

EdgeBox-ESP-100 User Manual

V1.0

A light weight IoT controller for industrial applications



Revision History

Revision	Date	Changes
1.0	01-08-2022	Initial

Explanation of symbols used

The following symbols are used in these instructions:



NOTE

NOTE indicates tips, recommendations and useful information on specific actions and facts.



NOTICE

NOTICE indicates a situation which may lead to property damage if not avoided.



CAUTION

CAUTION indicates a dangerous situation of risk

EdgeBox-ESP-100 User Manual

Contents

1.	Introduction.....	1
1.1.	Features.....	1
1.2.	Interfaces.....	2
1.3.	Block Diagram.....	4
2.	Installation and Wiring.....	5
2.1.	Mounting.....	5
2.2.	Connectors and Interfaces.....	6
2.2.1.	Multi-Func phoenix connector.....	6
2.2.2.	Serial Port (CAN BUS and RS485).....	7
2.2.3.	Ethernet.....	8
2.2.4.	LED.....	8
2.2.5.	SMA Connector.....	9
2.2.6.	SIM card slot.....	10
2.2.7.	Reset button.....	10
2.3.	GPIO Multiplex.....	11
2.4.	I2C.....	12
2.4.1.	I2C devices.....	12
2.4.2.	I2C PIN Map.....	12
3.	Main board.....	13
3.1.	4G/LTE.....	15
3.2.	Programming/Debug port.....	16
3.3.	Analog Input.....	17
3.4.	Analog Output.....	18
4.	Drivers and Programming.....	19
5.	Applications.....	19
6.	Electrical specifications.....	19
6.1.	Power consumption.....	19

1. Introduction

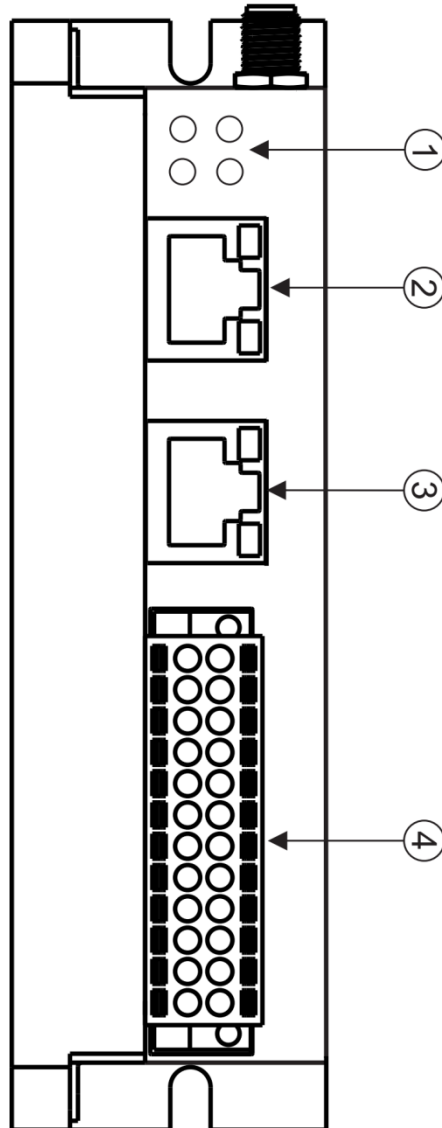
EdgeBox-ESP-100 enabled SCADA equipment via software selectable 4G/LTE to remote networks or select Industrial Internet of Things (IIoT) Cloud platforms. Featuring an event-based engine that can trigger I/O or send SMS text messages based on real-time operational data, EdgeBox-ESP-100 controller can perform advanced local edge control and alert personnel of critical events. A built-in I/O concentrator allows the controller to collect sensor data and optimize cellular data consumption by optionally reporting only on an exception or only transmitting relevant data points. With built-in Ethernet, serial, I/O and GPS, EdgeBox-ESP-100 controller easily integrate with existing equipment enabling remote monitoring and control for M2M applications in industries including oil and gas, water, utility, transportation and mining.

1.1. Features

- Rugged, reduced-maintenance hardware
- High isolation, surge, and short circuit protection
- Open architecture support custom programming
- Ethernet, I/O ,4G/LTE, CANopen and Modbus bridging
- Natively Supports Modbus & CANopen Protocols
- Cloud Connectivity to IIoT Cloud Platforms
- Integrated wired solution for all analog and discrete I/O interface designs
- IEC 61131-3 compliant programs support (under developing)
- 35mm DIN Rail support
- Wide power supply from 1.8 to 36V DC

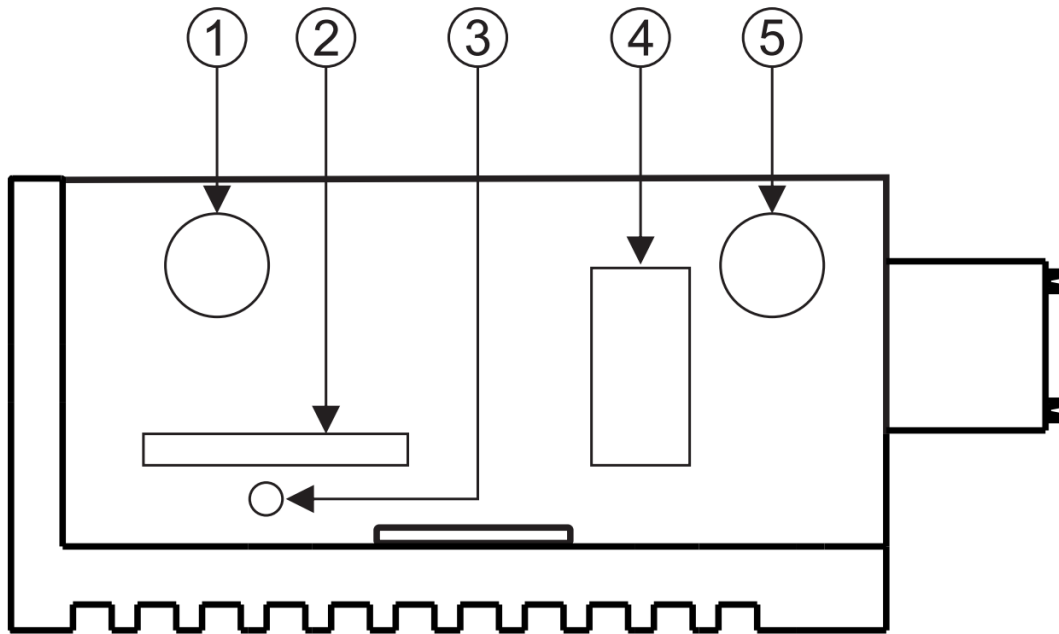
These features make the EdgeBox-ESP-100 designed as a cost-effective controller that provides the functions required for a variety of field automation applications. The EdgeBox-ESP-100 monitors, measures, and controls equipment in a remote environment. It is ideal for applications requiring flow computation; Proportional, Integral, and Derivative (PID) control loops; logic sequencing control; and a gateway with flexible wireless and field sensors expansion.

1.2. Interfaces



1. LED
2. EtherNET
3. CAN bus and RS485
4. Multi-Func phoenix connector

EdgeBox-ESP-100 User Manual



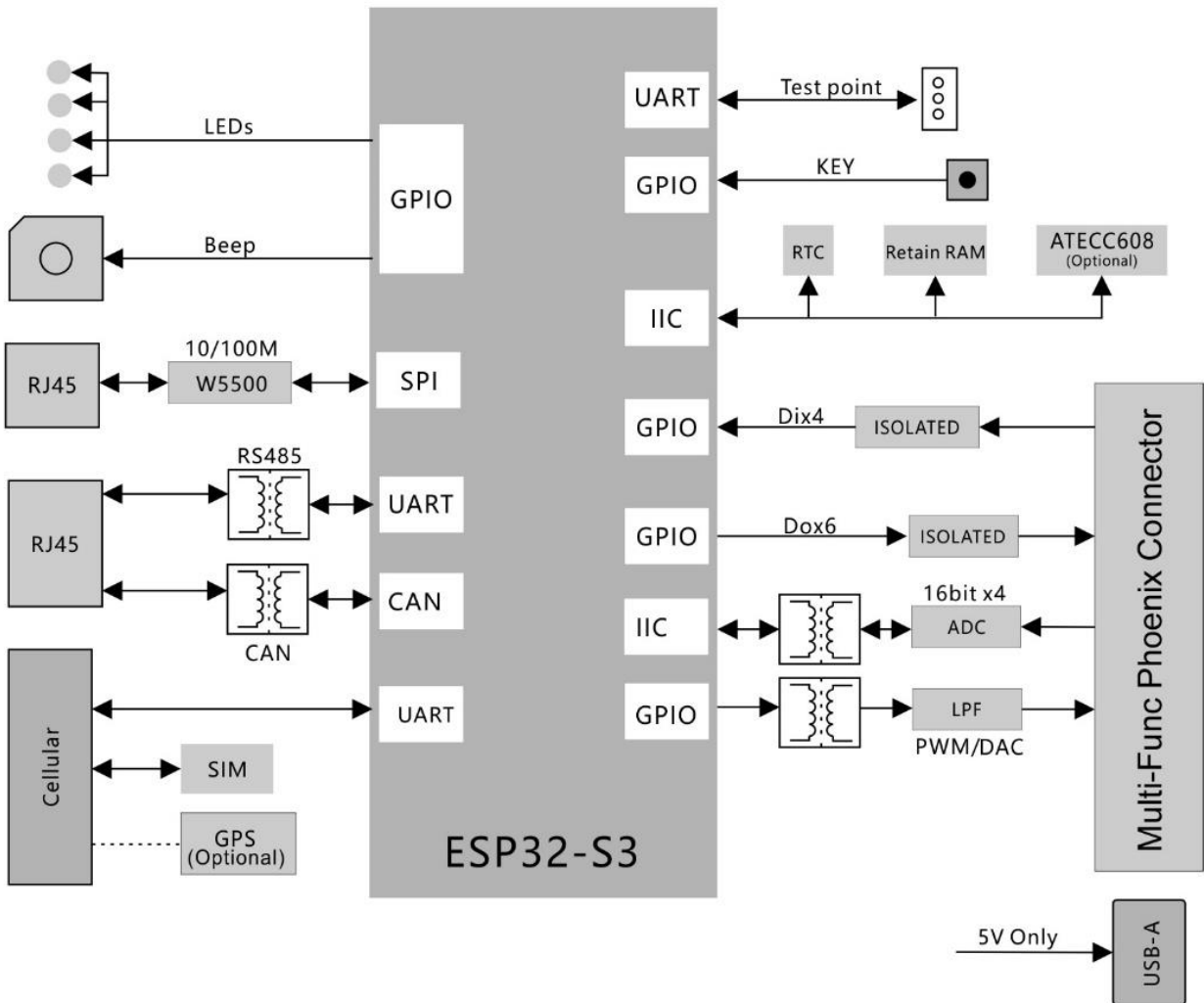
1. Ant.1
2. SIM CARD
3. Reset
4. USB PORT (5V power output only)
5. Ant.2

NOTE:

- 1.The Ant.1 is used for WI-FI signal, and Ant.2 is used for 4G/LTE in default.
- 2.The USB port if ONLY used for 5V power output, no USB function.

1.3. Block Diagram

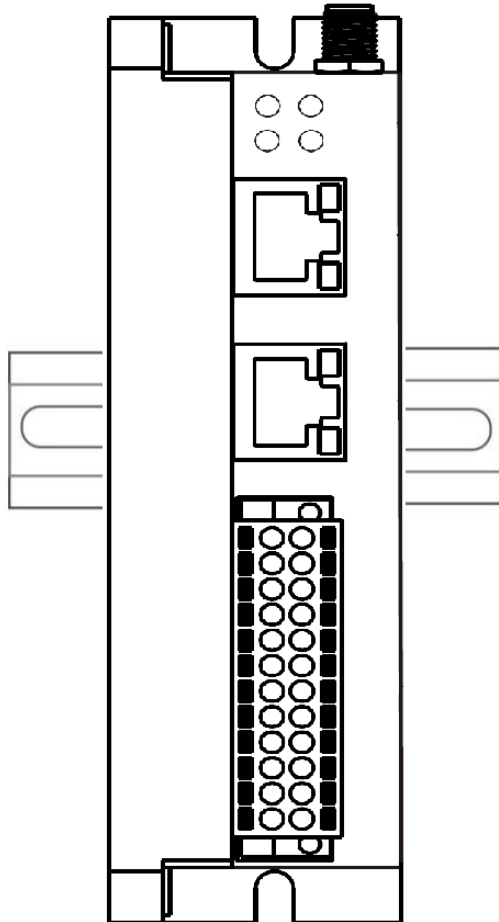
The whole controller is built around ESP32 SOC. Refer to next figure for the block diagram.



2. Installation and Wiring

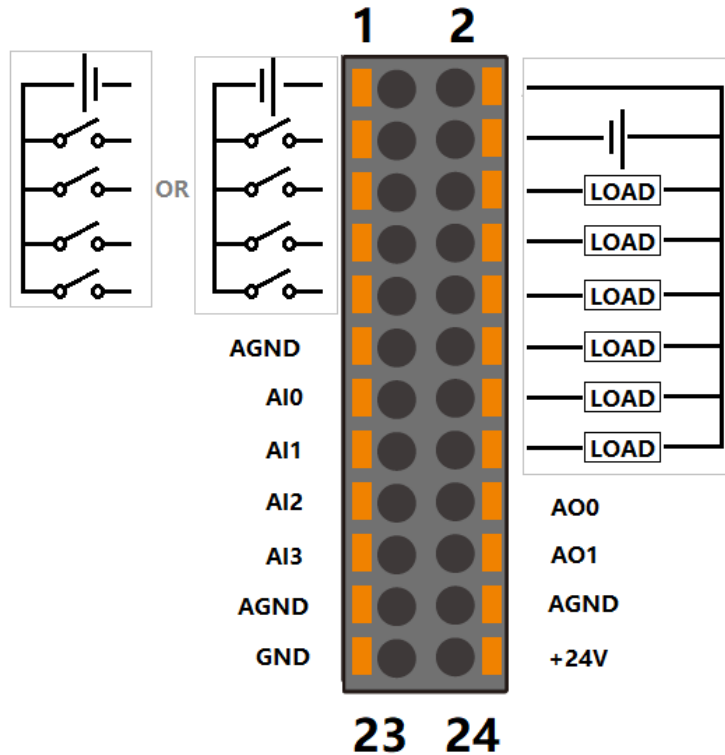
2.1. Mounting

DIN-rail mount is recommended. Refer to next figure for mounting orientation.



2.2. Connectors and Interfaces

2.2.1. Multi-Func phoenix connector

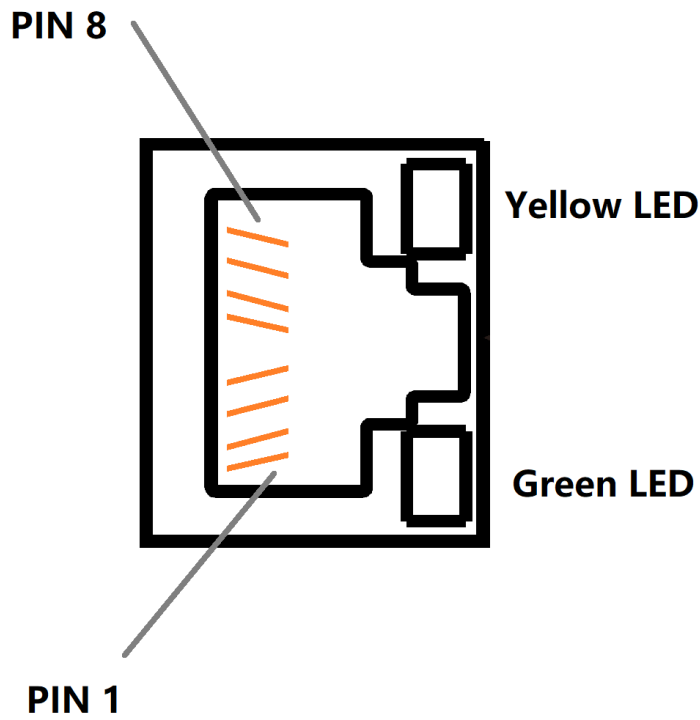


Note	Func name	PIN #	PIN#	Func name	Note
	S/S	1	2	DO_24V	
	DI0	3	4	DO_0V	
	DI1	5	6	DO0	
	DI2	7	8	DO1	
	DI3	9	10	DO2	
	AGND	11	12	DO3	
	AI0	13	14	DO4	
	AI1	15	16	DO5	
	AI2	17	18	AO0	
	AI3	19	20	AO1	
	AGND	21	22	AGND	
	GND	23	24	+24V	

NOTE:

- 1.24awg to 16awg cable are suggested.
- 2.GND and AGND are isolated.
- 3.All AGND signals are connected internally.
- 4.DC voltage for input is 24V(+/- 10%).
- 5.DC voltage for output should be 24V(+/- 10%). , the current capacity is 1A.

2.2.2. Serial Port (CAN BUS and RS485)



Pin#	Signal	Description
4	CAN_H	CAN
5	CAN_L	CAN
7	RS485_A	RS485
8	RS485_B	RS485
1,2,3,6	N.C	Not used
Green LED	LED CAN	Active when TX and RX of CAN BUS
Yellow LED	LED RS485	Active when TX and RX of RS485

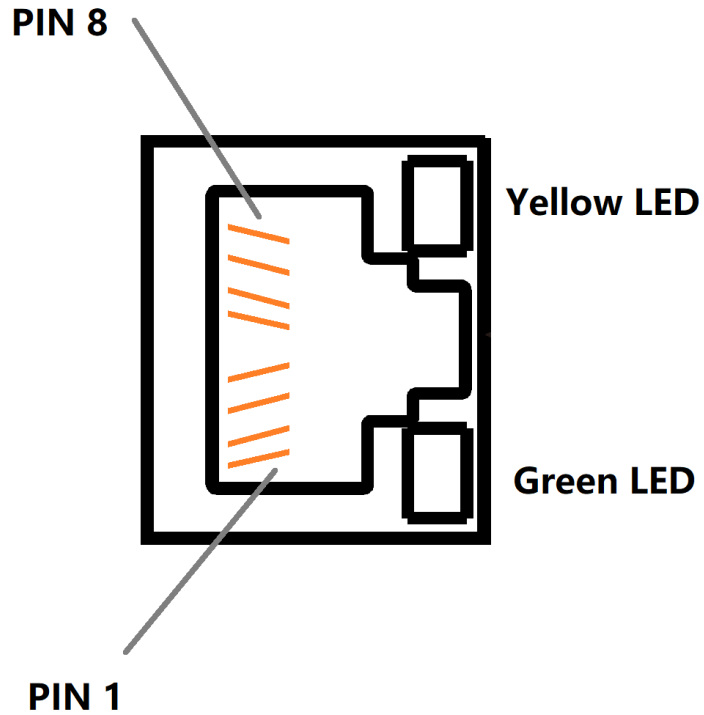
NOTE:

1. The 120 Ohm termination resistor for RS485 has been installed inside.
2. The 120 Ohm termination resistor for CAN BUS has been installed inside.

EdgeBox-ESP-100 User Manual

2.2.3. Ethernet

Ethernet interface comes from W5500, and connected ESP32 with SPI signals, 10/100-BaseT supported, available through the shielded modular jack. Twisted pair cable or shielded twisted pair cable can be used to connect to this port.



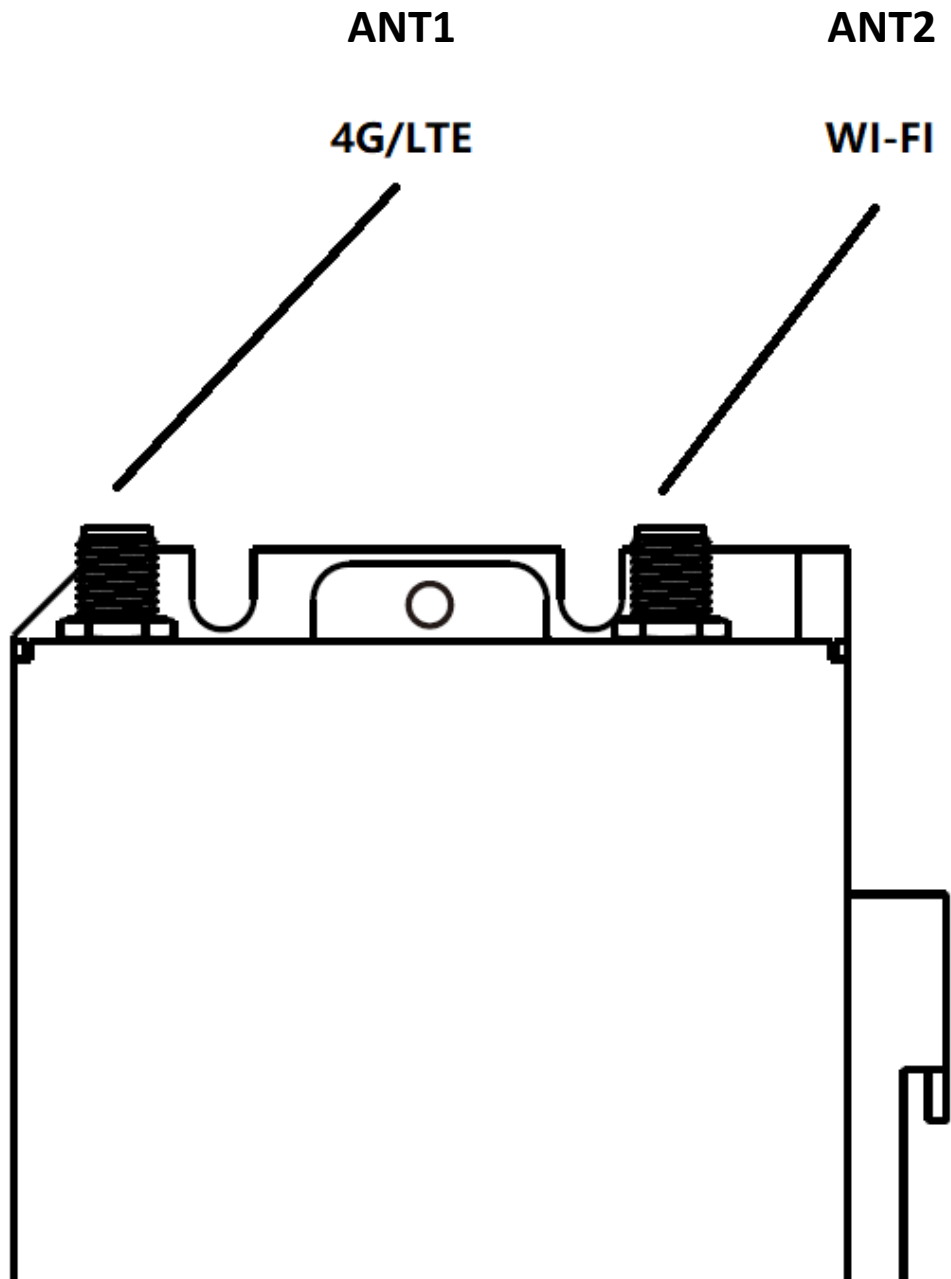
Pin#	Signal	Description
1	TXP	
2	TXN	
3	RXP	
6	RXN	
4,5,7,8	N.C	Not used
Green LED	LINK	Active when LINK UP
Yellow LED	ACTIVE	Active when TX and RX data come through

2.2.4. LED

LED	Signal	Description
PWR	Power supply	
Cellular	4G/LTE	
ACT		Multiplexed with U0TXD
ERR		Multiplexed with U0RXD

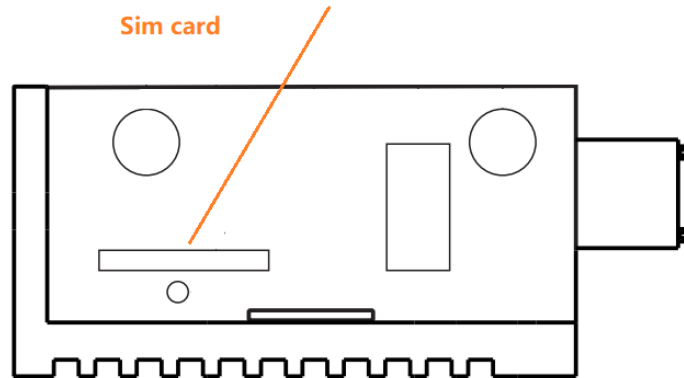
2.2.5. SMA Connector

There are two SMA Connector holes for antennas. The ANT1 is default used for Mini-PCle socket and ANT2 is for Internal WI-FI signal from CM4 module.

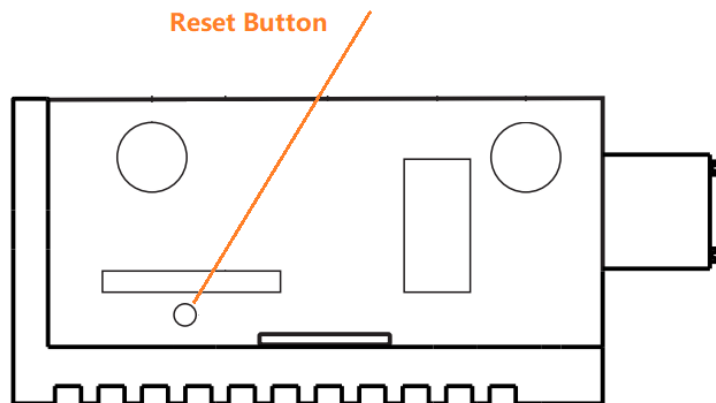


2.2.6. SIM card slot

The sim card is only needed in cellular network mode.



2.2.7. Reset button



The reset button has multiple functions.

1. When power up, the button is used to boot in download mode, it is useful if the OTA mode is crash.
2. In APPs, the user software can use the button to “RESET” to default user configurations, such as IP Address, Wi-Fi information, or other behavior and action.

EdgeBox-ESP-100 User Manual

2.3. GPIO Multiplex

All used PINs are multiplexed as following figure.

Name	IO of ESP32	Type	Function
DO0	IO40	Digital output	Digital output 0
DO1	IO39	Digital output	Digital output 1
DO2	IO38	Digital output	Digital output 2
DO3	IO37	Digital output	Digital output 3
DO4	IO36	Digital output	Digital output 4
DO5	IO35	Digital output	Digital output 5
DI0	IO4	Digital input	Digital input 0
DI1	IO5	Digital input	Digital input 1
DI2	IO6	Digital input	Digital input 2
DI3	IO7	Digital input	Digital input 3
AO0	IO42	Analog output	Analog output 0
AO1	IO41	Analog output	Analog output 1
RS485	IO17	U1TXD	
	IO18	U1RXD	
	IO8	RS485_RTS	
4G/LTE	IO48	U2TXD	WWAN
	IO47	U2RXD	
	IO21	PWR_KEY	
	IO16	PWR_EN	
Ethernet	IO10	FSPI_CS0	Connected to W5500
	IO11	FSPI_MISO	
	IO12	FSPI_MOSI	
	IO13	FSPI_SCLK	
	IO14	INT#	
	IO15	RST#	
CAN_TXD	IO1	CAN BUS	
CAN_RXD	IO2	CAN BUS	
TXD0/LED_ACT#	U0TXD		Programming/Debug and LED driver
RXD0/LED_ERR#	U0RXD		
Beep	IO45	Beep	High active enables Buzzer
Reset	IO0	Reset button	
I2C	IO19		I2C_SCL
	IO20		I2C_SDA
	IO9		Alarm or wake up from PCF8563

2.4.I2C

2.4.1.I2C devices

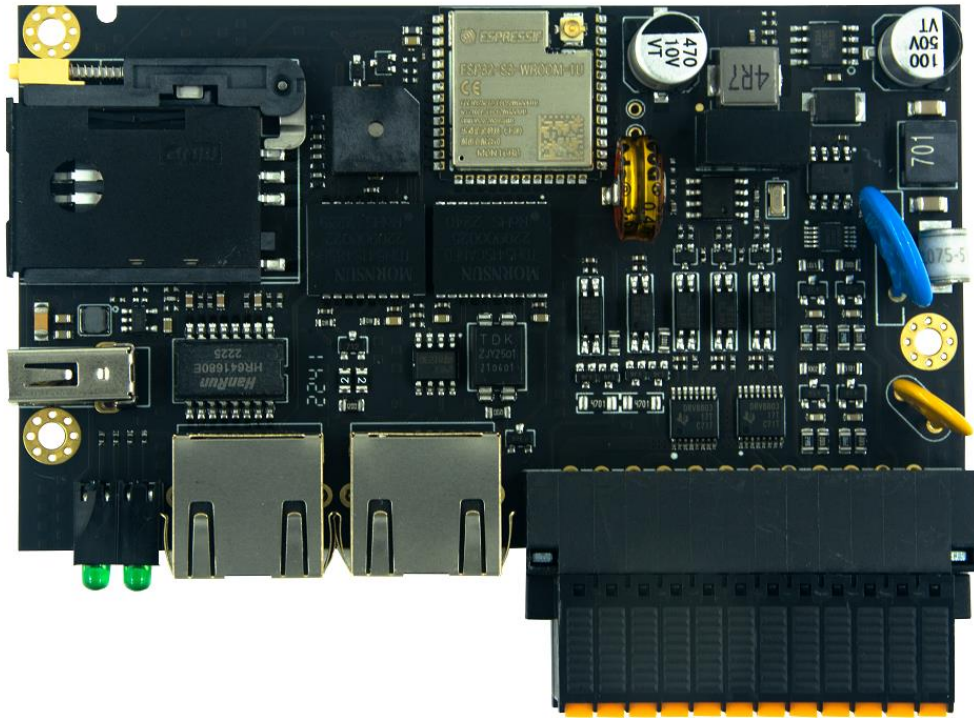
Device	Address	Function
FM24CL64B	0x50	Retain memory
PCF8563	0x51	RTC
Atecc608a	0x68	Crypto device
ADS1115 Or SGM58031	0x48	ADC

2.4.2.I2C PIN Map

I2C PIN	ESP32 IO
I2C_SDA	IO20
I2C_SCL	IO19
I2C_INT	IO9

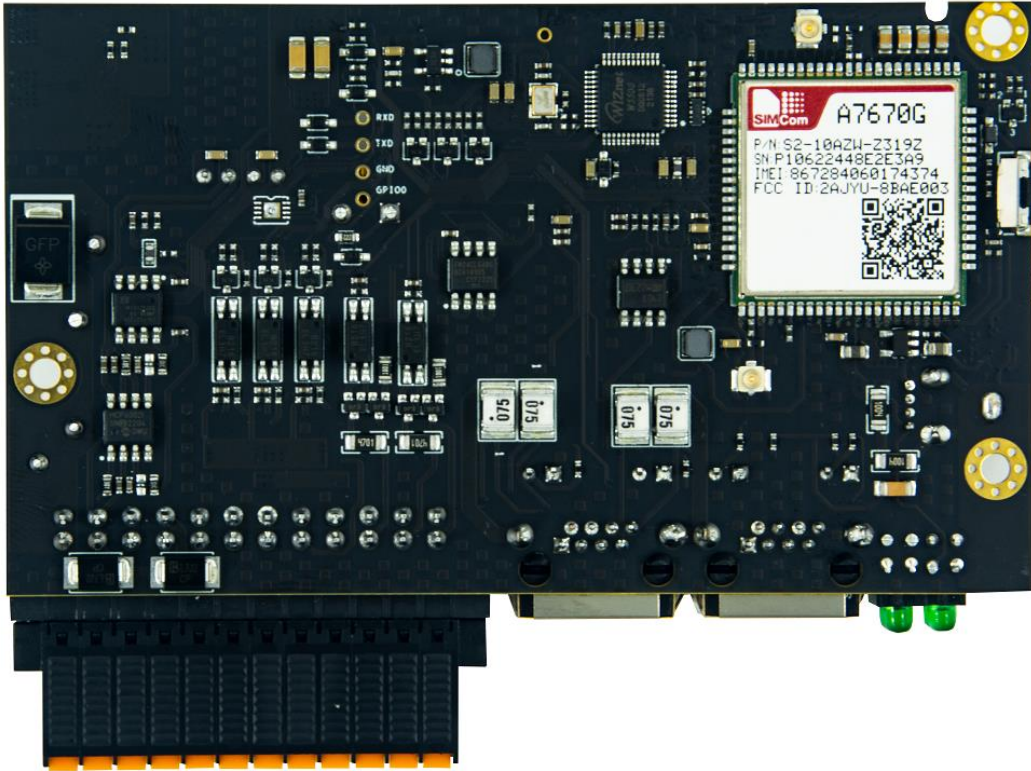
3. Main board

Top

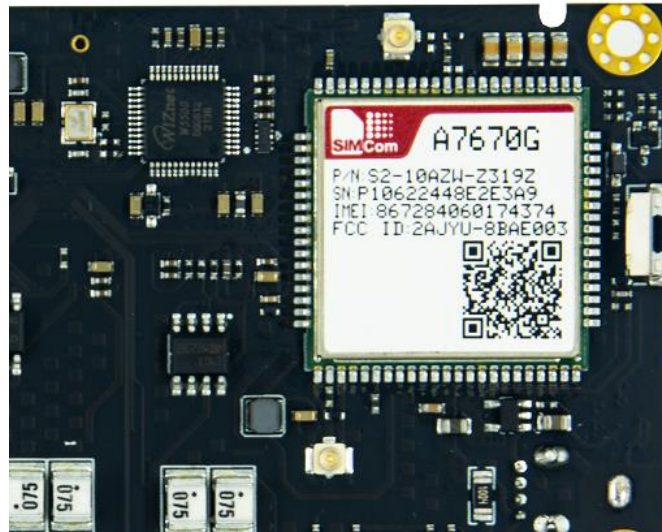


EdgeBox-ESP-100 User Manual

Bottom

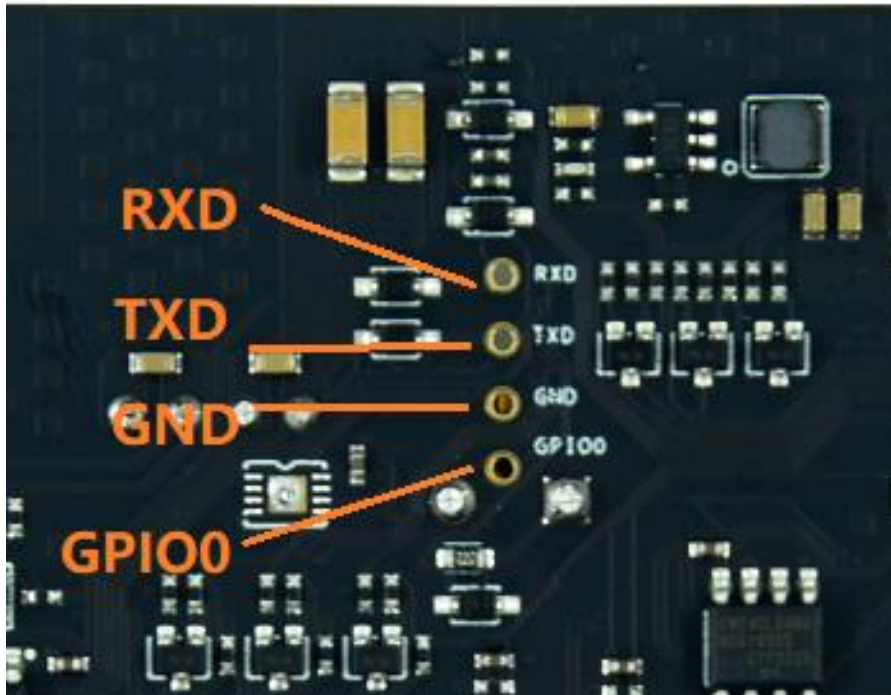


3.1.4G/LTE



A7670G 4G module	ESP32 IO	function
Enable power for A7670G through SY8089A	IO16	PWR_EN
PWRKEY	IO21	PWR_KEY
RXD	IO48	U2TXD
TXD	IO47	U2RXD

3.2. Programming/Debug port

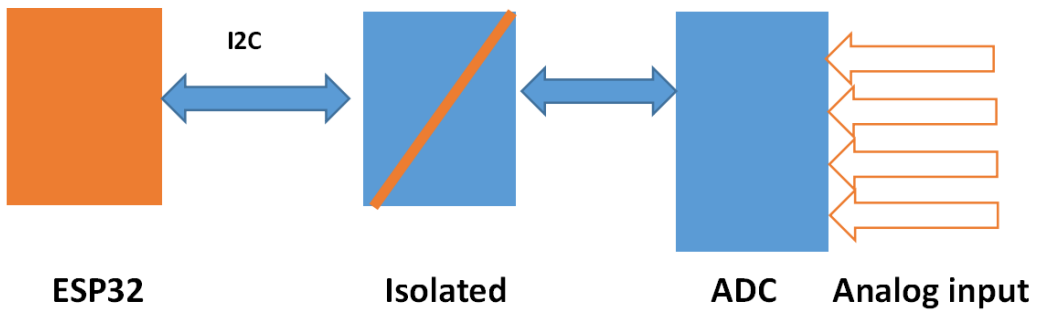


The GPIO0 is also connected to the Reset Button. And the RXD, TXD of UART0 are used in download mode. These allow the users to develop the EdgeBox-ESP-100 in bare meta.

Debug port	ESP32 IO	Other Function
RXD	RXD0	LED_ACT#
TXD	TXD0	LED_ERR#
GND	GND	
GPIO0	IO0	RESET Button

3.3. Analog Input

The AI (analog input) section of the controller is built around analog-to-digital converter ADS1115 or compatible with it. The resolution of the ADC is 16bit.



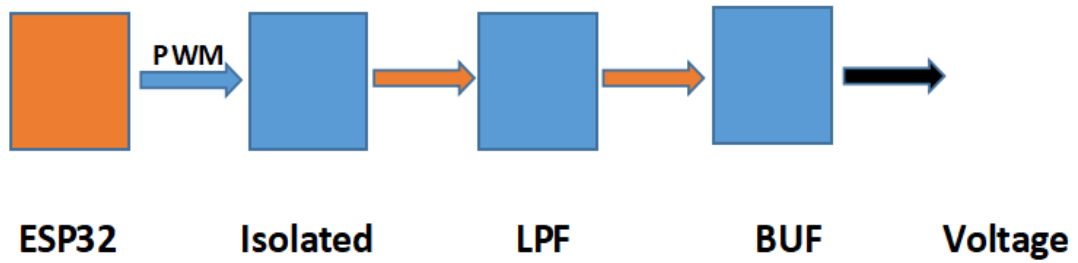
SGM58031 (I2C address 0X48)	IO
CH1+	AI0
CH2+	AI1
CH3+	AI2
CH4+	AI3
SDA	IO20/I2C_SDA
SCL	IO19/I2C_SCL

NOTE:

1. The default input type is 4-20ma.
2. 0-10V Input type is optional.

3.4. Analog Output

The dual AO channels are made up by PWM and LPF technology.



Analog output	ESP32 IO
AO0	IO42
AO1	IO41

4. Drivers and Programming

TBD

5. Applications

TBD

6. Electrical specifications

6.1. Power consumption

The power consumption of the EdgeBox-ESP-100 strongly depends on the application, the mode of operation and the peripheral devices connected. The given values have to be seen as approximate values.

Note: On condition of power supply 24V

Mode of operation	Current(ma)	Power	Remark
Idle	81		