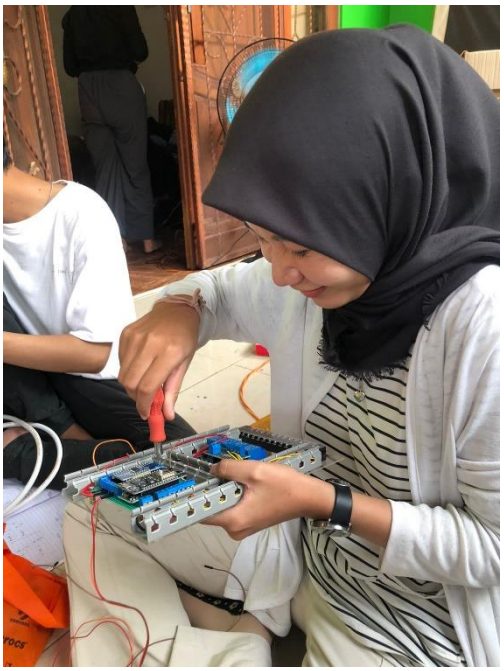
LAMPIRAN I

Proses Pemasangan Komponen, Perakitan, dan Pemotongan Pipa Pengaliran Air

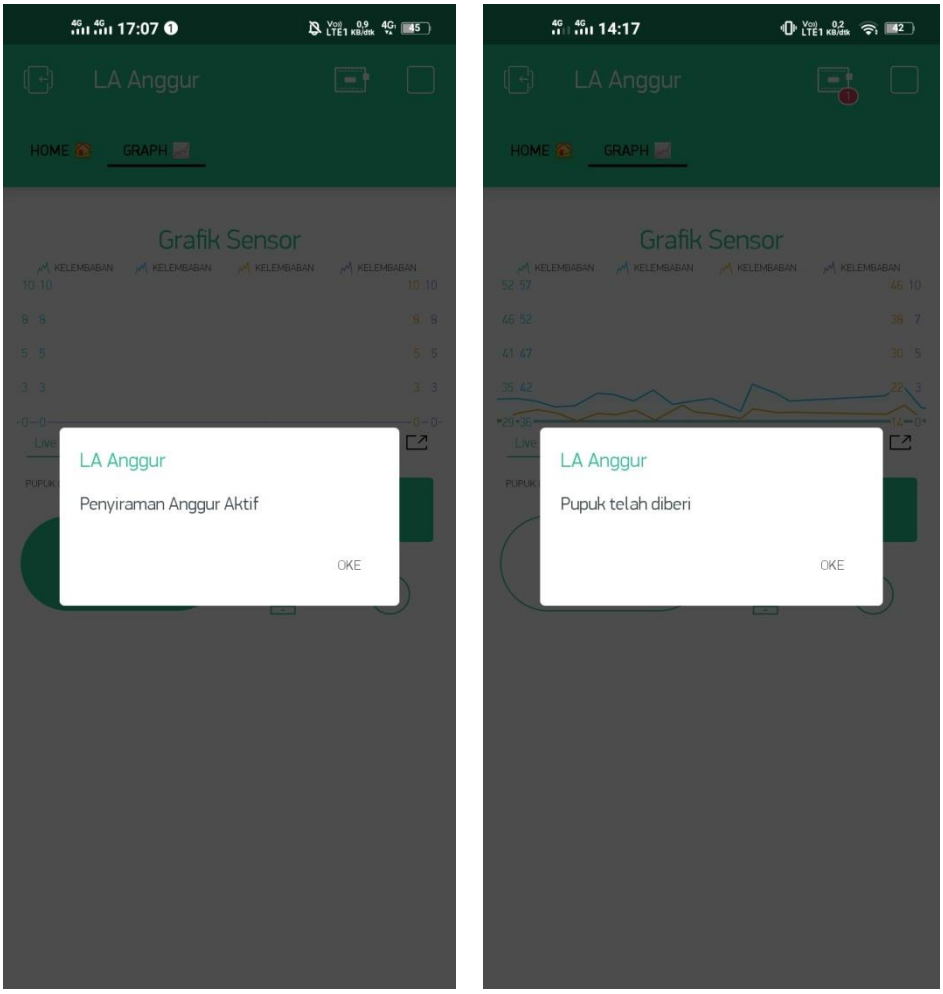


Pengecekan Akurasi Sensor DHT 21 Yang Terbaca Pada Aplikasi *Blynk* Dengan *Hygrometer*

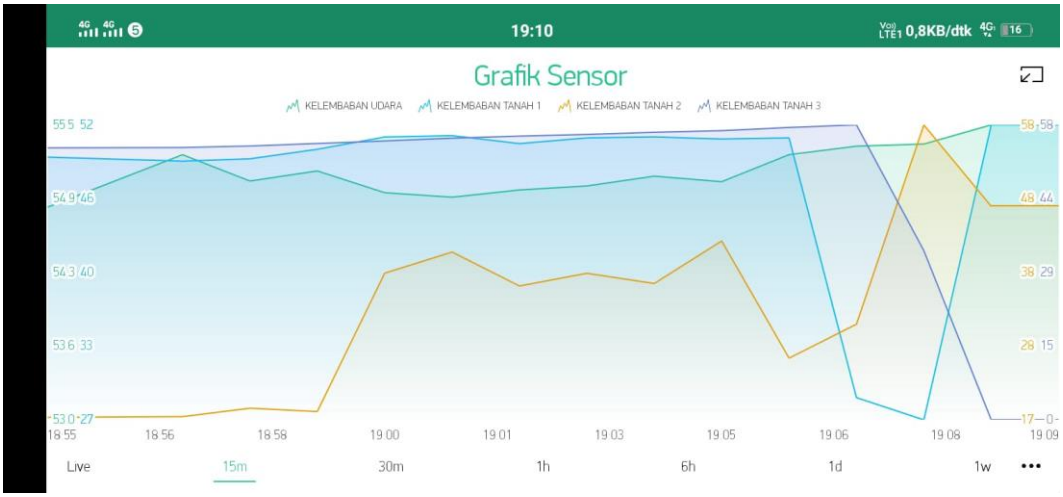
Foto Tanaman Anggur dan Alat di Lokasi Kediaman Bapak Ir. M. Nawawi, M.T

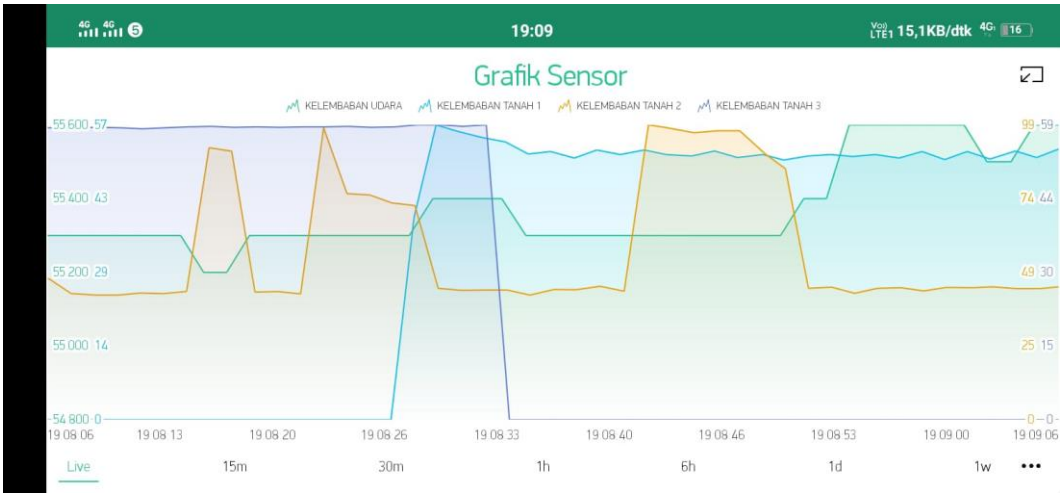
Pengecekan PH Tanah dan Kelembaban Tanah Dengan *Soil Meter*

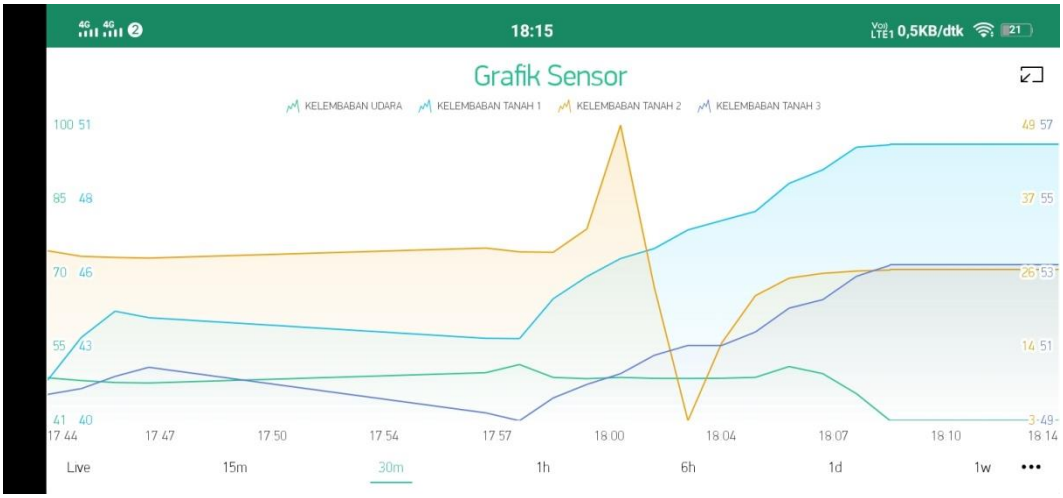
Tampilan Notifikasi Pada Aplikasi *Blynk*



Grafik Sensor







Tampilan *Devices Blynk*

LAMPIRAN II

No. Dok. : F-PBM-23 | Tgl. Berlaku : 13 Desember 2010 | No. Rev. : 00

KEMENTERIAN PENDIDIKAN, KEBUDAYAAN,
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PELAKSANAAN REVISI LAPORAN AKHIR

Mahasiswa berikut,

Nama	:	Rosahoka
NIM	:	062030320087
Jurusan/Program Studi	:	Teknik Elektro / D3 Teknik Elektronika
Judul Laporan Akhir	:	Rancang Bangun Perangkat Lunak Berbasis IoT Sebagai Solusi Pada Budidaya Tanaman Anggur Di Daerah Perkotaan

Telah melaksanakan revisi terhadap Laporan Akhir yang diujikan pada hari Rabu tanggal 16 bulan Agustus tahun 2023. Pelaksanaan revisi terhadap Laporan Akhir tersebut telah disetujui oleh Dosen Penguji yang memberikan revisi :

No.	Komentar	Nama Dosen Penguji *)	Tanggal	Tanda Tangan
1.	Acc/Cetak Revisi**	Dr. RD. Kusumanto, S.T., M.M	29/9-23	
2.	Acc.	Ir. Iskandar Lutfi, M.T	29/9 2023	
3.	Untuk direvisi	Niksen Alfarizal, S.T., M.Kom	26/9-23	
4.	Acc	Yeni Irdayanti, S.T., M.Kom	26/9-23	
5.	Acc.	Ibnu Maja, S.Si., M.M	26/9-23	

Palembang, 29 September 2023
Ketua Penguji **),

(Dr. RD. Kusumanto, S.T., M.M)
NIP 19660311192031004

Catatan:
*) Dosen penguji yang memberikan revisi saat ujian laporan akhir.
**) Dosen penguji yang ditugaskan sebagai Ketua Penguji saat ujian LA.
Lembaran pelaksanaan revisi ini harus dilampirkan dalam Laporan Akhir.

KEMENTERIAN, PENDIDIKANKEBUDAYAAN
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Website : www.polisriwijaya.ac.id **E-mail :** info@polsri.ac.id

REKOMENDASI UJIAN LAPORAN AKHIR (LA)

Pembimbing Laporan Akhir memberikan rekomendasi kepada,

Nama	:	Rosahoka
NIM	:	062030320087
Jurusan/Program Studi	:	Teknik Elektro / D3 – Teknik Elektronika
Judul Laporan Akhir	:	Rancang Bangun Perangkat Lunak Berbasis IoT Sebagai Solusi Pada Budidaya Tanaman Anggur di Daerah Perkotaan

Mahasiswa tersebut telah memenuhi persyaratan dan dapat mengikuti Ujian Laporan Akhir (LA) pada Tahun Akademik 2022/2023.

Palembang, 03 Agustus 2023

Pembimbing I,	Pembimbing II,
Ir. M. Nawawi., M.T.	Ir. Iskandar Lutfi, M.T.
NIP. 196312221991031006	NIP. 196501291991031002

KEMENTERIAN RISET,TEKNOLOGI DAN PENDIDIKAN TINGGI
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Website : www.polisriwijaya.ac.id **E-mail :** info@polsri.ac.id

KESEPAKATAN BIMBINGAN LAPORAN AKHIR (LA)

Kami yang bertanda tangan di bawah ini,

Pihak Pertama

Nama	: Rosahoka
NIM	: 062030320087
Jurusan	: Teknik Elektro
Program Studi	: D3 – Teknik Elektronika

Pihak Kedua

Nama	: Ir. M. Nawawi., M.T.
NIP	: 196312221991031006
Jurusan	: Teknik Elektro
Program Studi	: D3 – Teknik Elektronika

Pada hari ini Rabu tanggal 01 Maret 2023 telah sepakat untuk melakukan konsultasi bimbingan Laporan Akhir.

Konsultasi bimbingan sekurang-kurangnya 1 (satu) kali dalam satu minggu. Pelaksanaan bimbingan pada setiap hari Selasa pukul 15:00, tempat di Politeknik Negeri Sriwijaya.

Demikianlah kesepakatan ini dibuat dengan penuh kesadaran guna kelancaran penyelesaian Laporan Akhir.

Palembang, 18 Maret 2023

Pihak Pertama,

Rosahoka
NIM. 062030320087

Pihak Kedua,

Ir. M. Nawawi., M.T.
NIP. 196312221991031006

Mengetahui,
Ketua Jurusan

Ir. Iskandar Lutfi, M.T.
NIP. 196501291991031002

KEMENTERIAN RISET,TEKNOLOGI DAN PENDIDIKAN TINGGI
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KESEPAKATAN BIMBINGAN LAPORAN AKHIR (LA)

Kami yang bertanda tangan di bawah ini,

Pihak Pertama

Nama	: Rosahoka
NIM	: 062030320087
Jurusan	: Teknik Elektro
Program Studi	: D3 – Teknik Elektronika

Pihak Kedua

Nama	: Ir. Iskandar Lutfi, M.T.
NIP	: 196501291991031002
Jurusan	: Teknik Elektro
Program Studi	: D3 – Teknik Elektronika

Pada hari ini Kamis tanggal 06 Maret 2023 telah sepakat untuk melakukan konsultasi bimbingan Laporan Akhir.

Konsultasi bimbingan sekurang-kurangnya 1 (satu) kali dalam satu minggu. Pelaksanaan bimbingan pada setiap hari Selasa pukul 14:00, tempat di Politeknik Negeri Sriwijaya.

Demikianlah kesepakatan ini dibuat dengan penuh kesadaran guna kelancaran penyelesaian Laporan Akhir.

Palembang, 18 Maret 2023

Pihak Pertama,

Rosahoka
NIM. 062030320087

Pihak Kedua,

Ir. Iskandar Lutfi, M.T.
NIP. 196501291991031002

Mengetahui,
Ketua Jurusan

Ir. Iskandar Lutfi, M.T.
NIP. 196501291991031002

KEMENTERIAN PENDIDIKAN, KEBUDAYAAN
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LEMBAR BIMBINGAN LAPORAN AKHIR

Lembar : 1

Nama	:	Rosahoka
NIM	:	062030320087
Jurusan/Program Studi	:	Teknik Elektro / D3 – Teknik Elektronika
Judul Laporan Akhir	:	Rancang Bangun Perangkat Lunak Berbasis IoT Sebagai Solusi Pada Budidaya Tanaman Anggur di Daerah Perkotaan
Pembimbing I	:	Ir. M. Nawawi., M.T.

No.	Tanggal	Uraian Bimbingan	Tanda Tangan Pembimbing
1.	03/02-2023	Diskusi dan Pengajuan Judul LA	
2.	10/02-2023	Penentuan topik bahasan dari diskusi permasalahan judul Laporan Akhir.	
3.	15/02-2023	Diskusi – Konsultasi Judul, Kesepakatan Judul LA.	
4.	01/03-2023	Pengajuan Proposal	
5.	18/03-2023	Bimbingan BAB I dan BAB II	
6.	26/05-2023	Revisi BAB I (Latar Belakang), Acc BAB II	
7.	01/06-2023	Bimbingan BAB III, Acc BAB I dan III	

No.	Tanggal	Uraian Bimbingan	Tanda Tangan Pembimbing
8.	10/08-2023	Konsultasi Perkembangan Progres Alat	
9.	19/07-2023	Penentuan Lokasi Pemasangan Alat	
10.	29/07-2023	Pemasangan, Pengambilan Data BAB IV	
11.	31/07-2023	Bimbingan BAB IV, V dan Acc BAB IV, V	
12.	03/08-2023	Direkomendasi untuk mengikuti sidang LA	

Palembang, 03 Agustus 2023

Ketua Jurusan/KPS,

Dewi Permata Sari, S.T., M.Kom
NIP. 197612132000032001

Catatan:
*) melingkari angka yang sesuai.
Ketua Jurusan/Ketua Program Studi harus memeriksa jumlah pelaksanaan bimbingan sesuai yang dipersyaratkan dalam Pedoman Laporan Akhir sebelum menandatangani lembar bimbingan ini.
Lembar pembimbingan LA ini harus dilampirkan dalam Laporan Akhir.

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LEMBAR BIMBINGAN LAPORAN AKHIR

Nama : Rosahoka
NIM : 062030320087
Jurusan/Program Studi : Teknik Elektro / D3 – Teknik Elektronika
Judul Laporan Akhir : Rancang Bangun Perangkat Lunak Berbasis IoT Sebagai Solusi Pada Budidaya Tanaman Anggur di Daerah Perkotaan
Pembimbing II : Ir. Iskandar Lutfi., M.T.

No.	Tanggal	Uraian Bimbingan	Tanda Tangan Pembimbing
1.	08/02-2023	Konsultasi Judul dan Rencana Pembahasan LA	
2.	09/03-2023	Kesepakatan dan Pengajuan Proposal LA	
3.	06/04-2023	ACC Judul dan Proposal LA	
4.	05/05-2023	Bimbingan BAB I (Revisi rumusan masalah)	
5.	28/05-2023	ACC BAB I, Bimbingan BAB II (Revisi komponen yang digunakan di lengkapi)	
6.	09/06-2023	ACC BAB II, Bimbingan BAB III	
7.	05/08-2023	ACC BAB III, IV, Revisi V (kesimpulan)	

No.	Tanggal	Uraian Bimbingan	Tanda Tangan Pembimbing
8.	12/08-2023	ACC Laporan Akhir.	
9.	15/8 2023	Rekomendasi untuk ikut Uji CA	
10.			
11.			
12.			

Palembang, 03 Agustus 2023

Ketua Jurusan/KPS,

Dewi Permata Sari, S.T., M.Kom
NIP. 197612132000032001

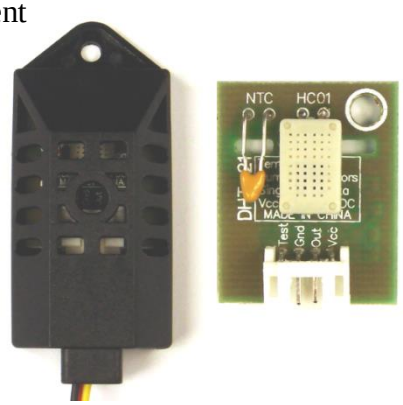
Catatan:
*) melingkari angka yang sesuai.
Ketua Jurusan/Ketua Program Studi harus memeriksa jumlah pelaksanaan bimbingan sesuai yang dipersyaratkan dalam Pedoman Laporan Akhir sebelum menandatangani lembar bimbingan ini.
Lembar pembimbingan LA ini harus dilampirkan dalam Laporan Akhir.

LAMPIRAN III

Digital temperature and humidity sensor

DHT21/AM2301

►Relative Humidity and Temperature Measurement
► Fully calibrated, digital output
► excellent long-term stability
► No additional parts required
► Ultra-long signal transmission distance
► ultra low power consumption
► 4 pin mount
► completely interchangeable



DHT21product description

DHT21 digital temperature and humidity sensor is a temperature and humidity composite sensor with calibrated digital signal output. It uses dedicated digital module acquisition technology and temperature and humidity sensing technology to ensure that the product has extremely high reliability and excellent long-term stability. The sensor includes a capacitive humidity sensing element and an NTC temperature measuring element, and is connected with a high-performance 8-bit microcontroller. Therefore, the product has the advantages of excellent quality, ultra-fast response, strong anti-interference ability, and high cost performance. Each DHT21 sensor is calibrated in an extremely precise humidity calibration chamber. The calibration coefficients are stored in the OTP memory in the form of a program, and these calibration coefficients are called in the sensor during the processing of the detection signal. Single-wire serial interface makes system integration easy and fast. The ultra-small size, extremely low power consumption, and the signal transmission distance can reach more than 20 meters, making it the best choice for various applications and even the most demanding applications. The product is packaged in a 4-pin single-row pin. The connection is convenient, and the special packaging form can be provided according to the needs of users.

Application field

► HVAC
► Testing and testing equipment
► car
► data logger
► consumer goods
► automatic control
► weather station
► home appliances
► humidity regulator
► the medical
► Dehumidifier

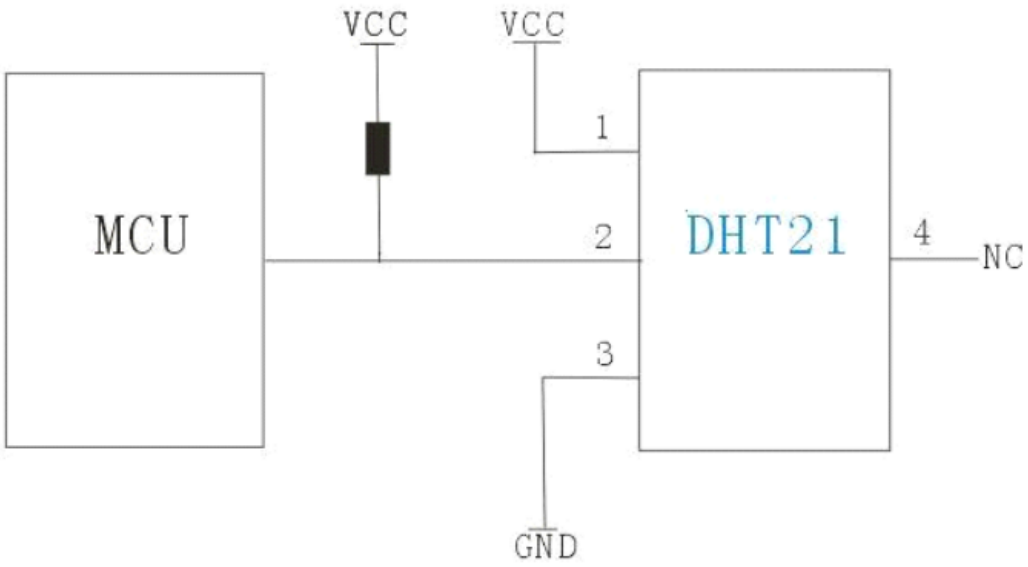
1. Sensor performance description

parameter	condition	Min	type	Max	unit
humidity					
resolution			0.1		%RH
			16		bit
repeatability			±1		%RH
precision	25℃		±3		%RH
	0—50℃			±5	%RH
Interchangeability	**fully interchangeable**				
The sampling period		1	2		S
Response time	1/e(63%)25℃, 1 m/s air		2		S
hysteresis			±0.3		%RH
long-term stability	typical value		±1		%RH/yr
temperature					
resolution			0.1		℃
			16		bit
repeatability			±0.5		℃
precision				±1	℃
Measuring range		-40		80	℃
Response time	1/e (63%)	6		20	S

2. The sampling period must not be lower than the minimum value, otherwise an error will be caused

3. Interface Description

It is recommended to use a 5K pull-up resistor when the length of the connecting line is shorter than 20 meters, and use a suitable pull-up resistor according to the actual situation when it is longer than 20 meters.



3. Power pin

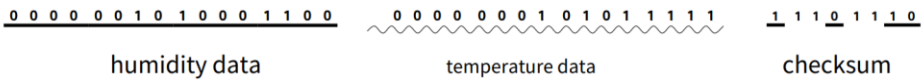
The power supply voltage of DHT21 is 5V. After the sensor is powered on, it needs to wait for 1s to overcome the unstable state, and there is no need to send any instructions during this period. A 100nF capacitor can be added between the power supply pins (VDD, GND) for decoupling and filtering.

4. Single bus interface

DATA is used for communication and synchronization between the microprocessor and DHT21. It adopts single-bus data format, and the communication time is about 5ms.

Data Format: 40bit data = 16bit humidity data + 16bit temperature data + 8bit checksum

Example: Receive 40bit data as follows:



high humidity 8 bit + low humidity 8 bit + temp high 8 bit + temp low 8 end of bit = 8bits = checksum

Example: 00000010+1000 1100+0000 0001+0101 1111=1110 1110 Humidity = 65.2%RH temperature =35.1℃ When the temperature is lower than0The highest position of the temperature data in °C is 1.

For example: -10.1℃ is expressed as1000 0000 0110 0101

After the user host (MCU) sends a start signal, DHT21 switches from low-power mode to high-speed mode, waits for the host start signal to end, DHT21 sends a response signal, sends 40bit data, and triggers a signal acquisition. (Note: The temperature and humidity data read by the host from DHT21 is always the previous measured value. If the interval between two measurements is very long, please read twice in a row to obtain real-time temperature and humidity values)

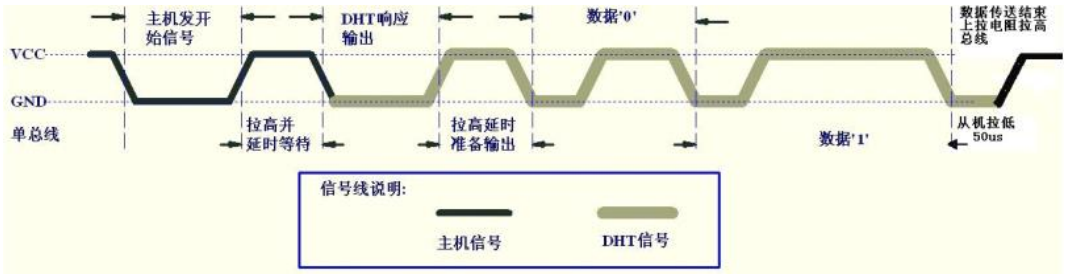


Figure 1

When idle, the bus is at high level. At the beginning of communication, the master (MCU) pulls down the bus for 500us and then releases the bus. After a delay of 20 -40us, the master starts to detect the response signal from the slave (DHT21).

The response signal of the slave is a low level of about 80us, and then the slave pulls up the bus for about 80us to indicate that it is about to enter the data transmission.

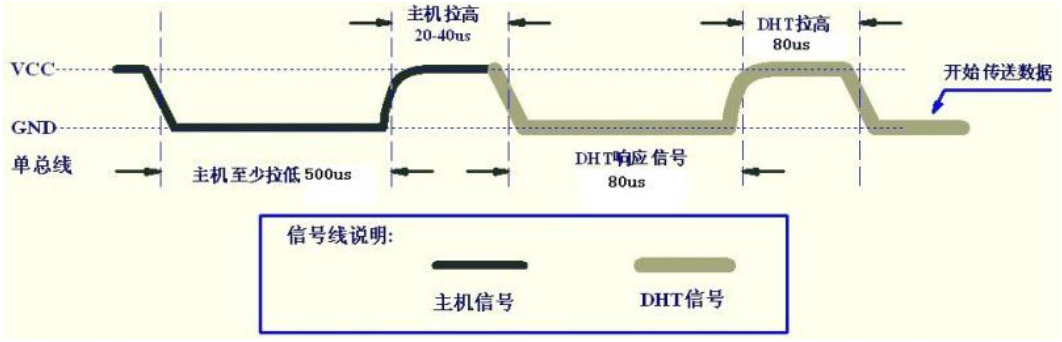


Figure 2

After the high level is the data bit, each 1bit of data is composed of a low level time slot and a high level group become. The low-level time slot is a low level of about 50us, which represents the beginning of the data bit, and the length of the subsequent high level determines the value represented by the data bit. The longer high level represents 1, and the shorter high level The level represents 0. A total of 40bit data, when the last bit data transmission is completed, the slave will pull down the bus again for about 50us, then release the bus, and pull it up by the pull-up resistor.

The digital 1 signal representation method is shown in Figure 4

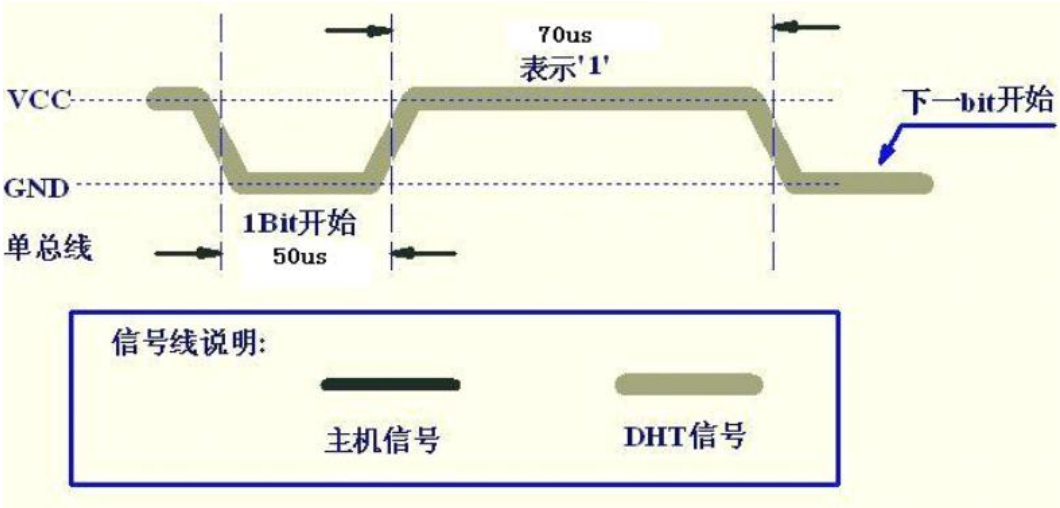


Figure 4

Digital 0 signal representation method. As shown in Figure 5

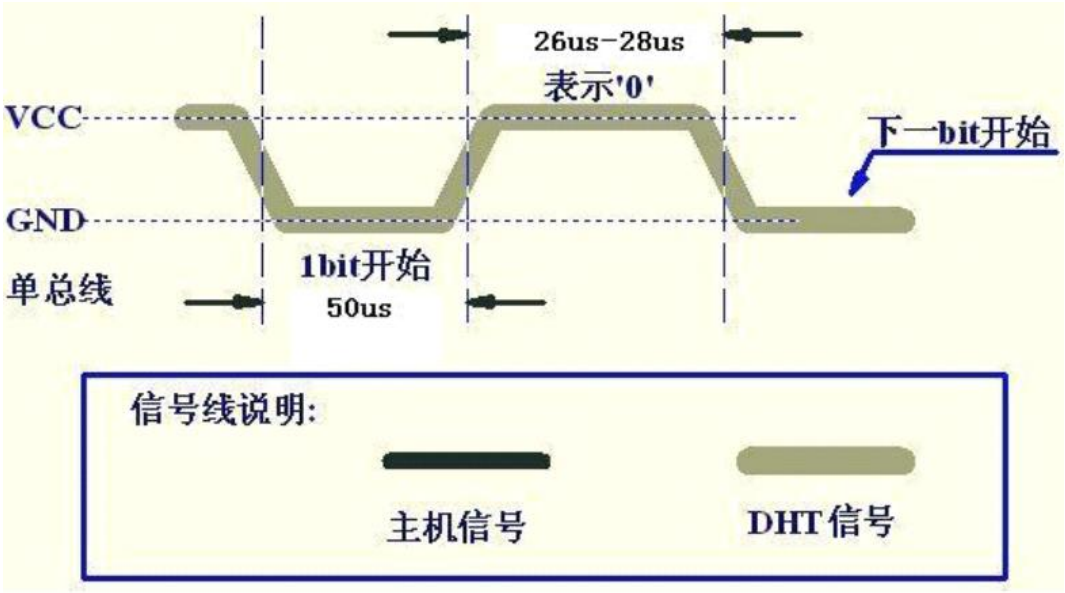


Figure 5

5. Measurement resolution

The measurement resolutions are 16bit (temperature) and 16bit (humidity).

6. Electrical characteristics VDD=5V,T = 25°C, unless otherwise noted

parameter	condition	min	type	max	unit
powered by	DC		3.3-5.5V		V
supply current	Measurement	1.3	1.5	2.1	mA
	standby	0.9	1.1	1.3	mA
The sampling period	Second	1		2	Second-rate

Note: The sampling cycle interval should not be less than 1.7 seconds (2 seconds is recommended).

7. application information

7.1 Working and storage conditions

Temporary drifting signals of up to 3%RH may result outside the recommended operating range. After returning to normal operating conditions, the

sensor will slowly return to calibration. To speed up the recovery process/see Section 7.3, "Recovery Processing". Prolonged use under abnormal working conditions will accelerate the aging process of the product.

7.2 Exposure to chemicals

The moisture-sensing layer of the capacitive humidity sensor will be disturbed by chemical vapor, and the diffusion of chemical substances in the sensing layer may cause the drift of the measured value and the decrease of sensitivity. In a pure environment, pollutants are released slowly. The recovery process described below will speed up this process. High concentrations of chemical contamination can lead to complete damage to the sensing layer of the sensor.

7.3 Recovery processing

Sensors placed under extreme working conditions or in chemical vapors can be restored to the state at the time of calibration through the following procedures. Keep at 50-60°C and < 10%RH for 2 hours (drying); then keep at 20-30°C and >70%RH for more than 5 hours.

7.4 Temperature effect

The relative humidity of a gas is largely dependent on temperature. Therefore, when measuring humidity, it should be ensured that the humidity sensor works at the same temperature as much as possible. If the printed circuit board is shared with the electronic components that release heat, the DHT21 should be installed as far away from the heat-generating electronic components as possible, and installed under the heat source, while keeping the casing well ventilated.

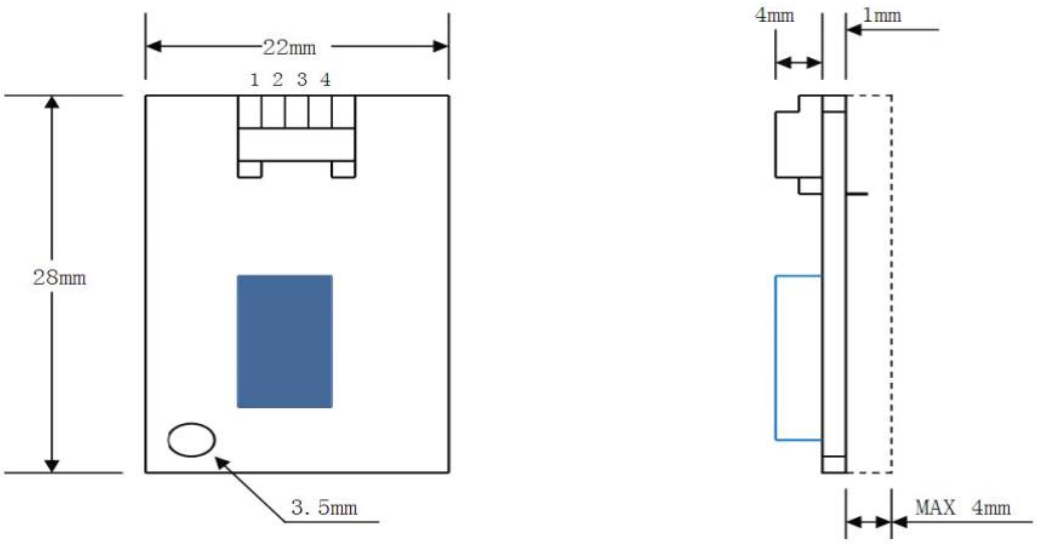
7.5 light

Prolonged exposure to sunlight or strong UV radiation will degrade performance.

7.6 Precautions for Wiring

The quality of DATA signal wire will affect the communication distance and communication quality, it is recommended to use high-quality shielded wire.

8. Packaging information



9. DHT21 pin description

Pin	name	note
1	VDD	Power supply 3 .3-5.5VDC
2	DATA	Serial data, single bus
3	GND	Ground, negative pole of power supply
4	NC	Empty pin, please leave it open (do not connect to Vcc or Gnd)

NODEMCU ESP8266

The NodeMCU (***N***ode ***M***icro***C***ontroller ***U***nit) is an open-source software and hardware development environment built around an inexpensive System-ona-Chip (SoC) called the ESP8266. The ESP8266, designed and manufactured by Espressif Systems, contains the crucial elements of a computer: CPU, RAM, networking (WiFi), and even a modern operating system and SDK. That makes it an excellent choice for Internet of Things (IoT) projects of all kinds.

However, as a chip, the ESP8266 is also hard to access and use. You must solder wires, with the appropriate analog voltage, to its pins for the simplest tasks such as powering it on or sending a keystroke to the "computer" on the chip. You also have to program it in low-level machine instructions that can be interpreted by the chip hardware. This level of integration is not a problem using the ESP8266 as an embedded controller chip in mass-produced electronics. It is a huge burden for hobbyists, hackers, or students who want to experiment with it in their own IoT projects.

But, what about Arduino? The Arduino project created an opensource hardware design and software SDK for their versatile IoT controller. Similar to NodeMCU, the Arduino hardware is a microcontroller board with a USB connector, LED lights, and standard data pins. It also defines standard interfaces to interact with sensors or other boards. But unlike NodeMCU, the Arduino board can have different types of CPU chips (typically an ARM or Intel x86 chip) with memory chips, and a variety of programming environments. There is an Arduino reference design for the ESP8266 chip as well. However, the flexibility of Arduino also means significant variations across different vendors. For example, most Arduino boards do not have WiFi capabilities, and some even have a serial data port instead of a USB port.

NodeMCU Specifications

The NodeMCU is available in various package styles. Common to all the designs is the base ESP8266 core. Designs based on the architecture have maintained the standard 30-pin layout. Some designs use the more common narrow (0.9″) footprint, while others use a wide (1.1″) footprint – an important consideration to be aware of.

The most common models of the NodeMCU are the Amica (based on the standard narrow pin-spacing) and the LoLin which has the wider pin spacing and large.

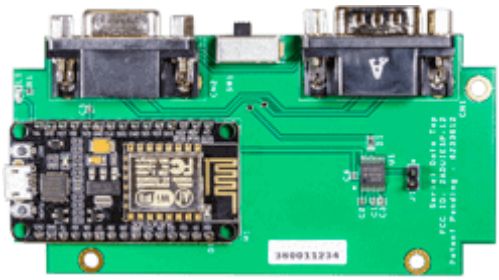
board. The open-source design of the base ESP8266 enables the market to design new variants of the NodeMCU continually.

OfficialAmica NodeMCU

Amica NodeMCU measures 49mm x 26mm with a standard pin space of 0.1″ between pins and 0.9″ between rows.

The Amica NodeMCU is approximately 25% smaller in size than a closely compatible LoLin style NodeMCU

OfficialAmicaNodeMCU on CarrierBoard

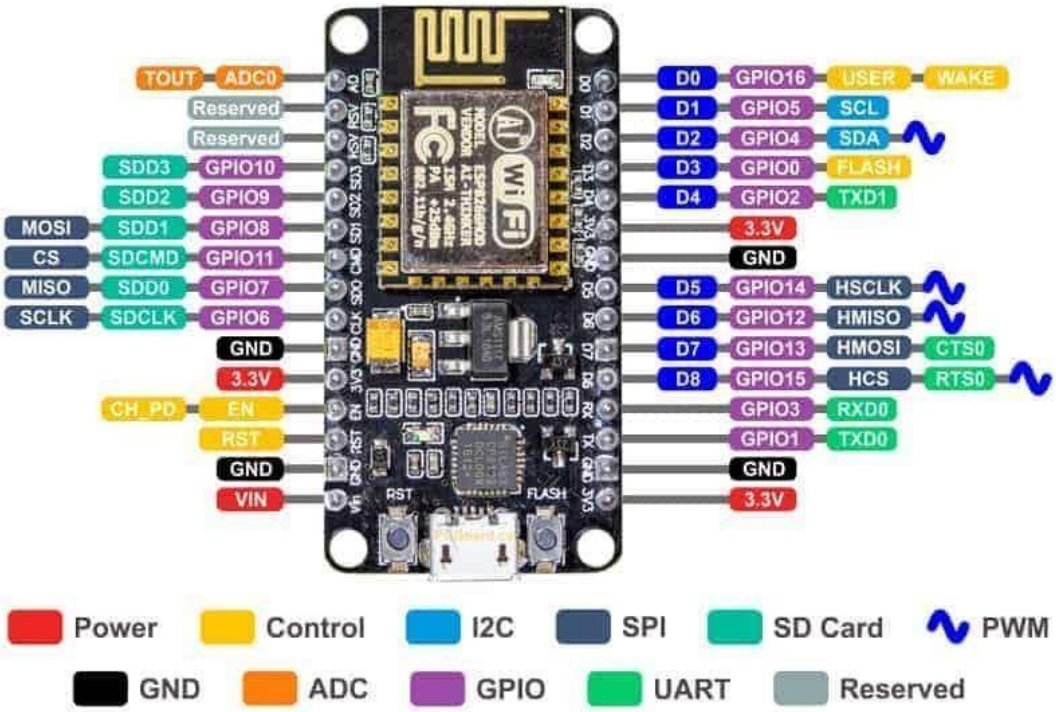


Amico NodeMCU mounted to a 102mm x 51mm carrier board with dual DB-09 male/female connectors

Lolin
NodeMCU

LoLin style NodeMCU measures 58mm x 32mm with a pin spacing of 0.1″ between pins and 1.1″ between row

NodeMCU Pinout and Functions Explained



• Power Pins There are four power pins. **VIN** pin and three **3.3V** pins. **VIN** can be used to directly supply the NodeMCU/ESP8266 and its peripherals. Power delivered on **VIN** is regulated through the onboard regulator on the NodeMCU module – you can also supply 5V regulated to the **VIN** pin

• **3.3V** pins are the output of the onboard voltage regulator and can be used to supply power to external components.

• GND are the ground pins of NodeMCU/ESP8266

- I2C Pins are used to connect I2C sensors and peripherals. Both I2C Master and I2C Slave are supported. I2C interface functionality can be realized programmatically, and the clock frequency is 100 kHz at a maximum. It should be noted that I2C clock frequency should be higher than the slowest clock frequency of the slave device.

- GPIO Pins NodeMCU/ESP8266 has 17 GPIO pins which can be assigned to functions such as I2C, I2S, UART, PWM, IR Remote Control, LED Light and Button programmatically. Each digital enabled GPIO can be configured to internal pull-up or pull-down, or set to high impedance. When configured as an input, it can also be set to edge-trigger or leveltrigger to generate CPU interrupts.

- ADC Channel The NodeMCU is embedded with a 10-bit precision SAR ADC. The two functions can be implemented using ADC. Testing power supply voltage of VDD3P3 pin and testing input voltage of TOUT pin. However, they cannot be implemented at the same time.

- UART Pins NodeMCU/ESP8266 has 2 UART interfaces (UART0 and UART1) which provide asynchronous communication (RS232 and RS485), and can communicate at up to 4.5 Mbps. UART0 (TXD0, RXD0, RST0 & CTS0 pins) can be used for communication. However, UART1 (TXD1 pin) features only data transmit signal so, it is usually used for printing log.

- SPI Pins NodeMCU/ESP8266 features two SPIs (SPI and HSPI) in slave and master modes. These SPIs also support the following general-purpose SPI features:
- 4 timing modes of the SPI format transfer
- Up to 80 MHz and the divided clocks of 80 MHz
- Up to 64-Byte FIFO

- SDIO Pins NodeMCU/ESP8266 features Secure Digital Input/Output Interface (SDIO) which is used to directly interface SD cards. 4-bit 25 MHz SDIO v1.1 and 4-bit 50 MHz SDIO v2.0 are supported.

- PWM Pins The board has 4 channels of Pulse Width Modulation (PWM). The PWM output can be implemented programmatically and used for driving digital motors and LEDs. PWM frequency range is adjustable from 1000 µs to 10000 µs (100 Hz and 1 kHz).

- Control Pins are used to control the NodeMCU/ESP8266. These pins include Chip Enable pin (EN), Reset pin (RST) and WAKE pin.
- **EN:** The ESP8266 chip is enabled when EN pin is pulled HIGH. When pulled LOW the chip works at minimum power.
- **RST:** RST pin is used to reset the ESP8266 chip.
- **WAKE:** Wake pin is used to wake the chip from deep-sleep.
-  Control Pins are used to control the

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PZEM-003/017 DC communication module

Overview

This document describes the specification of the PZEM-003/017 DC communication module, the module is mainly used for measuring DC voltage, current, active power, frequency and energy consumption, the module is without display function, the data is read through the RS485 interface.

PZEM-003: Measuring Range 10A (Built-in Shunt)

PZEM-017: Measuring Range 50A、100A、200A、300A (the current range is depend on the external shunt specification)

1. Function description

1.1 Voltage

1.1.1 Measuring range:0.05-300V. (when the test voltage is ＜ 7V, please use the independent power supply mode)

1.1.2 Resolution:0.01V.

1.1.3 Measurement accuracy:1%.

1.2 Current

1.2.1 Measuring range:0.01-10A(PZEM-003);0.02-300A(PZEM017;can be matched with 50、100、200、300A four kinds of shunt).

1.2.2 Resolution:0.01A

1.2.3 Measurement accuracy:1%

1.3 Power

1.3.1 Measuring range:0.1-3kW(PZEM-003);0.2-90kW(PZEM-017)

1.3.2 Resolution: 0.1W

1.3.3 Measurement accuracy:1%

1.4 Energy Consumption

1.4.1 Measuring range: 0−9999kWh

1.4.2 Resolution: 1Wh

1.4.3 Measurement accuracy:1%

1.4.4 Reset energy: use software to reset.

1.5 Over Voltage alarm

Voltage threshold can be set, divide into high voltage and low voltage threshold, when the measured voltage exceeds the threshold, it can alarm

The default high voltage threshold is 300V, the default low voltage threshold is 7V.

1.6 Communication interface

1. RS485 interface.

2. Communication protocol

2.1 Physical layer protocol

Physical layer use UART to RS485 communication interface. Baud rate is 9600, 8 data bits, 2 stop bit, no parity.

2.2 Application layer protocol

The application layer use the Modbus-RTU protocol to communicate. At present, it only supports function codes such as 0x03 (Read Holding Register), 0x04 (Read Input Register), 0x06 (Write Single Register), 0x41 (Calibration), 0x42 (Reset energy).etc.

0x41 function code is only for internal use (address can be only 0xF8), used for factory calibration and return to factory maintenance occasions, after the function code to increase 16-bit password, the default password is 0x3721.

The address range of the slave is 0x01 ~ 0xF7. The address 0x00 is used as the broadcast address, the slave does not need to reply the master. The address 0xF8 is used as the general address, this address can be only used in single-slave environment and can be used for calibration etc.operation.

2.3 Read the measurement result

The command format of the master reads the measurement result is(total of 8 bytes):

Slave Address + 0x04 + Register Address High Byte + Register Address Low Byte + Number of Registers High Byte + Number of Registers Low Byte + CRC Check High Byte + CRC Check Low Byte.

The command format of the reply from the slave is divided into two kinds:

Correct Reply: Slave Address + 0x04 + Number of Bytes + Register 1 Data High Byte + Register 1 Data Low Byte + ... + CRC Check High Byte + CRC Check Low Byte

Error Reply: Slave address + 0x84 + Abnormal code + CRC check high byte + CRC check low byte

Abnormal code analyzed as following (the same below)

- 0x01,Illegal function;
- 0x02,Illegal address;
- 0x03,Illegal data;

Register address	Description	Resolution
0x0000	Voltage value	1LSB correspond to 0.01V
0x0001	Current value	1LSB correspond to 0.01A
0x0002	Power value low 16 bits	1LSB correspond to 0.1W
0x0003	Power value high 16 bits	
0x0004	Energy value low 16 bits	1LSB correspond to 1Wh
0x0005	Energy value high 16 bits	
0x0006	igh voltage alarm status	0xFFFF is alarm,0x0000 is not alarm
0x0007	Low voltage alarm status	0xFFFF is alarm,0x0000 is not alarm

- 0x04,Slave error.

The register of the measurement results is arranged as the following table

For example, the master sends the following command (CRC check code is replaced by 0xHH and 0xLL, the same below):

0x01 + 0x04 + 0x00 + 0x00 + 0x00 + 0x08 + 0xHH + 0xLL

Indicates that the master needs to read 8 registers with slave address 0x01 and the start address of the register is 0x0000.

The correct reply from the slave is as following:

0x01 + 0x04 + 0x10 + 0x27 + 0x10 + 0x00 + 0x64 + 0x03 + 0xE8 + 0x00 + 0x00 + 0x00 +

0x00 + 0x00 + 0x00 + 0x00 + 0x00 + 0x00 + 0x00 + 0xHH + 0xLL

The above data shows

- Voltage is 0x2710，converted to decimal is 10000,display 100.00V；
- Current is 0x0064，converted to decimal is 100,display 1.00A；
- Power is 0x000003E8，converted to decimal is 1000,display 100.0W；
- Energy is 0x00000000，converted to decimal is 0,display 0Wh；
- High voltage alarm status 0x0000,indicates the current voltage is lower than the high voltage threshold.
- Low voltage alarm status 0x0000,indicates the current voltage is higher than the low voltage threshold.

2.4 Read and modify the slave parameters

At present,it only supports reading and modifying slave address and power alarm threshold The register is arranged as the following table

Register

address	Description	Resolution
0x0000	0x0002 Modbus-RTU address	The range is 0x0001~0x00F7
	0x0003 The current range(only for PZEM-017)	0x0000：100A 0x0001：50A 0x0002：200A 0x0003：300A

igh volx0001 threshol tageLow alarm voltage alarm threshold 1 LSB cord（5~350V1~350V),default）,default is is 7V,300V 0.01V respondlLSB correspond to to 0.01V

The command format of the master to read the slave parameters and read the measurement results are same(described in details in Section 2.3), only need to change the function code from 0x04 to 0x03.

The command format of the master to modify the slave parameters is (total of 8 bytes):

Slave Address + 0x06 + Register Address High Byte + Register Address Low Byte + Register Value High Byte + Register Value Low Byte + CRC Check High Byte + CRC Check Low Byte.

The command format of the reply from the slave is divided into two kinds:

Correct Response: Slave Address + 0x06 + Number of Bytes + Register Address Low Byte + Register Value High Byte + Register Value Low Byte + CRC Check High Byte + CRC Check Low Byte.

Error Reply: Slave address + 0x86 + Abnormal code + CRC check high byte + CRC check low byte.

For example, the master sets the slave's high voltage

alarm threshold: 0x01 + 0x06 + 0x00 +

0x00 + 0x4E + 0x20 + 0xHH + 0xLL

Indicates that the master needs to set the 0x0000 register (high voltage alarm threshold) to 0x4E20（200.00V）.

Set up correctly, the slave return to the data which is sent from the master. For example, the

master sets the low voltage alarm threshold of the slave 0x01 + 0x06 +

0x00 + 0x01 + 0x03 + 0xE8 + 0xHH + 0xLL

Indicates that the master needs to set the 0x0001 register (low voltage alarm threshold) to 0x03E8(10.00V).

Set up correctly, the slave return to the data which is sent from the master. For example, the

master sets the address of the slave

0x01 + 0x06 + 0x00 + 0x02 + 0x00 + 0x05 + 0xHH + 0xLL

Indicates that the master needs to set the 0x0002 register (ModbusRTU address) to 0x0005 Set up

correctly, the slave return to the data which is sent from the master.

The command format of the master to reset the slave's energy

is (total 4 bytes): Slave address + 0x42 + CRC check high

byte + CRC check low byte.

Correct reply: slave address + 0x42 + CRC check high byte + CRC check low byte.

Error Reply: Slave address + 0xC2 + Abnormal code + CRC check high byte + CRC check low byte

2.5 Calibration

The command format of the master to calibrate the slave is

(total 6 bytes): 0xF8 + 0x41 + 0x37 + 0x21 + CRC check

high byte + CRC check low byte.

Correct reply: 0xF8 + 0x41 + 0x37 + 0x21 + CRC check high byte + CRC check low byte.

Error Reply: 0xF8 + 0xC1 + Abnormal code + CRC check high byte + CRC check low byte.

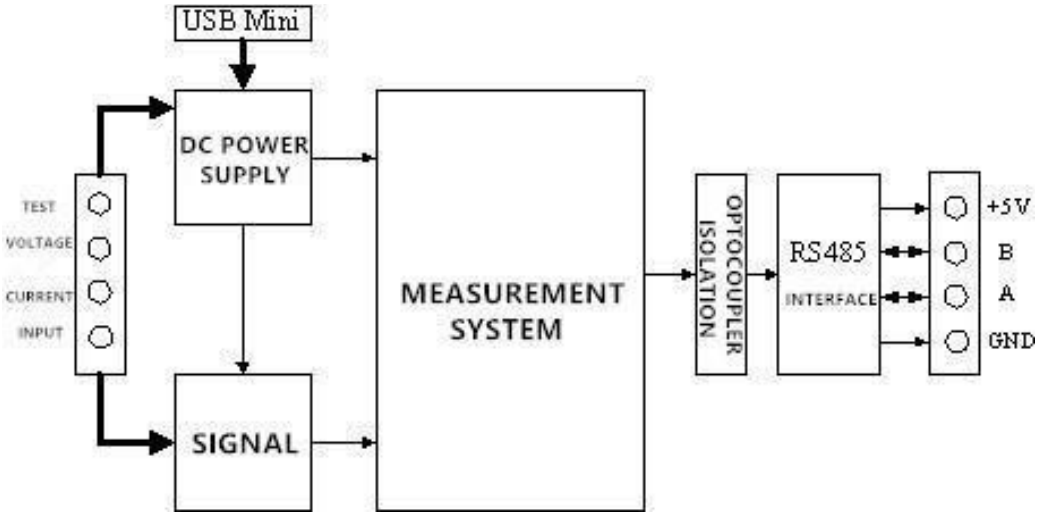
It should be noted that the calibration takes 3 to 4 seconds, after the master sends the command, if the calibration is successful, it will take 3 ~ 4 seconds to receive the response from the slave.

2.6 CRC check

CRC check use 16bits format, occupy two bytes, the generator polynomial is X16 + X15 + X2 +1, the polynomial value used for calculation is 0xA001.

The value of the CRC check is all results of a frame data checking divide CRC

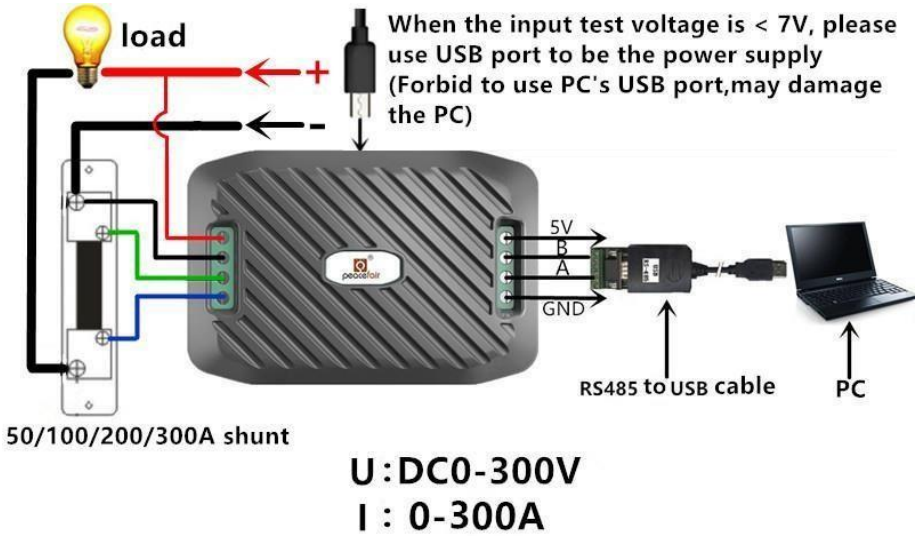
3. Functional block diagram



Picture 3　Functional block diagram

4.　Wiring diagram

Picture 4.1　PZEM-003Wiring diagram



Picture 4.2　PZEM-017 Wiring diagram

5.　Other instructions

5.1 RS485 interface is passive output, need external connect 5V power supply and the the external power supply should ＞100mA.

When the input test voltage is less than 7V, it must supply 5V independent work voltage

through MICRO USB port；