W311/321/341
Hardware User's Manual

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MOXA®

W311/321/341
Hardware User's Manual

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Introduction

The W300 series is a line of wireless RISC-based embedded computers that features 802.11a/b/g WLAN, RS-232/422/485 serial ports, and an Ethernet port in a small, rugged chassis. In addition, all models feature an SD slot, and the W341 features two USB 2.0 hosts and one relay output channel.

Your W300 series embedded computer is ideal for diverse, machine-to-machine embedded applications. It enables wireless operation for traditionally wired networks and serial devices. The W300 series not only provides transparent data transfers, but also numeric computing, protocol conversion, data processing and even data encryption. You will find it easier to build embedded systems for distributed peer-to-peer communication, turn wired devices into wireless devices, and introduce higher mobility and more intelligence to your system. In this chapter, you will learn about the capabilities of this embedded computer.

This chapter covers the following topics:

- ❑ **Overview**
- ❑ **Package Checklist**
- ❑ **Product Features**
- ❑ **Product Hardware Specifications**
- ❑ **Hardware Block Diagram**
    - ➢ W311
    - ➢ W321
    - ➢ W341

Overview

The W300 Series wireless embedded computer is designed around the Moxa ART ARM9 32-bit RISC processor. Unlike the X86 CPU, which uses a CISC design, the Moxa ART ARM9 uses RISC architecture and modern semiconductor technology to provide a powerful computing engine without generating significant heat. The processor also integrates UART and LAN functions to provide exceptional communication performance, but without the bus bandwidth limitations associated with general ARM-based communication products.

On-board NOR Flash ROM and SDRAM provides ample storage capacity, and for select models, the SD slot gives applications extra room to expand. The built-in WLAN function supports the 802.11a/b/g standard, providing transmission security with WEP, WPA and WPA2. The backup LAN port not only provides an alternative solution for networking but also supports Ethernet clients, allowing any network device to plug in and connect to the WLAN. The built-in RS-232/422/485 serial ports support a wide range of serial devices, making this platform suitable for data acquisition and protocol conversion applications.

The Linux-based operating system comes pre-installed and ready to run, providing an open platform for software development. Software written for desktop PCs can easily be ported to W300 Series embedded computers by using a common complier, so little time is spent modifying existing software code. In addition, the operating system, device drivers, and user-developed software can all be stored in the built-in flash memory.

Package Checklist

The W300 Series includes the following models:

W311-LX

A small, RISC-based, ready-to-run, wireless embedded computer with WLAN, one serial port, Ethernet, SD slot, and Linux OS

W321-LX

A small, RISC-based, ready-to-run, wireless embedded computer with WLAN, two serial ports, Ethernet, SD slot, and Linux OS

W341-LX

A RISC-based, ready-to-run, wireless embedded computer with WLAN, four serial ports, Ethernet, SD slot, USB port, relay output, and Linux OS

Each model is shipped with the following items:

- W300 Series wireless embedded computer
- Quick Installation Guide
- Documentation & Software CD
- 100 cm RJ45-to-RJ45 Ethernet cross-over cable
- 100 cm console port cable (CBL-4PINDB9F-100)
- Universal Power Adaptor
- Product Warranty Statement

Optional Accessories

- 35 mm DIN-rail mounting kit (DK-35A)

NOTE: *Notify your sales representative if any of the above items are missing or damaged.*

Product Features

W300 Series computers have the following features:

- Moxa ART 32-bit ARM9 industrial communication processor
- 32 MB on-board RAM (64 MB for W341)
- 16 MB built-in flash memory
- 802.11a/b/g Wireless LAN
- WEP, WPA and WPA2 encryption
- Infrastructure mode and Ad-Hoc mode
- RS-232/422/485 serial ports with software selectable interface
- Baudrates between 50 and 921.6 Kbps; supports non-standard baudrates
- 10/100M Ethernet for backup networking
- SD card slot for storage expansion
- Withstands 5G continuous vibration and 50G shock
- LED indicators for status, serial transmission, and wireless signal strength
- Ready-to-run Linux platform
- Installation on DIN-rail or wall
- Fanless design for increased ruggedness

Product Hardware Specifications

System

CPU	Moxa ART ARM9 32-bit RISC CPU, 192 MHz		
DRAM	W311: 32 MB	W321: 32 MB	W341: 64 MB
Flash	W311: 16 MB	W321: 16 MB	W341: 64 MB
Storage Expansion	W311: SD slot x 1	W321: SD slot × 1	W341: SD slot × 1
USB	W341: USB 2.0 host × 2		
Relay Output	Form C, SPDT × 1		
	Normal switching:	2A @ 30 VDC	
	Capacity:	60W max.	
	Switching power:	220 VDC max.	
	Switching voltage:	2A max.	
	Switch current:	4 ms @ 20°C	
	Operation time:	100 Mohm max.	
	Initial contact resistance:		
Console Port	RS-232 × 1 (TxD, RxD, GND), 4-pin header output, "115200, n, 8, 1"		
Button	Reset button × 1, supports "Reset to Factory Default"		
Others	RTC, buzzer, Watchdog Timer		
OS	Built-in Embedded Linux with MMU support, based on Linux Kemel 2.6		

WLAN Communication

Standard Compliance	802.11a/b/g
Radio Frequency Type	DSSS, CCK, OFDM
Media Access Protocol	Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA)
Modulation	802.11a/g: OFDM (64-QAM, 16-QAM, QPSK, BPSK) 802.11b: DSSS (DBPSK, DQPSK, CCK)
Transmission Power (Typical)	5.15 to 5.35 GHz: 15 dBm @6 Mbps; 12 dBm @54 Mbps 5.725 to 5.825 GHz: 15 dBm @6 Mbps; 12 dBm @54 Mbps USA: 2.412 to 2.462 GHz (IEEE802.11g): 17 dBm @6 Mbps; EU: 2.412 to 2.472 GHz 15 dBm @54Mbps 2.412 to 2.462 GHz (IEEE802.11b): 18 dBm@ 1 to 11 Mbps
Receiver Sensitivity (Typical)	5.15 to 5.35 GHz: 6 Mbps @ -90 dBm; 54 Mbps @ -72 dBm 5.47 to 5.725 GHz: 6 Mbps @ -90 dBm; 54 Mbps @ -72 dBm 5.725 to 5.825 GHz: 6 Mbps @ -89 dBm; 54 Mbps @ -72 dBm USA: 2.412 to 2.462 GHz (IEEE802.11g): 6 Mbps @ -90 dBm; EU: 2.412 to 2.472 GHz 54 Mbps @ -73 dBm USA: 2.412 to 2.462 GHz (IEEE802.11b): 11 Mbps @ -87 dBm; EU: 2.412 to 2.472 GHz 1 Mbps @ -94 dBm
Transmission Rate	54 Mbps with auto fallback (54, 48, 36, 24, 18, 12, 11, 9, 6, 5.5, 2, 1 Mbps) 802.11b supported rates: 1, 2, 5.5, 11 Mbps 802.11a/g supported rates: 6, 9, 12, 18, 24, 36, 48, 54 Mbps
Transmission Distance	100 meters at 11 Mbps (with no obstructions)
Security	WEP 64-bit/128-bit, WPA, WPA2 data encryption
Antenna Connector	Reverse SMA
Antenna	External 2 dBi dipole antenna
WLAN Mode	Infrastructure, Ad-Hoc

Network Communication

LAN	10/100 Mbps RJ45 × 1, auto-sensing
Protection	1.5 KV built-in magnetic isolation protection

Serial Communication

Serial Port	W311: RS-232/422/485 DB9 male × 1 W321: RS-232/422/485 DB9 male × 2 W341: RS-232/422/485 DB9 male × 4
Protection	15 KV built-in ESD protection for all signals
Data bits	5, 6, 7, 8
Stop bits	1, 1.5, 2
Parity	None, Even, Odd, Space, Mark
Flow Control	RTS/CTS, XON/XOFF, RS-485 ADDC™
Speed	50 bps to 921.6 Kbps; supports non-standard baudrates

LEDs

System	Ready, SD activity
WLAN	Enable, signal strength

| LAN | 10 M/Link, 100 M/Link (RJ45 connector) |
| Serial | TxD, RxD |

Power Requirements

Power Input	12 to 48 VDC
Power Consumption	W311: 400 mA @ 12 VDC
	W321: 400 mA @ 12 VDC
	W341: 600 mA @ 12 VDC with no USB devices attached
	1.2A @ 12 VDC with USB devices on each port at max spec
	500 mA @ 5 VDC

Mechanical

Dimension	(without wall mount ear or antenna)
(W × D × H)	W311: 77 × 111 × 26 mm
	W321: 77 × 111 × 26 mm
	W341: 150 × 100 × 38 mm
Antenna	110 mm
Construction Material	W311: aluminum, 1 mm
	W321: aluminum, 1 mm
	W341: aluminum, 1 mm / SECC, 1 mm for rear panel
Mounting	DIN-rail, wall

Environmental

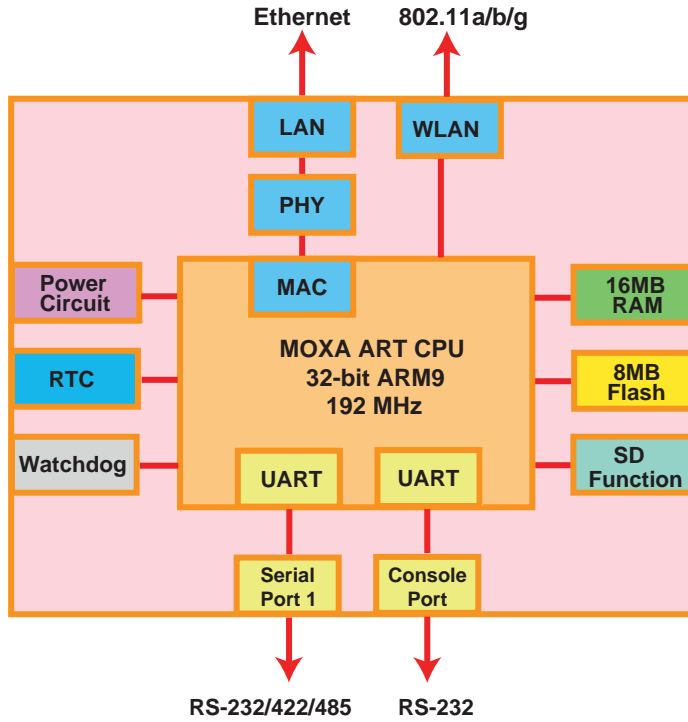| Operating Temperature | -10 to 60°C (14 to 140°F), 5 to 95% RH |
| Storage Temperature | -20 to 80°C (-4 to 176°F), 5 to 95% RH |

Regulatory Approvals

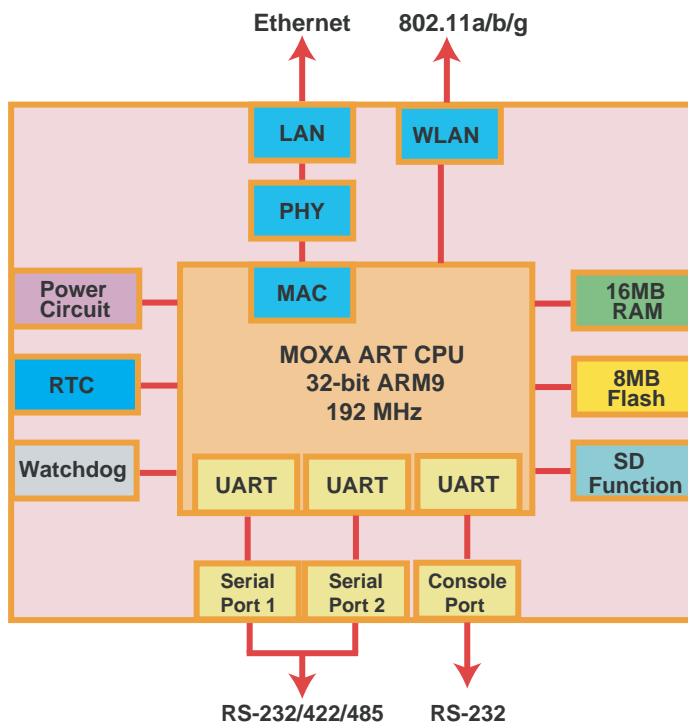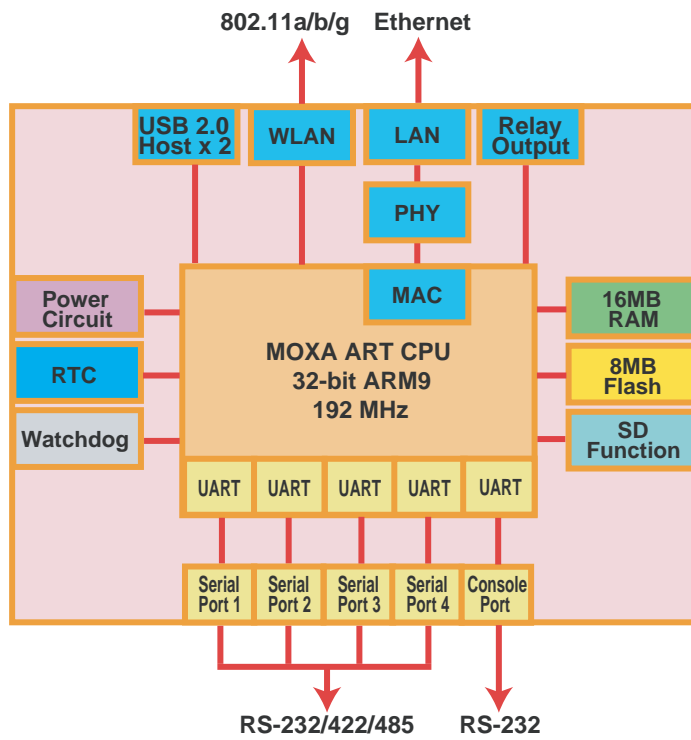| EMC | FCC, CE (Class A) |
Safety	TUV, UL, cUL
Others	RoHS, CRoHS, WEEE
Warranty	5 years

Hardware Block Diagram

W311

W321

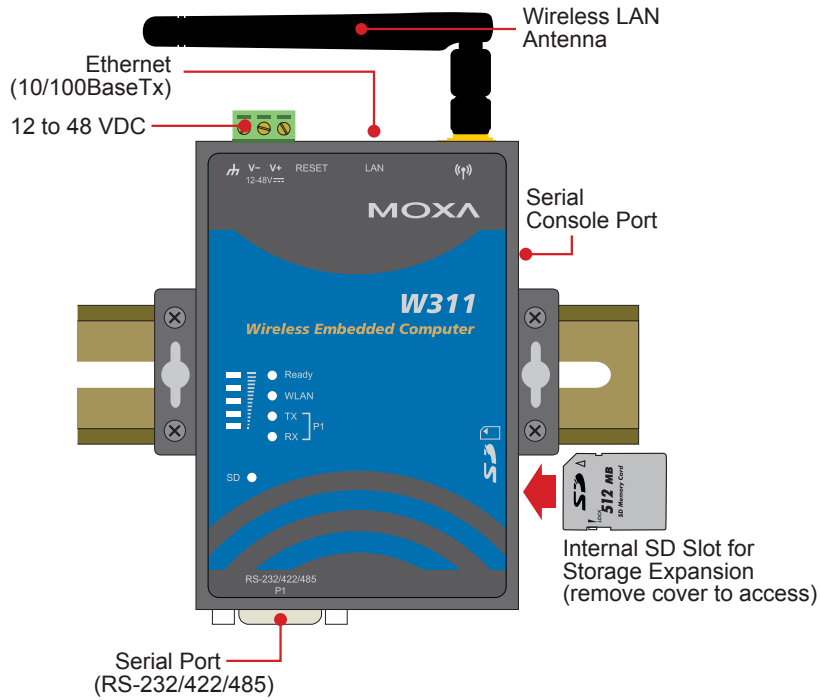## W341

2

Hardware Introduction

The W300 series hardware is compact, well-designed, and built rugged for industrial applications. LED indicators help you monitor the performance and identify trouble spots. Multiple ports allow the connection of different devices for wireless operation. With the reliable and stable hardware platform that is provided, you may devote your attention to the development of your application. In this chapter, learn the basics about the embedded computer hardware and its different parts.

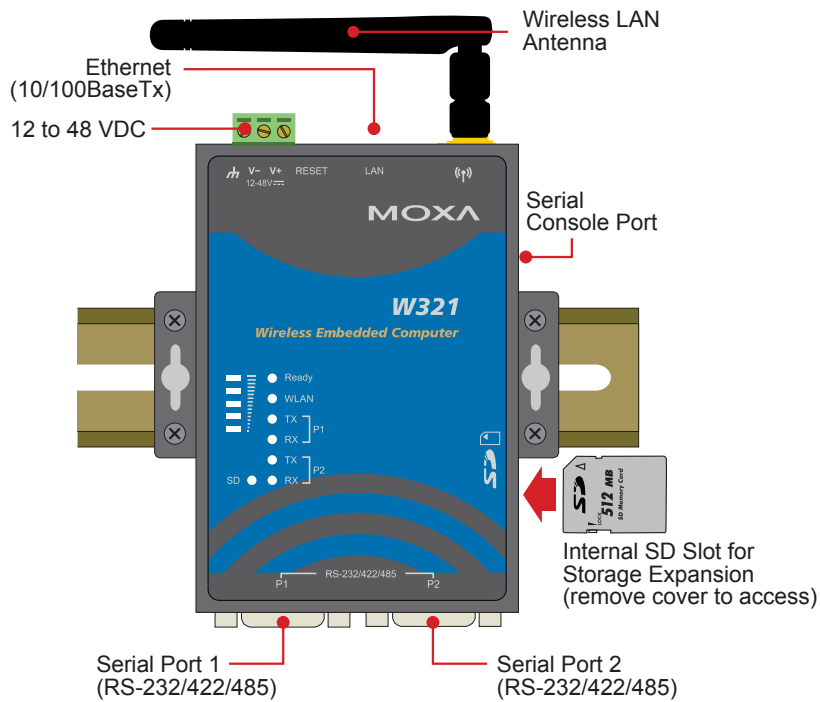This chapter covers the following topics:

❑ **Appearance**
  ➢ W311
  ➢ W321
  ➢ W341
❑ **Dimensions**
  ➢ W311
  ➢ W321
  ➢ W341
❑ **LED Indicators**
❑ **Reset Button**
❑ **Real Time Clock**

Appearance

W311

Wireless LAN Antenna

Ethernet (10/100BaseTx)

12 to 48 VDC

Serial Console Port

Internal SD Slot for Storage Expansion (remove cover to access)

Serial Port (RS-232/422/485)

W321

Wireless LAN Antenna

Ethernet (10/100BaseTx)

12 to 48 VDC

Serial Console Port

Internal SD Slot for Storage Expansion (remove cover to access)

Serial Port 1 (RS-232/422/485)

Serial Port 2 (RS-232/422/485)

W341

Top View

Reset Button   Relay Output   USB 2.0 Host   Internal SD Slot for Storage Expansion (remove cover to access)

12 to 48 VDC   Ethernet 10/100BaseTX   Wireless LAN antenna

Front View

USB 2.0 Host x 2

Ethernet (10/100BaseTx)

Relay Output

12 to 48 VDC

Wireless LAN Antenna

Internal SD Slot for Storage Expansion (remove cover to access)

W341
Wireless Embedded Computer

MOXA

Serial Console Port

Serial Port 1 to 4 (RS-232/422/485)

Bottom View

RS-232/422/485   P1   P2   RS-232/422/485   P3   P4

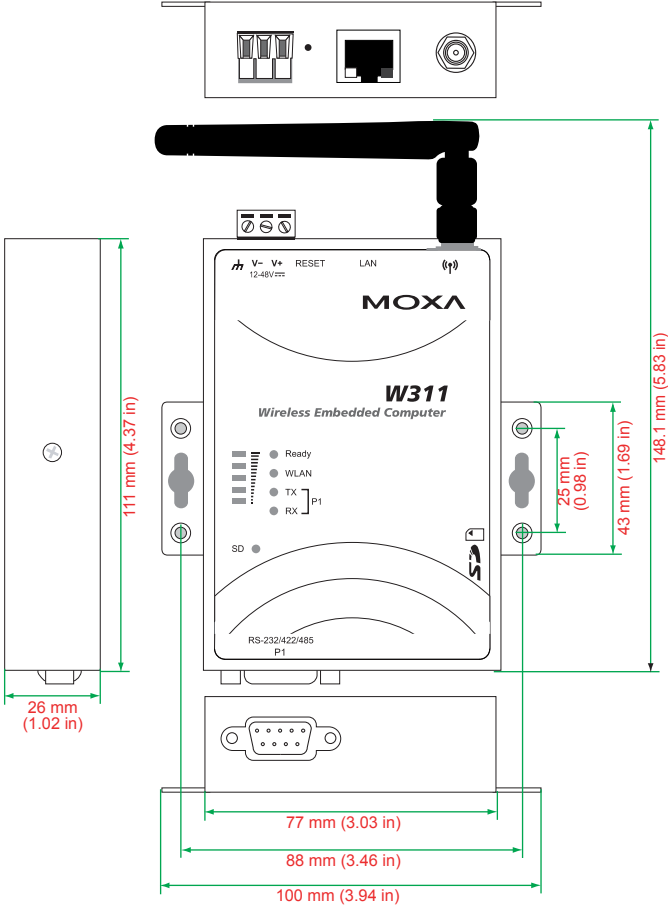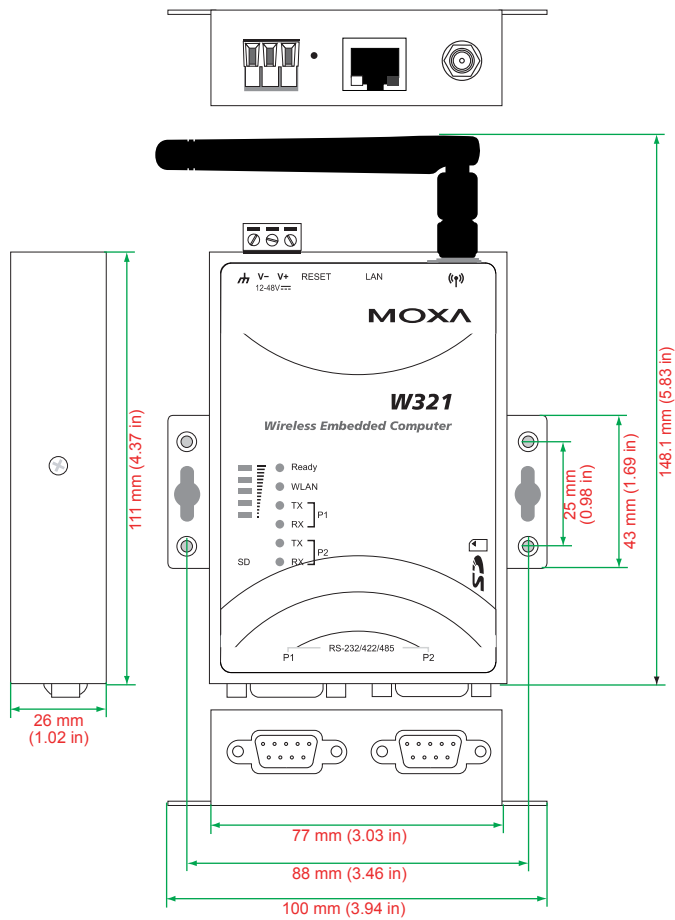Serial Port x 4 (RS-232/422/485)

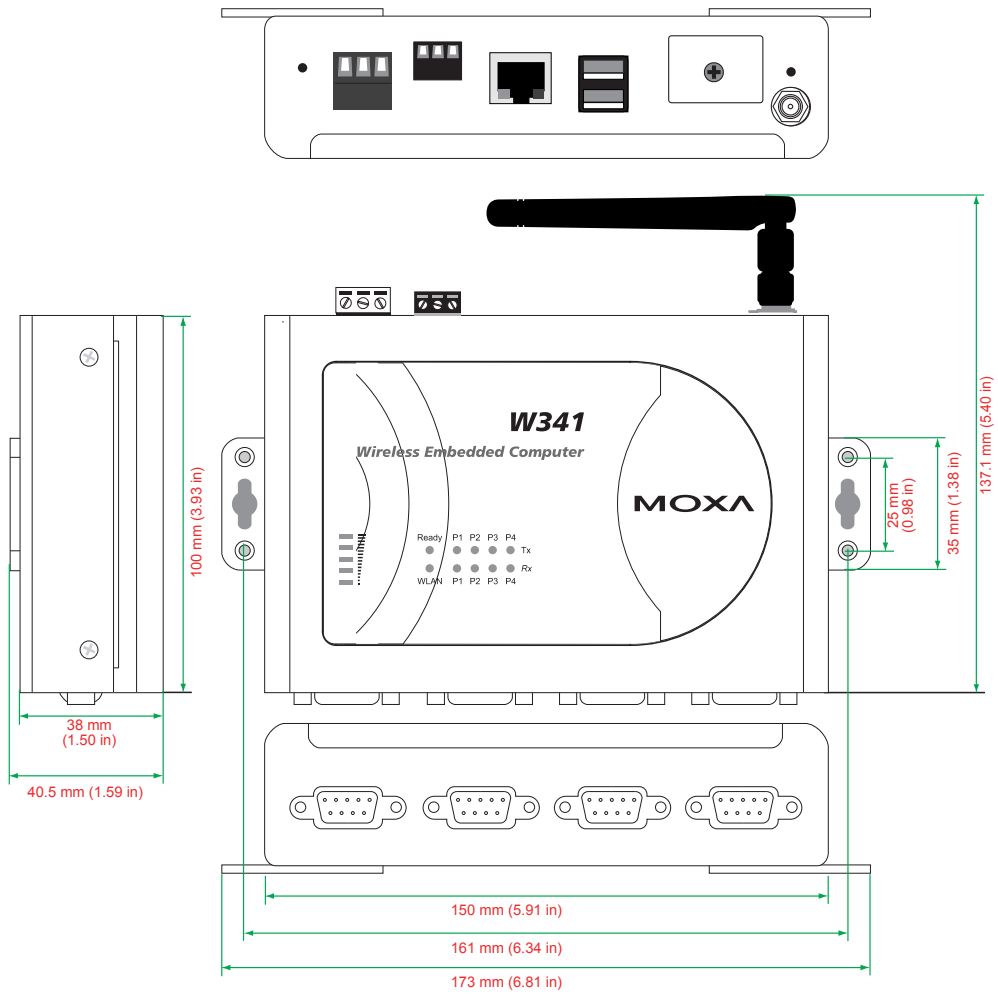# Dimensions

W311

W321

W341

LED Indicators

Please note that the W311 does not include an SD slot, so it will not have an SD LED.

LED Name	LED Color	LED Function
Ready	Green	Power is on and functioning normally
	Off	Power is off or there is another power error
SD	Green	SD card is detected
	Off	No SD card is detected
WLAN	Green	ON: WLAN is ready
		Blinking: Conflict with WLAN IP or no response from DHCP server
	Off	WLAN is not ready or function error
Signal Strength	Green	Number of glowing LEDs indicates signal strength 5: Excellent 4: Very good 3: Good 2: Fair 1: Bad
	Off	No signal or WLAN connection failed
LAN	Orange	10 Mbps Ethernet link
	Green	100 Mbps Ethernet link
	Off	Disconnected or short circuit
TxD P1-P4	Green	Serial ports P1-P4 transmitting data
	Off	Serial ports P1-P4 not transmitting data
RxD P1-P4	Yellow	Serial ports P1-P4 receiving data
	Off	Serial ports P1-P4 not receiving data

Reset Button

Hold the reset button down for 5 seconds to load the factory default configuration. After loading the factory defaults, the system will reboot automatically. We recommend that you use this function only if the software is not working properly. To reset the Linux system software, always use the software reboot command ("reboot") to protect the integrity of data.

The reset button is NOT designed as a hard reboot for the embedded computer.

ATTENTION

Restoring default settings preserves your data

Resetting the embedded computer to factory defaults will NOT format the user directory and will NOT erase the user's data. The reset button only loads a configuration file. All files in the /etc directory will revert to their factory defaults, but all other user data will remain intact in the Flash ROM.

Please note that if there is a problem with the /etc directory, the embedded computer may be unable to restore the factory default settings.

Real Time Clock

The embedded computer's real-time clock is powered by a lithium battery. We strongly recommend that you NOT replace the lithium battery on your own. If the battery needs to be changed, please contact the Moxa RMA service team.

⚠ **ATTENTION**

There is a risk of explosion if the wrong type of battery is used. To avoid this potential danger, always be sure to use the correct type of battery. Contact the Moxa RMA service team for battery replacement.

3

Hardware Connection Description

W300 Series wireless embedded computers are equipped for multiple types of connections. WLAN, Ethernet, and multiple serial interfaces are built into every model, including a serial console port for monitoring of bootup messages. Select models also include an SD slot for storage expansion, USB ports for additional device and storage options, and relay output connections. With the open-source Linux kernel, you are free to develop custom applications for remote, wireless operation of your device. In this chapter, learn how to connect the embedded computer to the network and to various devices.

This chapter covers the following topics:

❑ **Wiring Requirements**
  ➢ Connecting the Power
  ➢ Grounding the Unit
❑ **Connecting Data Transmission Cables**
  ➢ Connecting to the Network
  ➢ Connecting to the WLAN
  ➢ Connecting to a Serial Device
  ➢ Serial Console Port
❑ **SD Slot**
❑ **USB (W341 only)**
❑ **Relay Output (W341 only)**

Wiring Requirements

This section describes how to connect serial devices to the embedded computer.

You should heed the following common safety precautions before proceeding with the installation of any electronic device:

- Use separate paths to route wiring for power and devices. If power wiring and device wiring paths must cross, make sure the wires are perpendicular at the intersection point.

  NOTE: Do not run signal or communication wiring and power wiring in the same wire conduit. To avoid interference, wires with different signal characteristics should be routed separately.

- Use the type of signal transmitted through a wire to determine which wires should be kept separate. The rule of thumb is that wiring that shares similar electrical characteristics can be bundled together.
- Keep input wiring and output wiring separate.
- It is advisable to label the wiring to all devices in the system.

⚠️ **ATTENTION**

Safety First!

Be sure to disconnect the power cord before installation and/or wiring.

Watch Electrical Current!

Calculate the maximum possible current in each power wire and common wire. Observe all electrical codes dictating the maximum current allowable for each wire size.

If the current goes above the maximum ratings, the wiring could overheat, causing serious damage to your equipment.

Watch Temperature!

Be careful when handling the unit. When the unit is plugged in, the internal components generate heat, and consequently the outer casing may feel hot to the touch.

Connecting the Power

Connect the "live-wire" end of the 12-48 VDC power adapter to the embedded computer's terminal block. When power is properly supplied, the "Ready" LED will glow a solid green after a 25 to 30 second delay.
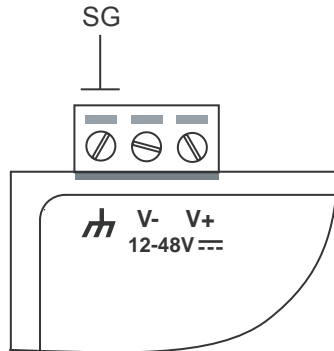
Grounding the Unit

Grounding and wire routing help limit the effects of noise due to electromagnetic interference (EMI). Before connecting any devices, run a ground wire from the ground screw to the grounding surface.

⚠ **ATTENTION**

This product should be mounted to a well-grounded mounting surface such as a metal panel.

SG

SG: The *Shielded Ground* (sometimes called Protected Ground) contact is the left most contact of the 3-pin power terminal block connector, as viewed from the angle shown here. Connect the SG wire to an appropriate grounded metal surface.

V- V+
12-48V ⎓

Connecting Data Transmission Cables

This section describes how to connect cables for the network, serial devices, and serial COM terminal.

Connecting to the Network

Plug your network cable into the embedded computer's Ethernet port. The other end of the cable should be plugged into your Ethernet network. When the cable is properly connected, the LEDs on the embedded computer's Ethernet port will glow to indicate a valid connection.

The 10/100 Mbps Ethernet LAN port uses 8-pin RJ45 connectors. The following diagram shows the pinouts for these ports.
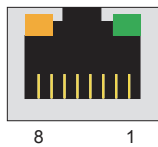
The LED indicator on the right glows a solid green color when the cable is properly connected to a 100 Mbps Ethernet network. The LED will flash on and off when Ethernet packets are being transmitted or received.

The LED indicator on the left glows a solid orange color when the cable is properly connected to a 10 Mbps Ethernet network. The LED will flash on and off when Ethernet packets are being transmitted or received.

Pin	Signal
1	ETx+
2	ETx-
3	ERx+
4	---
5	---
6	ERx-
7	---
8	---

8   1

Connecting to the WLAN

The wireless embedded computer is WLAN ready and includes an 802.11 a/b/g WLAN module. It supports WEP, WPA and WPA2 data encryption. To verify WLAN operation, first configure your WLAN settings on the embedded computer using the serial console or a wired network connection. Please refer to the operating system user's manual for further detail.

Connecting to a Serial Device

Your serial device can plug into the embedded computer's serial port using a serial cable. Serial ports P1 to P4 have male DB9 connectors and can be configured for RS-232, RS-422, or RS-485 communication through software. The pin assignments are shown in the following table:
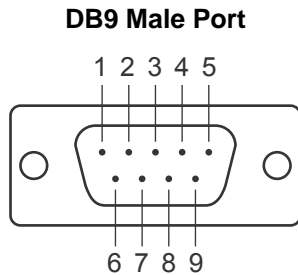
DB9 Male Port   **RS-232/422/485 Pinouts**

Pin	RS-232	RS-422	RS-485 (4-wire)	RS-485 (2-wire)
1	DCD	TxDA(-)	TxDA(-)	---
2	RxD	TxDB(+)	TxDB(+)	---
3	TxD	RxDB(+)	RxDB(+)	DataB(+)
4	DTR	RxDA(-)	RxDA(-)	DataA(-)
5	GND	GND	GND	GND
6	DSR	---	---	---
7	RTS	---	---	---
8	CTS	---	---	---

Serial Console Port

The serial console port is a 4-pin pin-header RS-232 port. It is designed for serial console terminals, which are useful for viewing boot-up messages.

Serial Console Port & Pinouts   **Serial Console Cable**

Pin	Signal
1	TxD
2	RxD
3	NC
4	GND

SD Slot

The W311/321/341 provide an SD slot for storage expansion. Moxa provides an SD flash disk for plug & play expansion that allows users to plug in a Secure Digital (SD) memory card compliant with the SD standard V1.0 for up to 1 GB of additional memory space. The following steps show you how to install SD card into the W311/321/341.

W311/321

The SD slot is located on the right side of the W311/321 enclosure. To install an SD card, you must first remove the SD slot's protective cover to access the slot, and then plug the SD card directly into the slot.

The SD card will be mounted at **/mnt/sd.** Detailed installation instructions are shown below:

Step 1:   Use a screwdriver to remove the screws holding the SD slot's outer cover.

Step 2:   After removing the cover, insert the SD memory card as shown.

W341

The SD slot is located on the front panel of the W341. To install an SD card, you must first remove the SD slot's protective cover to access the slot, and then plug the SD card directly into the slot.

The SD card will be mounted at /mnt/sd. Detailed installation instructions are shown below:

Step 1: Use a screwdriver to remove the screws holding the SD slot's outer cover, and then remove the cover.

Step 2: Insert the SD memory card as shown.

NOTE: To remove the SD card from the slot, press the SD card in slightly with your finger, and then remove your finger to cause the card to spring out partially. You may now grasp the top of the card with two fingers and pull it out.

Before removing the SD card, remember to type **/sync** to ensure that your data has been written.
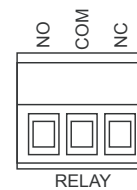
USB (W341 only)

The W341 includes two USB 2.0 hosts. These hosts can be used for an external flash disk or hard drive in order to store large amounts of data.

USB 2.0 Ports

Relay Output (W341 only)

The W341 includes a relay output channel. There is a 3-pin terminal block for the relay output connection, with pinouts as shown in the figure.

A
Regulatory Approval Statement

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20 cm between the radiator & your body.

With the 5.15-5.25 GHz band, U-NII devices will be restricted to indoor operations to reduce any potential for harmful interference to co-channel MSS operations.

Warning: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user authority to operate the equipment.

This product has been tested and complies with the specifications for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used according to the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which is found by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

Reorient or relocate the receiving antenna
Increase the separation between the equipment or devices
Connect the equipment to an outlet other than the receiver's
Consult a dealer or an experienced radio/TV technician for assistance