Communication Protocol

pH/ Conductivity/DO Meter

1. Communication interface

The communication interface of this instrument is TTL level serial port. Note that it is not RS232 level. It only needs a simple USB cable to connect the instrument and PC. the parameters of serial port communication interface are fixed, as follows:
Baud rate 9600, 8 data bits, 1 stop bit, no parity check

2. Communication protocol

This instrument implements a simple upper application security protocol based on serial port. Two concepts of "request to connect package" and "request to disconnect package" are added here. That is to say, after opening the serial port of PC, the correct communication cannot be obtained immediately. At this time, the hardware communication layer is connected at most, but the upper application layer is not connected yet, Therefore, after successfully opening the serial port, the PC upper computer must immediately send a "request connection package" to the instrument, and then the PC upper computer should enter the waiting state in the program, waiting for the instrument to return a response. If the instrument successfully receives the "request connection package", the instrument will immediately return the received "request connection package" as a response to the PC upper computer intact, Then the computer icon 🖥will be displayed on the right side of the title bar on the top of the LCD screen, which means that the connection of the instrument is successful. If the PC host computer successfully receives the response from the instrument, then the PC host computer should also think that the connection is successful, and then the two sides can enter the real interaction stage, Now let's briefly introduce the concept of "request to disconnect the package". When the PC wants to exit the communication, it should send this package to the instrument to notify the instrument to disconnect. If the instrument receives this "request to disconnect the package", the icon 🖥 on the LCD screen of the instrument will disappear immediately, which means that the connection between the two parties is successfully disconnected, Note that at this time, the instrument will not return the response to the PC host computer, so the PC host computer can directly close the application and exit after sending the "request to disconnect the package". In fact, the "request to disconnect the package" is not necessary, because its function is only to make the icon on the LCD screen disappear, making the communication more friendly and complete

2.1 communication data packet format

When the instrument communicates with PC, all the interactive commands are a data packet, and the length of the data packet is variable, so it is very flexible. Now, the format of the data packet is introduced in detail.

Field	Meaning
The head of package	One byte in length, Fixed as 0 x 15
Data field length	One byte in length, Indicates the specific length of the data field in the packet
Data field	Real communication data, The length is not fixed, But the maximum is 255 bytes
The tail of package	One byte in length, Fixed to 0 x 16

2.2 interactive command

The interaction between the instrument and the host computer is bidirectional. Once the connection is established successfully, the instrument will continuously send "measurement parameter data package" to the PC host computer at an interval of about 800ms. At this time, the PC host computer needs to analyze the specific meaning of the data package, and then render it. Of course, in addition, the PC host computer can actively send data package to the instrument to set various system parameters of the instrument, The following is a detailed introduction of various functional interactive commands (a command is a packet)

Note: the introduction of packet header (0x15) and packet tail (0x16) is omitted for all packets below, because their values are fixed

2.2.1 request connection packet

Field	Specific value
Data field length	1
Data field	0x22

The data packet is sent to the instrument by PC, and then the instrument returns it to PC passively

2.2.2 request to disconnect packets

Field	Specific value
Data field length	1
Data field	0x23

This data packet is sent to the instrument by PC

2.2.3 measurement parameter data package

Field	Specific value
Data field length	70
Data field	Please see params_ Packet structure

This data packet is the most important data packet in the whole communication, because it contains pH, cond, DO and other measurement parameter values, as well as various system setting values. It is sent to the PC by the instrument active interval (about 800ms). Because the data domain of this data packet is very complex, the following is a separate introduction

```
typedef __ packed struct{
u8 model:4;// The model of the instrument, accounting for 4%
u8 cmd:4;// Command number, 4 bits, fixed to 1
u8 cond_ unit:4;//cond Company
u8 cond_ mode:2;//cond pattern
u8 cond_ r esolution:2;//cond resolving power
u8 ph_ tmp_ src:1;//ph Temperature source
u8 cond_ tmp_ src:1;//cond Temperature source
u8 do_ tmp_ src:1;//do Temperature source
u8 cond_ std_ type:1;//cond Type of standard buffer
u8 ph_ std_ type:2;//ph Type of standard buffer
u8 ph_ h2o_ type:2;//ph Water type
u8 tmp_ unit:1;// Unit of temperature
u8 is_ ph_ stable:1;//ph Is it stable
u8 is_ cond_ stable:1;//cond Is it stable
u8 is_ do_ stable:1;//do Is it stable
u8 ph_ r esolution:2;//ph resolving power
u8 do_ r esolution:2;//do Resolution of
float ph_ Val; / / pH value
float mv_ Val; / / MV value
float ph_ tmp_ Val; / / current temperature of pH parameter
float cond_ Val; / / cond conductivity value
float cond_ tmp_ Val; / / current temperature of cond parameter
float do_ Val; / / do
float do_ sat_ The saturation value of Val; / / do
float do_ tmp_ Val; / / the current temperature of the do parameter
float do_ Current; / / the current value of the do parameter

float ph_ mtc_ Manual temperature value of TMP; / / pH parameter

float cond_ mtc_ Manual temperature value of TMP; / / cond parameter

float do_ mtc_ Manual temperature value of TMP; / / do parameter

float cond_ tmp_ Temperature compensation coefficient of COE; / / cond parameter

float cond_ tds_ TDS coefficient of COE; / / cond parameter

float cond_ k. The conductance electrode constant of / / cond parameter

float do_ Atmospheric pressure compensation value of pressure; / / do parameter

u8 do_ Salinity compensation value of SAL; / / do parameter

u8 is_ ph_ atc:1;//ph Is the current parameter ATC automatic temperature compensation

u8 is_ cond_ atc:1;//cond Is the current parameter ATC automatic temperature compensation

u8 is_ do_ atc:1;//do Is the current parameter ATC automatic temperature compensation

u8 cond_ ref_ tmp:5;//cond Reference temperature of parameter

}PARAMS_ PACKET;
```

This structure is written in C language. If you don't understand it, please do it yourself. In addition, this structure contains data of cond, do and other parameters. If it's only an pH meter, you can ignore the data of cond, do and other parameters

2.2.4 pH system parameter setting data package

Field	Specific value
Data field length	5
Data field	Please see setting_ Packet structure

This data packet is sent to the instrument by PC

```
typedef __ packed struct{

u8 setting_ No; / / the number of the system setting item

Float Val; / / / the value of the system setting item

}SETTING_ PACKET;
```

setting_ The specific meaning of no is as follows:

Number value	Specific value

0	Modify the ammonia compensation of the instrument
	Val = 0 for "ordinary water"
	Val =1 for "pure water"
	Val =2 for "ammoniated pure water"

1	Clear all records of pH

2	Modify the temperature source of pH
	Val = 0, automatic temperature compensation
	Val =1, manual temperature compensation

3	Modification of standard solution series of pH
	Val = 0, national standard series
	Val =1, NIST series
	Val=2, USA Europe and America Series

4	Modify pH resolution For low precision pH meter: Val = 1, "0.1 pH" Val = 2, "0.01 pH" For high precision pH meter: Val = 2, "0.01 pH" Val = 3, "0.001 pH" Please select the resolution group according to the specific model of the instrument
5	Modify the manual compensation temperature of pH The range of Val is 0.0-99.9 ℃
6	PH returned to factory
24	Save the pH data of the current measurement
27	Query pH records Once the instrument receives this command, it will enter the record upload mode. Each record is sent in the form of a packet. For details, please see "pH record upload packet". When all records are uploaded, the instrument will send a "pH record upload packet" to the PC, The purpose is to tell the PC that the host computer can display all the records just received

2.2.5 pH record upload data packet

Field	Specific value
Data field length	57
Data field	Please see RECORD_ Packet structure

This data packet is sent to PC by the instrument. The number of records stored by the instrument will be sent as many times as possible

typedef __ packed struct{

u8 model:4;// The model of the instrument, accounting for 4%

u8 cmd:4;// Command number, 4 bits, fixed to 2

```
RECORD record;
}RECORD_ PACKET;

typedef struct{
Char no [4]; / / store record number
Char val1 [14]; / / used to store the principal value of pH, such as 6.86 pH
Char val2 [12]; / / used to store MV value, such as "414 MV"
Char TMP [9]; / / used to store temperature, such as "25.0 ℃"
Char date [17]; / / used to record the date of saving, such as "2018 / 8 / 8 12:12"
}RECORD;
```

2.2.6 pH record upload end data packet

Field	Specific value
Data field length	1
Data field	The value of the high 4 bits is fixed as 3, and the value of the low 4 bits is the model of the instrument

This data packet is sent to PC by the instrument. It is sent once after the record is uploaded