Overview

EM-500 is a high cost performance industrial control gateway developed by Guangzhou ZHIYUAN Electronics Co., Ltd. for industrial control machines.

The EM-500 industrial control gateway adopts a 792MHz CPU as the main controller, with onboard 512MB DDR3 and 4GB eMMC. The EM-500 offers numbers of various functional interfaces, including RS232 (for debugging), 4 channels of isolated RS485, 3 channels of isolated CAN, 2 channels of Fast Ethernet, LVDS, TF card, 2 channels of USB2.0, 8 channels of optocoupler-isolated input(DI) and relay-isolated output(DO), 6 channels of high-side and low-side driver output(DO), 4 channels of ADC, MiniPCIE socket which support wireless modules with USB or UART interface, such as 4G modules, WiFi modules, LoRa modules, etc.

Feature

◆ 792MHz CPU;

◆ 512MB DDR3;

◆ 4GB EMMC;

◆ On board independent watchdog;

◆ Supports multi channel hardware interface

➢ Two 10/100M Ethernet interface;

➢ Two USB interface;

➢ Three isolated CAN-bus interface;

➢ Four isolated RS485 interface;

➢ One TF card interface;

➢ One DVI interface(LVDS signal);

➢ One miniPCIE interface;

➢ Four ADC interface;

➢ Eight DI interface;

➢ Fourteen DO interfaces;

➢ Support backup power for 5 seconds;

➢ Eight LED display

Product Application

◆ Industrial control;

◆ Industrial gateway

Ordering information

model	temperature range
EM-500	-40°C~+60°C

Product image

Revision History

Version	Date	Changes
V1.00	August 19, 2023	Initial Release.

Contents

1. Product Introduction

1.1 Product image

Figure 1 is the appearance of the EM-500 and the rear panel of the machine shown as Figure 2.

Figure 1   Product Appearance

Figure 2   Rear Panel of the Whole Machine

Note: The appearance of the product in order to prevail in kind. This document is only for illustration.

1.2 Main parameter

Table 1   EM-500 Main Parameters

Name	Main parameter
Processor	792MHz CPU
Memory	DDR3 512MB
Storage	EMMC 4GB
Watchdog	On board hardware watchdog
Working temperature	-40~+60℃
Working humidity	5%~95%
altitude	Below 2,000 meters

1.3 Hardware resource

Table 2　Hardware Resource Table

Hardware interfaces/peripherals	Quantity	Note
Ethernet	2 channel	10/100Mbps
USB	2 channel	Host
CAN-bus	3 channel	Isolated
RS485	4 channel	Isolated
RS232	1 channel	Debugging interface
TF card	1 channel	Standard TF card socket
LVDS	1 channel	The physical interface is DVI (including 1 USB for touch screen)
MiniPCIE interface	1 channel	Support wireless module with USB and UART interfaces
ADC	4 channel	0-20mA, 0-10V, accuracy 1%, sampling rate 40SPS
DI	8 channel	Optocoupler isolation
DO	8 channel	Relay isolation
DO	4 channel	High edge driver
DO	2 channel	Low edge driver
Supercapacitor	1 channel	Power outage endurance for 5S
LED indicator	8 channel	Among them, 4 channels are programmable

1.4 Software Resources

- RT Linux kernel;

- Ubuntu system;

- EMMC driver;

- Ext file system;

- LVDS display driver, LCD backlight driver, touch screen driver;

- USB Host driver, supporting USB keyboard, USB mouse, and USB disk;

- 100M Ethernet driver;

- CAN-Bus driver;

- RS485/RS232 driver;

- TF card driver, supporting hot swapping;

- I2C driver program, including RTC driver, etc;

- LED indicator driver;

- 4G module driver;

- Universal digital I/O driver;

- Buzzer driver;

- Watchdog and reset driver;

- ADC driver.

1.5 Application scope

- industrial control

- Industrial gateway

2. Electrical characteristics

2.1 Working conditions

Name	Work environment
input voltage	DC +12-+24V
Working temperature	-40 ℃~+60 ℃
Environmental humidity	5%~95%RH

Note:The EM-500 actual input voltage supports the deviation of 12~ 24v plus and minus 10%, which is the minimum not less than 10.8v, and the maximum is no more than 26.4v

This equipment is not suitable for use in locations where children are likely to be present.

2.2 Power and power consumption characteristics

Parameter	Name	Minimum	Typical	Maximum	Unit	Note
working voltage	VPower	12.0	24.0	24.0	V	
Rated power	PPower	-	8	12	W	CPU fully loaded, connect to LMT070DICFWD-AKA screen, all external interfaces running (with nothing connected to miniPCIE interface)

This product is intended to be supplied by a Listed Power Supply Unit which classified as LPS and ES1 and rated 24 V dc, 2000 mA.

2.3 Interface performance

2.3.1 System frequency parameters

Name	Minimum	Typical	Maximum	Unit	Note
System main frequency	-	792	-	MHz	Maximum 792MHz

2.3.2 TF card storage performance parameters

Parameter	Test conditions	Minimum	Typical	Maximum	Unit	Test TF card
Write speed	Write 10/100/1000MB of data	0.47	4.2	4.9	MB/s	SanDisk TF card 16GB
Reading speed	Read 10/100/1000MB of data	1.5	18	18.5	MB/s	SanDisk TF card 16GB

Figure 3   Testing TF Card

2.3.3 USB storage performance parameters

Parameter	Test conditions	Minimum	Typical	Maximum	Unit	Test USB disk
Write speed	Write 10/100/1000MB of data	0.438	6.365	7.02	MB/s	Lenovo USB drive 32GB
Reading speed	Read 10/100/1000MB of data	1.5	17.241	23.2	MB/s	Lenovo USB drive 32GB

Figure 4   Testing USB drive

Note: When the USB interface is connected to an external load, the current of a single interface should not exceed 500mA.

2.3.4 DI interface performance parameters

Interface screen name	Signal type	Input high-level effective voltage	Input low-level invalid voltage	Note
HDI1~HDI4	Wet node	9~24V	0-7V	
LDI1~LDI4	Dry node	-	-	For external passive switch use

2.3.5 DO interface performance parameters

Interface screen name	Interface type	Continuous current (on load)	Prototype version	Note
HSD1~HSD4	High-side driver	2A	S0.01	Used in conjunction with GND
LSD1~LSD2	Low-side driver	0.8A	S0.01	Used in conjunction with VCC
DO1~DO4	Mechanical relay	4A/24V DC 1A/250V AC	S0.01	Under the 4A load, the time interval between each relay on/off should not be less than 15S
DO5~DO8	Solid-state relay	0.25A	S0.01	-

Note: The high-side driver shared the same the input power supply of the entire machine with low-side driver, and the maximum total load of both driver should not exceed 4A.

2.3.6 LVDS interface performance parameters

Interface screen name	Socket	Maximum Drive Screen Load	Note
LVDS	DVI	5W	Detailed pin definitions can be found in the hardware interface section

2.3.7 Debug serial port performance parameters

Interface screen name	Socket	Interface level	Default Baud Rate	Note
Debug	DB-9 base	RS232 standard level	115200	Detailed pin definitions can be found in the hardware interface section

2.3.8 RS485 interface performance parameters

Interface screen name	Socket	Interface level	Baud Rate	Note
485A1~485A4 485B1~485B4 485G1~485G4	OPEN 3.81 Industrial socket	RS485 standard level	4800/9600/19200/115200	Detailed pin definitions can be found in the hardware interface section

2.3.9 CAN interface performance parameters

Interface screen name	Socket	Interface level	Baud Rate	Note
CANH1~CANH3 CANL1~CANL3 CANG1~CANG3 CANA1~CANA3	OPEN 3.81 Industrial socket	CAN standard level	5kbps~1000kbps	Detailed pin definitions can be found in the hardware interface section

2.3.10   Ethernet interface performance parameters

Interface screen name	Socket	Test conditions	Sending rate	Receiving rate	Note
NET1	Report RJ45 socket	one-way	92.648Mb/s	94.872Mb/s	-
NET2	Report RJ45 socket	one-way	93.32Mb/s	94.784Mb/s	-

2.3.11 ADC interface performance parameters

Interface screen	Socket	Input current	Input voltage	Accuracy	Note
ADC1~ADC4	OPEN 3.5	0-20mA	0-10V	1%	-

AGND	industrial socket				

2.4 electromagnetic compatibility

Test project	Test standards	Test interface	Test level	Note
Electrostatic discharge immunity test	GB/T 17626.2-2018/IEC61000-4-2:2008	Contact discharge 6KV: Power interface CANH/CANL LDI/DO (LDI1~LDI4, DO1~DO8) RS485 interface HDI/LSD/HSD DEBUG interface Antenna interface Ethernet interface USB interface LVDS interface Air discharge 8KV: SIM card slot TF card slot indicator light reset hole	Level 3	CANA/CANG contact discharge 4KV
Electrical fast transient pulse group immunity test	GB/T 17626.4-2018/IEC61000-4-4:2012	Power interface RS485 interface CAN interface Ethernet interface	Level 3	-
Lightning (surge) immunity test	GB/T 17626.5-2019/IEC61000-4-5:2014	Power interface RS485 interface CAN interface Ethernet interface	Level 3	-
Conducted disturbance immunity test induced by radio frequency field	GB/T 17626.6-2017/IEC61000-4-6:2013	RS485 interface CAN interface Ethernet port	10V	-
Conducted disturbance test	GB/T 6113.201-2018/CISPR 16-2-1:2017	Power and signal ports	Class A	-

Note: The DI/DO interface does not undergo EFT testing.

2.5 Environmental adaptability

Test project	Test standards	Test condition	Result
Low temperature startup	GBT 2423.1-2008	-42 ℃	PASS

and operation test			
High temperature startup and operation test	GBT 2423.2-2008	+72 ℃	PASS
Constant damp heat test	GB/T 2423.3-2016	+42 ℃/95% RH	PASS
Temperature change test	GB/T 2423.22-2012	-42 ℃~+72 ℃	PASS

3. Mechanical dimensions

3.1 Contour size

Figure 5 shows the dimensions of the em-500 whole machine.
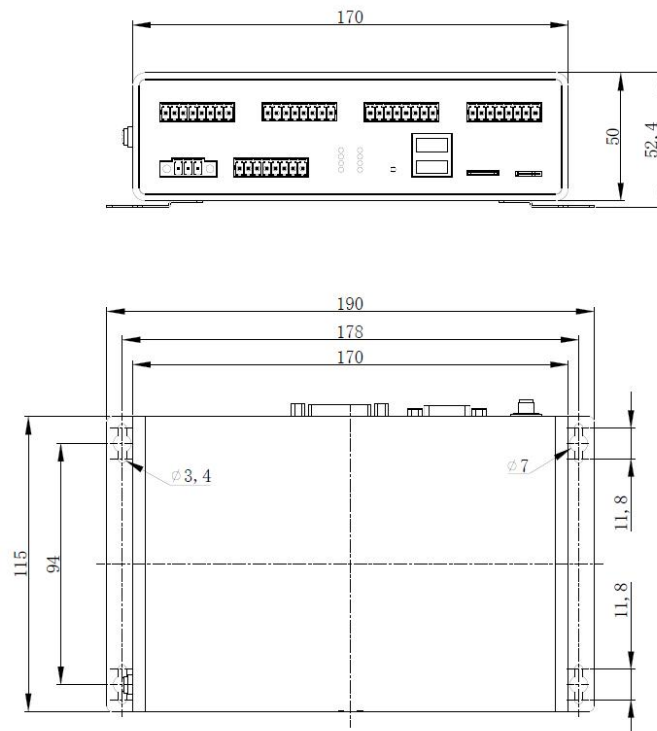

Figure 5   Outline Dimension Diagram

3.2 Installation schematic

3.2.1 Mounting to cabinet

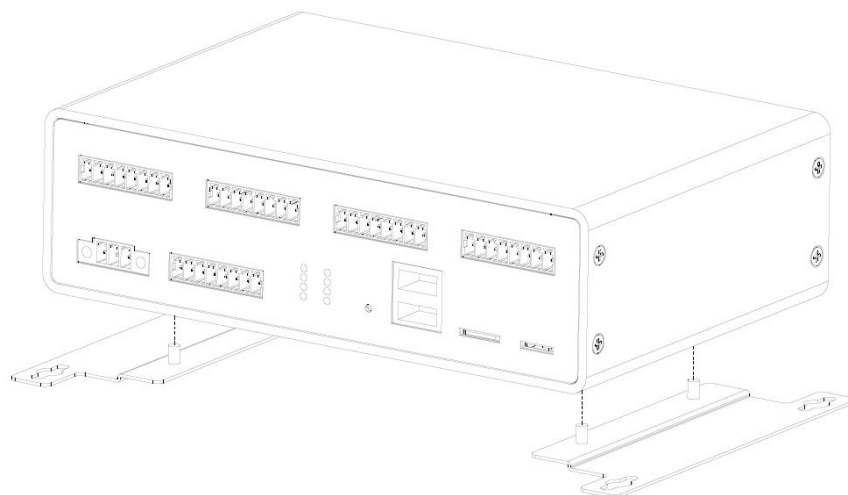Install the scaffold to the product,as shown in figure 6.

Figure 6   Installation schematic

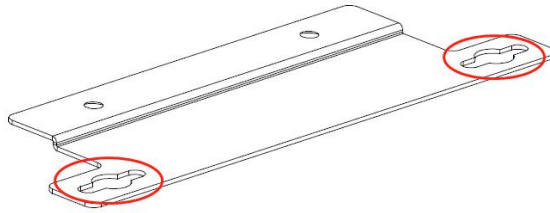Use the combination screw(PM3*10,D=5.5,washers=9) to anchor the product holder to the cabinet.

Figure 7   Installation bracket schematic

3.2.2 Install to DIN guide

Install the din support to the product with a metric sunk head screw(KM3*8,D=6) and then install the stent to the DIN guide.
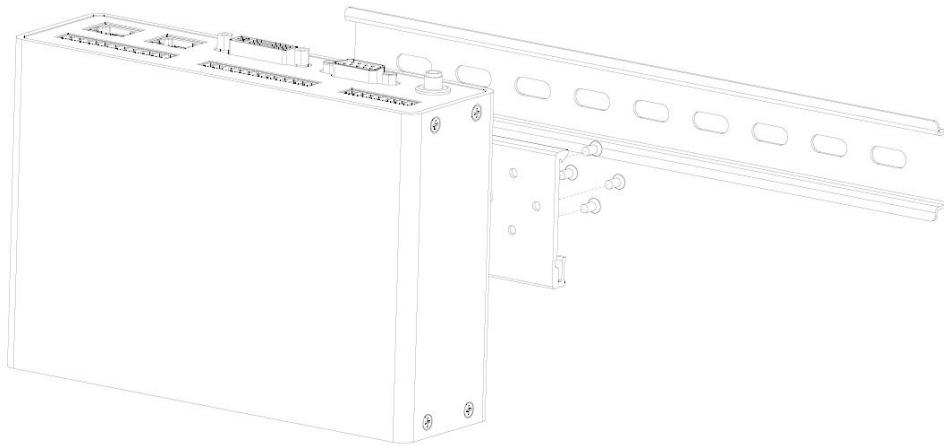

Figure 8   DIN guide installation schematic

4. Accessories supported

The accessories supported by EM-500 are as follows Table3.

Table3　List of Accessories Supported

Number	Accessory Name	Model	Manufacturer	Note
1	Hardware bracket	DIN rail bracket, 48 * 37 * 9.5mm, aluminum	ZLG	/
2	4G module	EC200U-CN	QUECTEL	LTE Cat1 Wireless Communication Module
3	4G module	EC200A-CN	QUECTEL	LTE Cat4 Wireless Communication Module
4	4G module	EC20	QUECTEL	LTE Cat4 Wireless Communication Module
5	4G module	SLM770A	MEIGLink	LTE Cat4 Wireless Communication Module
6	4G module	EG21-G	QUECTEL	LTE Cat1 Wireless Communication Module
7	4G module	EG25-G	QUECTEL	LTE Cat4 Wireless Communication Module
8	2G module	BG95-M3	QUECTEL	LTE Cat-M1 Wireless Communication Module
9	4G module	EG912U-GL	QUECTEL	LTE Cat1 Wireless Communication Module
10	4G module	L610-CN	FIBOCOM	LTE Cat1 Wireless Communication Module
11	4G module	NL668	FIBOCOM	LTE Cat4 Wireless Communication Module
12	LCD display screen	LMT070DICFWD-AKA	TOPWAY	7 inches, 800 * 480, resistive touch
13	LCD display screen	LMK104DNEFWU-AKA	TOPWAY	10.4 inch, 800 * 600, resistive touch
14	LCD kit	LCD-1280800W101TC	ZLG	10.1-inch, 1280 * 800
15	DVI connection cable	DVI-I24+5, SIGE	TOPWAY	Connecting the LCD display screen
16	DVI connection cable	SAMZHE 1.5m 25-pin DVI male to male	SAMZHE	Connecting the LCD display screen
17	USB WiFi	AC650 (chip: RTL8821CU)	UGREEN	Supports front panel USB port insertion and use
18	USB WiFi	FW150US (chip MT7601U)	BROADCOM	Supports front panel USB port insertion and use
19	USB WiFi	AC1300 (chip RTL8822BU)	UGREEN	Supports front panel USB port insertion and use

20	USB Bluetooth	CSR8510 (Blue 4.0 chip BCM2046)	BROADCOM	Supports front panel USB port insertion and use
21	USB Bluetooth	Youlian/Youlian (Blue 5.1 chip RTL8761B)	UGREEN	Supports front panel USB port insertion and use
22	USB Bluetooth	AC1300 Bluetooth&WiFi (Blue 5.0 chip RTL8822Bu)	UGREEN	Supports front panel USB port insertion and use

Note: The display signal format supported by the product is JEIDA, and VESA format is not supported.

5. Packing list

The product packing list for EM-500 is shown in Table 4.

Table 4　Packing List

Number	Material code	Name	Model	Quantity	Note
1		ARM industrial computer	EM-500	1	
2	19.04.00293	Terminal blocks	3.81-03P	1	Power wiring terminal, been plugged on the gateway
3	19.04.00209	Terminal blocks	3.81-12P	2	RS485 and CAN-Bus terminal blocks, been plugged on the gateway
4	19.04.00021	Terminal blocks	3.5-08P	6	DI/DO and ADC terminal blocks, been plugged on the gateway
5	24.08.00175	Hardware bracket	DIN rail bracket, 48 * 37 * 9.5mm, aluminum	1	Guide rail installation accessories
6	27.01.00084	Metric screw	M3 * 8, countersunk head	4	DIN rail bracket fixing screws
7	27.03.00009	Combination screw	PM4 * 8 triple combination flat washer	1	Side grounding screw
8	30.07.00001	Certificate of conformity	Certificate of conformity	1	Certificate of conformity

6. Disclaimers

Based on the principle of providing better service to users, Guangzhou ZHIYUAN Electronics Co., Ltd. (hereinafter referred to as "ZHIYUAN Electronics") will present detailed and accurate product information to users as much as possible in this manual. However, due to the timeliness of the content in this manual, ZHIYUAN Electronics cannot fully guarantee the timeliness and applicability of this document at any time. ZHIYUAN Electronics reserves the right to update the content of this manual without prior notice. In order to obtain the latest version of information, please visit the official website of ZHIYUAN Electronics regularly or contact the staff of ZHIYUAN Electronics. Thank you for your tolerance and support!

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customer first, professional focus, and focus on being

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