

VM-1220 Series Hardware User Manual

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VM-1220 Series Hardware User Manual

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1. Introduction

The VM-1220 is an all-in-one EMS controller designed for Battery Energy Storage Systems (BESS) applications. The controller comes with four RS-485-2w (including one software selectable RS-232/RS-485-2w) serial ports, four 10/100 Mbps Ethernet ports, two CAN ports, sixteen DIs, four DOs, and four DIOs. The Armv8 Cortex-A53 dual-core processor in the VM-1220-T is optimized for energy, battery, and environmental management applications.

Model Descriptions

The VM-1220 Series includes the following models:

- **VM-1220-T:**
Arm® Cortex®-A53 dual-core 64-bit 1-GHz all-in-one controller with 4 LANs, 4 serial ports, 2 CANs, 16 DIs, 4 DOs, 4 DIOs, -40 to 75°C operating temperature
- **VM-1220-T-BESS:**
Arm® Cortex®-A53 dual-core 64-bit 1-GHz all-in-one controller with 4 LANs, 4 serial ports, 2 CANs, 16 DIs, 4 DOs, 4 DIOs, -40 to 75°C operating temperature, **Moxa BESS software**

Package Checklist

Before installing a VM-1220 Series, verify that the package contains the following items:

- VM-1220 Series controller
- Screws for Mini PCIe module x2
- Console cable
- Wall-mount kit
- Quick installation guide (printed)
- Warranty card



NOTE

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

Product Features

- Arm® Cortex®-A53 dual-core 64-bit 1-GHz
- 4 auto-sensing 10/100 Mbps Ethernet ports
- 4 serial ports supporting RS-485-2w (includes one software-configurable RS-232/RS-485-2w)
- 2 CAN ports that support CAN 2.0A / CAN 2.0B
- 16 DIs, 4 DOs, and 4 DIOs
- 1 microSD socket for storage expansion
- -40 to 75°C operating temperature range
- Long-term Linux support until 2031; includes bug fixes and security patches

Product Specifications



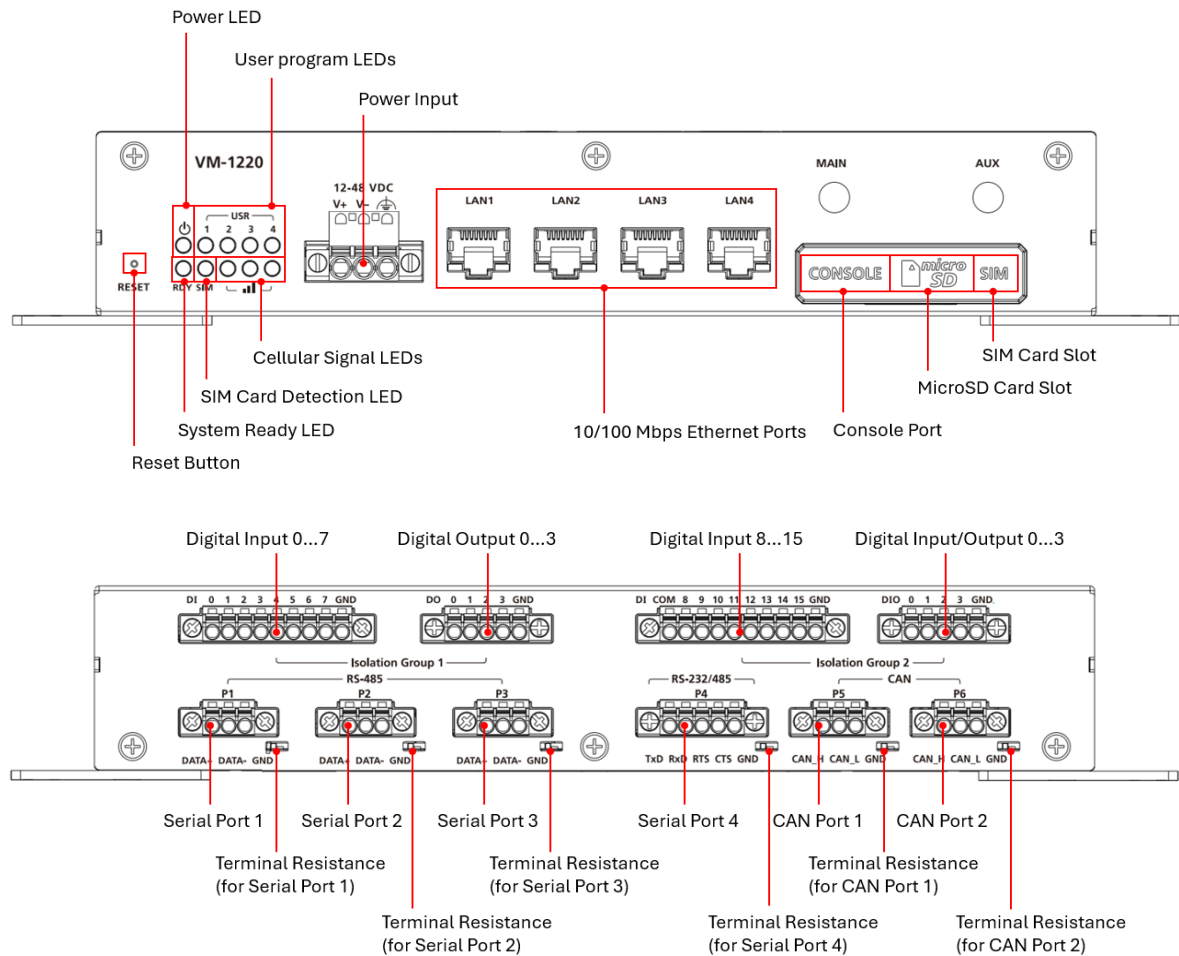
NOTE

The latest specifications for the VM-1220 Series, refer to the **VM-1220 Series Datasheet** for more detail.

2. Hardware Introduction

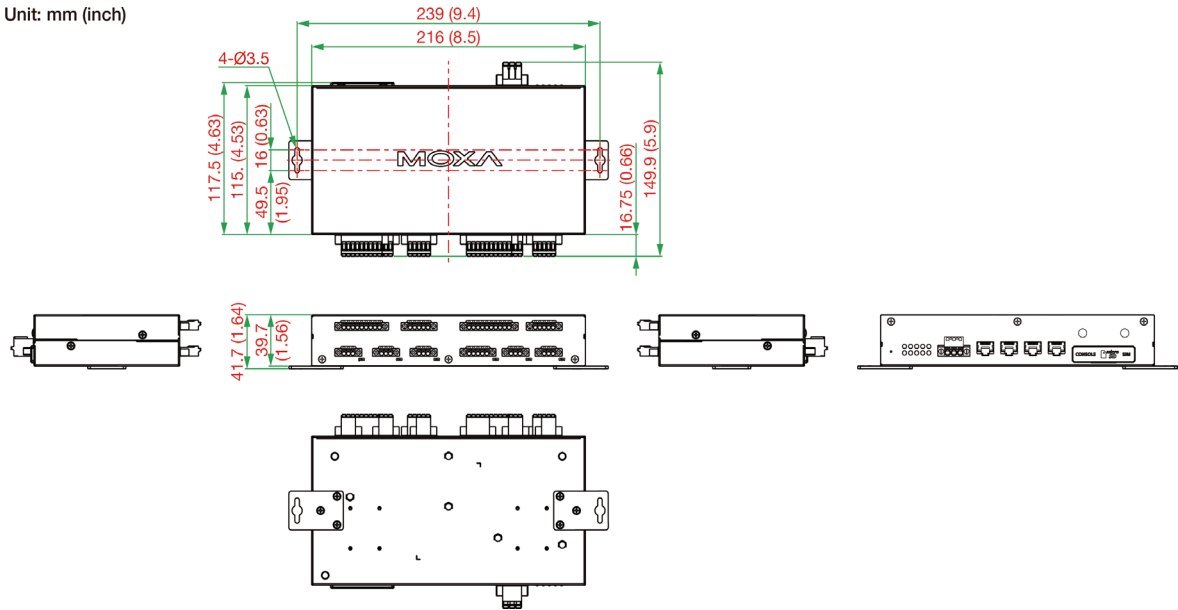
The VM-1220 controllers are compact and rugged, making them suitable for industrial applications. The LED indicators allow you to monitor device performance and quickly identify issues, and the multiple ports can be used to connect a variety of devices. The VM-1220 Series comes with a reliable and stable hardware platform that lets you devote the bulk of your time to application development. In this chapter, we provide basic information about the embedded computer's hardware and its various components.

Appearance



Dimensions

Unit: mm (inch)



LED Indicators

The function of each LED is described in the table below:

LED Name	LED Status		Function
PWR	Green	Steady on	Power is on
	Off	Off	Power is off
RDY	Green	Steady on	Device has booted (all system service initialized)
	Green	Blinking	Device is booting up
	Red	Steady on	Device boot failure, meaning any of the system services cannot to initialize
	Off	–	The device is still in the bootloader stage and has not booted into the kernel yet
SIM	Green	Steady on	SIM card is inserted and functional
	Off	–	SIM not detected
Cellular signal	Green	Steady on	The number of glowing LEDs shows the signal strength. 3: Excellent 2: Good 1: Poor
		Blinking	1: Very Poor
	Off	Off	All 3 LED off: LTE disconnected
USR 1 to 4	Green	Steady on/Blinking/Off	User programmable

System Reboot

To reboot the computer, press the **RESET** button for 1 second.

Reset to Default

Press and hold the **RESET** button for between seven to nine seconds to reset the computer to the factory default settings. When the reset button is held down, the **Ready (RDY)** LED will blink once every second and become steady after seven to nine seconds. Release the button within this period to load the **factory** default settings. The **RESET** button function can be customized if needed. Refer to **Moxa Industrial Linux manual for VM-1220-T** for more detail.

Real-time Clock

A lithium battery powers the real-time clock in the VM-1220 Series. We strongly recommend that you do not replace the lithium battery without the help of a Moxa support engineer. If you need to change the battery, contact the Moxa RMA service team.



WARNING

To reduce the risk of fire or burns, do not disassemble, crush, or puncture the battery; do not dispose of it in fire or water, and do not short external contacts.

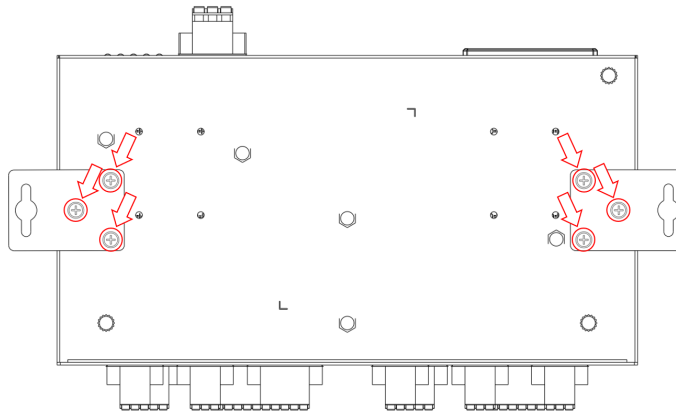
Installation Options

Wall Mounting

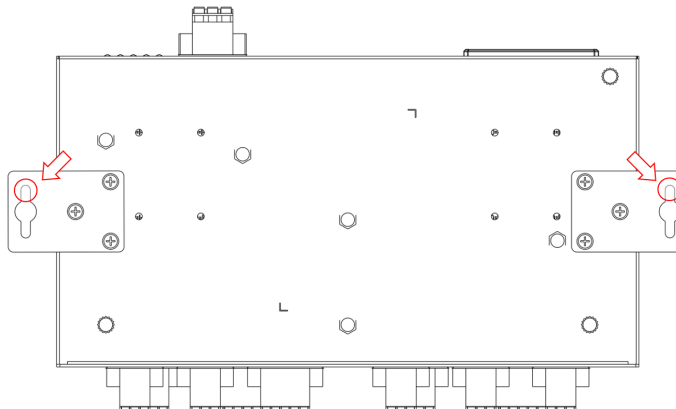
Mount the VM-1220 Series on a wall using a wall-mounting kit. The wall-mounting kit contains two plates (43 x 30 mm) and six screws (FMS M3 x 4 mm).

Follow these steps to mount the computer on to a wall:

Step 1: Use the six screws to fasten the wall-mounting kits on the computer.



Step 2: Use other screws to mount the computer on a wall or in a cabinet.



IMPORTANT!

To firmly install the computer on the wall, the diameter of the screw heads should be greater than 5.25 mm and less than 7 mm; the diameter of the shafts should be 3 mm. The length of the screws should be greater than 7 mm.



NOTE

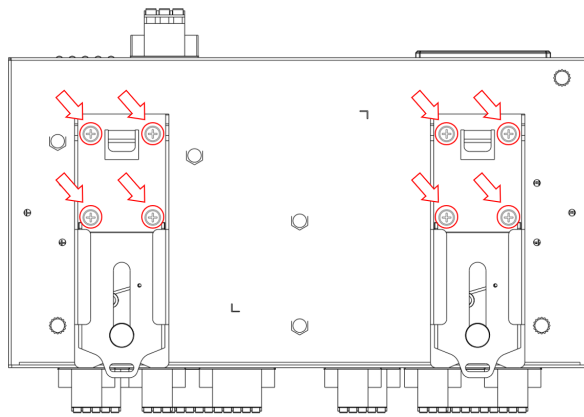
- Test the screw head and shank size by inserting the screws into one of the keyhole-shaped apertures of the wall-mounting plates before attaching the plate to the wall.
- Do not drive the screws in all the way—leave a space of about 2 mm to allow room for sliding the wall mount panel between the wall and the screws.

DIN-rail Mounting (optional)

The VM-1200 Series has a DIN-rail kit option to allow installation on a DIN rail. You can purchase separate DIN-rail attachments to mount the product on a DIN rail. The DIN-rail kit contains two plates (100 x 35 mm) and eight screws (FMS M3 x 4 mm).

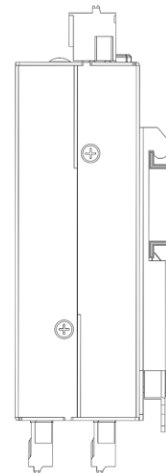
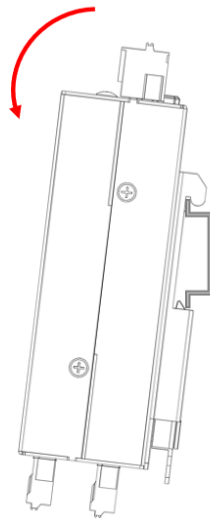
Follow these steps to mount the VM-1220-T on to a DIN rail:

Step 1: Use eight screws to fasten the DIN-rail kits on the computer with tightening torque: 4.5 kgf-cm +/- 0.5, screw type: type F, PH2.



Step 2: Insert the upper lip of the DIN-rail kit into the mounting rail.

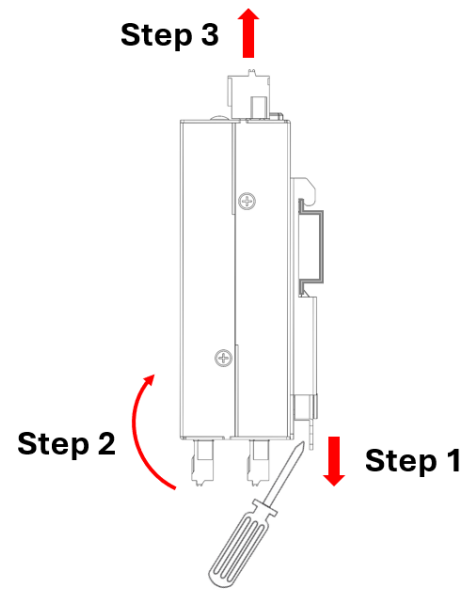
Step 3: Press the VM-1220 towards the mounting rail until it snaps into place.



To remove the VM-1220 from the DIN rail, do:

Step 1: Pull down the latch on the DIN-rail kit with a screwdriver.

Step 2&3: Slightly pull the VM-1220 forward and lift it up to remove it from the mounting rail.



3. Hardware Connection Description

In this chapter, we describe how to connect the VM-1220 Series to various devices.

Wiring Requirements

In this section, we describe how to connect various devices to a computer. Be sure to 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 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 separately.
- When necessary, it is strongly advised that you label wiring to all devices in the system.



ATTENTION

Safety First!

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

Electrical Current Caution!

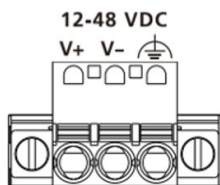
Calculate the maximum possible current in each power wire and common wire. Observe all electrical codes dictating the maximum current allowable for each wire size.

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 be too hot to touch.

Connecting Power



Connect the DC power to the terminal block of the VM-1220 Series. It takes about 30 seconds for the system to boot up. Once the system is ready, the Power LED will light up.

Use wires with 12 to 26 AWG (3.31 to 0.129 mm²) to connect to V+, V-, and GND. The wire size of the power input and the earthing conductor must be the same. The wiring for the input terminal block should be installed by a skilled person. The wire type should be copper (Cu).



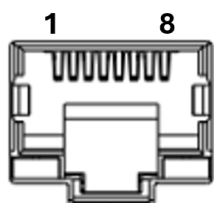
WARNING

- This product is intended to be supplied by a UL Listed power adapter or DC power source, which output meets SELV/LPS. A power source rated 12 to 48 VDC, with a minimum of 1 A and a Tma of at least 75°C, is required.
- Connect the power adapter to a socket outlet with an earthing connection.

If you need further information or assistance, contact a Moxa representative.

Connecting to the Network

The four Ethernet ports are located on the front panel of the VM-1220 computers. The pin assignments for the Ethernet port are shown in the following table. If you are using your own cable, make sure that the pin assignments on the Ethernet cable connector match the pin assignments on the Ethernet port.

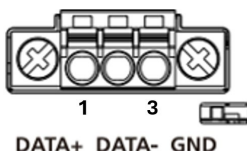


Pin	10/100Mbps
1	Tx+
2	Tx-
3	Rx+
4	-
5	-
6	Rx-
7	-
8	-

Connecting to Serial Ports

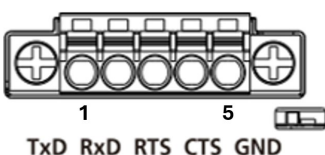
The four serial ports (P1 to P4) use terminal blocks. P1 to P3 only support RS-485, P4 supports either RS-232 or RS-485, which can be configured by software. The pin assignments for the ports are shown in the following table:

P1...3



Pin	RS-485
1	DATA+
2	DATA-
3	GND

P4



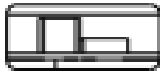
Pin	RS-232	RS-485
1	TxD	-
2	RxD	-
3	RTS	DATA+
4	CTS	DATA-
5	GND	GND

The wiring suggestion is using 16 to 24 AWG (1.31 to 0.21 mm²), the wire type should be copper (Cu).

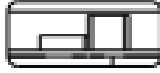
Terminal resistance

There is a slide switch for each serial port at the right-bottom corner of the terminal block for the 120-ohm terminal resistance setting.

The definition is as follows:



Open (default)



120-ohm

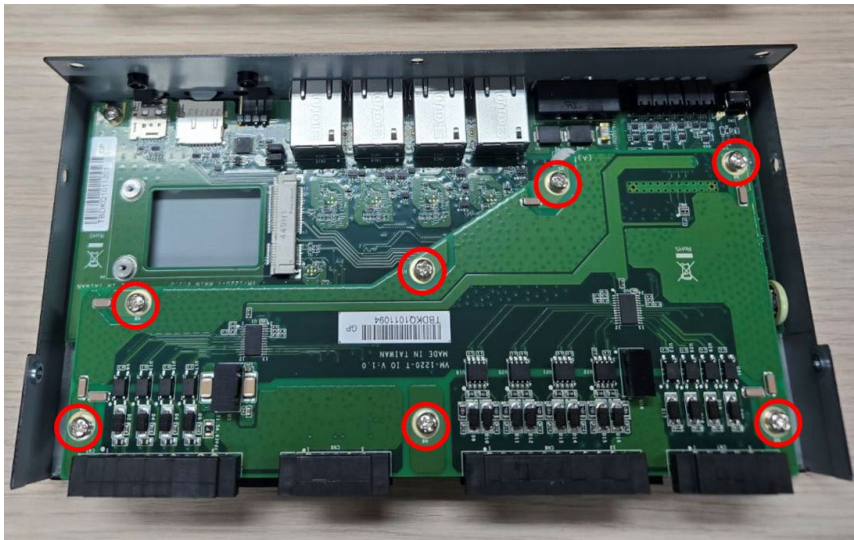
Pull high/low resistance

To stable the serial signal, the pull high /pull low resistance is required. Follow these steps to use the jumper to set the pull high /pull low resistance for each channel.

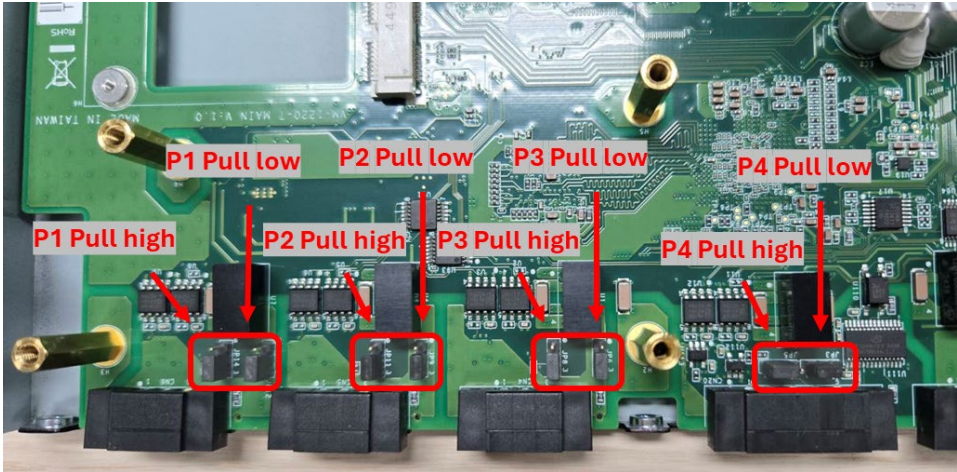
1. Remove all the terminal blocks and ten screws around the computer.



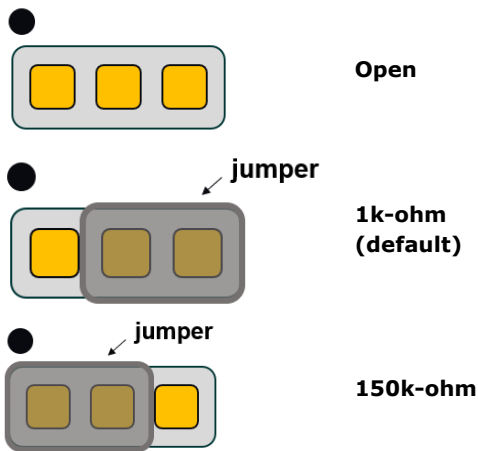
2. Remove all seven screws for the I/O board.



3. After the I/O board is removed, you can see the jumpers for resistor settings beside each channel.



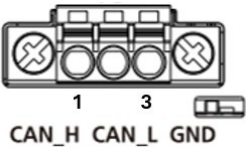
4. The definition of the jumper is as follows:



5. When finished, replace the I/O board with screws intact, and replace the top cover and put the screws and terminal blocks back onto the computer.

Connecting to CAN Ports

The two CAN ports (P5 to P6) use terminal blocks. The pin definition refers to the figure below:

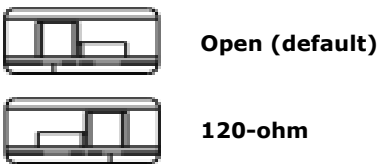


Pin	Definition
1	CAN_H
2	CAN_L
3	GND

Terminal resistance

There are slide switches for each CAN port at the right-bottom corner of the terminal block for the 120-ohm terminal resistance setting.

The definition is as follows:



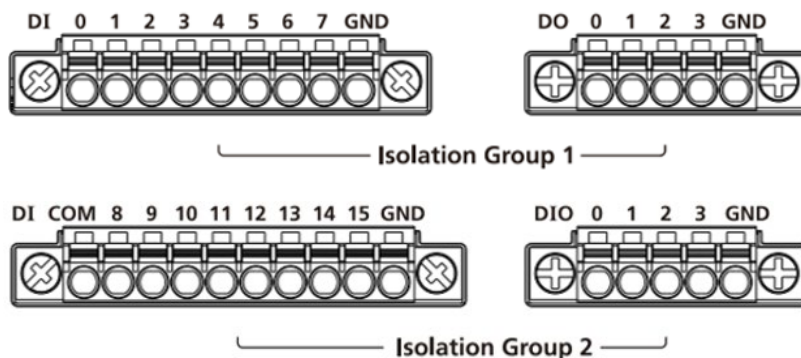
The wiring suggestion is using 16 to 24 AWG (1.31 to 0.21 mm²); the wire type should be copper (Cu).

Connecting Digital Inputs and Outputs

The VM-1220 Series features 16 DIs, 4 DOs, and 4 DIOs using terminal blocks. The DIO 0...3 can be configured separately to either digital input or digital output via software settings.

I/O Definition

For the definition and the wiring diagram, refer to the figure below:



I/O	Support I/O Type
DI 0...7	DI dry contact
DO 0...3	DO (Sink)
DI 8...15	DI dry or wet contact (sink or source)
DIO 0...3	DI mode: DI dry DO mode: DO (Sink)

The wiring suggestion is using 16 to 24 AWG (1.31 to 0.21 mm²); the wire type should be copper (Cu).

I/O Initial State

There are few ways to get DI or set DO status: either by **MCIM**, **I/O API** or **Moxa BESS software**. The meaning of DI/DO status corresponding to the electrical signal level refers to the table below:

I/O Type	Signal Level	MCIM	I/O API	Moxa BESS software
DI dry contact	Open	high	0	0
	Short to GND	low	1	1
DI wet contact - Sink/NPN	10 to 30 VDC	low	1	1
	0 to 3 VDC	high	0	0
DI wet - Source/PNP	10 to 30 VDC	low	1	1
	0 to 3 VDC	high	0	0
DO - Sink	Close	low	1	1
	Open	high	0	0

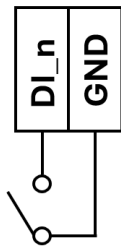


NOTE

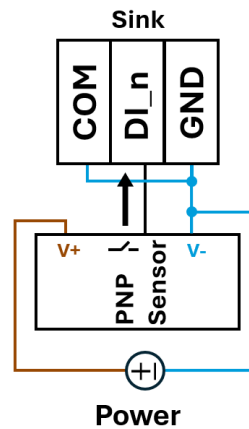
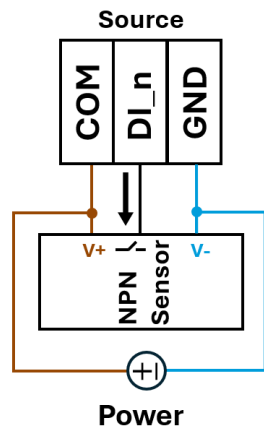
- For more details of **MCIM** (Moxa Computer Interface Manager), refer to **Moxa Industrial Linux Manual for VM-1220-T**.
- For more details of **I/O API**, refer to **vm-1220-t-programming-guide**.
- Moxa BESS software** only applies to **VM-1220-T-BESS** model. For more details, refer to **Moxa BESS Software User Manual**.

I/O Wiring

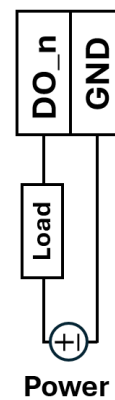
DI Dry Contact



DI Wet Contact

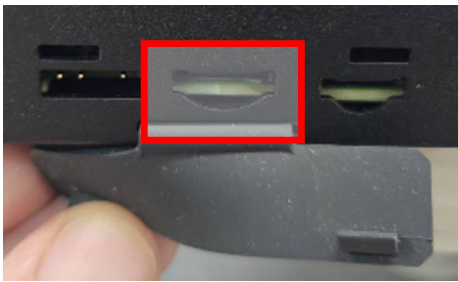


DO (Sink)



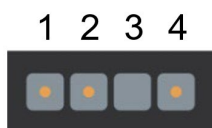
Inserting the microSD Card

The VM-1220 Series comes with a microSD socket for storage expansion. The microSD socket is in the rubber cover on the front panel. To install the card, remove the rubber cover to access the socket and insert the microSD card into the socket directly. You will hear a click when the card is in place. To remove the card, push the card in before releasing it.



Connecting to the Console Port

The console port is an RS-232 port inside a rubber cover and can be connected to a 4-pin header cable. Use this port for debugging or firmware upgrades.



Pin	Signal
1	TxD
2	RxD
3	NC
4	GND

Inserting the SIM Card

The VM-1220 computer comes with a SIM card socket that allows users to install a SIM card for cellular communication. To install the SIM card, remove the rubber cover to access the socket and insert the SIM card into the socket directly. You will hear a click when the card is in place. To remove the card, push the card in before releasing it.



Installing the Cellular Module

The VM-1220 Series comes with Mini PCIe sockets, allowing users to install a cellular module. Follow these steps to install the cellular module.

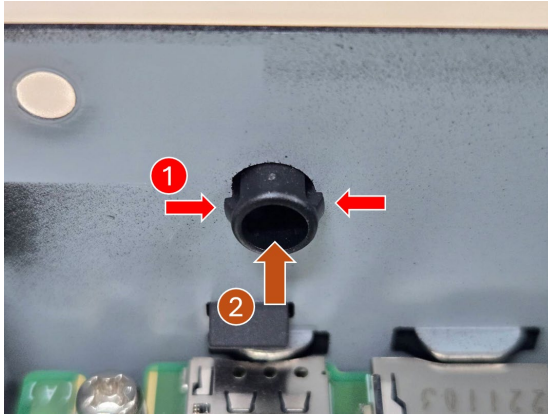
1. Remove all the terminal blocks and ten screws around the computer.



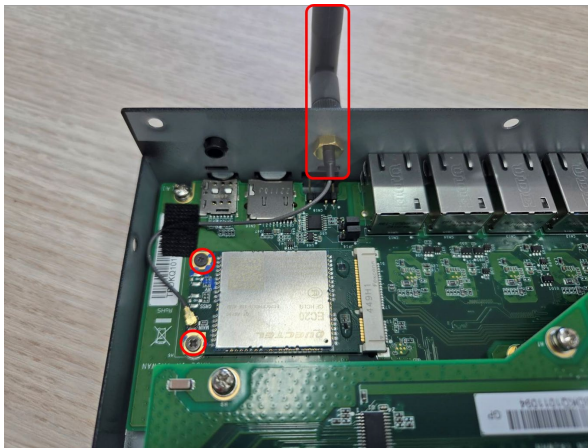
2. Remove the top cover of the computer. The socket is on the main board of the computer.



3. Remove the plug(s) on the front panel for installing the antenna later.



4. Install wireless module onto the socket and fasten the two screws on the module.
5. Install antenna(s) on the front panel and connect to the wireless module with cable(s).



6. When finished, replace the top cover and put the screws and terminal blocks back onto the computer.

A. Regulatory Approval Statements



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.

Class A: FCC Warning! This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the users will be required to correct the interference at their own expense.



European Community



WARNING

This is a class A product. In a domestic environment, this product may cause radio interference in which case the user may be required to take adequate measures.