

W321/341 Series Compact Computers: Hardware Manual

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MOXA[®]

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W321/341 Series Compact Computers: Hardware Manual

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Table of Contents

1. Introduction	1-1
Overview	1-2
Package Checklist	1-2
Product Features	1-2
Product Hardware Specifications	1-3
Hardware Block Diagram	1-6
W321	1-6
W341	1-6
2. Hardware Features	2-1
Appearance.....	2-2
W321.....	2-2
W341.....	2-3
Dimensions	2-4
W321.....	2-4
W341.....	2-4
LED Indicators.....	2-5
Reset Button	2-5
Real Time Clock.....	2-6
3. Setting Up the W321/341	3-1
Installing the W321/341	3-2
Wiring Requirements.....	3-3
Connecting the Power	3-4
Grounding the Unit	3-4
Connecting Data Transmission Cables	3-4
Connecting to the Network	3-4
Connecting to the WLAN.....	3-4
Connecting to a Serial Device	3-5
Serial Console Port	3-5
SD Slot.....	3-6
Digital Input/Output Channels (W321 only).....	3-7
USB (W341 only).....	3-8
Relay Output (W341 only)	3-8
A. Regulatory Approval Statement	A-1

Introduction

The W321/341 series is a line of compact, wireless RISC platform computers that feature 802.11 b/g/n WLAN, 2 or 4 RS-232/422/485 serial ports, an SD slot, and an Ethernet port, all in a small, rugged chassis. Additionally, the W321 comes with 4 digital input and 4 digital output channels, while the W341 features two USB 2.0 hosts and one relay output channel.

Your W321/341 series embedded computer is ideal for diverse, machine-to-machine embedded applications. It enables wireless operations for traditionally wired networks and serial devices. The W321/341 series not only provides transparent data transfers, but also numeric computing, protocol conversion, data processing and even data encryption. You may use W321/341 computers to build embedded systems for distributed peer-to-peer communication, to transform wired devices into wireless devices, and to provide your system with higher mobility and more intelligence. In this chapter, you will learn about the capabilities of this embedded computer.

The following topics are covered in this chapter:

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

Overview

W321/341 Series wireless embedded computers are 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 802.11 b/g/n 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 W321/341 computers by using a common compiler, 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 W321/341 Series includes the following models:

W321-LX

A small, RISC-based, ready-to-run, wireless embedded computer with WLAN, two serial ports, 4 DIs, 4 DOs, 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:

- 1 W321/341 embedded computer
- Wall mounting kit (W341 only)
- Quick Installation Guide
- Document & Software CD
- Ethernet Cable: RJ45 to RJ45 cross-over cable, 100 cm
- CBL-4PINDB9F-100: 4-pin header to DB9 female console port cable, 100 cm
- WLAN Antenna
- 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

W321/341 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
- 802.11 b/g/n wireless LAN

- WEP, WPA and WPA2 encryption
- Infrastructure and ad-hoc Wi-Fi modes
- RS-232/422/485 serial ports with software selectable interface
- Supports all baudrates (including non-standard) between 50 and 921.6 Kbps;
- 10/100M Ethernet for backup networking
- SD memory 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 durability

Product Hardware Specifications

Computer

CPU: MOXA ART ARM9 32-bit 192 MHz

OS (pre-installed): Embedded Linux with MMU support

DRAM:

W321: 32 MB

W341: 64 MB

Flash: 16 MB

USB: (W341 only) USB 2.0 compliant hosts x 2, type A connector

Relay Output: (W341 only)

- Form C, SPDT x 1
- Normal Switching Capacity: 2 A @ 30 VDC
- Switching Power: 60 W max.
- Switching Voltage: 220 VDC max.
- Switching Current: 2 A max.
- Operating Time: 4 ms @ 20°C
- Initial Contact Resistance: 100 milli-ohm max.

Digital Input/Output (W321 only)

Input Channel: 4, sink type

Input Voltage: -0.5 to 3.3 VDC

Digital Input Levels :

- Logic level 0: + 0.8 V max.
- Logic level 1: + 2 V min.

Connector Type: 2 x 5 pin header

Output Channel: 4, source type

Output Current: 50 mA

Digital Output Levels :

- Logic level 0: + 0 V
- Logic level 1: +3.3 V

Connector Type: 2 x 5 pin header

Storage

Storage Expansion: SD slot

Ethernet Interface

LAN: 1 auto-sensing 10/100 Mbps port (RJ45)

Magnetic Isolation Protection: 1.5 KV built-in

WLAN Interface

Standard Compliance: 802.11b/g/n

Radio Frequency Type: DSSS, CCK, OFDM

Media Access Protocol: CSMA/CA (Carrier Sense Multiple Access with Collision Avoidance)

Antenna: 1 x U.FL connector, 1T1R (4-Pin or USB Type A) Printed antenna, 1T1R (4-Pin or USB Type A)

Operating Frequency: b/g/n ISM Band: 2.412~2.4835GHz

Modulation:

802.11b: DSSS (DBPSK, DQPSK, CCK)

802.11g: OFDM (BPSK,QPSK,16-QAM,64-QAM)

802.11n: OFDM (BPSK,QPSK,16-QAM,64-QAM)

Output Power (1TX):

802.11b: 17dBm ± 2dBm@11Mbps

802.11g: 14dBm ± 2dBm@54Mbps

802.11n HT20: 14dBm ± 2dBm@MCS7

802.11n HT40: 13dBm ± 2dBm@MCS7

Receiver Sensitivity:

802.11b: -88dBm ± 2dBm@11Mbps

802.11g: -71Bm ± 2dBm@54Mbps

802.11n HT20: -69dBm ± 2dBm@MCS7

802.11n HT40: -66dBm ± 2dBm@MCS7

Security:: WEP 64-bit/128-bit, WPA, WPA2 data encryption

Antenna Connector: Reverse SMA

WLAN Modes: Ad-hoc, Infrastructure

Serial Interface

Serial Standards: 2 or 4 RS-232/422/485 ports, software-selectable (DB9 male)

ESD Protection: 15 KV ESD protection for all signals

Console Port: RS-232 interface (TxD, RxD, GND), with 4-pin pin header output

Serial Communication Parameters

Data Bits: 5, 6, 7, 8

Stop Bits: 1, 1.5, 2

Parity: None, Even, Odd, Space, Mark

Flow Control: RTS/CTS, XON/XOFF, ADDC® (automatic data direction control) for RS-485

Baudrate: 50 bps to 921.6 Kbps (non-standard baudrates supported; see user's manual for details)

Serial Signals

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

RS-422: TxD+, TxD-, RxD+, RxD-, GND

RS-485-4w: TxD+, TxD-, RxD+, RxD-, GND

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

LEDs

System: Ready, SD

LAN: 10M/Link, 100M/Link (on connector)

WLAN: Enable, Signal Strength

Serial: TxD, RxD

Switches and Buttons

Reset Button: Supports "Reset to Factory Default"

Physical Characteristics

Housing: Aluminum (1 mm)

Weight:

W321: 185 g

W341: 390 g

Dimensions: (without ears or antenna)

W321: 77 x 111 x 26 mm (3.03 x 4.37 x 1.02 in)

W341: 150 x 100 x 38 mm (5.91 x 3.94 x 1.50 in)

Mounting: DIN-rail (requires optional DK-35A DIN-rail kit), wall

Environmental Limits

Operating Temperature: -10 to 60°C (14 to 140°F)

Storage Temperature: -20 to 80°C (-4 to 176°F)

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

Anti-vibration: 5 g's @ IEC-68-2-6, sine wave, 5-500 Hz, 1 Oct./min, 1 hr/axis (without any USB devices attached)

Anti-shock: 50 g's @ IEC-68-2-6, half-sine wave, 30 ms

Power Requirements

Input Voltage: 12 to 48 VDC

Power Consumption:

W321: 5.2 W

- 216 mA @ 24 VDC
- 433 mA @ 12 VDC

W341:

With no load on USB ports: 5.2 W

- 216 mA @ 24 VDC
- 433 mA @ 12 VDC

With full load on USB ports: 11 W

- 458 mA @ 24 VDC
- 916 mA @ 12 VDC

Standards and Certifications

Safety: UL 60950-1, EN 60950-1

EMC: EN 55022 Class A, EN 61000-3-2, EN 61000-3-3, EN 55024

Radio: EN 301 489-1/17, EN 301 893, EN 300 328, EN 50392, FCC Part 15, Subpart C/E

Green Product: RoHS, CRoHS, WEEE

Reliability

Alert Tools: Built-in buzzer and RTC (real-time clock) with battery backup

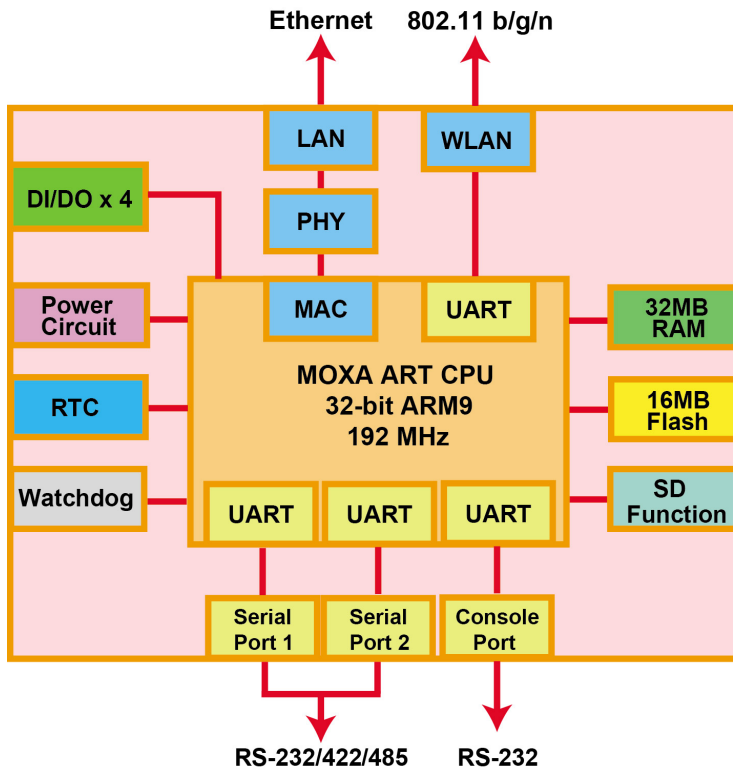
Automatic Reboot Trigger: Built-in WDT (watchdog timer) supporting 1-255 level time interval system reset, software programmable

Warranty

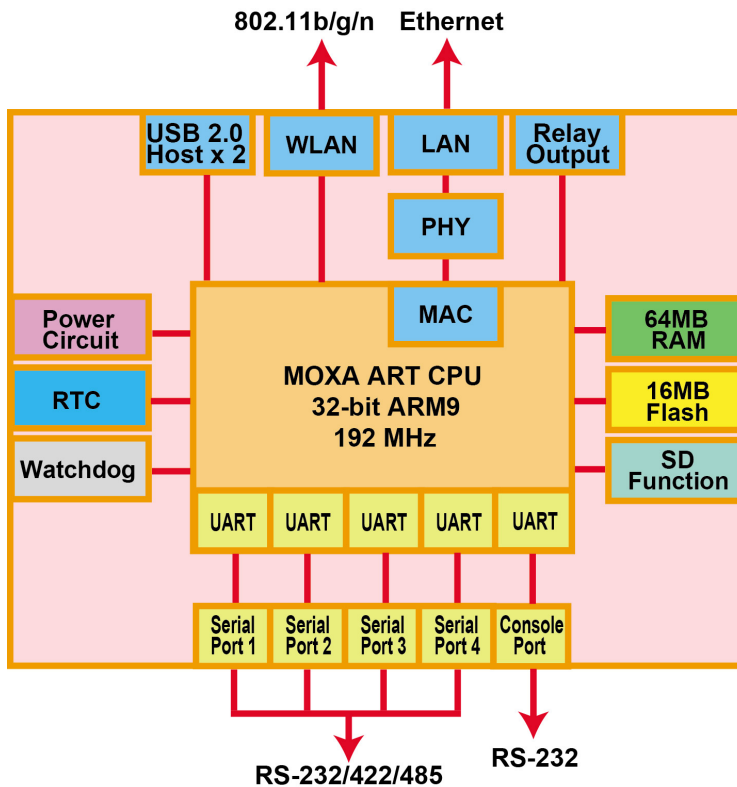
Warranty Period: 5 years

Hardware Block Diagram

W321



W341



Hardware Features

The W321/341 series hardware is compact, well-designed, and ruggedly built 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. The W321/341 provides a reliable and extremely stable computing platform that allows developers to devote their attention to the authoring and optimization of user applications. The stability comes from a careful selection of hardware components which are introduced in this chapter.

The following topics are covered in this chapter:

- **Appearance**

- W321
- W341

- **Dimensions**

- W321
- W341

- **LED Indicators**

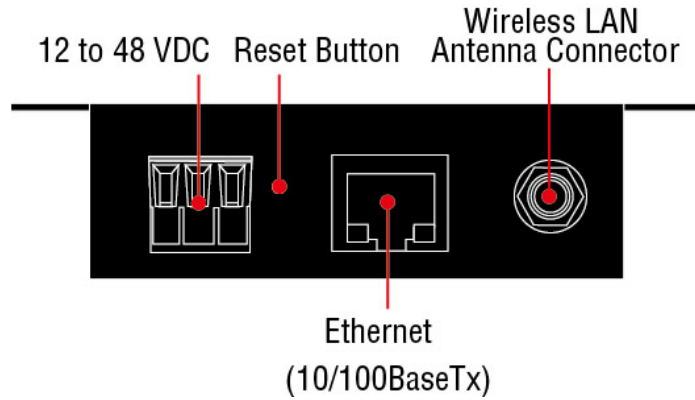
- **Reset Button**

- **Real Time Clock**

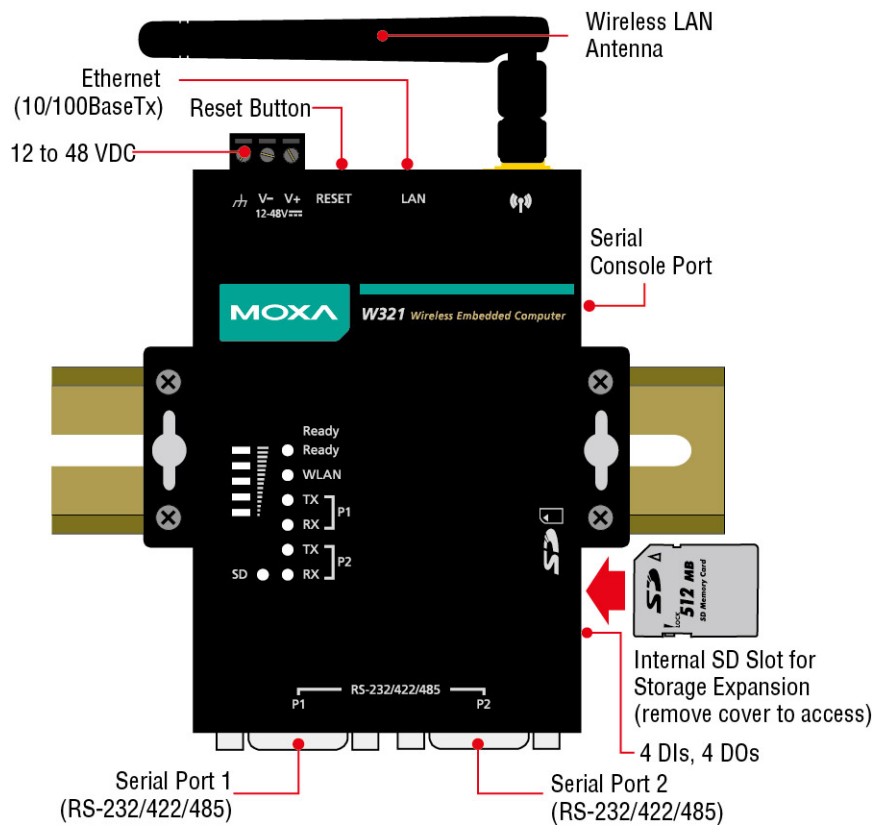
Appearance

W321

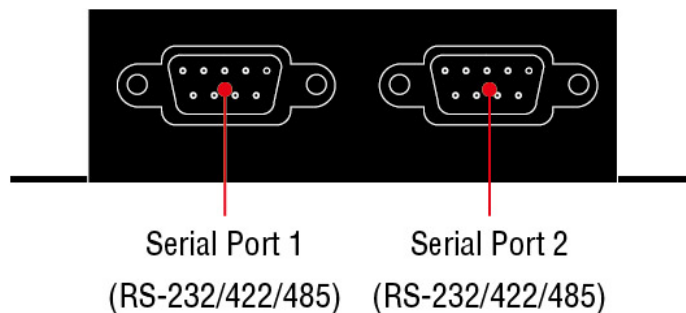
Top View



Front View

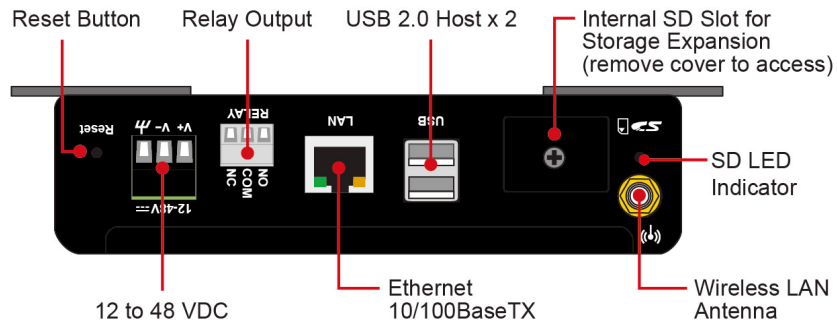


Bottom View

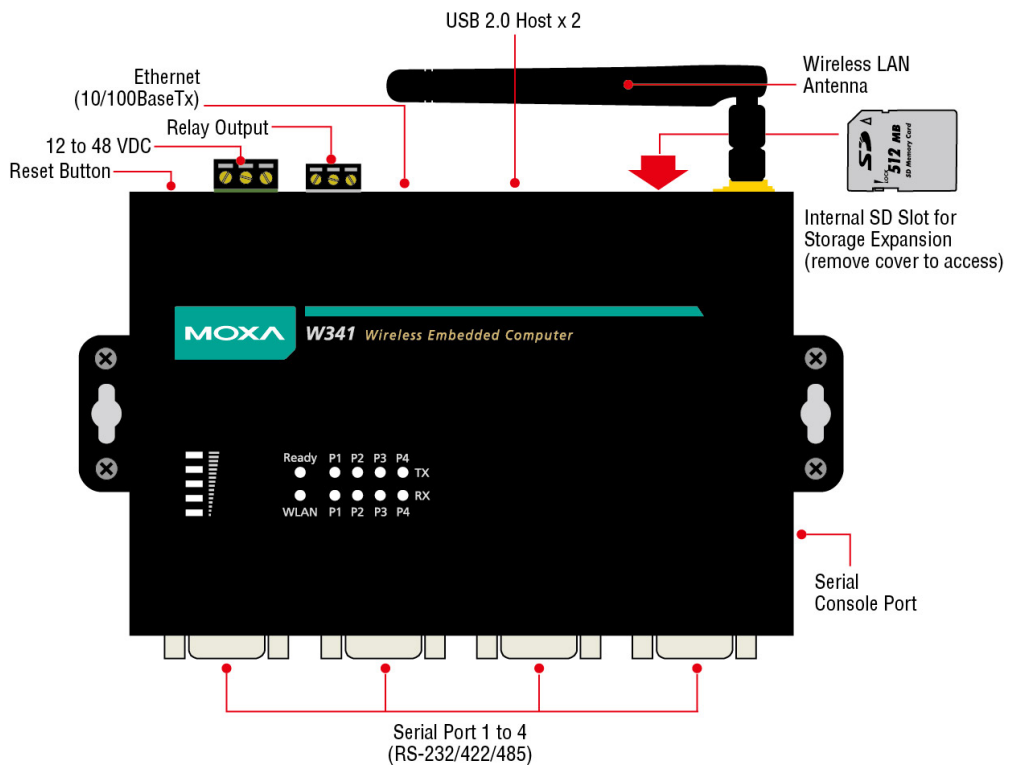


W341

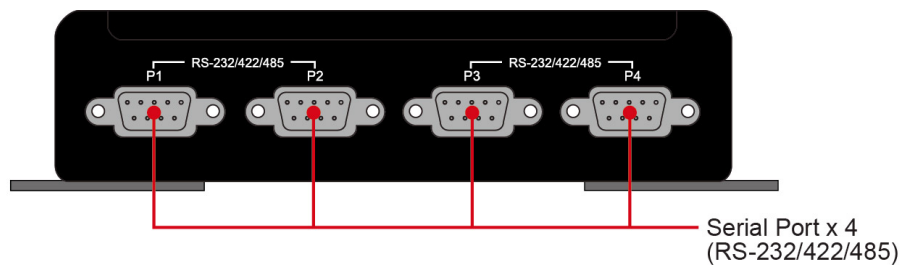
Top View



Front View

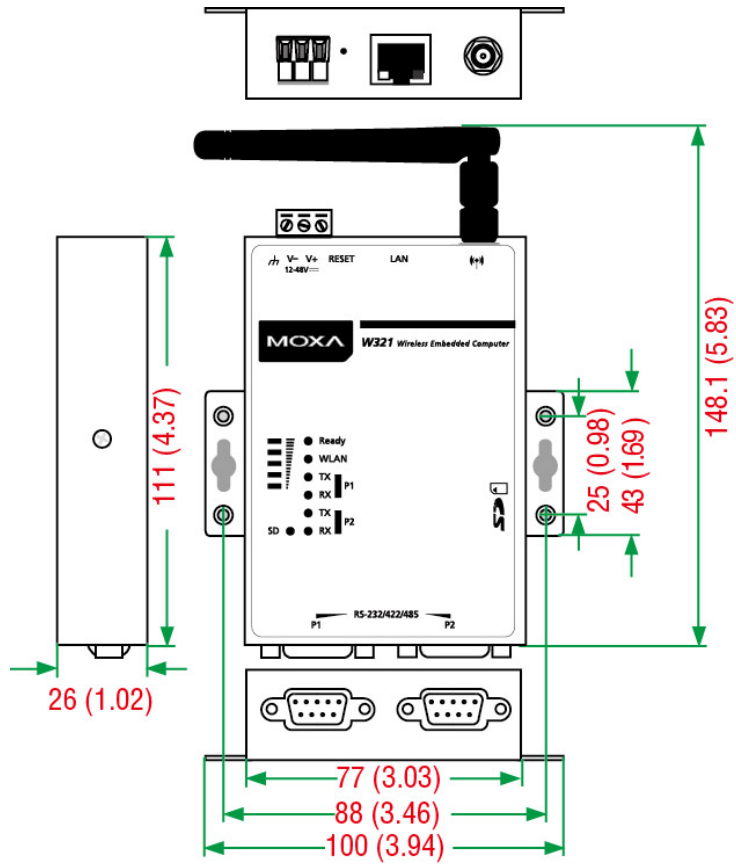


Bottom View

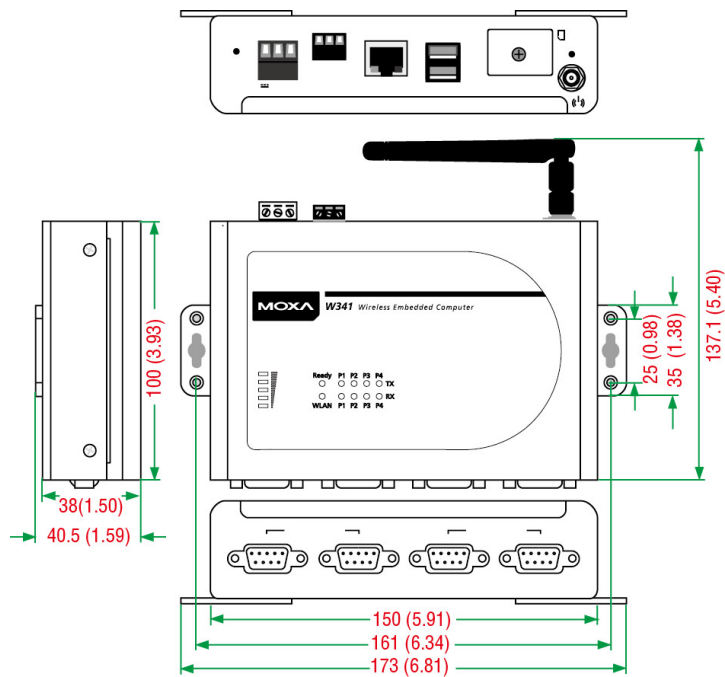


Dimensions

W321



W341



LED Indicators

LED Name	LED Color	LED Function
Ready	Green	Power is on and functioning normally
	Off	Power is off or there is a power supply error
SD	Green	SD memory card is detected
	Off	No SD memory 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 hardware 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 port (1-2 for W321, 1-4 for W341) transmitting data
	Off	Serial port (1-2 for W321, 1-4 for W341) not transmitting data
RxD P1-P4	Yellow	Serial port (1-2 for W321, 1-4 for W341) receiving data
	Off	Serial port (1-2 for W321, 1-4 for W341) not receiving data

NOTE If you find a weak wireless communication (where the signal meter indicates “Bad”), you may need to install additional access points or wireless bridges, or relocate the W321/341 computers within a stronger signal range.

Reset Button

Hold the reset button down for 5 seconds to load the factory default configuration. The system will perform reset-to-factory default in several seconds after the processes are synchronized and killed. 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 user data. The reset button only loads a configuration file. All files in the /etc directory will revert to their factory defaults, but all user data on the Flash ROM will remain intact.

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 danger, always be sure to use the correct type of battery. Contact the Moxa RMA service team for details instructions on battery replacement.

Setting Up the W321/341

The W321/341 Series wireless embedded computers are equipped with multiple communications interfaces. WLAN, Ethernet, and various serial interfaces are built into every model, along with a dedicated serial console interface for monitoring of kernel messages. Select models also include an SD slot for storage expansion, USB ports for additional device and storage options, and digital I/O. 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.

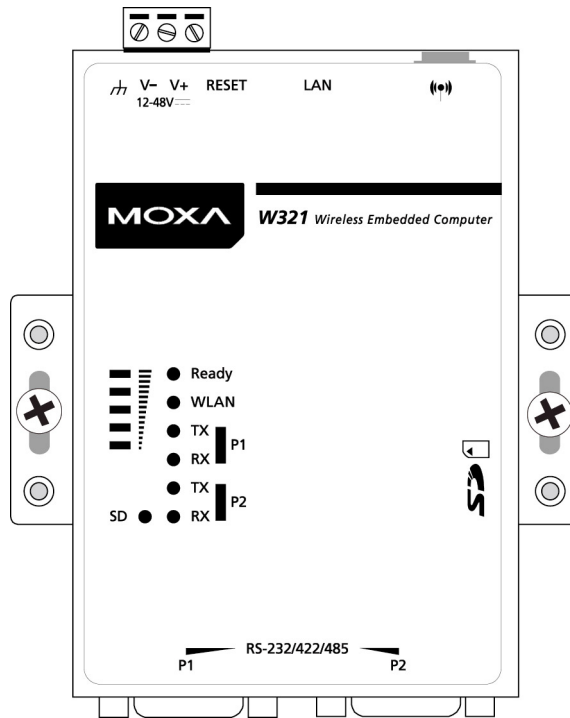
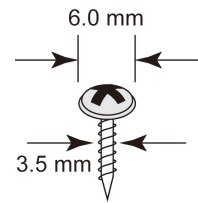
The following topics are covered in this chapter:

- ❑ **Installing the W321/341**
- ❑ **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**
- ❑ **Digital Input/Output Channels (W321 only)**
- ❑ **USB (W341 only)**
- ❑ **Relay Output (W341 only)**

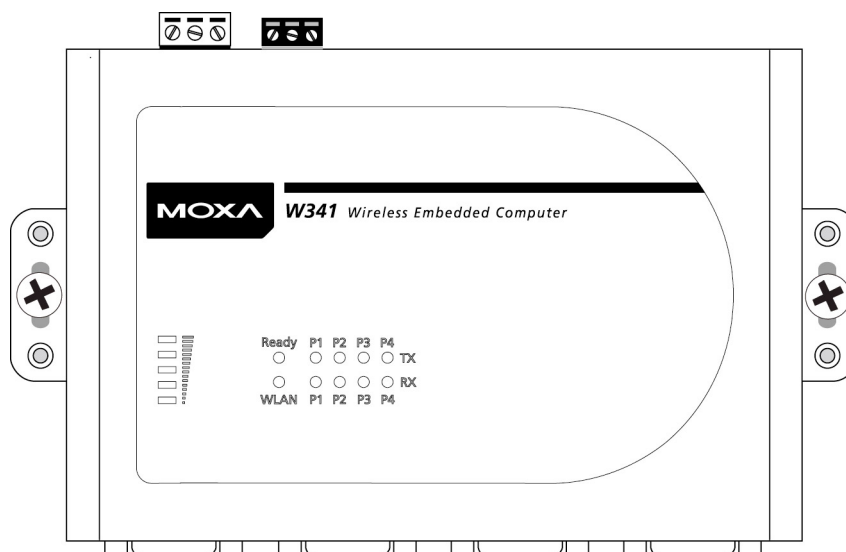
Installing the W321/341

Wall or Cabinet Mounting

The W321/341 embedded computers have built-in “ears” for attaching the computers to a wall or inside a cabinet. We suggest using two screws per ear to attach these computers to a wall or cabinet. The heads of the screws should be less than 6.0 mm in diameter, and the shafts should be less than 3.5 mm in diameter, as shown by the figure at the right.



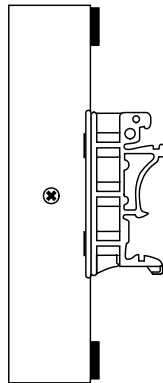
The W341 comes with two metal attachment plates (“ears”) for attaching the embedded computer to a wall or the inside of a cabinet. First, use two screws per bracket to attach the brackets to the rear of the W341. Next, use two screws per bracket to attach the W341 to a wall or cabinet.



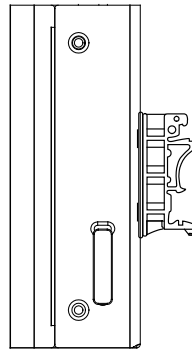
DIN-Rail Mounting

DIN-rail attachments can be purchased separately to attach the product to a DIN-rail. When snapping the attachments to the DIN-rail, make sure that the stiff metal springs are at the top.

W321



W341



Wiring Requirements

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

You should heed the following safety precautions, and review them carefully 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 30-to-60 second delay.

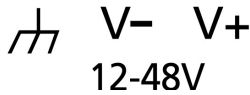
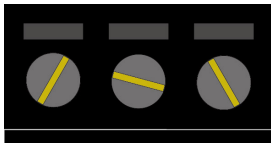
Grounding the Unit

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: 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.

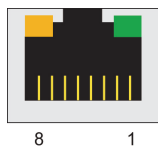
Connecting Data Transmission Cables

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	---

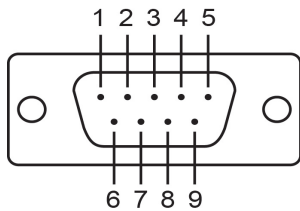
Connecting to the WLAN

The wireless embedded computer is WLAN ready and includes an 802.11 b/g/n 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 software 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



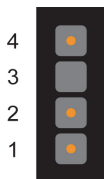
RS-232/422/485 Pinouts

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



Pin	Signal
1	TxD
2	RxD
3	NC
4	GND

Serial Console Cable



SD Slot

The W321/341 provides 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 1.0 standard for up to 1 GB of additional memory space, or a Secure Digital High Capacity (SDHC) memory card compliant with the SD 2.0 standard for up to 16 GB of additional memory space. The following steps show you how to install SD memory card into the W321/341.

W321

The SD slot is located on the right side of the W321 enclosure. To install an SD memory card, you must first remove the SD slot's protective cover to access the slot, and then plug the SD memory card directly into the slot.

The SD memory card will be mounted at **/var/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 top panel of the W341. To install an SD memory card, you must first remove the SD slot's protective cover to access the slot, and then plug the SD memory card directly into the slot.

The SD memory card will be mounted at `/var/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.

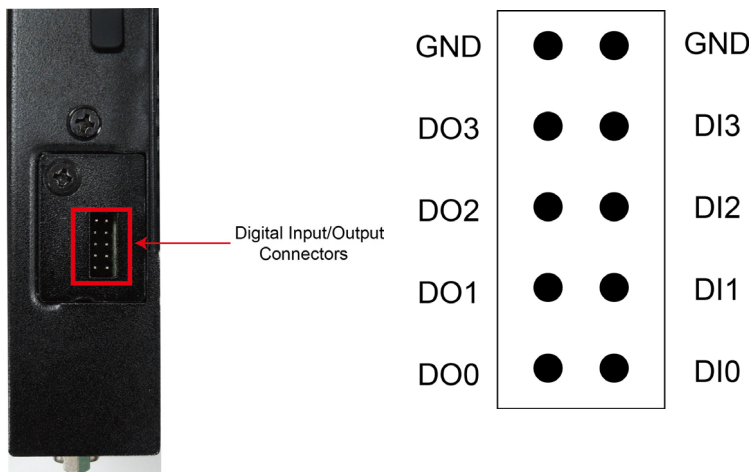


NOTE To remove the SD memory card from the slot, using a fingertip, gently press the card further into the machine and then remove the pressure, allowing the card to spring outwards. You may now grasp the top of the card with two fingers and pull it out.

Before removing the SD memory card, remember to check the `/sync` directory to ensure that your data has been written.

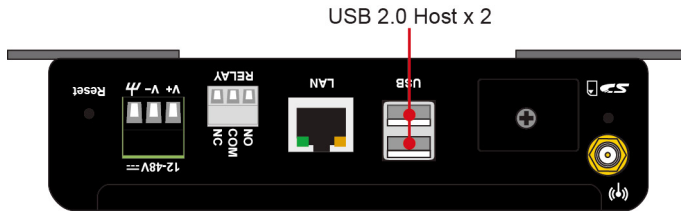
Digital Input/Output Channels (W321 only)

The W321 comes with 4 digital input channels and 4 digital output channels located on the right side of the computer. See the following figures for the location of the DI/DO connectors and pin definitions.



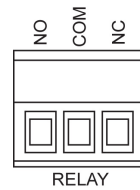
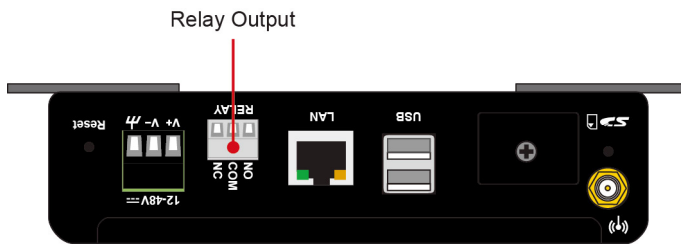
USB (W341 only)

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.



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.



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 away from the radiator or 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