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E64-T100S2 Datasheet V1.0

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1. Introduction

E64-T100S2

1.1 Feature

E64-T100S2



E64-T100S2 is applicable for star network with low power consumption. The biggest feature is to support at most 31 slaves send data to master at the same time and WOR mode for slaves(the average current is below 30uA). Data reliability and accuracy are guaranteed by strict data parity and automatic re-transmission mechanism between master and slave.

E64-T100S2 can be either master or slave. When module works as master, it can monitor and receive data from slaves. And when module works as slave, it can be set to work at WOR mode or slave-transmitter mode. WOR mode allows master send data to initiate slave, while slave-transmitter mode only allows slave to send data to master initiative.

E64-T100S2 is a 100mW wireless transceiver module, operates at 425-451.3MHz. User can access the module via UART interface, I/O level is 3.3V and have 5V tolerance. The input of the power is 2.1V-5.5V.

No.	Feature	Description
1	Star network	Support at most 31 slaves send data to master at the same time. Eight groups of network can be run simultaneously in the same area, and 31 slaves for each group.
2	Handshake	The handshake between the master and the slave will make the whole communication more reliable. Once one of the transceivers starts a communication and the communication is being interfered, the transmitter will retransmit the data for at most three times. The result of the communication will be given to the user.
3	Ultra-low power consumption	WOR (wake on radio) , especially suitable for battery powered applications. When module works at slave-receiver mode (mode 2), the module' s maximum receiving response time is 2000ms, which the average current is below 30uA.
4	FEC	Forward Error Correction, high coding efficiency & good correction performance. In the case of sudden interference, it can correct the interfered data packets automatically, so that the reliability & transmission range are improved correspondingly. Without FEC, those date packets can only be dropped.
5	Encryption Algorithm	The module has the function of data encryption & compression. The data transmitted features randomness. With such function, data interception becomes pointless. Data compression can decrease the transmission time & probability of being interfered, while improving the reliability & transmission efficiency.
6	Watch dog	Built-in watch dog, the module will never go crash.
7	Sleep	When the module works in sleep mode (mode 3), transmitting & receiving is not available, while the configuration is available. The typical current is 2.0uA .
See more details in related manual.		

1.2 Electrical parameters**E64-T100S2**

No.	Item	Parameter details	Description
1	Size	17 * 30mm	Without antenna
2	Weight	2.4 g	Without antenna
3	Frequency Band	Default: 433.0MHz	425~451.3MHz Channel : 256
4	Connector	1 * 7 * 2.00mm	SMD
5	Supply voltage	2.1~ 5.5V DC	Note: the voltage higher than 5.5V is forbidden
6	Communication level	UART, USART	-
7	Operation Range	1500m	Test condition : clear and open area & 20dBm , antenna gain: 5dBi , height:> 2m , air data rate: 8kbps
8	Transmitting power	20dBm	100mW Four optional level (20, 17, 14, 10dBm)
9	Air data rate	8kbps	Can be configured to 2, 5, 8, 20kbps
10	Standby current	2.0uA	Mode 3 (M0=1 , M1=1)
11	Transmitting current	89mA@20dBm	-
12	Receiving current	16mA	-
13	Communication interface	UART	UART, 8N1, 8E1, 8O1 , Eight kinds of UART baud rate, from 1200 to 115200 bps (Default : 9600bps)
14	Driving mode	UART	UART can be configured to push-pull/high pull, open-drain
15	Transmitting length	55 bytes buffer	-
16	Receiving length	55 bytes buffer	-
17	Address	31 configurable address	Easy for network
18	WOR	Available	Lowest average power consumption is 30uA Suitable for the application with battery supply.
19	RSSI support	Built-in intelligent processing	-
20	Antenna type	IPEX/Spring antenna/External	External thread hole, 50Ω impedance
21	Receiving sensitivity	-121dBm@1kbps	Sensitivity has nothing to do with baud rate and timing
22	Operating temperature	-40 ~ +85°C	-
23	Operating humidity	10% ~ 90%	-
24	Storage temperature	-40 ~ +125°C	-

1.3 E64 series

E64-T100S2

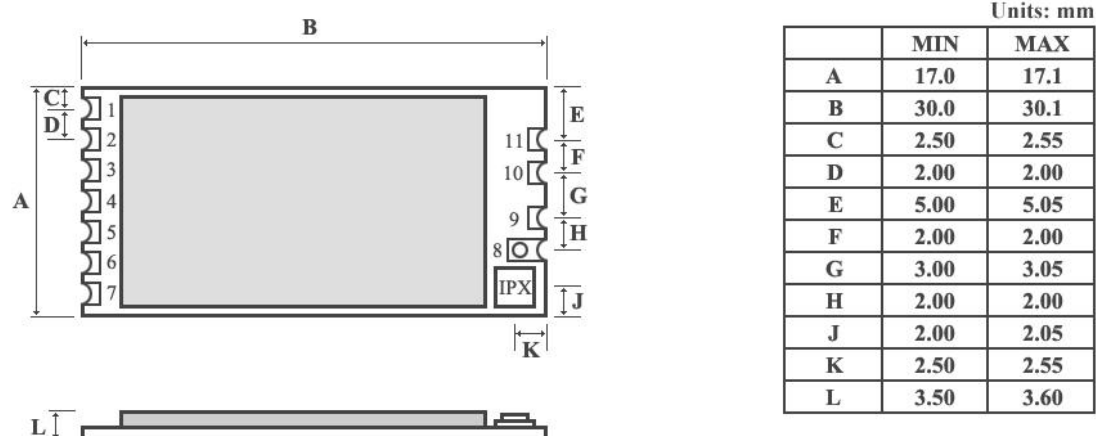
Model	Interface	Frequency band (Hz)	Power (dBm)	Operation range (km)	Air data rate (bps)	Size (mm)	Package
E64-T100S2	UART	425~ 451.3MHz	20	1.5	2k~20k	17*30	SMD
E64-T100S2 can be compatible with other E64 series.							

2. Functional description

E64-T100S2

2.1 Pin definition

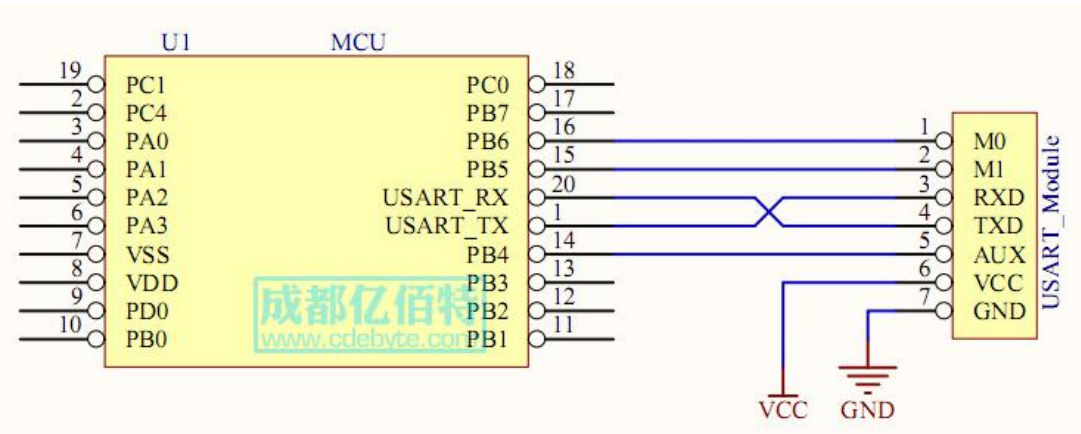
E64-T100S2



No.	Item	Pin direction	Application
1	M0	Input (weak pull-up)	Work with M1 & decide the four operating modes. Floating is not allowed, can be ground.
2	M1	Input (weak pull-up)	Work with M0 & decide the four operating modes. Floating is not allowed, can be ground.
3	RXD	Input	TTL UART inputs, connects to external TXD output pin. Can be configured as open-drain or pull-up input.
4	TXD	Output	TTL UART outputs, connects to external RXD input pin. Can be configured as open-drain or push-pull output
5	AUX	Output	To indicate module' s working status & wakes up the external MCU. During the procedure of self-check initialization, the pin outputs low level. Can be configured as open-drain output or push-pull output (floating is allowed).
6	VCC		Power supply 2.1V-5.5V DC
7	GND		Ground
8	ANT		Antenna
9	GND		Ground
10	GND		Ground
11	GND		Ground

2.2 Connect to MCU

E64-T100S2



No.	Description (STM8L MCU)
1	The UART module is TTL level.
2	For some MCU works at 5VDC, it may need to add 4-10K pull-up resistor for the TXD & AUX pin.

2.3 Reset

E64-T100S2

No.	Description
1	When the module is powered, AUX outputs low level immediately, conducts hardware self-check and set the operating mode on the basis of the user parameters. During the process, the AUX keeps low level. After the process completes, the AUX outputs high level and starts to work as per the operating mode combined by M1 and A0

2.4 AUX description

E64-T100S2

AUX Pin can be used as indication for module' s statue and self-checking.

It can indicate whether the module is in transmission now. There are 3 different situations for effectiveness for AUX, which is self-check for module, module is interacting with target device and module is about to output data.

No.	Description
1	<p>【Indication of UART output】 can be used to wake up external MCU.</p> <p>AUX-pin sequence diagram when UART transmits data</p>

2

【Indication of wireless transmitting】

There are three phases for wireless transmitting, which are UART-data-receiving , handshake and return the result.

First, user transmit the data to the module via UART. Once the transmission is over, the AUX turns low and the module will analyse the data to see if it matches the E64' s protocol.

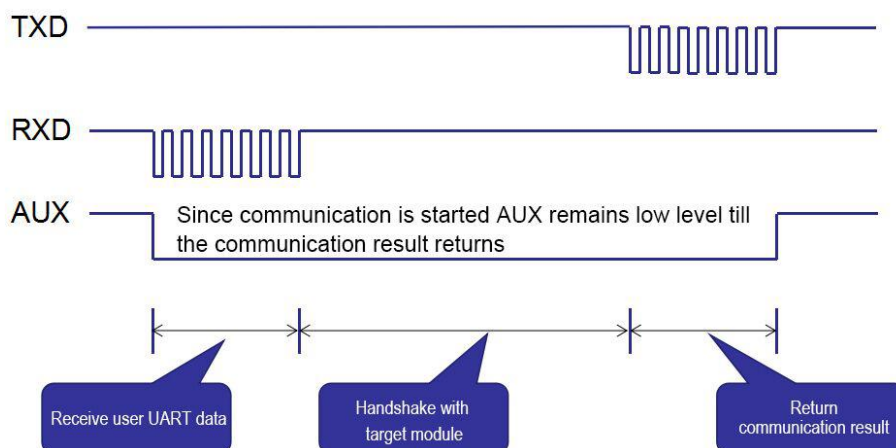
Second, when the data matches the E64' s protocol, the master and the slave will start handshake and send the data.

Third, the module of return the result of the transaction.

The AUX-pin will turn high level after the transaction is complete, whether the transaction succeeded or failed.

When RXD receives serial data, AUX output low level at once. If data frame is compliant with E64' s protocol when RXD ends, AUX remains low level when the module (master or slave) starts to handshake with target module(slave or master)

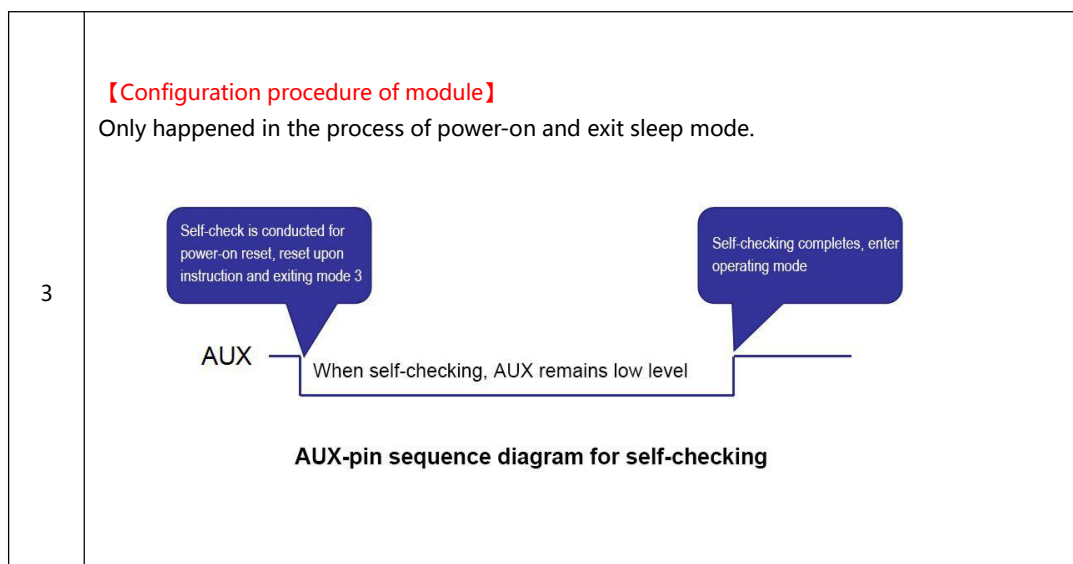
When AUX=1, it means communication results will return whether communication completes, succeeded or failed.



AUX-pin sequence diagram for wireless transmission

After the slave start a transaction, the time of the transaction will take is showed as below. AUX remains low level during this time.

Air data rate	2Kbps	5Kbps	8Kbps	20Kbps
Normal communication time	About 3s	About 2s	About 1s	About 1s
Longest waiting time	About 58s	About 32s	About 20s	About 20s



No.	Notes for AUX
1	When AUX outputs low level, module can not process any data.
2	When AUX outputs low level, it means the module is busy & can not conduct operating mode checking. After AUX outputs high level 1ms later, it will complete the mode-switch task.
3	After switching to new operating mode, it won't work in the new mode immediately until AUX rising edge 2ms later. If AUX is on the high level, the operating mode switch can be effective immediately.
4	When the user switches to other operating modes from mode 3 (sleep mode) or it's still in reset process, the module will reset user parameters, during which AUX outputs low level.

3. Operating mode

E64-T100S2

Contents in below table are the introduction of input status of M1 & M0 and their corresponding mode:

Mode (0-3)	M0	M1	Mode introduction	Notes
Master (Mode 0)	0	0	Monitor all the slaves work at the same channel. If the WOR is turned on, master can wake up slave.	The receiver must work in Mode 2.
Slave-transmitter (Mode 1)	1	0	Send the data to master.	The receiver must be the master.
Slave-receiver (Mode 2)	0	1	Turn on WOR, wait for the data from master.	
Sleep (Mode3)	1	1	Parameter setting.	

3.1 Master (Mode 0)

E64-T100S2

	When M0 = 0, M1 = 0, module works in mode 0
Transmitting	Work as master, can perform fixed-point transmission.
Receiving	At most 31 slaves can update data to master at the same time.

3.2 Slave-transmitter (Mode 1)

E64-T100S2

	When M0 = 1, M1 = 0, module works in mode 1
Transmitting	Slave can send data to master by sending protocol.
Receiving	N/A

3.3 Slave-receiver (Mode 2)

E64-T100S2

	When M0 = 0, M1 = 1, module works in mode 2
Transmitting	N/A
Receiving	Slave works at WOR mode and waits for the data from master.

3.4 Sleep mode (Mode 3)

E64-T100S2

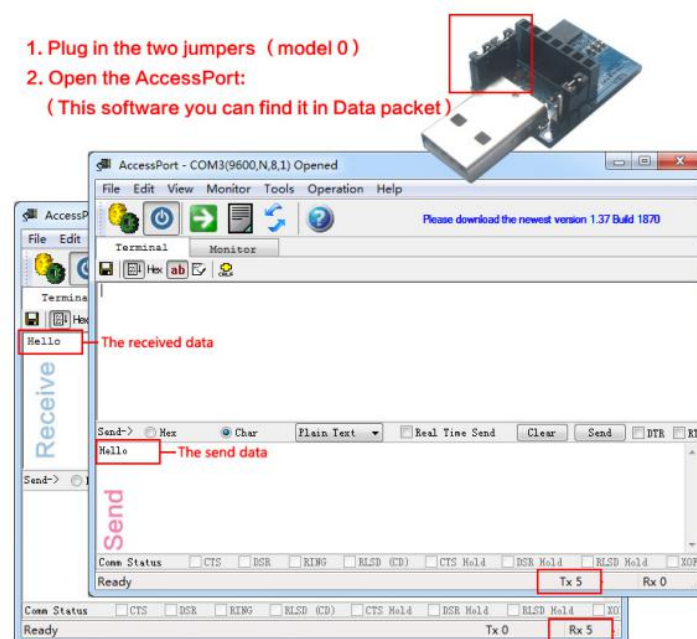
	When M0 = 1, M1 = 1, module works in mode 3
Transmitting	N/A
Receiving	N/A
Parameter setting	This mode can be used for parameter setting. It uses serial port 9600 & 8N1 to set module working parameters through specific instruction format.
Notes	When the mode changes from stand-by mode to others, the module will reset its parameters, during which the AUX keeps low level and then outputs high level after reset completing. It is recommended to check the AUX rising edge for user.

3.5 Quick communication test

E64-T100S2

Steps	Operation
1	Plug the USB test board (E15-USB-T2) into computer, make sure the driver is installed correctly.
2	Optional power supply, 3.3V or 5V.
3	Plug mode-select jumper in the USB test board, master (M1=0, M0=0), slave (M1=0, M0=0).
4	Operate AccessPort software and select the correct serial port code.
5	The master send data to slave on the basis of communication protocol.

1. Plug in the two jumpers (model 0)
2. Open the AccessPort:
(This software you can find it in Data packet)



4. Instruction format**E64-T100S2**

In sleep mode (mode 3 : M1=1, M0=1), it supports below instructions on list.

(Only support 9600 and 8N1 format when setting)

No.	Instruction format	Illustration
1	C0 + working parameters	C0 + 5 bytes working parameters are sent in hexadecimal format. 6 bytes in total and must send in succession. (Save the parameters when power-down)
2	C1+C1+C1	Three C1 are sent in hexadecimal format. The module returns the saved parameters and must send in succession.
3	C2+ working parameters	C2 + 5 bytes working parameters are sent in hexadecimal format. 6 bytes in total and must send in succession. (Not save the parameters when power-down)
4	C3+C3+C3	Three C3 are sent in hexadecimal format. The module returns the version information and must send in succession.
5	C4+C4+C4	Three C4 are sent in hexadecimal format. The module will reset one time and must send in succession.

4.1 Default parameter**E64-T100S2**

Default parameter values : C0 00 00 18 00 40							
Model	network number	Slave address	Air data rate	Baud rate	Parity	Transmitting power	FEC
E64-T100S2	0x00	0x00	8kbps	9600	8N1	100mW	Enable

4.2 Reading operating parameters**E64-T100S2**

Instruction format	Description
C1+C1+C1	In sleep mode (M0=1 , M1=1) , User gives the module instruction (HEX format): C1 C1 C1, Module returns the present configuration parameters. For example, C0 00 00 18 00 44.

4.3 Reading version number**E64-T100S2**

Instruction format	Description
C3+C3+C3	In sleep mode (M0=1 , M1=1) , User gives the module instruction (HEX format): C3 C3 C3, Module returns its present version number, for example C3 64 xx yy. 64 here means the module model (E64 series); xx is the version number and yy refers to the other module features.

4.4 Reset instruction**E64-T100S2**

Instruction format	Description
C4+C4+C4	In sleep mode (M0=1 , M1=1) , User gives the module instruction (HEX format): C4 C4 C4, the module resets for one time. During the reset process, the module will conduct self-check, AUX outputs low level. After reset completing, the AUX outputs high level, then the module starts to work regularly which the working mode can be switched or be given another instruction.

4.5 Parameter setting instruction**E64-T100S2**

The difference between C0 command and C2 command is that C0 command will write parameters into the internal flash memory and can be saved when power down, while C2 command cannot be saved when power down, because C2 command is temporarily mend instruction.C2 is recommended for the occasion that need to change the operating parameters frequently, such as C0 00 00 18 03 44.

No.	Item	Description	Notes
0	HEAD	Fix 0xC0 or 0xC2, it means this frame data is control command.	<ul style="list-style-type: none"> Must be 0xC0 or 0xC2 C0: Save the parameters when power-down C2: Not save the parameters when power-down
1	NC	Reserved	
2	NC	Reserved	
3	SPED	<p>Rate parameter, including UART baud rate and air date rate</p> <p>7 , 6 : UART parity bit 00 : 8N1 (default) 01 : 8O1 10 : 8E1 11 : 8N1 (equal to 00)</p> <p>-----</p> <p>5 , 4 , 3 TTL UART baud rate (bps) 000 : 1200 001 : 2400 010 : 4800 011 : 9600 (default) 100 : 19200 101 : 38400 110 : 57600 111 : 115200</p> <p>-----</p> <p>2 , 1 , 0 Air date rate (bps) 000 : Reserved 001 : 2kb 010 : 5k 011 : 8k (default) 100 : Reserved 101 : Reserved 110 : 20k 111 : Reserved</p>	<ul style="list-style-type: none"> UART mode can be different between communication parties UART baud rate can be different between communication parties The UART baud rate has nothing to do with wireless transmission parameters & won' t affect the wireless transmit / receive features. The lower the air date rate, the longer the transmitting distance, better anti-interference performance and longer transmitting time. The air date rate must keep the same for both communication parties.

4	CHAN	<p>7 , 6 , 5 Network group number 00-07H</p> <p>000 : Team 0 001 : Team 1 (default) 010 : Team 2 011 : Team 3 100 : Team 4 101 : Team 5 110 : Team 6 111 : Team 7</p> <p>-----</p> <p>4 , 3 , 2 , 1 , 0 Slave address 00-1EH (the default 0)</p>	<ul style="list-style-type: none"> • The network with same number cannot exist in the same region. • Communication is not available for the devices with different network. • Only one master exists in the network. <p>-----</p> <ul style="list-style-type: none"> • 31 slaves • The number cannot be repeated for slave in one network. • those parameters are invalid for the master
5	OPTION	<p>7 Reserved</p> <p>-----</p> <p>6 IO drive mode(the default 1) 1 : TXD and AUX push-pull outputs, RXD pull-up inputs 0 : TXD、AUX open-collector outputs, RXD open-collector inputs</p> <p>-----</p> <p>5 , 4 , 3 wireless wake-up time (for the receiver, it means the monitor interval time ,while for the transmitter it means continuously sending preamble code time.)</p> <p>000 : 0ms 001 : 250ms 010 : 500ms 011 : 750ms 100 : 1000ms(default) 101 : 1250ms 110 : 1500ms 111 : 2000ms</p>	<p>-----</p> <ul style="list-style-type: none"> • This bit is used to the module internal pull-up resistor. It also increases the level' s adaptability in case of open drain. But in some cases, it may need external pull-up resistor. <p>-----</p> <ul style="list-style-type: none"> • The wake-up time for master cannot be less than the monitor interval time of slave, otherwise, it may leads data loss. • The longer the wake-up time, the lower the average receive current consumption. • The same WOR time for master and slave is recommended when master needs to wake up slave.

		<div>-----</div> <div>2 , FEC switch</div> <div>0 : Turn off FEC</div> <div>1 : Turn on FEC (default)</div> <div>-----</div> <div>1, 0 transmission power</div> <div>(approximation)</div> <div>00 : 20dBm(default)</div> <div>01 : 17dBm</div> <div>10 : 14dBm</div> <div>11 : 11dBm</div>	<div>-----</div> <div><ul style="list-style-type: none">After turn off FEC, the actual data transmission rate increases while anti-interference ability decreases. Also the transmission distance is relatively short.Both communication parties must keep on the same pages about turn-on or turn-off FEC.</div> <div>-----</div> <div><ul style="list-style-type: none">The external power must make sure the ability of current output more than 200mA and ensure the power supply ripple within 100mV.Low power transmission is not recommended due to its low power supply efficiency.</div>					
For example: The meaning of No.3 “SPED” byte:								
The binary bit of the byte	7	6	5	4	3	2	1	0
The specific value (user configures)	0	0	0	1	1	0	0	1
Meaning	UART parity bit 8N1		UART baud rate is 9600			Air date rate is 2k		
Corresponding hexadecimal	1				9			

5. Parameter setting

E64-T100S2

Step	Operation	Description
1	Install Driver	Please install the USB adapter driver (CP2102).
2	Pull out the jumper	Pull the M0, M1 jumper out. 3.3V or 5V are available for jumper.
3	Connect to module	Connect the module with USB adapter. Connect to the USB interface of PC.
4	Open serial port	Operate the parameter setting software, choose corresponding serial number and press the "OpenPort" button. Please choose other serial numbers until open successfully.
5	Interface	Press "Get Param" button, If failed, please check if the module is in mode 3, or the driver has been installed or not.
6	Set parameter	Please adjust the parameter as your request according to the corresponding setting, then click "Set Param" button, write the new parameter to the module
7	Complete the operation	Please operate the "Fifth step" if you need to reconfigure, if the configuration is completed, Please click "ClosePort" and then take off the module.
8	Commands Configuration	Parameter configuration is also available for MCU (in mode 3).



6. Communication protocol

E64-T100S2

6.1 Overview

E64-T100S2

This protocol is applicable for E64-T100S2 module. E64-T100S2 can be configured into master mode and slave mode to implement star network, and both master and slave can be transmitter or receiver.

In order to facilitate the user to understand the internal state of module and command execution status, protocol transmission is adopted for networking. This protocol stipulates data structure instruction type and working status etc. strictly, please read it carefully before test.

6.2 Structure

E64-T100S2

Data is transmitted by frame, and the effective data length of each frame cannot be greater than 55 bytes.

1) The packet structure of each frame is as follows

Byte address	Length(Byte)	Code	Description
0	1	FEh	Beginning sign for frame.
1	1	0Ah	The effective data length, for example 0Ah means the effective data length is 10-byte.
2	1	00h	Address 0~30 or instruction, for example 00h corresponds to the slave module which address is 0 when module works at slave mode.
3~58	0~55	-	Effective data(depends on the data of address 1)

2) Address 2 format description

BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
(000) : Sending data user->module			Address 0~30				
(001) : Receiving data module->user							
(010) :Succesed module->user			Invalid				
(011) : Failed module->user							
(100) : Reserved							
(101) :Format error module->user							
(110) : Reserved							
(111) : Reserved							

6.3 Detailed example

E64-T100S2

6.3.1 The communication from master to slave

This example describes the sending procedure from master to slave and corresponding output data. Master sends instruction, result returns, then slave outputs instruction.

1) Master sends 2-byte(05H, A0H) data to 0AH slave

Master send	Frame start	Data Length	Instruction & Channel	Effective data
FE 02 0A 05 A0	FEH	02H	0AH	05H, A0H

Master return	Frame start	Data Length	Instruction&Channel	Effective data
Send completed, master return FE 00 40	FEH	00H	40H	-
Send failed, master return FE 00 60 (Automatic retransmission, Waiting time is a little bit longer)	FEH	00H	60H	-

Slave output	Frame start	Data Length	Instruction&Channel	Effective data
FE 02 2A 05 A0	FEH	02H	20H	05H, A0H

6.3.2 Slave sends data to master

This example describes the sending procedure from slave to master and corresponding output data. When slave sends data to master, the target channel address is 0.

Slave(0AH) sends 2-byte data(05H,A0H) to master. The specified channel is fixed to 31H when slave sends, it means the data send to master.

Slave send	Frame start	Data Length	Instruction&Channel	Effective data
FE 02 00 05 A0	FEH	02H	00H	05H, A0H

Slave return	Frame start	Data Length	Instruction&Channel	Effective data
Send completed, slave return FE 00 40	FEH	00H	40H	-
Send failed, slave return FE 00 60 (Waiting time is a little bit longer)	FEH	00H	60H	-

Master output	Frame start	Data Length	Instruction&Channel	Effective data
FE 02 2A 05 A0 (Automatic resolution address 0A)	FEH	02H	2AH	05H,A0H

7. About us

E64-T100S2



Chengdu Ebyte Electronic Technology Co., Ltd., a high-tech company focusing on application of Internet of Things, owns a number of independently researched and developed products and obtains unanimous approvals from customers. With a powerful R&D team, perfect after-sales system, our company provides perfect solutions and technical assistance, shortens R&D period, reduces R&D cost and provides a strong platform for brand new ideas about product R&D.

Our products have been widely applied in various fields, such as consumer electronics, industrial control, healthcare, security alarm, field acquisition, smart home, expressway, property management, water and electricity meter reading, power monitoring, etc.



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