ThinkCore W315/325/345
Hardware User's Manual

www.moxa.com/product

First Edition, May 2007

Moxa Systems Co., Ltd.
Tel: +886-2-2910-1230
Fax: +886-2-2910-1231
Web: www.moxa.com

MOXA Technical Support
Worldwide: support@moxa.com
The Americas: support@usa.moxa.com

ThinkCore W315/325/W345
Hardware User's Manual

Copyright Notice

Trademarks

Disclaimer

Table of Contents

1

Introduction

The ThinkCore W315/W325/W345 series of wireless RISC-based embedded computers feature a GSM/GPRS module, RS-232/422/485 serial ports, and an Ethernet port in a small, rugged chassis. In addition, the W325 and W345 models come with an SD slot, and the W345 also has two USB 2.0 hosts and one relay output channel.

The W300 series embedded computers are ideal for diverse, machine-to-machine embedded applications. The computers enable the wireless operation of traditionally wired network and serial devices, and can handle transparent data transfer, 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, we cover the various capabilities of the W300 series embedded computers.

In this chapter, we cover the following topics:

- **Overview**
- **Package Checklist**
- **Product Features**
- **Product Hardware Specifications**
- **Hardware Block Diagram**
  - ThinkCore W315
  - ThinkCore W325
  - ThinkCore W345

Overview

The ThinkCore W315/W325/W345 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 a significant amount of 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.

An onboard NOR Flash ROM and SDRAM provide ample storage capacity, and the SD slot gives applications extra room to expand. The built-in GSM/GPRS function supports the 850/900/1800/1900 MHz frequency bands, providing coding scheme from CS-1 to CS-4. 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 GPRS network. 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 be ported easily to W300 series embedded computers by using a common complier, so you do not need to spend a lot of time 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 ThinkCore W300 Series includes the following models:

ThinkCore W315-LX
Mini RISC-based, ready-to-run, wireless embedded computer with GSM/GPRS, one serial port, LAN, SD, and Linux OS

ThinkCore W325-LX
Mini RISC-based, ready-to-run, wireless embedded computer with GSM/GPRS, two serial ports, LAN, SD, and Linux OS

ThinkCore W345-LX
RISC-based, ready-to-run, wireless embedded computer with GSM/GPRS, four serial ports, LAN, SD, USB, relay output, and Linux OS

Each model is shipped with the following items:

- ThinkCore W300 Series wireless embedded computer
- Quick Installation Guide
- Document & Software CD
- 100 cm RJ45-to-RJ45 Ethernet cross-over cable
- CBL-4PINDB9F-100: 100 cm 4-pin header to female DB9 console port cable
- 1 dBi antenna
- Universal power adaptor
- Product Warranty Statement

Optional Accessories

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

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

Product Features

W315/W325/W345 series embedded comptuers have the following features:

- MOXA ART 32-bit ARM9 RISC industrial communication processor
- 32 MB on-board RAM (64 MB for W345)
- 16 MB built-in flash memory
- RS-232/422/485 serial ports with software selectable interface
- Baudrate between 50 and 921.6Kbps; supports ANY BAUDRATE
- 10/100M Ethernet for backup networking
- Built-in quad band 850/900/1800/1900 MHz GSM/GPRS module
- GPRS class 10
- Coding scheme from CS1 to CS4
- SD card slot for storage expansion
- Designed to withstand continuous 5G vibration and a 50G shock
- LED indicators for status, serial transmission, and wireless signal strength
- Ready-to-run Linux platform
- Install on a DIN-rail or wall
- Fanless design for increased ruggedness

Product Hardware Specifications

System

CPU	MOXA ARM9-based 32-bit RISC CPU, 192 MHz
RAM	W315: 32 MB W325: 32 MB W345: 64 MB
Flash	W315: 16 MB W325: 16 MB W345: 16 MB
Storage Expansion	W315: SD slot x 1 W325: SD slot x 1 W345: SD slot x 1
USB	W345:USB2.0 host x 2
Relay Output	Form C, SPDT x 1 Normal switching capacity: 2A@30 VDC Switching power: 60 W max. Switching voltage: 220 VDC max. Switching current: 2 A max. Operation time: 4 ms @ 20°C Initial contact resistance: 100 MΩ max.
Console port	RS-232 x 1 (TxD, RxD, GND); 4-pin header output, "115200, n, 8, 1"
Button	Reset button x 1; supports "Reset to Factory Default"
Other	RTC, buzzer, Watchdog Timer
OS	Built-in Embedded Linux with MMU support; based on Linux Kemel 2.6

Cellular Communication

Standard Compliance	GSM (Global Service for Mobile) and GPRS (General Packet Radio Service)
Radio Band Selection	Quad-band 850 MHz, 900 MHz, 1800 MHz, and 1900 MHz
GPRS Multi-slot Class	Class 10

Coding Schemes	CS1 to CS4
GPRS Terminal Device Class	Class B (simultaneous GPRS/CSD connections are not supported)
CSD Data Transmission Rate	Up to 14,400 bps
SMS	Point-to-point Text(MT/MO) and Cell Broadcast
SIM Control	3V/1.8V Interface
Antenna	1 dBi antenna, 8.33 cm

Network Communication

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

Serial Communication

Serial Port	W315: RS-232/422/485, male DB9 x 1 W325: RS-232/422/485, male DB9 x 2 W345: RS-232/422/485, male DB9 x 4
Protection	15 KV built-in ESD protection for all signals
Data bits	5, 6, 7, 8
Stop bit(s)	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 ANY BAUDRATE

LEDs

System	Ready, SD activity (for W325 and W345 only)
GPRS	Enable, signal strength
LAN	10 M/Link, 100 M/Link (RJ45 connector)
Serial	TxD, RxD

Power Requirements

Power Input	12 to 48 V
Power Consumption	In GPRS mode: W315: 1A @ 12 VDC W325: 1A @ 12 VDC W345: 1.2A @ 12 VDC with USB devices on each port at max spec In idle mode: W315: 240 mA @ 12 VDC W325: 270 mA @ 12 VDC W345: 800 mA @ 12 VDC with USB devices on each port at max spec

Mechanical

Dimensions (W x D x H)	(without wall mount ears or antenna) W315: 77 x 111 x 26 mm W325: 77 x 111 x 26 mm W345: 150 x 100 x 38 mm
Construction Material	W315: aluminum, 1 mm W325: aluminum, 1 mm W345: aluminum, 1 mm / SECC, 1 mm for rear panel
Mounting	DIN-rail, wall

Environment

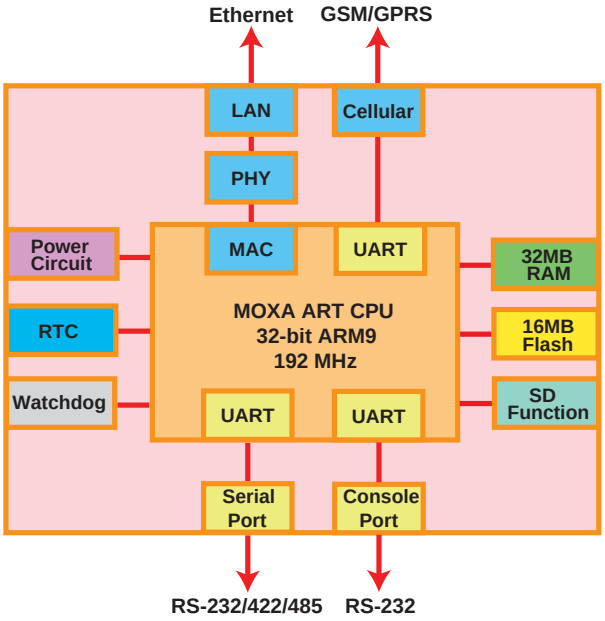
Operating Temperature	-10 to 60°C (14 to 140°F), 5 to 95% RH
Storage Temperature	-20 to 80°C (-4 to 176°F), 5 to 95% RH

Regulatory Approvals

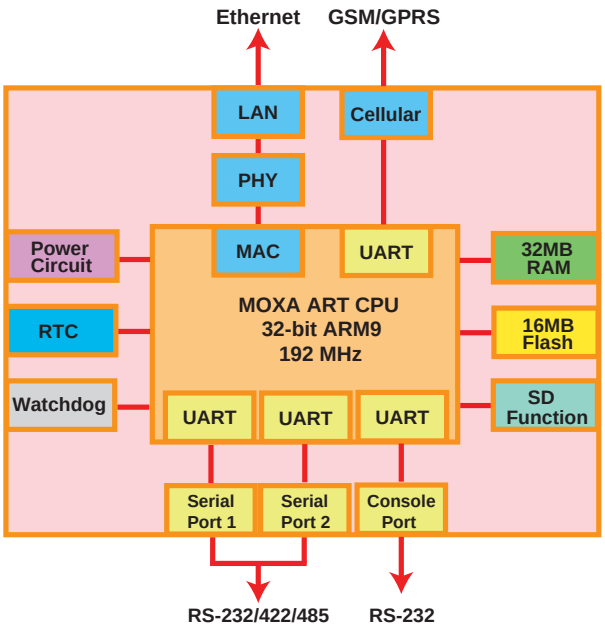
EMC	FCC, CE (Class A)
Safety	UL, cUL
Other	RoHS, CRoHS, WEEE
Warranty	5 years

Hardware Block Diagram

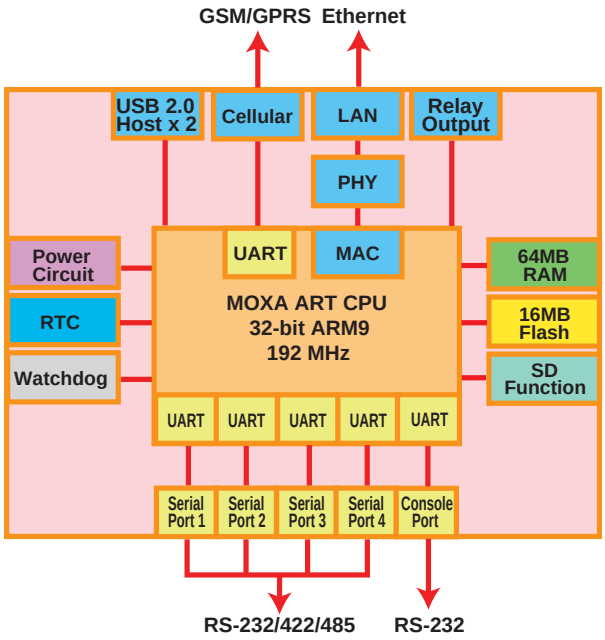
ThinkCore W315



ThinkCore W325



ThinkCore W345



2

Hardware Introduction

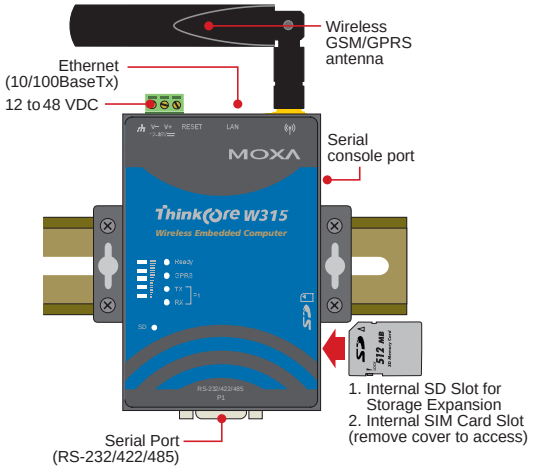
The ThinkCore W300 series embedded computers are compact, well-designed, and built rugged enough for industrial applications. LED indicators help you monitor performance and identify trouble spots, multiple serial ports allow you to connect different devices for wireless operation, and the reliable and stable hardware platform lets you devote your attention to developing your applications.

In this chapter, we cover the following topics:

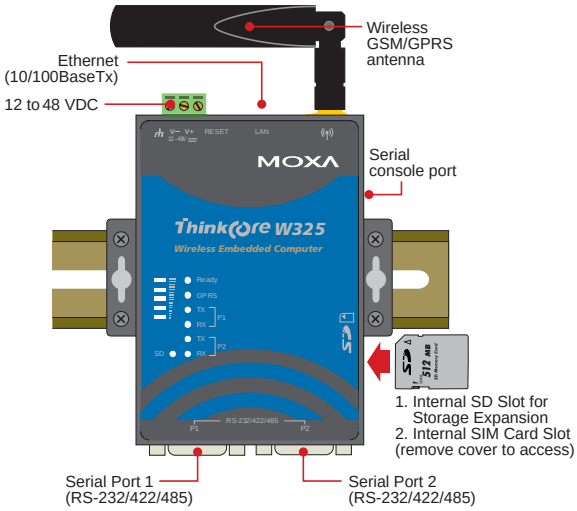
- **Appearance**
  - ThinkCore W315
  - ThinkCore W325
  - ThinkCore W345
- **Dimensions**
  - ThinkCore W315
  - ThinkCore W325
  - ThinkCore W345
- **LED Indicators**
- **Reset Button**
- **Real Time Clock**

Appearance

ThinkCore W315

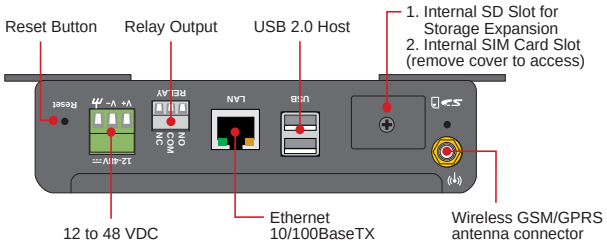


ThinkCore W325

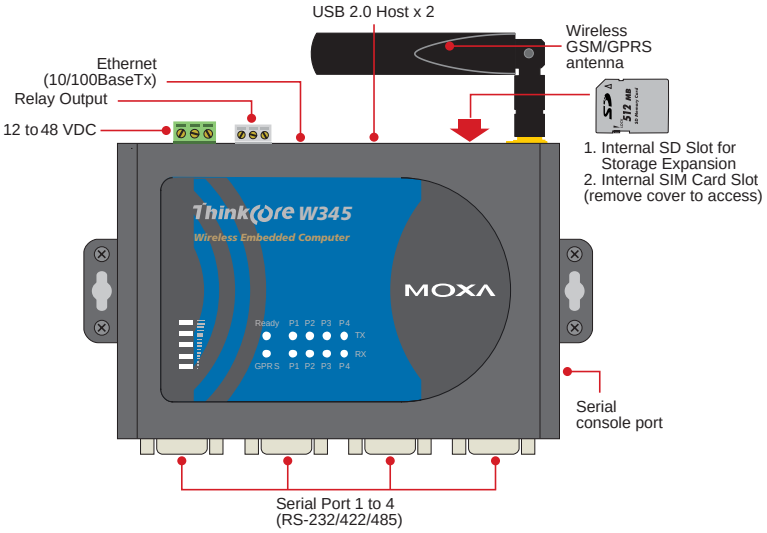


ThinkCore W345

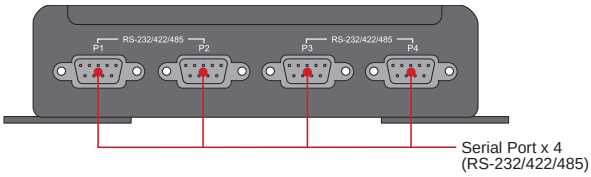
Top View



Front View

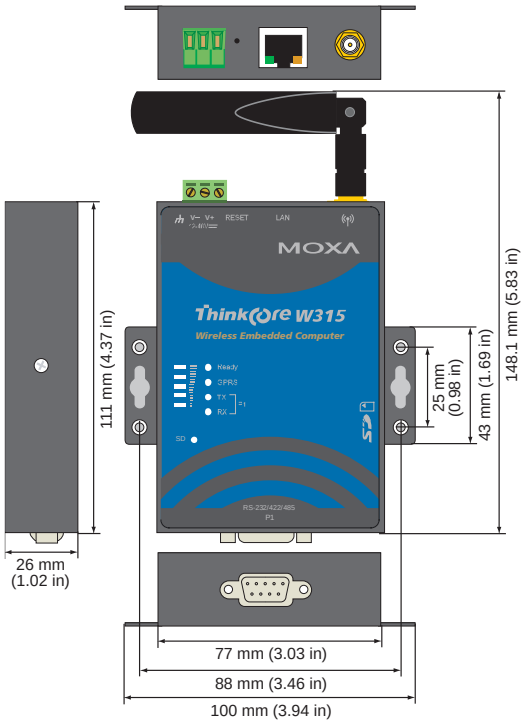


Bottom View

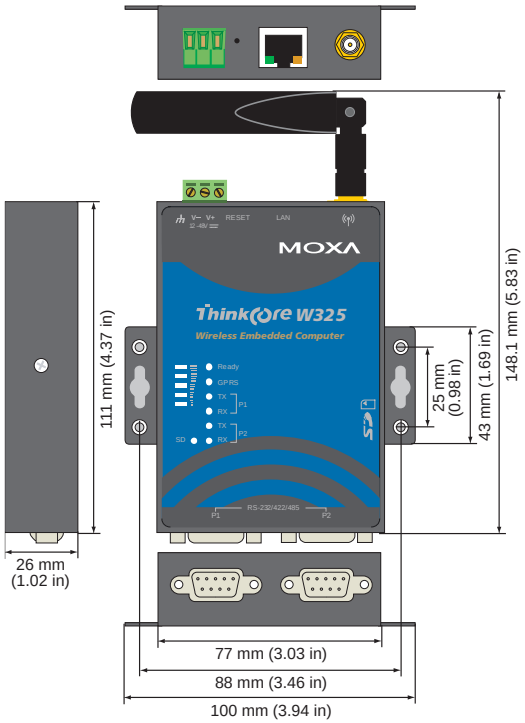


Dimensions

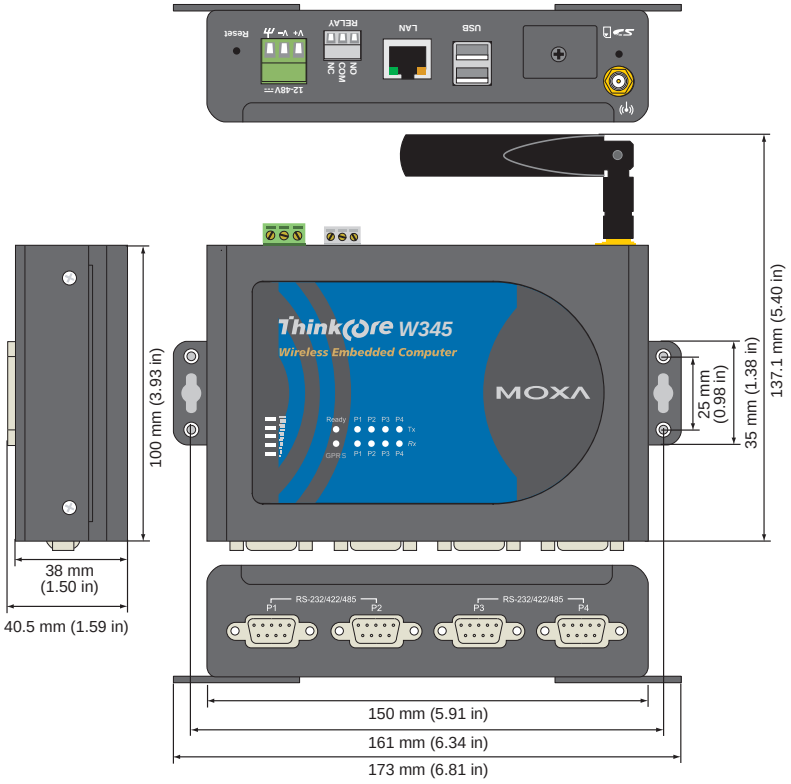
ThinkCore W315



ThinkCore W325



ThinkCore W345



LED Indicators

Note that the W315 does not have an SD slot, so it does not have an SD LED.

LED Name	LED Color	LED Function
Ready	Green	Power is on and functioning normally
	Off	Power is off or a power error exists
SD	Green	SD card is detected
	Off	SD card is not detected
GPRS	Green	ON: GPRS is ready
		Blinking: Conflict with GPRS IP or no response from DHCP server
	Off	GPRS is not ready or function error exists
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 GPRS 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 in the reset button 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 your 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 if you need to replace your battery.

Caution

There is a risk of explosion if the battery is replaced by an incorrect type. Dispose of used batteries according to the instructions on the battery.

3

Hardware Connection Description

The ThinkCore W300 series wireless embedded computers support multiple types of connections. GSM/GPRS, Ethernet, and one or more serial ports are built into every model. In addition, the computers come with a serial console port for monitoring bootup messages. All models include an SD 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.

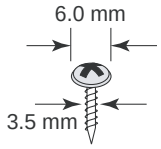
In this chapter, we cover the following topics:

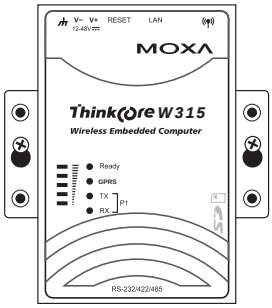
- **Installing the W315/W325/W345**
- **Wiring Requirements**
  - Connecting the Power
  - Grounding the Unit
- **Connecting Data Transmission Cables**
  - Connecting to the Network
  - Connecting to a Serial Device
  - Connecting to a Serial Console Port
  - Connecting an Antenna
- **Installing a SIM Card and SD Card**
  - Installing a SIM card
  - Installing an SD card for Storage Expansion (W325/345)
- **USB (W345 only)**
- **Relay Output (W345 only)**

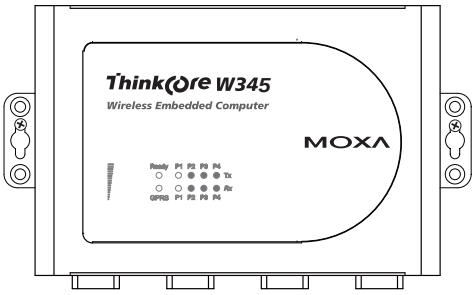
Installing the W315/W325/W345

Wall or Cabinet Mounting

The ThinkCore W315/325/345 embedded computers have built-in "ears" for attaching the embedded computers to a wall or the inside of a cabinet. We suggest using two screws per ear to attach the W315/325/345 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.

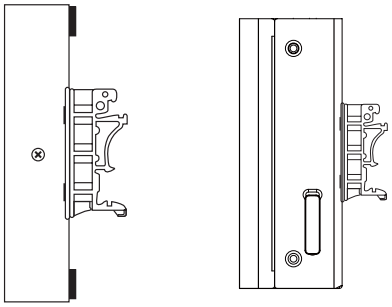






DIN-Rail Mounting

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.



Wiring Requirements

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

You should read and follow these 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 together with 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 W315/325.

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 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

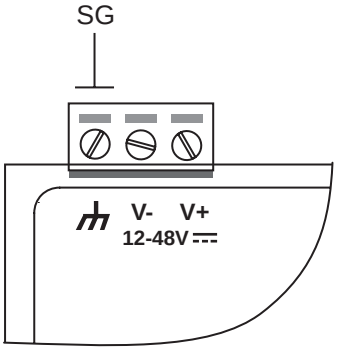
The PC's power source should be provided by a UL listed class 2 or "Limited Power Source" (LPS), with external adaptor output rated 12 to 48 VDC, minimum 1.2A. If the power is supplied properly, the "Ready" LED will glow a solid green after a 25 to 30 second delay.

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: 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.

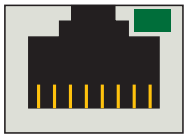
Connecting Data Transmission Cables

This section describes how to connect the W315/325/345 embedded computers to the network, serial devices, and a serial COM terminal.

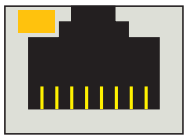
Connecting to the Network

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 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.



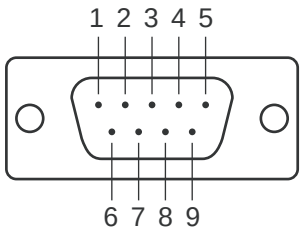
The LED indicator in the lower left corner glows a solid orange color when the cable is properly connected to a 10 Mbps Ethernet network. The LED will flash on and off when Ethernet packets are being transmitted or received.

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

Connecting to a Serial Device

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

DB9 Male Port



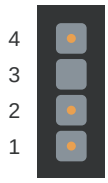
RS-232/422/485 Pinouts

Pin	RS-232	RS-422	RS-485 (4-wire)	RS-485 (2-wire)
1	DCD	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	---	---	---

Connecting to the 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 message.

Serial Console Port & Pinouts

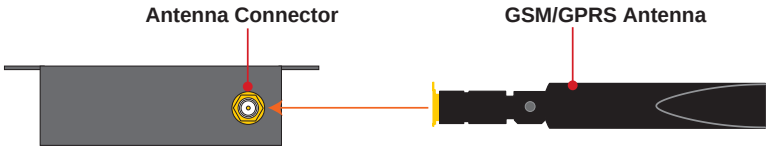


Pin	Signal
1	TxD
2	RxD
3	NC
4	GND

Serial Console Cable

Connecting an Antenna

The ThinkCore W315/325/345 embedded computers come with a 1 dBi antenna for GPRS communication. Connect the antenna to the SMA connector located on the front panel of the embedded computer. Connect the antenna to the computer by rotating it in a clockwise direction.



Installing a SIM Card and SD Card

Installing a SIM Card

The ThinkCore W315/325/345 embedded computers have a built-in GSM/GPRS cellular module to provide long-range communication. SIM (Subscriber Identity Module) cards are used to authenticate and identify subscribers when connecting to a network.

The SIM card and SD card slot are located on the right side of the W315/325's casing, and on the front panel of the W345.

W315/W325

W345

Follow these steps to install a SIM card:

Step1: Before you install a SIM card, make sure the embedded computer is powered off.

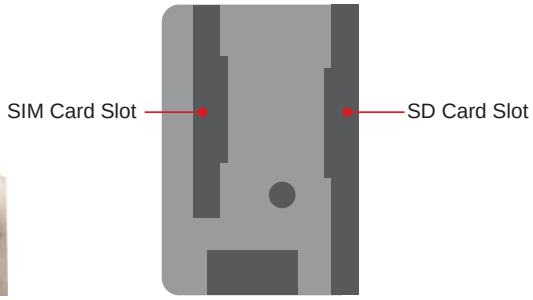
Step2: Use a screwdriver to remove the protective cover to access the slot. Note that the SD slot and SIM card slot for the W315/W325 share the same protective cover.

W315/W325

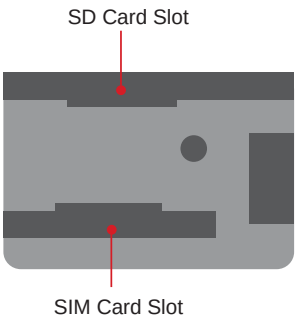
W345

Step3: When inserting the SIM card, make sure the chip is facing upwards. Plug the SIM card directly into the slot.

W315/325



W345



Step 4: Power on the embedded computer and tart the operating system.

Step 5: To operate GPRS connection, please refer to the operating system user's manual for further detail.

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

Installing an SD Card for Storage Expansion

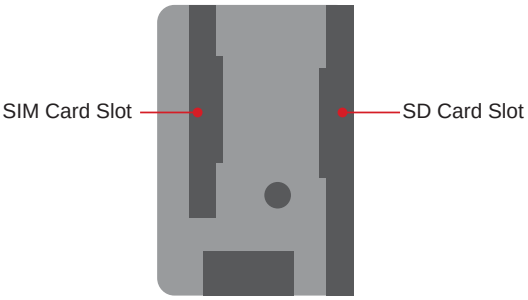
The ThinkCore W315/W325/W345 provide an SD slot for storage expansion. The SD slot allows users to plug in a Secure Digital (SD) memory card compliant with SD standard V1.0 for up to 1 GB of additional memory space. The following steps show you how to install SD card.

W315/W325

The SD slot is located on the right side of the W315/W325 casing. To install an SD card, first remove the protective cover to access the slot, and then plug the SD card directly into the slot.

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

Step 2: After removing the cover, insert the SD memory card into the slot.

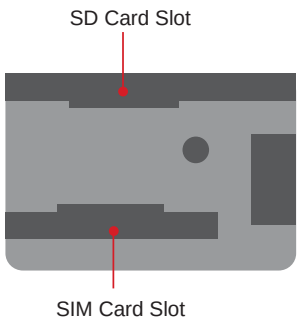


W345

The SD slot is located on the front panel of the W345. To install an SD card, you must first remove the protective cover to access the slot, and then plug the SD card directly into the slot.

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

Step 2: After removing the cover, insert the SD memory card into the slot.



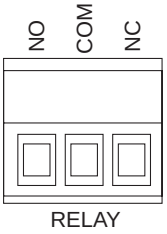
NOTE: To remove the SD card from the slot, press the SD card in slightly with your finger, and then remove your finger to allow the card to spring out partially. You may now grasp the top of the card with two fingers and pull it out.

USB (W345 only)

The ThinkCore W345 includes two USB 2.0 hosts. The hosts can be used for an external flash disk or hard drive for storing large amounts of data.

Relay Output (W345 only)

The ThinkCore W345 includes a relay output channel. A 3-pin terminal block is used for the relay output connection. Pinouts as shown in the figure at the right.



A

FCC Warning 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.
2. This device must accept any interference received, including interference that may cause undesired operation.

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 to 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.

Prohibition of co-location:

This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter.

Safety Information:

To maintain compliance with the FCC's RF exposure guidelines, when installing and/or operating this equipment, you should maintain a minimum distance of 20 cm between the transmitter and your body. Use only the supplied antenna. Unauthorized antennae, modifications, or attachments could damage the transmitter and may violate FCC regulations. The device includes a GPRS module. This module has approved by FCC. The FCC ID is 09EQ24PL001

B

Service Information

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

In this appendix, we cover the following topics:

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

MOXA Internet Services

Customer satisfaction is our primary concern. 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

Website for product information:.....http://www.moxa.com

Problem Report Form

MOXA ThinkCore W315/325/345 Series

Customer name:	
Company:	
Tel:	**Fax:**
Email:	**Date:**

MOXA Product: ☐ ThinkCoreW315 ☐ ThinkCoreW325 ☐ ThinkCoreW345

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.