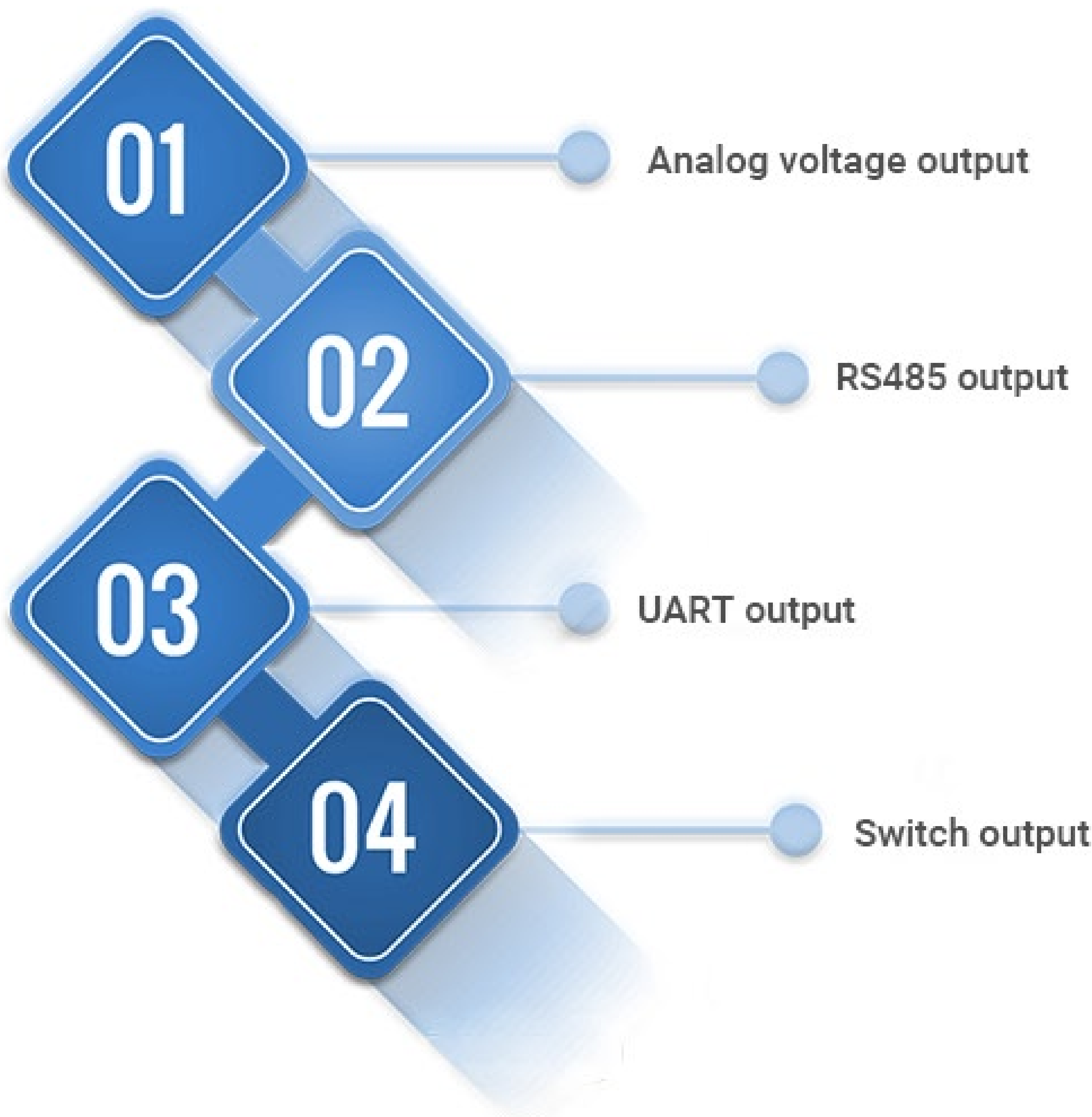
DS1603 Module Output Interface

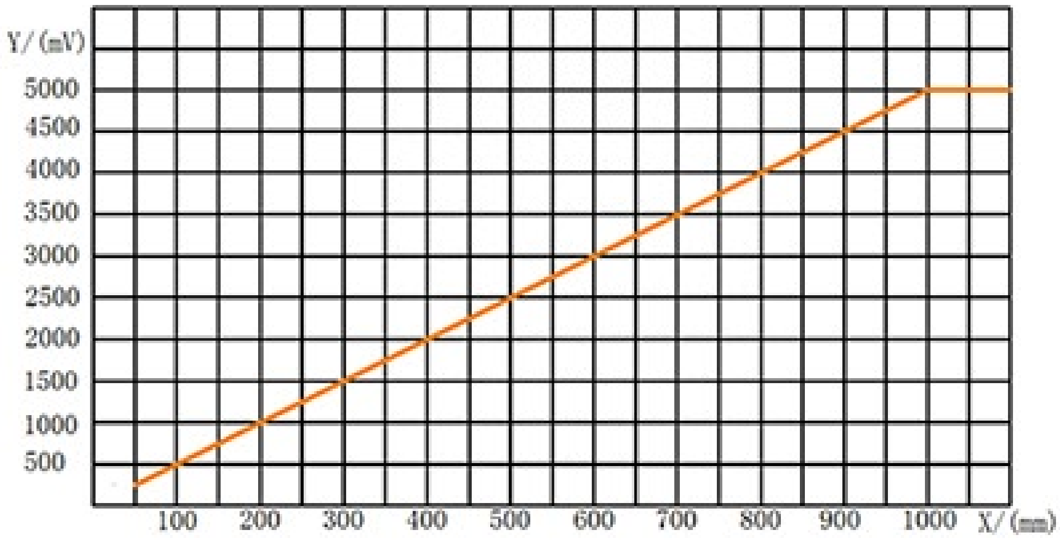


1. Analog Voltage output

(1) Pin definition

Wire color	Mark	Pin description	Remark
Red	VCC	Power input	
Black	GND	GND	
Yellow	OUT	Analog voltage output	
White	Empty	Empty	

(2) Distance vs. voltage diagram



Note: The X-axis represents distance, and the Y-axis represents voltage.

(3) Formula

By reading the voltage value output by the output pin "OUT", the corresponding distance value can be calculated. The sensor factory defaults to a voltage value of 0-5000mV corresponding to a distance value of 0-1000mm, and a voltage of 5mV corresponds to a distance of 1mm. When the detection distance is greater than 1000mm, the output voltage is 5000mV, and when no liquid is detected, the output voltage is less than 50mV.

For example: when the output voltage value of the "OUT" pin is currently read as 3000mV

By: S=U/5000*1000;

Get: distance=3000/5000*1000=600mm;

Therefore: the current detection distance value of the liquid is 600mm.

(4) Led Indicator

1. The blue LED is always on: The module is power on but no liquid is detected.
2. Blue LED flashes slowly: The module detects liquid, and the LED flashes at a frequency of 1 time per second

2. RS485 Output

(1) Pin Definition

Wire color	Pin Name	Pin description	Remark
Red	VCC	Power input	
Black	GND	GND	
Yellow	A	DATA +	
White	B	DATA –	

(2) Protocol

The sensor has built-in two controllable communication protocols, DYP protocol and modbus protocol, and it is a slave device. The two protocols can automatically determine which protocol data frame received , and use the data frame of the corresponding protocol to respond.

1. Communication

RS485 interface

Data Bit	Stop Bit	Parity check	Baud rate
8	1	N/A	9600bps

2. Scope

This product can communicate with any host device with RS485 communication interface and support Modbus protocol (need to support 0x03 function code and 0x06 function code) or support DYP protocol.

(3) Protocol

1 .Modbus Protocol

1 .(1) Modbus Register

Protocol: Modbus Mode:RTU Liquid level sensor as slave Slave address 0X01 as default

Modbus Read function address, Code:0X03			
Status	Register address	Register information	Description
Read only	0x00	Processing value	Processing value, unit 1mm
Read only	0x01	Real time value	Real time value, unit 1mm
Reserved	0x02	Reversed	Reversed
Modbus Write function address, Code 0X06			
Reserved	0x03	Reversed	Reversed
Read-Write	0x04	Slave address	Modbus slave address, default is 0X01, Range 0X01~0XF7, save when power off
Read-Write	0x05	Set measuring medium	0x01: water 0x02: oil, default 0x01
Read-Write	0x06	Operating cycle setting	Set the working speed of the probe to work once in N seconds, the value of N is 0x01~0x3C, the unit is second, the default value is 0x02

Remarks:

1. The value processed by the sensor after multiple measurements of the liquid level.
2. Real-time value is the liquid level value of each measuring.

1 .(2) Example

1. Read the value of the register, address 0X01 (real-time value), return value is 0x00D2

Host Request: 01 03 00 01 00 01 D5 CA

Slave Response: 01 03 02 00 D2 38 19

2. Read two data starting from address 0X00, processing value and real-time value, return data processing value is 0x00DC, real-time value is 0x00DD

Host Request: 01 03 00 00 00 02 C4 0B

Slave Response: 01 03 04 00 DC 00 DD FB 90

3. Write data 0x02 to address 0x05, the measuring medium is oil.

Host request: 01 06 00 05 00 02 18 0A

Slave response: 01 06 00 05 00 02 18 0A

4. Write data 0x0A to address 0x06, change the operating cycle to 10 seconds.

Host request: 01 06 00 06 00 0A E9 CC

Slave response: 01 06 00 06 00 0A E9 CC

5. Write data 0X02 to address 0X04, set the slave address to 0x02

Host request: 01 06 00 04 00 02 49 CA

Slave response: 01 06 00 04 00 02 49 CA

6. After changing the slave address, read the value of the register at address 0X01 (real-time value), 0x0082

Host request: 02 03 00 01 00 01 D5 F9

Slave response: 02 03 02 00 82 7C 25

7. After changing the slave address, write data 0x01 to address 0x06, change the operating cycle to 1 second.

Host request: 02 06 00 06 00 01 A8 38

Slave response: 02 06 00 06 00 01 A8 38

Remarks: The above values are all hexadecimal numbers

2 . DYP Protocol

1.Data format

(1) Control code

Description	Read Processing value	Read Real time value	Modify sensor address	Medium speed setting	Operating cycle setting
Code	0x01	0x02	0x03	0x04	0x05

(2) Data frame format

Frame data	Description	Byte
Start bit	0x55	1Byte
Start bit	0xaa	1Byte
Address	Default 0x01	1Byte
Code	Control code	1Byte
Data_H	Data High 8 bits	1Byte
Data_L	Data low 8 bits	1Byte
Checksum	Checksum	1Byte

2. Formula

Checksum=(start bit+address+code+data)&0x00ff

3. Example

3.(1) Read liquid level value

There are two instruction feature codes for reading the level value

(1) Read processing value feature code: 0x01

(2) Read real-time value feature code: 0x02

The operation mode of the two instruction feature codes is the same. The following takes the read processing value as an example to introduce the method of reading the liquid level value.

	Start bit		Address	Code	Data		Checksum
Master request	0x55	0xaa	0x01	0x01	N/A	N/A	Checksum
Slave Response	0x55	0xaa	0x01	0x01	Data_H	Data_L	Checksum

Example: Read processing value of address 0x01 device

Sensor address	0x01
Master request	0x55 0xaa 0x01 0x01 checksum
Checksum	(0x55+0xaa+0x01+0x01) &0x00ff = 0x01
Sensor response	0x55 0xaa 0x01 0x01 0x02 0x33 checksum
Checksum	(0x55+0xaa+0x01+0x01+0x02+0x33) &0x00ff = 0x36
Instruction	0x02 is the high data of the distance, 0x33 is the low data of the distance; The distance value is 0x0233; converted to decimal is 563; the unit is: mm

3.(2) Modify Sensor address

Modify sensor address code:0x03 (ADD: the address need to change)

	Start bit		Address	Code	Data		Checksum
Master request	0x55	0xaa	ADD	0x03	N/A	N/A	Checksum
Slave Response	0x55	0xaa	ADD	0x03	N/A	N/A	Checksum

Example: Change address 0x01 to 0x05

Sensor address	0x01	New address	0x05
Master request	0x55 0xaa 0x05 0x03 checksum		
Checksum	(0x55+0xaa+0x05+0x03) &0x00ff = 0x07		
Sensor response	0x55 0xaa 0x05 0x03 checksum		
Checksum	(0x55+0xaa+0x05+0x03) &0x00ff = 0x07		
Instruction	If the returned data frame is the same as the sent data frame, the setting is successful. Otherwise fail		

Example of Read processing value after changed address

Sensor address	0x01
Master request	0x55 0xaa 0x05 0x01 checksum
Checksum	(0x55+0xaa+0x05+0x01) &0x00ff = 0x05
Sensor response	0x55 0xaa 0x05 0x01 0x02 0x33 checksum
Checksum	(0x55+0xaa+0x05+0x01+0x02+0x33) &0x00ff = 0x3a
Instruction	0x02 is the high data of the distance, 0x33 is the low data of the distance; The distance value is 0x0233; converted to decimal is 563; the unit is: mm

Example of change medium after changed address

Sensor address	0x01
Master request	0x55 0xaa 0x05 0x04 0x00 0x02 checksum
Checksum	(0x55+0xaa+0x05+0x04+0x00+0x02) &0x00ff = 0x0a
Sensor response	0x55 0xaa 0x05 0x04 0x00 0x02 checksum

Checksum	(0x55+0xaa+0x05+0x04+0x00+0x02) &0x00ff = 0x0a
Instruction	If the returned data frame is the same as the sent data frame, the setting is successful. Otherwise fail

3.(3) Change detection medium

Modify sensor detection medium code: 0x04

	Start bit		Address	Code	Data		Checksum
Master request	0x55	0xaa	ADD	0x04	Data	Data	Checksum
Slave Response	0x55	0xaa	ADD	0x04	Data	Data	Checksum

Example: Change medium to diesel, 0x01 is water,0x02 is diesel. Default 0x01

Sensor address	0x01
Master request	0x55 0xaa 0x01 0x04 0x00 0x02 checksum
Checksum	(0x55+0xaa+0x01+0x04+0x00+0x02) &0x00ff = 0x06
Sensor response	0x55 0xaa 0x01 0x04 0x00 0x02 checksum
Checksum	(0x55+0xaa+0x01+0x04+0x00+0x02) &0x00ff = 0x06
Instruction	If the returned data frame is the same as the sent data frame, the setting is successful. Otherwise fail

3.(4) Setting operating cycle

Modify sensor operation cycle code: 0x05

	Start bit		Address	Code	Data		Checksum
Master request	0x55	0xaa	ADD	0x05	Data	Data	Checksum
Slave Response	0x55	0xaa	ADD	0x05	Data	Data	Checksum

Example: Set the sensor operating cycle to 10 seconds, then fill in 0x000a in the data field, and the value range is 0x01~0x3C. Default value 0x02

Sensor address	0x01
Master request	0x55 0xaa 0x01 0x05 0x00 0x0a checksum
Checksum	(0x55+0xaa+0x01+0x04+0x00+0x0a) &0x00ff = 0x0f
Sensor response	0x55 0xaa 0x01 0x05 0x00 0x0a checksum
Checksum	(0x55+0xaa+0x01+0x05+0x00+0x0a) &0x00ff = 0x0f
Instruction	If the returned data frame is the same as the sent data frame, the setting is successful. Otherwise fail

3.(5) Broadcast address

Broadcast address:0xFF

	Start bit		Address	Code	Data		Checksum
Master request	0x55	0xaa	0xff	0x01	N/A	N/A	Checksum
Slave Response	0x55	0xaa	0xff	0x01	Data_H	Data_L	Checksum

Example: Use the 0x01 instruction to read the processed value through the 0xFF broadcast address

Sensor address	0x01
Master request	0x55 0xaa 0xff 0x01 checksums
Checksum	(0x55+0xaa+0xff+0x01) &0x00ff = 0xff
Sensor response	0x55 0xaa 0x01 0x01 0x02 0x45 checksums
Checksum	(0x55+0xaa+0x01+0x01+0x02+0x45) &0x00ff = 0x48
Instruction	0x02 is the high data of the distance; 0x45 is the low data of the distance; The distance value is 0x0245; converted to decimal system is 581; the unit is: mm

Example: Use the 0x03 instruction to read the current address value through the 0xff broadcast address

Sensor address	0x01
Master request	0x55 0xaa 0xff 0x03 checksum
Checksum	(0x55+0xaa+0xff+0x03) &0x00ff = 0x01
Sensor response	0x55 0xaa 0x01 0x03 checksum
Checksum	(0x55+0xaa+0x01+0x03) &0x00ff = 0x03
Instruction	0x01 Address value is 0x01

Example: Use the 0x04 instruction to read the currently set measurement medium through the 0xff broadcast address.

Sensor address	0x01
Master request	0x55 0xaa 0xff 0x04 checksum
Checksum	(0x55+0xaa+0xff+0x04) &0x00ff = 0x02
Sensor response	0x55 0xaa 0x01 0x04 0x00 0x02 checksum
Checksum	(0x55+0xaa+0x01+0x04+0x00+0x02) &0x00ff = 0x06
Instruction	The data value is 0x0002, and the currently set measuring medium is diesel

Example: Use the 0x05 instruction to read the currently set work cycle through the 0xff broadcast address

Sensor address	0x01
Master request	0x55 0xaa 0xff 0x04 checksum
Checksum	(0x55+0xaa+0xff+0x04) &0x00ff = 0x02

Sensor response	0x55 0xaa 0x01 0x05 0x00 0x0a checksum
Checksum	(0x55+0xaa+0x01+0x05+0x00+0x0a) &0x00ff = 0x0f
Instruction	The data value is 0x000a, then the duty cycle is 10 seconds

Notice:

(1) Regardless of the value of the sensor's address, once a data frame with an address value of 0xff is received, it will respond according to the command feature code of the data frame, and the response address value is the local address value, not 0xff.

(2) When using the broadcast address with the 0x03 command, 0xff will not be set as the sensor address, only the current address value of the sensor will be returned.

(3) The broadcast address can be used when the address of the sensor cannot be obtained, and the address of the current sensor can be obtained according to the address bit of the data frame of the reply.

(4) The broadcast address cannot be used on a bus with multiple sensors, otherwise multiple modules will respond at the same time and cause the bus communication to fail. It can only be used in the case of one host for one sensor.

(4) Indicator instruction

The indicator light flashes slowly when the sensor detects liquid, and the indicator light is always on when the sensor does not detect liquid.

3. UART Output

(1) Pin Definition

Wire color	Pin Name	Pin description	Remark
Red	VCC	Power input	
Black	GND	GND	
Yellow	TX	UART Output	
White	RX	EMPTY	

(2) Instruction

(2) 1. UART communication instruction

UART	Data bit	Stop bit	Parity check	Baud rate
TTL Level	8	1		9600bps

(2) 2. UART output format

Frame data	Start bit	Data_H	Data_L	SUM
Description	0XFF	Distance value high 8 bits	Distance value low 8 bits	Checksum
Byte	1Byte	1Byte	1Byte	1Byte

(2) 3. Example

Start bit	Data_H	Data_L	SUM
0XFF	0X07	0XA1	0XA7

Remark: checksum only reserve low 8 bit value
SUM =(Start+ Data_H+ Data_L)&0x00FF
=(0XFF + 0X07 + 0XA1)&0x00FF
=0XA7;
Liquid level value= Data_H*256+ Data_L=0X07A1;
converts to decimal is equal to 1953,Means current detection value is 1953mm.

(3) Led indicator

(1) LED is always on: the module is powered on but no liquid is detected.
(2) LED flashes slowly: When the module detects liquid, the LED indicator flashes at a frequency of 1 time per second.

4. Switch Output

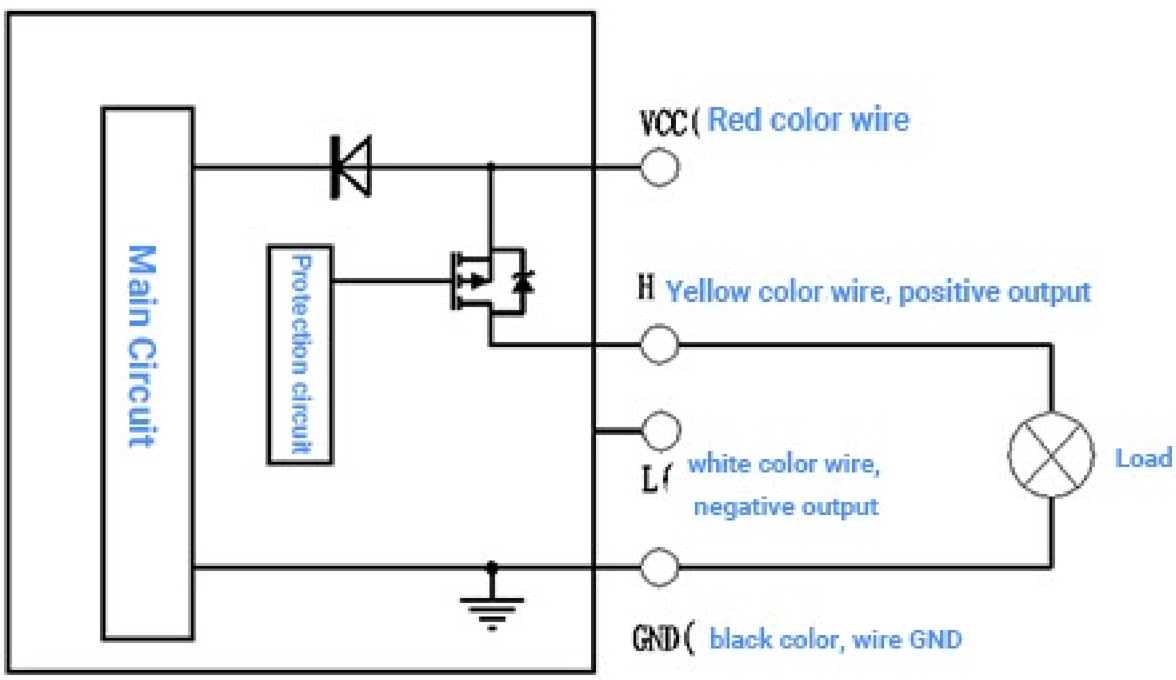
(1) Pin Definition

Wire color	Pin Name	Pin description	Remark
Red	VCC	Power input	

Black	GND	GND	
Yellow	H	Positive switch output	
White	L	Negative switch output	

(2) Instruction

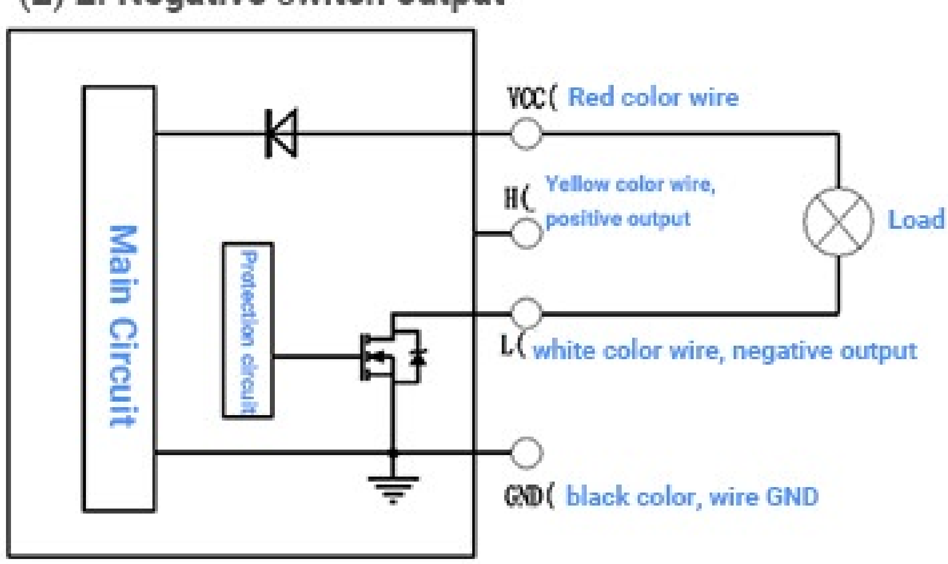
(2) 1. Positive switch output



Positive switch output wiring diagram

1. The sensor module detects liquid, the LED flashes at a frequency of 1 time per second, the internal MOSFET is turned on, output of positive output lead H (yellow wire) is equal to VCC.
2. The sensor module does not detect liquid, the LED is always on, the internal MOSFET is off, and positive output lead H (yellow wire) has no output.
3. The switching output load capacity should be less than 500mA resistive load.

(2) 2. Negative switch output



Negative switch output wiring diagram

1. The sensor detects the liquid, the LED flashes at a frequency of 1 time per second, and the negative output lead L (white wire) is directly connected to GND.
2. The sensor module does not detect liquid, the LED keeps on, the internal MOSFET is off, and the negative output lead L (white wire) has no output.
3. The switching output load capacity should be less than 500mA resistive load.

(3) Led indicator

LED is always on: The module is powered on but no liquid is detected.
LED flashes slowly: When the module detects liquid, the LED indicator flashes at a frequency of 1 time per second.