

# ThinkCore W341/321/311 Hardware User's Manual

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[www.moxa.com/product](http://www.moxa.com/product)

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# **ThinkCore W341/321/311 Hardware User's Manual**

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# Introduction

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The RISC-based wireless embedded computer, ThinkCore W300 Series, including W311, W321 and W341, features 802.11a/b/g WLAN, 1/2/4 RS-232/422/485 serial ports, Ethernet, and SD socket as well as the two USB 2.0 hosts and one relay output channel for W341 into a mini size, rugged chassis, to provide users the experience with a small package, versatile communication and strong computing platform. To use ThinkCore W341/321/311 Series Embedded Computer, the network device or serial device will become the wireless device and fulfill the demand to do the numeric computing, protocol conversion, data processing and even data encryption, not only the simply data transparent transferring. This will help user to build peer-to-peer, distributed wireless communication embedded system, make traditional wired devices wireless, provide higher mobility and more intelligence. It is really ideal for the diverse M2M embedded applications.

This manual covers the following topics:

## **❑ Overview**

- Package Checklist
- Product Features
- Product Hardware Specifications
- Hardware Block Diagrams

## **❑ Hardware Introduction**

- Appearance
- Dimensions
- LED Indicators
- Reset Buttons
- Real Time Clock

## **❑ Hardware Connection Description**

- Wiring Requirement
- Connecting the Power
- Grounding ThinkCore W341/321/311
- Connecting to the Network
- Connecting to a Serial Device
- Connecting to the Console Port
- Internal SD Socket
- USB Hosts
- Relay Output



## Overview

ThinkCore W300 Series use the MOXA ART ARM9 32-bit RISC processor. Unlike the X86 CPU, which uses a CISC design, the ARM9's RISC design architecture and modern semiconductor technology provide ThinkCore W341/321/311 with a powerful computing engine, but without generating too much heat. In addition to the ARM9 core, the MOXA ART ARM9 processor integrates UART and LAN functions, provide the extreme communication performance without the bus bandwidth limitation as general ARM-based communication products.

Moreover, the on-board NOR Flash ROM and SDRAM give you enough storage capacity and the additional SD socket provide the flexible storage expansion to run applications. The built-in WLAN function supports the popular 802.11a/b/g standard, provide the transmission security including WEP, WPA and WPA2. The backup LAN port not only provides the alternative solution on networking but also supports the Ethernet Client capability, to make the network device to be hooked on WLAN by easily plug-in step. Besides, the RS-232/422/485 serial ports allow you to connect a variety of different types of serial device, make this communication platform suitable for some of the more simple data acquisition and protocol conversion applications.

The pre-installed ready-to-run Linux-based operating system provides an open software operating system for software program development. This means that software written for desktop PCs is easily ported to ThinkCore W341/321/311 by using a common compiler, so that you will not need to spend time modifying existing software code. The Operating System, device drivers, and your own software can all be stored in ThinkCore W300's Flash memory.

## Package Checklist

The ThinkCore W300 Wireless Embedded Computer Series models currently available are:

### ThinkCore W311-LX

Mini RISC-based Ready-to-Run Wireless Embedded Computer with WLAN, 1 Serial Ports, Ethernet, µClinix OS

### ThinkCore W321-LX

Mini RISC-based Ready-to-Run Wireless Embedded Computer with WLAN, 2 Serial Ports, Ethernet, SD, µClinix OS

### ThinkCore W341-LX

RISC-based Ready-to-Run Wireless Embedded Computer with WLAN, 4 Serial Ports, Ethernet, SD, USB, Relay Output, Linux OS

ThinkCore W341/321/311 Series products are shipped with the following items:

- 1 ThinkCore W341/321/311

- Quick Installation Guide
- Documentation & Software CD
- Ethernet cross-over cable: RJ45 to RJ45, 100 cm
- Console port cable  
CBL-4PINDB9F-100: 4-pin header to DB9 (Female) cable, 100 cm
- Universal Power Adaptor
- Product Warranty Statement

*Optional Accessories*

- DK-35A DIN-Rail Mounting Kit (35 mm)

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

## Product Features

ThinkCore W341/321/311 Series products have the following features:

- Moxa ART 32-bit ARM9 industrial communication processor
- On-board 64 MB RAM for W341, 16 MB for W321/311
- Built-in 16 MB Flash for W341, 8 MB for W321/311
- 802.11a/b/g Wireless LAN
- WEP, WPA and WPA2 encryption
- Support Infrastructure mode and Ad-Hoc mode
- Software selectable 1/2/4 RS-232/422/485 serial ports
- 50 to 921.6 Kbps, support ANY BAUD RATE
- 10/100M Ethernet for backup networking
- Support SD socket for storage expansion (W341/321 only)
- 5G continuous vibration and 50G shocking endurable
- LED indicators for System Ready, SD Status, Serial Port and WLAN signal strength
- Ready-to-Run Linux Communication Platform
- Din-rail and Wall mount installation
- Robust, Fanless Design

## Product Hardware Specifications

### System

<b>CPU</b>	MOXA ART ARM9 32-bit RISC CPU, 192 MHz
<b>DRAM</b>	64 MB for W341, 16 MB for W321/311
<b>Flash</b>	16 MB for W341, 8 MB for W321/311
<b>Storage Expansion</b>	SD socket x 1 for storage expansion (W341/321 only)
<b>USB</b>	USB 2.0 Host x 2
<b>Realy Output</b>	Form C, SPDT x 1 Normal Switching Capacity: <a href="#">2A@30VDC</a> Switching Power: 60W max. Switching Voltage: 220 VDC max. Switch Current: 2A max.

<b>Console Port</b>	Operate Time: 4 ms @20°C Initial Contact Resistance: 100 mohm max.
<b>Button</b>	RS-232 x 1 (Tx, Rx, GND), 4-pin header output, "115200, n, 8, 1"
<b>Others</b>	Reset button x 1, support "Reset to Factory Default"
<b>OS</b>	RTC, buzzer, Watchdog Timer Built-in Embedded Linux for W341 with MMU support μClinix for W321/311, based on Linux Kernel 2.6

## WLAN Communication

<b>Standard Compliance</b>	802.11a/b/g
<b>Radio Frequency Type</b>	DSSS, CCK, OFDM
<b>Radio Frequency Band</b>	802.11a: 5.15~5.25GHz, 5.725~5.825GHz 802.11b/g: U.S., Europe and Japan product covering 2.4 to 2.484 GHz Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA)
<b>Media Access Protocol</b>	802.11a/g: OFDM (64-QAM, 16-QAM, QPSK, BPSK)
<b>Modulation</b>	802.11b: DSSS (DBPSK, DQPSK, CCK) 5.15~5.25GHz: 15dBm@ 6Mbps; 12dBm@ 54Mbps 5.725~5.825GHz: 15dBm@ 6Mbps; 12dBm@ 54Mbps 2.412~2.483GHz (IEEE802.11g): 17dBm@ 6Mbps; 15dBm@ 54Mbps 2.412~2.472GHz (IEEE802.11b): 18dBm@ 1~11Mbps
<b>Transmission Power (Typical)</b>	5.15~5.25GHz: 6Mbps@ -90dBm; 54Mbps@ -72dBm 5.725~5.825GHz: 6Mbps@ -90dBm; 54Mbps@ -72dBm 2.412~2.472G(IEEE802.11g): 6Mbps@ -90dBm; 54Mbps@ -73dBm 2.412~2.472G(IEEE802.11b): 11Mbps@ -87dBm; 1Mbps@ -94dBm
<b>Receiver Sensitivity (Typical)</b>	54 Mbps with auto fallback (54, 48, 36, 24, 18, 12, 11, 9, 6, 5.5, 2, 1 Mbps) 802.11b support rate: 1M, 2M, 5.5M, 11Mbps 802.11a/g support rate: 6M, 9M, 12M, 18M, 24M, 36M, 48M, 54Mbps
<b>Transmission Rate</b>	Up to 100 meters (@ 11 Mbps, in open areas)
<b>Transmission distance</b>	WEP 64-bit/128-bit, WPA, WPA2 data encryption
<b>Security</b>	Reverse SMA
<b>Antenna Connector</b>	External 2 dbi Dipole Antenna
<b>Antenna</b>	Infrastructure, Ad-Hoc
<b>WLAN Mode</b>	Infrastructure, Ad-Hoc

## Network Communication

<b>LAN Protection</b>	Auto-sensing 10/100Mbps x 1, RJ45 built-in 1.5KV magnetic isolation protection
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## Serial Communication

<b>Serial Port</b>	One software-selectable RS-232/422/485 port for W311, DB9 connector Two software-selectable RS-232/422/485 port for W321, DB9 connector Four software-selectable RS-232/422/485 port for W341, DB9 connector built-in 15KV ESD protection for all signals
<b>Protection</b>	5, 6, 7, 8
<b>Data bits</b>	1, 1.5, 2
<b>Stop bits</b>	None, Even, Odd, Space, Mark
<b>Parity</b>	RTS/CTS, XON/XOFF, RS-485 ADDC™
<b>Flow Control</b>	50 bps to 921.6 Kbps, support any baud rate

## LEDs

<b>System</b>	Ready, SD (W341/321 only)
<b>WLAN</b>	Enable, Signal Strength (5 LEDs)
<b>LAN</b>	10M/Link (on connector), 100M/Link (on connector)
<b>Serial</b>	TxD, RxD

## Power Requirements

<b>Power Input</b>	12 to 48V
<b>Power Consumption</b>	W311: <a href="#">250mA@12VDC</a> , 3W
	W321: <a href="#">300mA@12VDC</a> , 3.6W
	W341: <a href="#">540mA@12VDC</a> , 6.5W

## Mechanical

<b>Dimension (WxDxH)</b>	W311: 67 x 100.4 x 22 mm (without wall mount ear and antenna) W321: 77 x 111 x 26 mm (without wall mount ear and antenna) W341: 150 x 100 x 38 mm (without wall mount ear and antenna)
<b>Antenna</b>	110 mm
<b>Construction Material</b>	W311: aluminum, 1 mm W321: aluminum, 1 mm W341: aluminum, 1 mm / SECC, 1 mm for rear panel

**Mounting** DIN-rail, wall mounting

## Environmental

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

## Regulatory Approvals

<b>EMC</b>	FCC, CE (Class A)
<b>Safety</b>	TÜV, UL, cUL
<b>Others</b>	RoHS, CRoHS, WEEE
<b>Warranty</b>	5 years

## Hardware Block Diagram

The following block diagrams show the layout of ThinkCore W341/321/311s' internal function blocks and components

### ThinkCore W311

### ThinkCore W321

ThinkCore W341

## 2

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Hardware Introduction

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In this chapter, we will introduce the detail of ThinkCore W341/321/311 hardware, includes the following sections.

- Appearance**
- Dimensions**
- LED Indicators**
- Reset Buttons**
- Real Time Clock**

## **Appearance**

The view of ThinCore W341/321/311 Series are shown in the following figures. Please notice W311 doesn't support the SD expansion function.

### **ThinkCore W311**

Rear View

Top View

Front View

### **ThinkCore W321**

Rear View

Top View

Front View

## ThinkCore W341

Rear View

Top View

Front View

## Dimensions

The dimensions of ThinkCore W341/321/311 are shown in the following figures.

## ThinkCore W311

ThinkCore W321

ThinkCore W341

## LED Indicators

The following table explains the function of the LED indicators located on ThinkCore W341/321/311, please notice W311 doesn't support SD expansion function, there is no SD LED on it.

LED Name	LED Color	LED Function
Ready	Green	Power is on and functioning normally
	Off	Power off or any other power error
SD	Green	SD card is detected
	Off	No SD card detected
WLAN	Green	ON: WLAN is ready
		Blinking: WLAN IP conflict or DHCP server no response
	OFF	WLAN is not ready or function error
Signal Strength (5 LEDs)	Green	Lighting LED number means different signal strength status. 5: Excellent 4: Very good 3: Good 2: Fair 1: Bad
	Off	No signal or WLAN connection failed
LAN	Orange	10Mbps Ethernet link
	Green	100Mbps Ethernet link
	Off	Disconnected or short circuit
TxD1~4	Green	Serial port 1~4 is transmitting data
	Off	Serial port 1~4 is not transmitting data
RxD1~4	Yellow	Serial port 1~4 is receiving data
	Off	Serial port 1~4 is not receiving data

## Reset Button

Press the “RESET” button continuously for more than 5 seconds to load the factory default configuration. After loading the factory defaults, the system will reboot automatically. The System Ready LED will blink for the first 5 seconds. We recommend that you only use this function 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 that is in the process of being transmitted. The reset button is NOT designed to Hard Reboot ThinkCore W300 Series products.



### ATTENTION

#### Reset to Default preserves user's data

Resetting to factory defaults will NOT format the user directory and erase the user's data. Pressing this Reset button will only load the configuration file. All files in the `/etc` directory will revert to their factory defaults, but other User Data will still exist in the Flash ROM.

This function only takes effect when the user directory is working correctly. If the user directory has crashed, the kernel will automatically load the factory defaults.

## Real Time Clock

ThinkCore W341/321/311's real time clock is powered by a lithium battery. We strongly

recommend that you do not replace the lithium battery without the help of MOXA's support team. If the battery needs to be changed, contact the MOXA RMA service team for RMA service.

**ATTENTION**

The battery may explode if replaced by an incorrect type. To avoid this potential danger, always be sure to use the correct type of battery.



# 3

## Hardware Connection Description

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This chapter describes how to connect ThinkCore W341/321/311 hardware, includes information about the power connecting, wiring and function introduction.

This chapter covers the following topics:

- Wiring Requirement**
- Connecting the Power**
- Grounding ThinkCore W341/321/311**
- Connecting to the Network**
- Connecting to a Serial Device**
- Connecting to the Console Port**
- Internal SD Socket**
- USB Hosts**
- Relay Output**

### Wiring Requirements

This section describes how to connect ThinkCore W341/321/311 to serial devices.

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 installing and/or wiring your ThinkCore W341/321/311.

#### **Wiring Caution!**

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.

#### **Temperature Caution!**

Be careful when handling ThinkCore W341/321/311. When plugged in, ThinkCore W341/321/311's 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 ThinkCore W341/321/311’s terminal block. If the power is properly supplied, the “Ready” LED will glow a solid green after a 25 to 30 second delay.

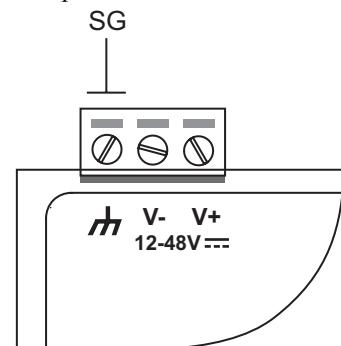
## Grounding W341/321/311

Grounding and wire routing help limit the effects of noise due to electromagnetic interference (EMI). Run the ground wire from the ground screw to the grounding surface prior to connecting devices.



### 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 when 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 ThinkCore W341/321/311 to the network, serial devices,

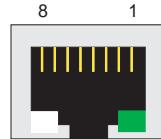
and serial COM terminal.

## Connecting to the Network

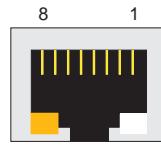
Connect one end of the Ethernet cable to ThinkCore W341/321/311's 10/100M Ethernet port and the other end of the cable to the Ethernet network. If the cable is properly connected, ThinkCore W341/321/311 will indicate a valid connection to the Ethernet in the following ways:

- The top-right LED on the connector glows a solid green when connected to a 100 Mbps Ethernet network.
- The top-left LED on the connector glows a solid orange when connected to a 10 Mbps Ethernet network.
- The LEDs will flash when Ethernet packets are being transmitted or received.

The 10/100 Mbps Ethernet LAN port use 8-pin RJ45 connectors. Pinouts for these ports are given in the following diagram.



The LED indicator in the lower right corner 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 in the lower left corner 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

ThinkCore W341/321/311 is the WLAN ready wireless embedded computer, embeds an 802.11 a/b/g WLAN module inside and support the WEP, WPA and WPA2 data encryption. To make sure the WLAN function works normally, please enter the system first to do the associated WLAN configuration via fixed network or serial console, you may refer to the OS operating user's manual for the further detail.

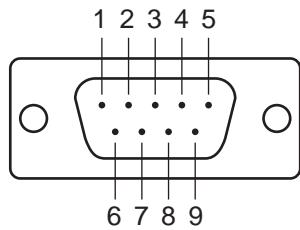
## Connecting to a Serial Device

Connect the serial cable between ThinkCore W341/321/311 and the serial device(s).

Serial ports P1 to P4 use male DB9 connectors, and can be configured for RS-232/422/485 by 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	TxD(-)	TxD(-)	---
2	RxD	TxD(+)	TxD(+)	---
3	TxD	RxD(+)	RxD(+)	DataB(+)
4	DTR	RxD(-)	RxD(-)	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 identifying the ThinkCore W341/321/311 boot up message.

### Serial Console Port & Pinouts



Pin	Signal
1	TxD
2	RxD
3	NC
4	GND

### Serial Console Cable



## Internal SD Socket

ThinkCore W341/321 provides an internal SD socket for storage expansion. It 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. To install an additional SD card, you must first remove the W341/321's SD outer cover to access the slot. The internal SD socket is located at the ThinkCore W341/321 bottom board; you can find the SD plug-in slot at the lower right side of W321 and top right side of W341 shown as figures. Plug the SD card into the socket directly and remember to press the SD card first if you want to take it out.



## USB

ThinkCore W341 provides two USB 2.0 hosts, which supports the ability to connect a flash disk or 2.5 inch hard drive for storing large amounts of data.

## Relay Output

ThinkCore W341 provides a relay output channel. There is a 3-pin terminal block for this relay output connection. The pinouts for the relay output channel are shown in the figure.



# A

## Service Information

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This appendix shows you how to contact MOXA for information about this and other products, and how to report problems.

The following topics are covered in this appendix:

- MOXA Internet Services**
- Problem Report Form**
- Product Return Procedure**

## **MOXA Internet Services**

Customer satisfaction is our number one concern, and to ensure that customers receive the full benefit of our products, Moxa Internet Services has been set up to provide technical support, driver updates, product information, and user's manual updates.

The following services are provided

E-mail for technical support.....[support@moxa.com](mailto:support@moxa.com)

World Wide Web (WWW) Site for product information:

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

# Problem Report Form

## MOXA ThinkCore W341/321/311 Series

<b>Customer name:</b>	
<b>Company:</b>	
<b>Tel:</b>	<b>Fax:</b>
<b>Email:</b>	<b>Date:</b>

- 1. Moxa Product:**  ThinkCore W341       ThinkCore W321       ThinkCore W311

**2. Serial Number:** \_\_\_\_\_

**Problem Description:** Please describe the problem clearly. Include as many details as you can. This will help us reproduce the problem, and expedite the repair of your product.

## **Product Return Procedure**

For product repair, exchange, or refund, the customer must:

- ◆ Provide evidence of original purchase.
- ◆ Obtain a Product Return Agreement (PRA) from the sales representative or dealer.
- ◆ Fill out the Problem Report Form (PRF). Include as much detail as possible for a shorter product repair time.
- ◆ Carefully pack the product in an anti-static package, and send it, pre-paid, to the dealer. The PRA should be visible on the outside of the package, and include a description of the problem, along with the return address and telephone number of a technical contact.

## **FEDERAL COMMUNICATIONS COMMISSION INTERFERENCE STATEMENT**

This equipment has been tested and found to comply with the limits 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 in accordance with 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 can be determined 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 and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

### **CAUTION:**

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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.

### **FCC RF Radiation Exposure Statement**

This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment.

### **RF exposure warning**

This equipment must be installed and operated in accordance with provided instructions and the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter. End-users and installers must be provided with antenna installation instructions and transmitter operating conditions for satisfying RF exposure compliance.