超声波水表

测试通讯协议

【V1.0c】

修订历史

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 日期 | 修订前  版本 | 修订后  版本 | 修订人 | 说明 |
| 2019-08-16 | - | 1.0a | T.Fan | 初始发布 |
| 2019-08-16 | 1.0a | 1.0b | T.Fan | 1 3.2.7 写LoRa参数的数据长度由33H修正为23H |
| 2019-08-28 | 1.0b | 1.0c | T.Fan | 1 完成读/写水表参数指令  2 3.2.11 写LCD的数据长度由03H修正为13H |

# 范围

本协议用于测试系统与水表之间的通讯，遵从CJ/T 188-2018《户用计量仪表数据传输技术条件》。

# 控制位定义

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| B7 | B6 | B5 | B4 | B3 | B2 | B1 | B0 |
| 传输方向 | 通讯状况 |  |  | 加密 |  |  |  |
| 0:M2S  1:M2S | 0:通讯正常  1:通讯异常 | 功能码2  10b: 测试功能码 | | 0：明文  1：密文 | 功能码1  001b:读  100b:写 | | |

# 协议格式

## 概述

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **No.** | **说明** | **控制码** | **回复** | **数据标识(DI0DI1)** | **备注** |
| 1 | 开始USM测试 | 24H | A4H | 457DH | 自定义 |
| 2 | 读USM测试结果 | 21H | A1H | 457DH | 自定义 |
| 3 | 阀控命令 | 24H | A4H | 461CH | 自定义 |
| 4 | 读阀控状态 | 21H | A1H | 461CH | 自定义 |
| 5 | LoRa测试 | 24H | A4H | 4C27H | 自定义 |
| 6 | 读LoRa测试结果 | 21H | A1H | 4C27H | 自定义 |
| 7 | 写LoRaWAN参数 | 24H | A4H | C71EH | 自定义 |
| 8 | 读LoRaWAN参数 | 21H | A1H | C71EH | 自定义 |
| 9 | 写水表参数 | 24H | A4H | 57D3H | 自定义 |
| 10 | 读水表参数 | 21H | A1H | 57D3H | 自定义 |
| 11 | 写LCD | 24H | A4H | 7C34H | 自定义 |

## 详细说明

### 开始USM测试(457DH)

1. 命令帧：

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **起始码** | **仪表类型** | **地址码** | **控制码** | **数据长度** | **数据码** | **校验码** | **结束码** |
| 68H | 10H | A0～A6 | 24H | 03H | DATA | CS | 16H |

数据

|  |  |  |  |
| --- | --- | --- | --- |
| **序号** | **名称** | **值** | **说明** |
| 0 | DI0 | 45H | 数据标识0 |
| 1 | DI1 | 7DH | 数据标识1 |
| 2 | SER | XXH | 报文序列号 |

1. 回复帧

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **起始码** | **仪表类型** | **地址码** | **控制码** | **数据长度** | **数据码** | **校验码** | **结束码** |
| 68H | 10H | A0～A6 | 84H | 03H | DATA | CS | 16H |

数据

|  |  |  |  |
| --- | --- | --- | --- |
| **序号** | **名称** | **值** | **说明** |
| 0 | DI0 | 45H | 数据标识0 |
| 1 | DI1 | 7DH | 数据标识1 |
| 2 | SER | XXH | 报文序列号 |

### 3.2.2 读USM测试结果

1. 命令帧：

* 命令格式

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **起始码** | **仪表类型** | **地址码** | **控制码** | **数据长度** | **数据码** | **校验码** | **结束码** |
| 68H | 10H | A0～A6 | 21H | 03H | DATA | CS | 16H |

* 数据格式

|  |  |  |  |
| --- | --- | --- | --- |
| **序号** | **名称** | **值** | **说明** |
| 0 | DI0 | 45H | 数据标识0 |
| 1 | DI1 | 7DH | 数据标识1 |
| 2 | SER | XXH | 报文序列号 |

1. 回复帧

* 命令格式

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **起始码** | **仪表类型** | **地址码** | **控制码** | **数据长度** | **数据码** | **校验码** | **结束码** |
| 68H | 10H | A0～A6 | 81H | 06H | DATA | CS | 16H |

* 数据格式

|  |  |  |  |
| --- | --- | --- | --- |
| **序号** | **名称** | **值** | **说明** |
| 0 | DI0 | 45H | 数据标识0 |
| 1 | DI1 | 7DH | 数据标识1 |
| 2 | SER | XXH | 报文序列号 |
| 3 | D0 | 00H | 测试状态  00H 测试完成  01H 测试中 |
| 4 | D1 | XXH | 故障代码1  00000001b TIMEOUT\_UP  00000010b TIMEOUT\_DOWN  00000100b PW1ST\_UP  00001000b PW1ST\_DOWN |
| 5 | D2 | XXH | 故障代码2 |

### 3.2.3 阀控命令(461CH)

1. 命令帧：

* 命令格式

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **起始码** | **仪表类型** | **地址码** | **控制码** | **数据长度** | **数据码** | **校验码** | **结束码** |
| 68H | 10H | A0～A6 | 24H | 04H | DATA | CS | 16H |

* 数据

|  |  |  |  |
| --- | --- | --- | --- |
| **序号** | **名称** | **值** | **说明** |
| 0 | DI0 | 46H | 数据标识0 |
| 1 | DI1 | 1CH | 数据标识1 |
| 2 | SER | XXH | 报文序列号 |
| 3 | D0 | XXH | 命令  00H 关阀  01H 开阀 |

1. 回复帧

* 命令格式

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **起始码** | **仪表类型** | **地址码** | **控制码** | **数据长度** | **数据码** | **校验码** | **结束码** |
| 68H | 10H | A0～A6 | 84H | 03H | DATA | CS | 16H |

* 数据

|  |  |  |  |
| --- | --- | --- | --- |
| **序号** | **名称** | **值** | **说明** |
| 0 | DI0 | 46H | 数据标识0 |
| 1 | DI1 | 1CH | 数据标识1 |
| 2 | SER | XXH | 报文序列号 |

### 3.2.4 读阀控状态

1. 命令帧：

* 命令格式

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **起始码** | **仪表类型** | **地址码** | **控制码** | **数据长度** | **数据码** | **校验码** | **结束码** |
| 68H | 10H | A0～A6 | 21H | 03H | DATA | CS | 16H |

* 数据

|  |  |  |  |
| --- | --- | --- | --- |
| **序号** | **名称** | **值** | **说明** |
| 0 | DI0 | 46H | 数据标识0 |
| 1 | DI1 | 1CH | 数据标识1 |
| 2 | SER | XXH | 报文序列号 |

1. 回复帧

* 命令格式

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **起始码** | **仪表类型** | **地址码** | **控制码** | **数据长度** | **数据码** | **校验码** | **结束码** |
| 68H | 10H | A0～A6 | 81H | 05H | DATA | CS | 16H |

* 数据

|  |  |  |  |
| --- | --- | --- | --- |
| **序号** | **名称** | **值** | **说明** |
| 0 | DI0 | 46H | 数据标识0 |
| 1 | DI1 | 1CH | 数据标识1 |
| 2 | SER | XXH | 报文序列号 |
| 3 | D0 | 00H | 阀门状态  00H 水表不支持阀控  01H 已开  02H 正在开  03H 正在关  04H 已关  05H 故障 |
| 4 | D1 | XXH | 故障代码  00000001b 开阀超时  00000010b 关阀超时 |

### 

### 3.2.5 LoRa测试(4C27H)

1. 命令帧：

* 命令格式

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **起始码** | **仪表类型** | **地址码** | **控制码** | **数据长度** | **数据码** | **校验码** | **结束码** |
| 68H | 10H | A0～A6 | 24H | 03H | DATA | CS | 16H |

* 数据

|  |  |  |  |
| --- | --- | --- | --- |
| **序号** | **名称** | **值** | **说明** |
| 0 | DI0 | 4CH | 数据标识0 |
| 1 | DI1 | 27H | 数据标识1 |
| 2 | SER | XXH | 报文序列号 |
| 3 | D0 | XXH | 命令  00H 取消测试  01H 开始测试 |

1. 回复帧

* 命令格式

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **起始码** | **仪表类型** | **地址码** | **控制码** | **数据长度** | **数据码** | **校验码** | **结束码** |
| 68H | 10H | A0～A6 | 84H | 03H | DATA | CS | 16H |

* 数据

|  |  |  |  |
| --- | --- | --- | --- |
| **序号** | **名称** | **值** | **说明** |
| 0 | DI0 | 46H | 数据标识0 |
| 1 | DI1 | 1CH | 数据标识1 |
| 2 | SER | XXH | 报文序列号 |

### 3.2.6 读LoRa测试结果

1. 命令帧：

* 命令格式

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **起始码** | **仪表类型** | **地址码** | **控制码** | **数据长度** | **数据码** | **校验码** | **结束码** |
| 68H | 10H | A0～A6 | 21H | 03H | DATA | CS | 16H |

* 数据

|  |  |  |  |
| --- | --- | --- | --- |
| **序号** | **名称** | **值** | **说明** |
| 0 | DI0 | 4CH | 数据标识0 |
| 1 | DI1 | 27H | 数据标识1 |
| 2 | SER | XXH | 报文序列号 |

1. 回复帧

* 命令格式

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **起始码** | **仪表类型** | **地址码** | **控制码** | **数据长度** | **数据码** | **校验码** | **结束码** |
| 68H | 10H | A0～A6 | 81H | 03H | DATA | CS | 16H |

* 数据

|  |  |  |  |
| --- | --- | --- | --- |
| **序号** | **名称** | **值** | **说明** |
| 0 | DI0 | 4CH | 数据标识0 |
| 1 | DI1 | 27H | 数据标识1 |
| 2 | SER | XXH | 报文序列号 |
| 3 | D0 | XXH | 状态码  00H 测试完成  01H 测试中  02H LoRa故障 |
| 4 | D1 | XXH | 故障码 |

### 3.2.7 写LoRa参数(C71EH)

1. 命令帧：

* 命令格式

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **起始码** | **仪表类型** | **地址码** | **控制码** | **数据长度** | **数据码** | **校验码** | **结束码** |
| 68H | 10H | A0～A6 | 24H | 23H | DATA | CS | 16H |

* 数据

|  |  |  |  |
| --- | --- | --- | --- |
| **序号** | **名称** | **值** | **说明** |
| 0 | DI0 | C7H | 数据标识0 |
| 1 | DI1 | 1EH | 数据标识1 |
| 2 | SER | XXH | 报文序列号 |
| 3-10 | D0-D7 |  | dev\_eui [0][1]…[7] |
| 11-18 | D8-D15 |  | app\_eui [0][1]…[7] |
| 19-34 | D16-D31 |  | app\_key [0][1]…[15] |

1. 回复帧

* 命令格式

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **起始码** | **仪表类型** | **地址码** | **控制码** | **数据长度** | **数据码** | **校验码** | **结束码** |
| 68H | 10H | A0～A6 | 84H | 03H | DATA | CS | 16H |

* 数据

|  |  |  |  |
| --- | --- | --- | --- |
| **序号** | **名称** | **值** | **说明** |
| 0 | DI0 | C7H | 数据标识0 |
| 1 | DI1 | 1EH | 数据标识1 |
| 2 | SER | XXH | 报文序列号 |

### 3.2.8 读LoRa参数

1. 命令帧：

* 命令格式

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **起始码** | **仪表类型** | **地址码** | **控制码** | **数据长度** | **数据码** | **校验码** | **结束码** |
| 68H | 10H | A0～A6 | 21H | 03H | DATA | CS | 16H |

* 数据

|  |  |  |  |
| --- | --- | --- | --- |
| **序号** | **名称** | **值** | **说明** |
| 0 | DI0 | C7H | 数据标识0 |
| 1 | DI1 | 1EH | 数据标识1 |
| 2 | SER | XXH | 报文序列号 |

1. 回复帧

* 命令格式

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **起始码** | **仪表类型** | **地址码** | **控制码** | **数据长度** | **数据码** | **校验码** | **结束码** |
| 68H | 10H | A0～A6 | 81H | 23H | DATA | CS | 16H |

* 数据

|  |  |  |  |
| --- | --- | --- | --- |
| **序号** | **名称** | **值** | **说明** |
| 0 | DI0 | C7H | 数据标识0 |
| 1 | DI1 | 1EH | 数据标识1 |
| 2 | SER | XXH | 报文序列号 |
| 3-10 | D0-D7 |  | dev\_eui [0][1]…[7] |
| 11-18 | D8-D15 |  | app\_eui [0][1]…[7] |
| 19-34 | D16-D31 |  | app\_key [0][1]…[15] |

### 3.2.9 写水表参数(57D3H)

1. 命令帧：

* 命令格式

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **起始码** | **仪表类型** | **地址码** | **控制码** | **数据长度** | **数据码** | **校验码** | **结束码** |
| 68H | 10H | A0～A6 | 24H | 29H | DATA | CS | 16H |

* 数据

|  |  |  |  |
| --- | --- | --- | --- |
| **序号** | **名称** | **值** | **说明** |
| 0 | DI0 | 57H | 数据标识0 |
| 1 | DI1 | D3H | 数据标识1 |
| 2 | SER | XXH | 报文序列号 |
| 3-5 | D0-D2 |  | 采样时间（ms）,6位BCD，低位在前  例如：123456 BCD:563412 |
| 6-9 | D3-D6 |  | 零漂（Lh）,XXXXXX.XX,8位BCD，低位在前。  例如：123456.78 BCD:78563412 |
| 10 | D7 |  | 单位，Lh |
| 11 | D8 |  | PW1ST阈值，2位BCD X.X |
| 12-15 | D9-D12 |  | ToF上限（uS），XXXXXX.XX, 8位BCD，低位在前 |
| 16-19 | D13-D16 |  | ToF下限（uS），XXXXXX.XX, 8位BCD，低位在前 |
| 20-23 | D17-D20 |  | dToF最大值(uS)，XXXXXX.XX， 8位BCD |
| 24-27 | D21-D24 |  | 起始流量（Lh），XXXXXX.XX, 8位BCD。  例如：12345678.90 7856341290 |
| 28 | D25 |  | 单位，Lh |
| 29-32 | D26-D29 |  | 管段横向长度L1（mm），XXXXXX.XX, 8位BCD |
| 33-36 | D30-D33 |  | 管段纵向长度L2（mm），XXXXXX.XX, 8位BCD |
| 37-40 | D34-D37 |  | 管段半径（mm），XXXXXX.XX, 8位BCD |

1. 回复帧

* 命令格式

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 起始码 | 仪表类型 | 地址码 | 控制码 | 数据长度 | 数据码 | 校验码 | 结束码 |
| 68H | 10H | A0～A6 | 84H | 03H | DATA | CS | 16H |

* 数据

|  |  |  |  |
| --- | --- | --- | --- |
| **序号** | **名称** | **值** | **说明** |
| 0 | DI0 | 57H | 数据标识0 |
| 1 | DI1 | D3H | 数据标识1 |
| 2 | SER | XXH | 报文序列号 |

### 3.2.10 读水表参数

1. 命令帧：

* 命令格式

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **起始码** | **仪表类型** | **地址码** | **控制码** | **数据长度** | **数据码** | **校验码** | **结束码** |
| 68H | 10H | A0～A6 | 21H | 03H | DATA | CS | 16H |

* 数据

|  |  |  |  |
| --- | --- | --- | --- |
| **序号** | **名称** | **值** | **说明** |
| 0 | DI0 | 57H | 数据标识0 |
| 1 | DI1 | D3H | 数据标识1 |
| 2 | SER | XXH | 报文序列号 |

1. 回复帧

* 命令格式

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 起始码 | 仪表类型 | 地址码 | 控制码 | 数据长度 | 数据码 | 校验码 | 结束码 |
| 68H | 10H | A0～A6 | 81H | 0xH | DATA | CS | 16H |

* 数据

|  |  |  |  |
| --- | --- | --- | --- |
| **序号** | **名称** | **值** | **说明** |
| 0 | DI0 | 57H | 数据标识0 | |
| 1 | DI1 | D3H | 数据标识1 | |
| 2 | SER | XXH | 报文序列号 | |
| 3-5 | D0-D2 |  | 采样时间（ms）,6位BCD，低位在前 | |
| 6-9 | D3-D6 |  | 零漂（Lh）,XXXXXXXX.XX,8位BCD，低位在前。  例如：12345678.90 7856341290 | |
| 10 | D7 |  | 单位，Lh | |
| 11 | D8 |  | PW1ST阈值，2位BCD X.X | |
| 12-15 | D9-D12 |  | ToF上限（uS），XXXXXX.XX, 8位BCD，低位在前 | |
| 16-19 | D13-D16 |  | ToF下限（uS），XXXXXX.XX, 8位BCD，低位在前 | |
| 20-23 | D17-D20 |  | dToF最大值(uS)，XXXXXX.XX， 8位BCD | |
| 24-27 | D21-D24 |  | 起始流量（Lh），XXXXXXXX.XX, 8位BCD。  例如：12345678.90 7856341290 | |
| 28 | D25 |  | 单位，Lh | |
| 29-32 | D26-D29 |  | 管段横向长度L1（mm），XXXXXX.XX, 8位BCD | |
| 33-36 | D30-D33 |  | 管段纵向长度L2（mm），XXXXXX.XX, 8位BCD | |
| 37-40 | D34-D37 |  | 管段半径（mm），XXXXXXXX.XX, 8位BCD | |

### 3.2.11 写LCD(7C34H)

1. 命令帧：

* 命令格式

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **起始码** | **仪表类型** | **地址码** | **控制码** | **数据长度** | **数据码** | **校验码** | **结束码** |
| 68H | 10H | A0～A6 | 24H | 13H | DATA | CS | 16H |

* 数据

|  |  |  |  |
| --- | --- | --- | --- |
| **序号** | **名称** | **值** | **说明** |
| 0 | DI0 | 57H | 数据标识0 |
| 1 | DI1 | D3H | 数据标识1 |
| 2 | SER | XXH | 报文序列号 |
| 3 | D0-D15 |  | LCD buffer  COM0: D0-D3  COM1: D4-D7  COM2: D8-D11  COM3: D12-D15 |

1. 回复帧

* 命令格式

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 起始码 | 仪表类型 | 地址码 | 控制码 | 数据长度 | 数据码 | 校验码 | 结束码 |
| 68H | 10H | A0～A6 | 84H | 03H | DATA | CS | 16H |

* 数据

|  |  |  |  |
| --- | --- | --- | --- |
| **序号** | **名称** | **值** | **说明** |
| 0 | DI0 | 57H | 数据标识0 |
| 1 | DI1 | D3H | 数据标识1 |
| 2 | SER | XXH | 报文序列号 |