DO or Pulse Output

Pulse Output Frequency: 1 kHz

Over-voltage Protection: 45 VDC

Over-current Protection: 2.6 A (4 channels @ 650 mA)

Over-temperature Shutdown: 175°C (typical), 150°C (min.)

Current Rating: 200 mA per channel

Software Characteristics

Automation Languages: C/C++

Protocols: Modbus/TCP, Modbus/RTU Master

Power Requirements

Power Input: 24 VDC nominal, 9 to 48 VDC

Power Consumption:

• ioPAC 5542-HSPA Series: 9.65 W @ 24 VDC

• ioPAC 5542 Series: 8.3 W @ 24 VDC

Physical Characteristics

Housing: Aluminum

Dimensions: 90.05 x 135 x 105.4 mm (3.55 x 5.32 x 4.15 in)

Weight:

• ioPAC 5542-HSPA Series: 1100 g

• ioPAC 5542 Series: 1000 g

Mounting: DIN-rail mounting (standard), wall mounting (optional)

Connector: Spring-type terminal block

Environmental Limits

Operating Temperature:

• ioPAC 5542 Series: -40 to 75°C (-40 to 176°F)

• ioPAC 5542-HSPA Series: -30 to 75°C (-22 to 176°F)

Storage Temperature: -40 to 85°C (-40 to 185°F)

Ambient Relative Humidity: 5 to 95% (non-condensing)

Altitude: Up to 2000 m

Note: Contact Moxa if you require products guaranteed to function properly at higher altitudes.

Standards and Certifications

Safety: UL 508, NCC (Pending)

Hazardous Location: UL/cUL Class 1 Division 2; ATEX Zone 2 (Pending)

EMI: EN 55022, EN 61000-3-2, EN 61000-3-3, FCC Part 15 Subpart B Class A

EMS: EN 55024, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-4-8, EN 61000-4-11

Shock: IEC 60068-2-27

Freefall: IEC 60068-2-32

Vibration: IEC 60068-2-6

Rail Traffic: EN 50121-4 (Pending)

Note: Check Moxa's website for the most up-to-date certification status.

MTBF (mean time between failure)

Time:

• ioPAC 5542: 348,096 hrs

• ioPAC 5542-HSPA: 337,702 hrs
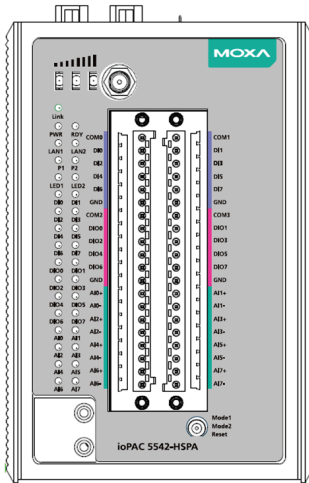
Database: Telcordia (Bellcore)
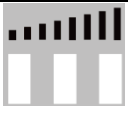
Warranty

Warranty Period: 5 years

Details: See www.moxa.com/warranty

ioPAC 5500 LED Indicators

There are 9 LEDs on the ioPAC controller.

Category	Label	Usage	
System	PWR	System Power	On: Power On Off: Power Off
	RDY	System (Kernel) Ready	Green: System Ready Green Blinking: System is booting up Red: System error or factory reset executing Red Blinking: Factory reset triggered
User-Defined	LED1, LED2	User-Defined	User-Defined
Communication	LAN1, LAN2	Ethernet Connection	Green: 100Mb Amber: 10Mb Blinking: data transmitting Off: disconnected
	P1, P2	Serial Connection	Green: Tx Amber: Rx Non-simultaneous Blinking: data transmitting Off: disconnected
	Link	Cellular Connection	Green: ISP/IP retrieved Off: ISP disconnected
	(signal bars icon)	Cellular Signal	1 & 2 & 3: ON (RSSI >= 24) 1 & 2: ON (18 <= RSSI < 24) 1: ON Only (12 <= RSSI < 18) Off: No Signal (RSSI < 12)
I/O	DIn, DIOn	Digital Input / Output Indicator	Green: Channel ON or counter signal in/pulse signal output (scan rate: 1 second) Off: Channel OFF or No Counter/Pulse Signal
	AIn	Analog Input Indicator	Green: Channel Enabled Red: Burn out & wire off when 4-20 mA current mode

System LEDs

PWR (Power LED)

The Power (PWR) LED indicates the status of the system power. When the system is on, this LED will turn green, and when the system power is off this LED will be off.

RDY (Ready LED)

The Ready (RDY) LED indicates the status of the system's kernel. When the LED is green the system kernel is ready. When the LED is green and blinking, the system's kernel is booting-up. When the Ready (RDY) LED is red, there is either a system error or the system is being reset to factory defaults. When the Ready LED is red and blinking, the device's factory default mode has been triggered.

Communication LEDs

P1 and P2

The ioPAC controller comes with two serial connections. P1 and P2 represent the status of each serial connection. When the LED is green, the ioPAC is transmitting data (Tx). When the the LED is amber, the ioPAC is receiving data (Rx). When the LED is blinking randomly, data is either being transmitted or received. For example, if P1 is blinking and is green, the ioPAC is transmitting data.

When the LED is off, the serial connection is disconnected.

LAN1 and LAN2

The ioPAC controller comes with two Ethernet ports, with the LAN1 and LAN2 LEDs used to represent the status of the two connections. When the LED is green, data is transmitting at 100 Mbps. When the LED is amber, data is transmitting at 10 Mbps. When the LED is blinking, data is being transmitted. When the LED is off, there is no Ethernet connection, or the Ethernet connection has been disconnected.

Cellular

The ioPAC 5542-HSPA RTU controller supports a cellular (HSPA) communications. The **Link LED** can detect the communication status and the cellular signal can detect the signal strength of the cellular connection.

User-Defined LEDs: LED1 and LED2

The ioPAC controller allows the user to custom configure these two LEDs (through the software interface). Refer to the **C/C++ Sample Code Programming Guide for ioPAC RTU Controllers** for details.

I/O LEDs

The ioPAC 5542 RTU controller has I/O LED indicators that directly display the status of I/Os on the front panel of the ioPAC 5542 RTU controller.

Toggle Switch: Mode 1 and Mode 2

The Mode 1 and Mode 2 toggle switches are user-defined by software (refer to the **C/C++ Sample Code Programming Guide for ioPAC RTU Controllers** for details).

Toggle Switch: Factory Reset Process

Use the following procedure to reset the ioPAC to the factory defaults. Note that when you reset the ioPAC, all of your tag definitions, software programs, and files will be deleted, and the service and runtime engine will be restarted.

1. When the system is booting up and the RDY LED is blinking GREEN, hold the toggle switch in the "reset" position.
2. Continue to hold toggle switch until the "RDY" LED turns a solid RED, and then release the toggle switch. It will take around 90 seconds to complete the factory reset process.
3. When the "RDY" LED starts blinking GREEN (indicating that the kernel is rebooting), the factory mode is completed.

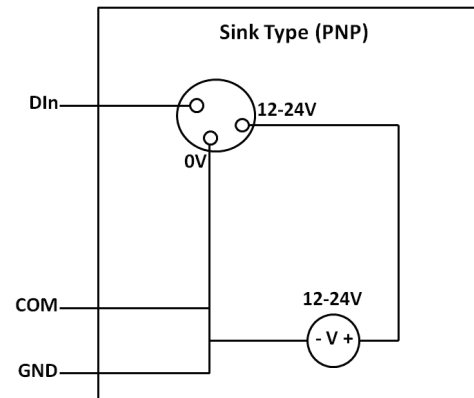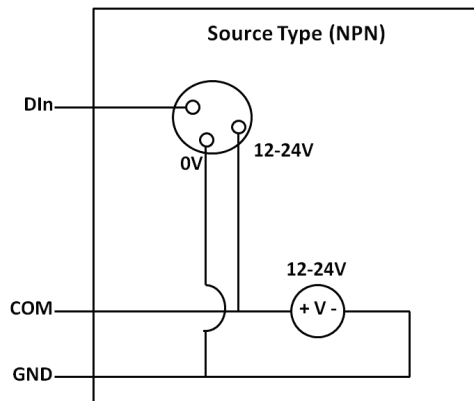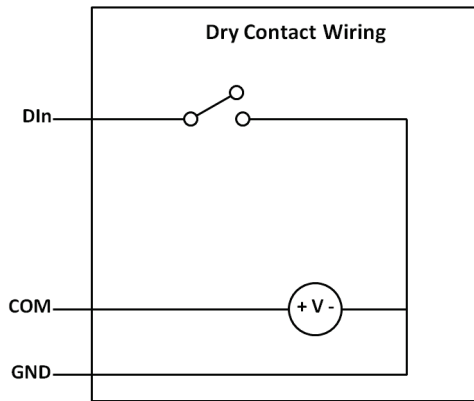|	
NOTE	Do NOT power off, operate, or connect any devices when the "RDY" LED is a solid RED. The factory reset function is only activated when the system is booting up.

Pin assignment and I/O wiring guide

The following is the ioPAC 5542 RTU controller's pin assignment and I/O wiring guide.

Pin Assignment
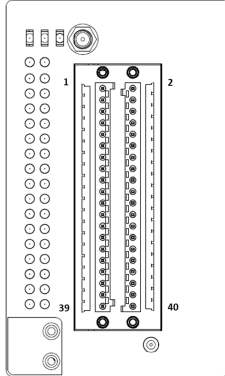
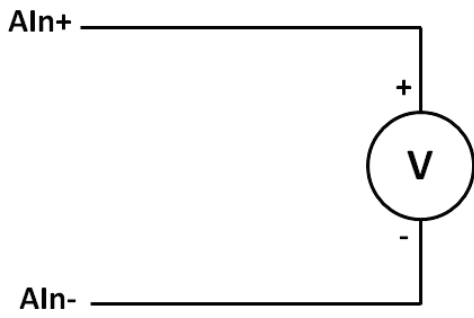| Pin	Name	Description	Pin	Name	Description
1	COM0	COM of DI0, DI2, DI4, and DI6	2	COM1	COM of DI1, DI3, DI5, and DI7
3	DI0	Digital Input Channel 0	4	DI1	Digital Input Channel 1
5	DI2	Digital Input Channel 2	6	DI3	Digital Input Channel 3
7	DI4	Digital Input Channel 4	8	DI5	Digital Input Channel 5
9	DI6	Digital Input Channel 6	10	DI7	Digital Input Channel 7
11	GND	Ground	12	GND	Ground
13	COM2	COM of DIO0, DIO2, DIO4, and DIO6	14	COM3	COM of DIO1, DIO3, DIO5, and DIO7
15	DIO0	Digital Input/Output Channel 0	16	DIO1	Digital Input/Output Channel 1
17	DIO2	Digital Input/Output Channel 2	18	DIO3	Digital Input/Output Channel 3
19	DIO4	Digital Input/Output Channel 4	20	DIO5	Digital Input/Output Channel 5
21	DIO6	Digital Input/Output Channel 6	22	DIO7	Digital Input/Output Channel 7
23	GND	Ground	24	GND	Ground
25	AI0+	Analog Input Channel 0 +	26	AI1+	Analog Input Channel 1 +
27	AI0-	Analog Input Channel 0 -	28	AI1-	Analog Input Channel 1 -
29	AI2+	Analog Input Channel 2 +	30	AI3+	Analog Input Channel 3 +
31	AI2-	Analog Input Channel 2 -	32	AI3-	Analog Input Channel 3 -
33	AI4+	Analog Input Channel 4 +	34	AI5+	Analog Input Channel 5 +
35	AI4-	Analog Input Channel 4 -	36	AI5-	Analog Input Channel 5 -
37	AI6+	Analog Input Channel 6 +	38	AI7+	Analog Input Channel 7 +
39	AI6-	Analog Input Channel 6 -	40	AI7-	Analog Input Channel 7 -

Digital Input

Dry Contact Wiring

DIn

COM + V -

GND

Source Type (NPN)

DIn

0V 12-24V

12-24V

COM + V -

GND

Sink Type (PNP)

DIn 12-24V

0V

COM 12-24V

GND - V +

Digital Output

DOn —— LOAD

+
V
-

GND

Analog Input (Voltage)

AIn+

+

V

-

AIn-

Analog Input (Current)

AIn+

mA

AIn-