**通 信 协 议**

**Communication Protocol**

协议名称:SP10/SP10W/SP70B/SP80B肺功能仪通信协议

Protocol Name: SP10/SP10W/SP70B/SP80B Spirometer Communication Protocol

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| 2019.05.20 | 1.0.0 | 首次下发。  First launched. | 盛建忠  Jianzhong Sheng |
| 2019.06.20 | 1.1.0 | 增加“获取设备中当前各参数的预计值”。  Added content ‘obtain predictive value of current parameters in the device’. | 盛建忠  Jianzhong Sheng |
| 2019.07.09 | 1.2.0 | 1、4.2、4.4章节中有错误，其中“向上取整”应为“四舍五入”；  Errors in chapter 4.2 and 4.4, ‘rounding up to an integer’ should be ‘rounding off’;  2、并说明4.4章节中设备显示“预计值比值”显示整数。  Illustrate in Chapter 4.4 that the ‘predictive value ratio’ displayed on the device is an integer. | 刘杨  Yang Liu |
| 2020.04.01 | 1.3.0 | 1. 增加4.1.2 EXP方案病例数目上传。   Add 4.1.2 EXP Program Number of Cases Uploading.   1. 增加4.2.2 测试结果上传（适用于EXP方案）。   Add 4.2.2 Test Results Uploading (applicable to EXP Program)   1. 增加4.3波形数据部分。   Add 4.3 Waveform Data Section   1. 增加4.5.2 获取EXP方案预计值。   Add 4.5.2 Obtain Predictive Value of EXP Program   1. 协议适用于SP10、SP10W。   Protocol is applicable to SP10, SP10W. | 刘杨  Yang Liu |
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# 引言 Introduction

## 目的 Purpose

编写此文档用于规范通信流程，明确该设备与相关设备之间信息交换的过程及数据格式，指导相关开发人员进行设备通信相关功能的设计与实现，使设备与相关软件保持高度的互连适配，也方便于客户对产品进行二次开发。

The purpose of this document is for standardizing the communication process, define the process and data format of information exchange between this device and the relevant device. Guiding relevant developers to design and realize relevant functions of device communication, which makes sure the high quality of interconnection and adaptation between the device and relevant software. This document is also applicable for customers’ secondary development.

预期读者为产品经理、系统分析师、工程师。

Expected readers are product managers, system analysts, and engineers.

## 适用范围 Scope Applies to

此协议适用于肺功能仪设备（以下简称 下位机）与需要同下位机进行信息交换的其他设备（如手机，以下简称 上位机）之间的蓝牙通信过程。

This protocol can be applied to the Bluetooth communication between spirometers (lower devices) and other devices (i.e. mobile phone, called upper devices) that need to exchange information with.

## 定义和缩写 Definitions & Abbreviations

|  |  |
| --- | --- |
| 术语 Terminology | 定义 Definition |
| 下位机  Lower Device | 肺功能仪设备  Spirometers |
| 上位机  Upper Device | 需要同下位机进行数据交换的其他设备，如手机  Other devices that need to exchange information with the lower device, i.e. mobile phone |
| BLE | 蓝牙4.0的低功耗模式，在Android、iOS等平台为GATT传输方式  Bluetooth 4.0 Low Energy Mode, it is GATT transmission on platforms such as Android, iOS and so forth. |

## 约定 Convention

### 字节内容描述 Description of Byte Content

* 1. xxxx xxxx 代表一个字节8位二进制数据，x取值为0或1；

xxxx xxxx represents one byte of 8-bit binary data, the value of x is 0 or 1;

* 1. 0xXX 代表一个字节十六进制数据，0x为十六进制标志，X取值为0-F；

0xXX represents one byte of hexadecimal data, 0x is a sign of hexadecimal, the value of X is 0-F.

### 字节内位数编号 Number of bits in a byte

最高位 The Most Significant Bit

最低位 The Least Significant Bit

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 第7位  The 7th Bit | 第6位  The 6th Bit | 第5位  The 5th Bit | 第4位  The 4th Bit | 第3位  The 3rd Bit | 第2位  The 2nd Bit | 第1位  The 1st Bit | 第0位  The 0 Bit |

## 参考资料 References

无。Not Applicable.

# 

# 通用规则 General Rules

## 数据包结构 Data Packet Structure

所有数据包均包括包头、数据（如果有）及校验和。

All data packets include header, data (if applicable) and checksum.

数据包结构

Data Packet Structure

|  |  |  |
| --- | --- | --- |
| 包头Header | 数据  Data | 校验和  Checksum |
| 1字节  1 Byte | N字节（N由包类型决定）  N Byte (N depends on type of packets) | 1字节  1 Byte |

包头 Header：

最高位恒为1

The most significant bit is constantly 1

代表不同的数据包类型

Represent different packet types

数据 Data：

最高位恒为0

The most significant bit is constantly 0

对于数据部分最高位有1出现的数据包，其数据的最高位查询协议里该包数据具体说明。否则，数据部分只使用低7位（第0~6位）。

As for a data packet with 1 on the most significant bit of data section, this packet of data specifies its most significant bit inquiry protocol of the data. Otherwise, only use the low-order 7 bits of the data section (the 1st to 6th bit).

校验和 Checksum：

最高位恒为 0

The most significant bit is constantly 0

包头及数据部分所有内容的累加和，取低7位（第0~6位）。

The accumulated sum of all content in header and data, take the low-order 7 bits (the 1st to 6th bit).

## 封包与解包过程 Packing and Unpacking Process

|  |  |  |
| --- | --- | --- |
| 步骤 Steps | 封包  Packing | 解包  Unpacking |
| 1 | 设置包头  Set header | 读取包头、数据及校验和  Read header, data and checksum |
| 2 | 设置数据  Set data | 计算并检查校验和  Calculate and check checksum |
| 3 | 数据高位提取（如果有）  Extract high-order bits of data  (if applicable) | 数据高位恢复（如果有）  Recover high-order bits of data (if applicable) |
| 4 | 计算并设置校验和  Calculate and set checksum | 提取数据  Extract data |

## 超时机制 Timeout Mechanism

程序应实现超时机制。

Program should implement timeout mechanism.

上位机或下位机在发送数据包后，设置可等待的最长应答时间（超时时间）为1000毫秒，超时后结束当前操作，自行提示错误及重启传输过程。

After upper or lower device sending data packet, set the longest response time (timeout period) as 1000 milliseconds, ending current operation after timeout, automatically reminding error and restarting transmission process.

## BLE模块透传服务 BLE Module Transparent Transmission Services

所有数据交换均通过BLE模块的串口透传服务进行。模块对应的Service和Characteristic如下表：利尔达BLE蓝牙模块

All data exchanges can be processed through serial porter transparent transmission service in BLE Module. Corresponding Service and Characteristic of the module is as following: Lierda BLE Bluetooth Module

|  |  |  |
| --- | --- | --- |
| Service名称  Service Name | UUID  （Little-endian） | 说明  Illustration |
| BLE Data Service | 0xFF12 | BLE串口透传服务  BLE Serial Port Transparent Transmission Service |

|  |  |  |  |
| --- | --- | --- | --- |
| Characteristic描述  Characteristic Description | UUID  （Little-endian） | 权限  Limits of Authority | 说明  Illustration |
| 上位机写入  Upper Device Write-in | 0xFF01 | Write without response | 上位机通过该描述符向下位机发送数据  The upper device sends data to the lower device by using this descriptor |
| 上位机读出  Upper Device Read-out | 0xFF02 | Notify | 上位机通过该描述符读取下位机发送的数据  The upper device reads data sent from the lower device by using this descriptor |

注意：此处描述UUID采取的是小端模式，在大端模式的运行平台（如Android Java）上，UUID为0x12FF等；

Note: the description of UUID here is utilizing Little-endian mode, on the Big-endian mode operation platforms (i.e. Android Java), UUID will be 0x12FF etc.;

## BLE模块广播包 BLE Module Broadcast Packet

为了加速上位机获取设备中相关工作信息的过程，BLE广播包的Manufacturer data字段中携带了若干个设备状态标识，以便上位机在执行蓝牙设备搜索时，即可得到设备中的状态信息。

In order to accelerate the process of upper device getting job information from relevant devices, the Manufacturer data field of BLE broadcast packet carries several device status identifications, so that when the upper device is executing Bluetooth devices searching, it can access the status information in the device.

状态标识为ASCII格式的英文单词或短语，多个标识之间使用分号“;”隔开。

The status identifications are English words or phrases in ASCII format, several identifications are separated by semicolon ‘;’.

|  |  |
| --- | --- |
| 状态标识  Status Identifications | 含义  Implication |
| DATA | 设备中存在未上传的新数据  There are new data in the device hasn’t been uploaded.  上位机获得此标识后，可以进行设备连接、通过协议主动向设备索要数据等操作  After receiving this identification, the upper device can perform operations such as device connection, initiatively asking data from device through protocol and so forth. |
| DT+6字节时间  DT+6 Byte Time | 上传设备时间。时间格式说明见下**备注**。  Upload device time. For the illustration of time format please refer to the following **Notes**.  上位机获得此标识后，判断设备时间是否正确，如果不正确，则进行设备连接，通过协议设置下位机时间  After receiving this identification, the upper device will judge whether the device time is correct or not. If the time is incorrect, it will perform device connection, and set up time for the lower device through the protocol. |

**备注：**

**Notes:**

设备时间为六个字节字符串。依次为 年-2000、月、日，均以两位数字表示，不足两位在前面补0。时间字符最大为DT991231。

The device time is a 6-byte character string. They are sequentially Year-2000, Month, Day and they are all represented in two digits. Complementing with 0 if it’s less than two digits. The largest character of time is DT991231.

例如：DT150714，表示机器时间为2015年7月14日。

For example, DT150714, represents that the device time is the 14th of July 2015.

# 设备基础协议（0x8X/0xFX）Device Fundamental Protocol

本章协议主要用于上下位机完成基础信息（不包含各生理数据项）的通信，实现工作状态、设备信息、设备参数等获取及设置。

This chapter of the protocol is mainly applied to the communication of fundamental information (except physiological data items) between the upper and lower device, and realize the obtain and set up for working status, device information, device parameters etc.

本章协议对应的通信序列图见附录A

Please refer to Appendix A for the corresponding Communication Sequence Diagram.

## 通信复位命令\* Communication Reset Command\*

上位机发送此包，用于命令下位机结束当前通信传输过程，回到等待命令状态。

The upper device sends this packet to command the lower device terminate the current communication transmission process and go back to status of waiting for command.

|  |  |  |
| --- | --- | --- |
| 序号  Sequence Number | 内容  Content | 含义  Implication |
| 1 | 1000 0000 | 包头Header 0x80 |
| 2 | 0xxx xxxx | 校验和 Checksum |

下位机返回应答包

The lower device returns the reply packet

|  |  |  |
| --- | --- | --- |
| 序号  Sequence Number | 内容  Content | 含义  Implication |
| 1 | 1111 0000 | 包头Header 0xF0 |
| 2 | 0xxx xxxx | 校验和Checksum |

**备注：在下位机收到上位机发送的命令包时，若下位机无法处理该命令，需回复此应答包作为响应。**

**Notes: When the lower device receives the command packet sent from the upper device, if the lower device cannot process this command, it needs to reply this reply packet as a response.**

## 查询设备版本\* Inquiry Device Version

上位机发送此包，用于从下位机获取设备版本信息。

The upper device sends this packet to achieve information of device version from the lower device.

|  |  |  |
| --- | --- | --- |
| 序号  Sequence Number | 内容  Content | 含义  Implication |
| 1 | 1000 0010 | 包头Header 0x82 |
| 2 | 0xxx xxxx | 校验和 Checksum |

下位机返回应答包

The lower device returns a reply packet

|  |  |  |
| --- | --- | --- |
| 序号  Sequence Number | 内容  Content | 含义  Implication |
| 1 | 1111 0010 | 包头0xF2  Header |
| 2 | 0xxx xxxx | 硬件版本号 低位  Hardware Version Number Low-order Bit |
| 3 | 0xxx xxxx | 硬件版本号 中位  Hardware Version Number Middle-order Bit |
| 4 | 0xxx xxxx | 硬件版本号 高位  Hardware Version Number High-order Bit |
| 5 | 0xxx xxxx | 软件版本号 低位  Software Version Number Low-order Bit |
| 6 | 0xxx xxxx | 软件版本号 中位  Software Version Number Middle-order Bit |
| 7 | 0xxx xxxx | 软件版本号 高位  Software Version Number High-order Bit |
| 8 | 0xxx xxxx | 校验和  Checksum |

注意：

Notes:

软硬件版本号均为A.B.C三段式，高位为A，中位为B，低位为C，取值范围0-127。

Notes: Hardware and software version numbers are all three stage - A.B.C, high-order bit is A, middle-order bit is B, low-order bit is C, the range of value is 0 to 127.

## 对时\* Time Matching

上位机发送此包，用于设置下位机时间

The upper device sends this packet to set up time for the lower device

|  |  |  |
| --- | --- | --- |
| 序号  Sequence Number | 内容  Content | 含义  Implication |
| 1 | 1000 0011 | 包头0x83  Header |
| 2 | 0xxx xxxx | 年=YYYY-2000  Year= YYYY-2000 |
| 3 | 0000 xxxx | 月 Month |
| 4 | 000x xxxx | 日 Day |
| 5 | 000x xxxx | 时Hour |
| 6 | 00xx xxxx | 分Minute |
| 7 | 00xx xxxx | 秒Second |
| 8 | 0xxx xxxx | 00（毫秒 第0-6位）  00 (Millisecond The 0 – 6th bit) |
| 9 | 0xxx xxxx | 00（毫秒 第7-13位）  00 (Millisecond The 7th – 13th bit) |
| 10 | 0xxx xxxx | 校验和 Checksum |

下位机返回应答包

The lower device returns the reply packet

|  |  |  |
| --- | --- | --- |
| 序号  Sequence Number | 内容  Content | 含义  Implication |
| 1 | 1111 0011 | 包头0xF3  Header |
| 2 | 0xxx xxxx | 0：对时成功  0: Time Matching is Successful |
| 非0：对时失败  Not 0: Time Matching is Failed |
| 3 | 0xxx xxxx | 校验和 Checksum |

## 查询电量信息\* Inquiry Battery Information

上位机发送此包，用于从下位机获取电量信息

The upper device sends this packet to obtain battery information from the lower device

|  |  |  |
| --- | --- | --- |
| 序号  Sequence Number | 内容  Content | 含义  Implication |
| 1 | 1000 0110 | 包头0x86 Header |
| 2 | 0xxx xxxx | 校验和Checksum |

下位机返回电量信息包

The lower device returns battery information packet

|  |  |  |
| --- | --- | --- |
| 序号  Sequence Number | 内容  Content | 含义  Implication |
| 1 | 1111 0110 | 包头Header 0xF6 |
| 2 | 0xxx xxxx | 电量百分比 0-100，大于100表示充电  Battery percentage is 0 to 100, larger than 100 percent represents it is charging |
| 3 | 0xxx xxxx | 校验和Checksum |

## 产品协议握手包 Product Protocol Handshake Packet

上位机发送此包，用于从下位机获取应答信息。

The upper device sends this packet to receive response messages from the lower device.

|  |  |  |
| --- | --- | --- |
| 序号  Sequence Number | 内容  Content | 含义  Implication |
| 1 | 1000 0111 | 包头Header 0x87 |
| 2 | 0xxx xxxx | 校验和Checksum |

下位机返回信息包

The lower packet returns the message packet

|  |  |  |
| --- | --- | --- |
| 序号  Sequence Number | 内容  Content | 含义  Implication |
| 1 | 1111 0111 | 包头Header 0xF7 |
| 2 | 0xxx xxxx | 校验和Checksum |

注：此包用于上下位机之间的握手，当上位机需要获取下位机是否连接状态时，可发送此包

Notes: this package is applied to the handshake between the upper and lower devices, when the upper device needs to require whether the lower device is at the connected status, this packet can be sent.

## 查询设备序列号\* Inquiry Device Serial Number

上位机发送此包，用于从下位机获取设备序列号字符串。

The upper device sends this packet to get the device serial number character string from the lower device.

|  |  |  |
| --- | --- | --- |
| 序号  Sequence Number | 内容  Content | 含义  Implication |
| 1 | 1000 1000 | 包头Header 0x88 |
| 2 | 0xxx xxxx | 校验和 Checksum |

下位机返回应答包（注意此包长度由产品序列号长度决定），其中从第3字节到校验和字节之前的内容为设备序列号的ASCII码字符串。

The lower device returns the reply packet (notes: the length of this packet depends on the length of the device serial number), of which the content from the 3rd byte to the content before checksum byte is the ASCII code character string of device serial number.

|  |  |  |
| --- | --- | --- |
| 序号  Sequence Number | 内容  Content | 含义  Implication |
| 1 | 1111 1000 | 包头Header 0xF8 |
| 2 | 0xxx xxxx | 产品序列号字符串长度  The length of character string of device serial number |
| 3 | 0xxx xxxx | 产品序列号字符1  Device serial number character 1 |
| 4 | 0xxx xxxx | 产品序列号字符2  Device serial number character 2 |
| ... | 0xxx xxxx | 产品序列号字符...  Device serial number character … |
| 10 | 0xxx xxxx | 校验和 Checksum |

## 查询设备时间\* Inquiry Device Time

上位机发送此包，用于从下位机获取设备时间信息。

The upper device sends this packet to get device time information from the lower device.

|  |  |  |
| --- | --- | --- |
| 序号  Sequence Number | 内容  Content | 含义  Implication |
| 1 | 1000 1001 | 包头Header 0x89 |
| 2 | 0xxx xxxx | 校验和 Checksum |

下位机返回应答包，其中从第2字节到校验和字节之前的内容为设备返回的时间信息。

The lower device returns the reply packet, of which the content from the 2nd byte to the content before checksum byte is the time information returned by the device.

|  |  |  |
| --- | --- | --- |
| 序号  Sequence Number | 内容  Content | 含义  Implication |
| 1 | 1111 1001 | 包头Header 0xF9 |
| 2 | 0xxx xxxx | 年=YYYY-2000  Year=YYYY-2000 |
| 3 | 0000 xxxx | 月Month |
| 4 | 000x xxxx | 日Day |
| 5 | 000x xxxx | 时Hour |
| 6 | 00xx xxxx | 分Minute |
| 7 | 00xx xxxx | 秒Second |
| 8 | 0xxx xxxx | 00（毫秒 第0-6位）  00 (Millisecond the 0 to 6th bit) |
| 9 | 0xxx xxxx | 00（毫秒 第7-13位）  00 (Millisecond the 7th to 13th bit) |
| 10 | 0xxx xxxx | 校验和 Checksum |

## 设置用户信息命令 Set User Information Command

上位机发送此包，用于给下位机发送用户信息。

The upper device sends this packet for sending user information to the lower device.

|  |  |  |
| --- | --- | --- |
| 序号  Sequence Number | 内容  Content | 含义  Implication |
| 1 | 1000 1011 | 0x8B |
| 2 | 0xxx xxxx | 0~5位依次存储3~8字节的最高位  The 0 to 5th bit successively stores the most significant bits of the 3rd to 8th bytes |
| 3 | 0xxx xxxx | 性别：0-男，1-女  Gender: 0-Male, 1-Female |
| 4 | 0xxx xxxx | 年龄：6~100  Age: 6~100 |
| 5 | 0xxx xxxx | 身高：80~240  Height: 80~240 |
| 6 | 0xxx xxxx | 体重：15~250  Weight: 15~250  （SP70B(标配方案)、SP80B(标配方案)无此参数）  （SP70B(Standard Program)、SP80B(Standard Program)This parameter is not applicable） |
| 7 | 0xxx xxxx | 标准：1-ERS（ECCS），2-KNUDSON，3-USA  Standards: 1-ERS（ECCS），2-KNUDSON，3-USA |
| 8 | 0xxx xxxx | 吸烟：0-不吸烟，1-吸烟  (SP70B(标配方案)、SP80B(标配方案)无此参数)  Smoking: 0-Do not smoke, 1-smoke  （SP70B(Standard Program)、SP80B(Standard Program)This parameter is not applicable） |
| 9 | 0xxx xxxx | 校验和 Checksum |

**注：**预期值标准中的ERS在不同的文件中又可以写成ECCS，二者意义等同。

**Notes:** ERS in Expected Value Standards can be written as ECCS in different documents, they have the equivalent meaning.

下位机返回应答包

The lower device returns the reply packet

|  |  |  |
| --- | --- | --- |
| 序号  Sequence Number | 内容  Content | 含义  Implication |
| 1 | 1111 1011 | 0xFB |
| 2 | 0xxx xxxx | 0：设置成功  0：Setup is Successful |
| 非0：设置失败  Not 0：Setup is Failed |
| 3 | 0xxx xxxx | 校验和 Checksum |

病人信息：性别，年龄，身高，标准，吸烟状态

Patient Information: Gender, Age, Height, Standard, Smoking Status

数据类型：8位无符号整型

Data Type: 8-bit unsigned integer

# 数据传输协议（0x9X/0xEX）Data Transmission Protocol

本章协议主要用于上下位机完成数据的通信，实现数据信息、测试参数数据获取等。

This chapter of protocol is mainly applied to the data transmission between the upper and lower device to realize the obtaining of data information, test parameter data etc.

本章协议对应的通信序列图见附录B

Please refer to Appendix B for the corresponding Communication Sequence Diagram.

## 病例数目上传 Number of Cases (of illness) Uploading

上位机发送此包，用于从下位机获取测试数据

The upper device sends this packet to get measurement data from the lower device.

|  |  |  |
| --- | --- | --- |
| 序号  Sequence Number | 内容  Content | 含义  Implication |
| 1 | 1001 0000 | 包头Header 0x90 |
| 2 | 0xxx xxxx | 校验和 Checksum |

4.1.1下位机返回存储数据适用于SP70B(标配方案)、SP80B(标配方案)

4.1.1 Returning stored data from the lower device is applicable to SP70B (Standard Program), SP80B (Standard Program)

|  |  |  |  |
| --- | --- | --- | --- |
| 序号  Sequence Number | 内容  Content | 含义  Implication | |
| 1 | 1110 0000 | 包头Header 0xE0 | |
| 2 | 0xxx xxxx | 病例数目低7位（第0~6位）  Number of Cases Low-order 7 bits (the 0 to 6th bit) |
| 3 | 0xxx xxxx | 病例数目高7位（第7~13位）  Number of Cases High-order 7 bits (the 7th to 13th bit) |
| 4 | 0xxx xxxx | 校验和 Checksum |

4.1.2下位机返回存储数据适用于SP10、SP10W、SP70B(EXP方案)、SP80B(EXP方案)

4.1.2 Returning stored data from the lower device is applicable to SP10, SP10W, SP70B (EXP Program), SP80B (EXP Program)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 序号  Sequence Number | 内容  Content | 含义  Implication | 备注  Notes | |
| 1 | 1110 0000 | 包头Header 0xE0 | 包头Header | |
| 2 | 0xxx xxxx | 病例数目低7位（第0~6位）  Number of Cases Low-order 7 bits (the 0 to 6th bit) | FVC测量数据总数  （不适用者归零）  Total number of FVC measurement data  (if not applicable, make zero) |
| 3 | 0xxx xxxx | 病例数目高7位（第7~13位）  Number of Cases High-order 7 bits (the 7th to 13th bit) |  |
| 4 | 0xxx xxxx | 病例数目低7位（第0~6位）  Number of Cases Low-order 7 bits (the 0 to 6th bit) | SVC测量数据总数  （不适用者归零）  Total number of SVC measurement data  (if not applicable, make zero) |
| 5 | 0xxx xxxx | 病例数目高7位（第7~13位）  Number of Cases High-order 7 bits (the 7th to 13th bit) |  |
| 6 | 0xxx xxxx | 病例数目低7位（第0~6位）  Number of Cases Low-order 7 bits (the 0 to 6th bit) | MVV测量数据总数  （不适用者归零）  Total number of MVV measurement data  (if not applicable, make zero) |
| 7 | 0xxx xxxx | 病例数目高7位（第7~13位）  Number of Cases High-order 7 bits (the 7th to 13th bit) |  |
| 8 | 0xxx xxxx | 病例数目低7位（第0~6位）  Number of Cases Low-order 7 bits (the 0 to 6th bit) | MV测量数据总数  （不适用者归零）  Total number of MV measurement data  (if not applicable, make zero) |
| 9 | 0xxx xxxx | 病例数目高7位（第7~13位）  Number of Cases High-order 7 bits (the 7th to 13th bit) |  |
| 10 | 0xxx xxxx | 校验和 Checksum | 校验和Checksum |

## 病例测试结果上传Tests Results of Cases Uploading

上位机发送此包，用于从下位机获取测试数据

The upper device sends this packet to get measurement data from the lower device.

|  |  |  |
| --- | --- | --- |
| 序号  Sequence Number | 内容  Content | 含义  Implication |
| 1 | 1001 0001 | 包头Header 0x91 |
| 2 | 0xxx xxxx | 0：开始发送数据  0: Begin to send data |
| 1：继续发送下一组未上传数据  1: Continue to send the next group of data that hasn’t been uploaded |
| 2：重发当前组数据  2：Resend the current group of data |
| 125：终止数据上传，不删除数据  125：Terminate data uploading, do not delete the data |
| 126：所有数据接收完毕，不删除数据  126：All data received, do not delete the data |
| 127：所有数据接收完毕，删除全部存储数据  127：All data received, delete all the stored data |
| 3 | 0xxx xxxx | 0：全部测量项目  0：All measurement items |
| 1：FVC测量  1：FVC Measurement |
| 2：VC测量  2：VC Measurement |
| 3：MVV测量  3：MVV Measurement |
| 4：MV测量  4：MV Measurement |
| 4 | 0xxx xxxx | 校验和 Checksum |

下位机返回存储数据

The lower device returns stored data

返回的参数依据产品型号不同而不同，但是发送规则一致。

Returned parameters will be different depends on different product models, but the sending rules are the same.

发送规则：数据最高位不进行提取。

Sending rule: do not extract the most significant bit of data

4.2.1下表适用于SP70B(标配方案)、SP80B(标配方案)：

4.2.1 The following table is applicable to SP70B (Standard Program), SP80B (Standard Program):

|  |  |  |  |
| --- | --- | --- | --- |
| 序号  Sequence Number | 内容  Content | 含义  Implication | 备注  Notes |
| 1 | 1110 0001 | 包头Header 0xE1 |  |
| 2 | 0xxx xxxx | 0：开始发送数据  0: Begin to send data |  |
| 1：继续发送下一组未上传数据  1: Continue to send the next group of data that hasn’t been uploaded |
| 2：重发当前组数据  2：Resend the current group of data |
| 125：终止数据上传，不删除数据，3字节开始，除校验和外，结果数据为零  125：Terminate data uploading, do not delete the data, start from the 3rd byte, result data is zero, except the checksum |
| 126：所有数据接收完毕，不删除数据，3字节开始，除校验和外，结果数据为零  126：All data received, do not delete the data, start from the 3rd byte, result data is zero, except the checksum |
| 127：所有数据接收完毕，删除全部存储数据，3字节开始，除校验和外，结果数据为零  127：All data received, delete all the stored data, start from the 3rd byte, result data is zero, except the checksum |
| 3 | 0xxx xxxx | 0x00 | 0：全部测量项目（SP70B、SP80B）  0：All Measurement items（SP70B、SP80B）  1：FVC测量  1：FVC Measurement  2：VC测量  2：VC Measurement  3：MVV测量  3：MVV Measurement  4：MV测量  4：MV Measurement |
| 4 | 0xxx xxxx | 病历号低7位（第0~6位）  Medical Record Number Low-order 7 bits (the 0 to 6th bit) | 从1开始累加  Accumulate from 1 |
| 5 | 0xxx xxxx | 病历号高7位（第7~13位）  Medical Record Number High-order 7 bits (the 7th to 13th bit) |
| 6 | 0xxx xxxx | 年=YYYY-2000  Year=YYYY-2000 |  |
| 7 | 0xxx xxxx | 月Month |  |
| 8 | 0xxx xxxx | 日Day |  |
| 9 | 0xxx xxxx | 时Hour |  |
| 10 | 0xxx xxxx | 分Minute |  |
| 11 | 0xxx xxxx | 秒Second |  |
| 12 | 0xxx xxxx | 性别Gender | 0-男，1-女  0-Male, 1-Female |
| 13 | 0xxx xxxx | 年龄Age | 6~100 |
| 14 | 0xxx xxxx | 身高低7位（第0~6位）  Height Low-order 7 bits (the 0 to 6th bit) | 身高范围：80~240  Height Range: 80~240 |
| 15 | 0xxx xxxx | 身高高7位（第7~13位）  Height High-order 7 bits (the 7th to 13th bit) |
| 16 | 0xxx xxxx | 标准  Standards | 1-ERS（ECCS），2-KNUDSON，3-USA |
| 17 | 0xxx xxxx | 用药情况  Medication Usage Status | 1. 用药前，1-用药后 2. Before using medication, 3. After using mediation |
| 18 | 0xxx xxxx | FVC低7位（第0~6位）  FVC Low-order 7 bits (the 0 to 6th bit) | 精确到小数点后两位，×100后传输  Accurate to two decimal places,  \* 100 and then transmit |
| 19 | 0xxx xxxx | FVC高7位（第7~13位）  FVC High-order 7 bits (the 7th to 13th bit) |
| 20 | 0xxx xxxx | FEV1低7位（第0~6位）  FEV1 Low-order 7 bits (the 0 to 6th bit) | 精确到小数点后两位，×100后传输  Accurate to two decimal places,  \* 100 and then transmit |
| 21 | 0xxx xxxx | FEV1高7位（第7~13位）  FEV1 High-order 7 bits (the 7th to 13th bit) |
| 22 | 0xxx xxxx | PEF低7位（第0~6位）  PEF Low-order 7 bits (the 0 to 6th bit) | 精确到小数点后两位，×100后传输  Accurate to two decimal places,  \* 100 and then transmit |
| 23 | 0xxx xxxx | PEF高7位（第7~13位）  PEF High-order 7 bits (the 7th to 13th bit) |
| 24 | 0xxx xxxx | FEV1/FVC低7位（第0~6位）  FEV1/FVC Low-order 7 bits (the 0 to 6th bit) | 精确到小数点后一位，×10后传输（无“%”单位）  Accurate to one decimal place, \* 10 and then transmit (no ‘%’ unit) |
| 25 | 0xxx xxxx | FEV1/FVC高7位（第7~13位）  FEV1/FVC High-order 7 bits (the 7th to 13th bit) |
| 26 | 0xxx xxxx | 校验和 Checksum |  |

数据说明：关于百分数数据的传输，如FEV1/FVC，实际数据保留小数点后1位数据（四舍五入），如84.3%，传输时，将数据部分84.3，乘以10后成为整型数据进行传输，变成843，进行传输。

Data description: Regarding the transmission of percentage data, take FEV1/FVC as an example, the actual data is accurate to one decimal place (rounding off). Taking 84.3% as an example, when transmitting the data, timing the number part 84.3 by 10 to get an integer data and then transmit. It will become 843, and then transmit.

4.2.2 适用于SP10、SP10W、SP70B(EXP方案)、SP80B(EXP方案)

4.2.2 is applicable to SP10, SP10W, SP70B (EXP Program), SP80B (EXP Program)

下位机返回FVC测量数据-基本信息部分数据包

The lower device return FVC measurement data – fundamental information section data packet

|  |  |  |  |
| --- | --- | --- | --- |
| 序号  Sequence Number | 内容  Content | 含义  Implication | 备注  Notes |
| 1 | 1110 0001 | 包头Header 0xE1 |  |
| 2 | 0xxx xxxx | 0：开始发送数据  0: Begin to send data |  |
| 1：继续发送下一组未上传数据  1: Continue to send the next group of data that hasn’t been uploaded |
| 2：重发当前组数据  2：Resend the current group of data |
| 125：终止数据上传，不删除数据，3字节开始，除校验和外，结果数据为零  125：Terminate data uploading, do not delete the data, start from the 3rd byte, result data is zero, except the checksum |
| 126：所有数据接收完毕，不删除数据，3字节开始，除校验和外，结果数据为零  126：All data received, do not delete the data, start from the 3rd byte, result data is zero, except the checksum |
| 127：所有数据接收完毕，删除全部存储数据，3字节开始，除校验和外，结果数据为零  127：All data received, delete all the stored data, start from the 3rd byte, result data is zero, except the checksum |
| 3 | 0xxx xxxx | 0x01 | 0：全部测量项目（SP70B、SP80B）  0：All Measurement items（SP70B、SP80B）  1：FVC测量  1：FVC Measurement  2：VC测量  2：VC Measurement  3：MVV测量  3：MVV Measurement  4：MV测量  4：MV Measurement |
| 4 | 0xxx xxxx | 病历号低7位（第0~6位）  Medical Record Number Low-order 7 bits (the 0 to 6th bit) | 从1开始累加  Accumulate from 1 |
| 5 | 0xxx xxxx | 病历号高7位（第7~13位）  Medical Record Number High-order 7 bits (the 7th to 13th bit) |
| 6 | 0xxx xxxx | 年=YYYY-2000  Year=YYYY-2000 |  |
| 7 | 0xxx xxxx | 月Month |  |
| 8 | 0xxx xxxx | 日Day |  |
| 9 | 0xxx xxxx | 时Hour |  |
| 10 | 0xxx xxxx | 分Minute |  |
| 11 | 0xxx xxxx | 秒Second |  |
| 12 | 0xxx xxxx | 性别Gender | 1. 男，1-女 2. Male, 1- Female |
| 13 | 0xxx xxxx | 年龄Age | 6~100 |
| 14 | 0xxx xxxx | 身高低7位（第0~6位）  Height Low-order 7 bits (the 0 to 6th bit) | 身高范围：80~240  Height Range: 80~240 |
| 15 | 0xxx xxxx | 身高高7位（第7~13位）  Height High-order 7 bits (the 7th to 13th bit) |
| 16 | 0xxx xxxx | 标准  Standards | 1-ERS（ECCS），2-KNUDSON，3-USA |
| 17 | 0xxx xxxx | 用药情况  Medication Usage Status | 1. 用药前，1-用药后   0-Before using medication,  1-After using mediation |
| 18 | 0xxx xxxx | FVC低7位（第0~6位）  FVC Low-order 7 bits (the 0 to 6th bit) | 精确到小数点后两位，×100后传输  Accurate to two decimal places,  \* 100 and then transmit |
| 19 | 0xxx xxxx | FVC高7位（第7~13位）  FVC High-order 7 bits (the 7th to 13th bit) |
| 20 | 0xxx xxxx | FEV0.5低7位（第0~6位）  FEV0.5 Low-order 7 bits (the 0 to 6th bit) | 精确到小数点后两位，×100后传输  Accurate to two decimal places,  \* 100 and then transmit |
| 21 | 0xxx xxxx | FEV0.5高7位（第7~13位）  FEV0.5 High-order 7 bits (the 7th to 13th bit) |
| 22 | 0xxx xxxx | FEV1低7位（第0~6位）  FEV1 Low-order 7 bits (the 0 to 6th bit) | 精确到小数点后两位，×100后传输  Accurate to two decimal places,  \* 100 and then transmit |
| 23 | 0xxx xxxx | FEV1高7位（第7~13位）  FEV1 High-order 7 bits (the 7th to 13th bit) |
| 24 | 0xxx xxxx | FEV1/FVC低7位（第0~6位）  FEV1/FVC Low-order 7 bits (the 0 to 6th bit) | 精确到小数点后一位，×10后传输（无“%”单位）  Accurate to one decimal place, \* 10 and then transmit (no ‘%’ unit) |
| 25 | 0xxx xxxx | FEV1/FVC高7位（第7~13位）  FEV1/FVC High-order 7 bits (the 7th to 13th bit) |
| 26 | 0xxx xxxx | FEV3低7位（第0~6位）  FEV3 Low-order 7 bits (the 0 to 6th bit) | 精确到小数点后两位，×100后传输  Accurate to two decimal places,  \* 100 and then transmit |
| 27 | 0xxx xxxx | FEV3高7位（第7~13位）  FEV3 High-order 7 bits (the 7th to 13th bit) |
| 28 | 0xxx xxxx | FEV6低7位（第0~6位）  FEV6 Low-order 7 bits (the 0 to 6th bit) | 精确到小数点后两位，×100后传输  Accurate to two decimal places,  \* 100 and then transmit |
| 29 | 0xxx xxxx | FEV6高7位（第7~13位）  FEV6 High-order 7 bits (the 7th to 13th bit) |
| 30 | 0xxx xxxx | PEF低7位（第0~6位）  PEF Low-order 7 bits (the 0 to 6th bit) | 精确到小数点后两位，×100后传输  Accurate to two decimal places,  \* 100 and then transmit |
| 31 | 0xxx xxxx | PEF高7位（第7~13位）  PEF High-order 7 bits (the 7th to 13th bit) |
| 32 | 0xxx xxxx | FEF25低7位（第0~6位）  FEF25 Low-order 7 bits (the 0 to 6th bit) | 精确到小数点后两位，×100后传输  Accurate to two decimal places,  \* 100 and then transmit |
| 33 | 0xxx xxxx | FEF25高7位（第7~13位）  FEF25 High-order 7 bits (the 7th to 13th bit) |
| 34 | 0xxx xxxx | FEF50低7位（第0~6位）  FEF50 Low-order 7 bits (the 0 to 6th bit) | 精确到小数点后两位，×100后传输  Accurate to two decimal places,  \* 100 and then transmit |
| 35 | 0xxx xxxx | FEF50高7位（第7~13位）  FEF50 High-order 7 bits (the 7th to 13th bit) |
| 36 | 0xxx xxxx | FEF75低7位（第0~6位）  FEF75 Low-order 7 bits (the 0 to 6th bit) | 精确到小数点后两位，×100后传输  Accurate to two decimal places,  \* 100 and then transmit |
| 37 | 0xxx xxxx | FEF75高7位（第7~13位）  FEF75 High-order 7 bits (the 7th to 13th bit) |
| 38 | 0xxx xxxx | FEF2575低7位（第0~6位）  FEF2575 Low-order 7 bits (the 0 to 6th bit) | 精确到小数点后两位，×100后传输  Accurate to two decimal places,  \* 100 and then transmit |
| 39 | 0xxx xxxx | FEF2575高7位（第7~13位）  FEF257 High-order 7 bits (the 7th to 13th bit) |
| 40 | 0xxx xxxx | PEFT低7位（第0~6位）  PEFT Low-order 7 bits (the 0 to 6th bit) | 单位：ms  Unit: ms |
| 41 | 0xxx xxxx | PEFT高7位（第7~13位）  PEFT High-order 7 bits (the 7th to 13th bit) |
| 42 | 0xxx xxxx | EVOL低7位（第0~6位）  EVOL Low-order 7 bits (the 0 to 6th bit) | 单位：ml  Unit: ml |
| 43 | 0xxx xxxx | EVOL高7位（第7~13位）  EVOL High-order 7 bits (the 7th to 13th bit) |
| 44 | 0xxx xxxx | 校验和 Checksum |  |

数据说明：关于百分数数据的传输，如FEV1/FVC，实际数据保留小数点后1位数据（四舍五入），如84.3%，传输时，将数据部分84.3，乘以10后成为整型数据进行传输，变成843，进行传输。

Data description: Regarding the transmission of percentage data, take FEV1/FVC as an example, the actual data is accurate to one decimal place (rounding off). Taking 84.3% as an example, when transmitting the data, timing the number part 84.3 by 10 to get an integer data and then transmit. It will become 843, and then transmit.

## 波形数据部分 Waveform Data Section

上位机发送0x92，请求测量数据-波形数据部分。（适用于SP10、SP10W、SP70B(EXP方案）、SP80B（EXP方案））

The upper device sends 0x92, requesting measurement data-waveform data section. (It is applicable to SP10、SP10W、SP70B(EXP Program）、SP80B（EXP Program））

|  |  |  |
| --- | --- | --- |
| 序号  Sequence Number | 内容  Content | 含义  Implication |
| 1 | 1001 0010 | 包头Header 0x92 |
| 2 | 0xxx xxxx | 0：发送本条病例数据的波形数据部分  0：send the waveform data section of the data of this case |
| 1：NC（空闲，不使用）  1: NC (free, not use) |
| 2：重发本条病例数据的波形数据部分  2：resend the waveform data section of the data of this case |
| 3 | 0xxx xxxx | 校验和 Checksum |

下位机返回测量数据-波形数据部分数据包（n字节）

The lower device returns measurement data – waveform data section (n byte) data packet

|  |  |  |
| --- | --- | --- |
| 序号 | 内容 | 含义 |
| 1 | 11100010 | 包头Header 0xE2 |
| 2 | 0xxx xxxx | 病历序号低7位（第0~6位）  Medical Record Sequence Number Low-order 7 bits (the 0 to 6th bits) |
| 3 | 0xxx xxxx | 病历序号高7位（第7~13位）  Medical Record Sequence Number High-order 7 bits (the 7th to 13th bits) |
| 4 | 0xxx xxxx | 波形数据点数 低7位（第0~6位）  Waveform data points Low-order 7 bits (the 0 to 6th bit) |
| 5 | 0xxx xxxx | 波形数据点数 高7位（第7~13位）  Waveform data points High-order 7 bits (the 7th to 13th bits) |
| 6 | 0xxx xxxx | 0-6位依次存储7-13字节最高位  0-6th bit successively stores 7 to 13 bytes the most significant bits |
| 7 | 0xxx xxxx | 第1点 时间 第 0~7 位  The 1st point Time the 0 to 7th bit |
| 8 | 0xxx xxxx | 第1点 时间 第8~15 位  The 1st point Time the 8th to 15th bit |
| 9 | 0xxx xxxx | 第1点 时间 第16~23位  The 1st point Time the 16th to 23rd bit |
| 10 | 0xxx xxxx | 第1点 流速 第 0~7 位  The 1st point Flow Rate the 0 to 7th bit |
| 11 | 0xxx xxxx | 第1点 流速 第8~15 位  The 1st point Flow Rate the 8th to 15th bit |
| 12 | 0xxx xxxx | 第1点 容量 第 0~7 位  The 1st point Volume the 0 to 7th bit |
| 13 | 0xxx xxxx | 第1点 容量 第8~15 位  The 1st point Volume the 8th to 15th bit |
| 14 | 0xxx xxxx | 0-6位依次存储15-21字节最高位  0 to 6th bit successively stores 15 to 21 bytes the most significant bits |
| 15 | 0xxx xxxx | 第2点 时间 第 0~7 位  The 2nd point Time the 0 to 7th bit |
| 16 | 0xxx xxxx | 第2点 时间 第8~15 位  The 2nd point Time the 8th to 15th bit |
| 17 | 0xxx xxxx | 第2点 时间 第16~23位  The 2nd point Time the 16th to 23th bit |
| 18 | 0xxx xxxx | 第2点 流速 第 0~7 位  The 2nd point Flow Rate the 0 to 7th bit |
| 19 | 0xxx xxxx | 第2点 流速 第8~15 位  The 2nd point Flow Rate the 8th to 15th bit |
| 20 | 0xxx xxxx | 第2点 容量 第 0~7 位  The 2nd point Volume the 0 to 7th bit |
| 21 | 0xxx xxxx | 第2点 容量 第8~15 位  The 2nd point Volume the 8th to 15th bit |
| …… | …… | …… |
| n | 0xxx xxxx | 校验和 Checksum |

波形数据说明如下表所示：

The description of Waveform data is as follow:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 序号  Sequence Number | 数据内容  Data Content | 数据缩放  Data Scaling | 传输数据格式  Data Transmission Format | 数据单位  Data Unit | 说明  Description |
| 1 | 时间  Time | 浮点型放大10000倍后四舍五入（+0.5）转为整形传输  After floating point amplified 10000 times, rounding off (+0.5) and turn to integer transmission | 24位无符号整形  24-bit unsigned integer | 秒（s）  Seconds | 累计时间  Accumulated Time |
| 2 | 流速  Flow Rate | 浮点型放大1000倍后四舍五入（+0.5）转为整形传输  After floating point amplified 1000 times, rounding off (+0.5) and turn to integer transmission | 16位有符号整形  16-bit signed integer | 升/秒（L/s）  Litter/Second | 瞬时流速  Instantaneous Flow Rate |
| 3 | 容量  Volume | 浮点型放大1000倍后四舍五入（+0.5）转为整形传输  After floating point amplified 1000 times, rounding off (+0.5) and turn to integer transmission | 16位有符号整形  16-bit signed integer | 升（L）  Litter | 累计容量  Accumulated Volume |

波形数据为流速-容量图和容量-时间图的坐标点，绘图说明如下：

Waveform data is the coordinate point of Flow Rate – Volume Chart and Volume – Time Chart, drawing description is as following:

流速-容量图：流速-容量图横轴为容量（单位：L），纵轴为流速（单位L/s），将数据中的流速和容量数据缩放处理后在坐标系第一、四象限逐点绘图（一象限流速为正值，四象限流速为负值；若设备不支持，则无负值流速数据）。

Flow Rate – Volume Chart: in Flow Rate – Volume Chart, the horizontal axis is Volume (Unit: L), vertical axis is Flow Rate (Unit: L/s), after scaling the Flow Rate data and Volume data, put these data into the first and the fourth quarter of the coordinate system and draw point by point (the value of Flow Rate in the first quarter is positive, the value of Flow Rate in the fourth quarter is negative; if the device does not support, then there will be no negative value of Flow Rate data).

容量-时间图：容量-时间图横轴为时间（单位：s），纵轴为容量（单位：L），将数据中的容量和时间数据缩放处理后在坐标系第一、四象限逐点绘图（一象限容量为正值，四象限容量为负值；若设备不支持，则无负值容量数据）。

Volume – Time Chart: in Volume – Time Chart, the horizontal axis is Time (Unit: s), vertical axis is Volume (Unit: L), after scaling the Volume and Time data, put these data into the first and the fourth quarters of coordinate system and draw point by point (the value of Volume in the first quarter is positive, the value of Volume in the fourth quarter is negative; if the device does not support, then there will be no negative value of Volume data).

## 数据删除（删除所有数据）Data Deletion (Delete all Data)

上位机发送此包，用于设置下位机时间

The upper device sends this packet to set up time for the lower device.

|  |  |  |
| --- | --- | --- |
| 序号  Sequence Number | 内容  Content | 含义  Implication |
| 1 | 1001 0011 | 包头Header 0x93 |
| 2 | 0xxx xxxx | 校验和 Checksum |

下位机返回应答包

The lower device returns the reply packet

|  |  |  |
| --- | --- | --- |
| 序号Sequence Number | 内容  Content | 含义  Implication |
| 1 | 1110 0011 | 包头Header 0xE3 |
| 2 | 0xxx xxxx | 0：删除成功  0: Deletion is Successful |
| 非0：删除失败  Not 0: Deletion is Failed |
| 3 | 0xxx xxxx | 校验和 Checksum |

## 获取设备中当前各参数的预计值 Obtain the Predicted Value of Current Parameters in the Device

上位机发送此包，用于设置下位机时间

The upper device sends this packet to set up time for the lower device

|  |  |  |
| --- | --- | --- |
| 序号  Sequence Number | 内容  Content | 含义  Implication |
| 1 | 1001 0100 | 包头Header 0x94 |
| 2 | 0xxx xxxx | 校验和 Checksum |

4.5.1下位机返回应答包（适用于SP70B（标配方案）、SP80B（标配方案））

4.5.1 The lower device returns the reply packet (it is applicable to SP70B（Standard Program）、SP80B（Standard Program））

|  |  |  |
| --- | --- | --- |
| 序号  Sequence Number | 含义  Content | 备注  Notes |
| 1 | 包头Header 0xE4 |  |
| 2 | 预计值数据长度  Length Predicted Value Data | 本表中预计值数据长度为8  The length of predicted value data in this table is 8 |
| 3 | FVC预计值（第0~6位）  FVC Predicted Value (the 0 to 6th bit) | 精确到小数点后两位，×100并向上取整后传输  Accurate to two decimal places,  \* 100 and rounding up to an integer, and then transmit |
| 4 | FVC预计值（第7~13位）  FVC Predicted Value (the 7th to 13th bit) |
| 5 | FEV1预计值（第0~6位）  FEV1 Predicted Value (the 0 to 6th bit) | 精确到小数点后两位，×100并向上取整后传输  Accurate to two decimal places,  \* 100 and rounding up to an integer, and then transmit |
| 6 | FEV1预计值（第7~13位）  FEV1 Predicted Value (the 7th to 13th bit) |
| 7 | PEF预计值（第0~6位）  PEF Predicted Value (the 0 to 6th bit) | 精确到小数点后两位，×100并向上取整后传输  Accurate to two decimal places,  \* 100 and rounding up to an integer, and then transmit |
| 8 | PEF预计值（第7~13位）  PEF Predicted Value (the 7th to 13th bit) |
| 9 | FEV1/FVC预计值（第0~6位）  FEV1/FVC Predicted Value (the 0 to 6th bit) | 精确到小数点后一位，×10并向上取整后传输（无“%”单位）  Accurate to one decimal place,  \* 10 and rounding up to an integer, and then transmit (no ‘%’ unit) |
| 10 | FEV1/FVC预计值（第7~13位）  FEV1/FVC Predicted Value (the 7th to 13th bit) |
| 11 | 校验和 Checksum |  |

备注：测量值与预计值的比值 = 测量值\*100 / 预计值，计算结果向上取整，单位为百分比（%）。

Notes: the ratio of measured to predicted value = measured value \* 100/ predicted value, rounding up the calculation result to an integer, unit will be percentage (%).

4.5.2下位机返回应答包（适用于SP10、SP10W、SP70B（EXP方案）、SP80B（EXP方案）

4.5.2 The lower device returns the replied packet (It is applicable to SP10, SP10W, SP70B（EXP Program）, SP80B（EXP Program）)

|  |  |  |
| --- | --- | --- |
| 序号  Sequence Number | 含义  Implication | 备注  Notes |
| 1 | 包头Header 0xE4 |  |
| 2 | 预计值数据长度  Length Predicted Value Data | 本表中预计值数据长度为20  The length of predicted value data in this table is 20 |
| 3 | FVC预计值（第0~6位）  FVC Predicted Value (the 0 to 6th bit) | 精确到小数点后两位，×100并四舍五入后传输  Accurate to two decimal places,  \* 100 and rounding off, and then transmit |
| 4 | FVC预计值（第7~13位）  FVC Predicted Value (the 7th to 13th bit) |
| 5 | FEV1预计值（第0~6位）  FEV1 Predicted Value (the 0 to 6th bit) | 精确到小数点后两位，×100并四舍五入后传输  Accurate to two decimal places,  \* 100 and rounding off, and then transmit |
| 6 | FEV1预计值（第7~13位）  FEV1 Predicted Value (the 7th to 13th bit) |
| 7 | PEF预计值（第0~6位）  PEF Predicted Value (the 0 to 6th bit) | 精确到小数点后两位，×100并四舍五入后传输  Accurate to two decimal places,  \* 100 and rounding off, and then transmit |
| 8 | PEF预计值（第7~13位）  PEF Predicted Value (the 7th to 13th bit) |
| 9 | FEV1/FVC预计值（第0~6位）  FEV1/FVC Predicted Value (the 0 to 6th bit) | 精确到小数点后一位，×10并四舍五入后传输（无“%”单位）  Accurate to one decimal place, \* 10 and rounding off, and then transmit (no ‘%’ unit) |
| 10 | FEV1/FVC预计值（第7~13位）  FEV1/FVC Predicted Value (the 7th to 13th bit) |
| 11 | FEF25预计值（第0~6位）  FEF25 Predicted Value (the 0 to 6th bit) | 精确到小数点后两位，×100并四舍五入后传输  Accurate to two decimal places,  \* 100 and rounding off, and then transmit |
| 12 | FEF25预计值（第7~13位）  FEF25 Predicted Value (the 7th to 13th bit) |
| 13 | FEF50预计值（第0~6位）  FEF50 Predicted Value (the 0 to 6th bit) | 精确到小数点后两位，×100并四舍五入后传输  Accurate to two decimal places,  \* 100 and rounding off, and then transmit |
| 14 | FEF50预计值（第7~13位）  FEF50 Predicted Value (the 7th to 13th bit) |
| 15 | FEF75预计值（第0~6位）  FEF75 Predicted Value (the 0 to 6th bit) | 精确到小数点后两位，×100并四舍五入后传输  Accurate to two decimal places,  \* 100 and rounding off, and then transmit |
| 16 | FEF75预计值（第7~13位）  FEF75 Predicted Value (the 7th to 13th bit) |
| 17 | FEF2575预计值（第0~6位）  FEF2575 Predicted Value (the 0 to 6th bit) | 精确到小数点后两位，×100并四舍五入后传输  Accurate to two decimal places,  \* 100 and rounding off, and then transmit |
| 18 | FEF2575预计值（第7~13位）  FEF2575 Predicted Value (the 7th to 13th bit) |
| 19 | FEV3预计值（第0~6位）  FEV3 Predicted Value (the 0 to 6th bit) | 精确到小数点后两位，×100并四舍五入后传输  Accurate to two decimal places,  \* 100 and rounding off, and then transmit |
| 20 | FEV3预计值（第7~13位）  FEV3 Predicted Value (the 7th to 13th bit) |
| 21 | FEV6预计值（第0~6位）  FEV6 Predicted Value (the 0 to 6th bit) | 精确到小数点后两位，×100并四舍五入后传输  Accurate to two decimal places,  \* 100 and rounding off, and then transmit |
| 22 | FEV6预计值（第7~13位）  FEV6 Predicted Value (the 7th to 13th bit) |
| 23 | 校验和 Checksum |  |

备注：测量值与预计值的比值 = 测量值\*100 / 预计值，设备将计算结果显示为整数（四舍五入），单位为百分比（%）。

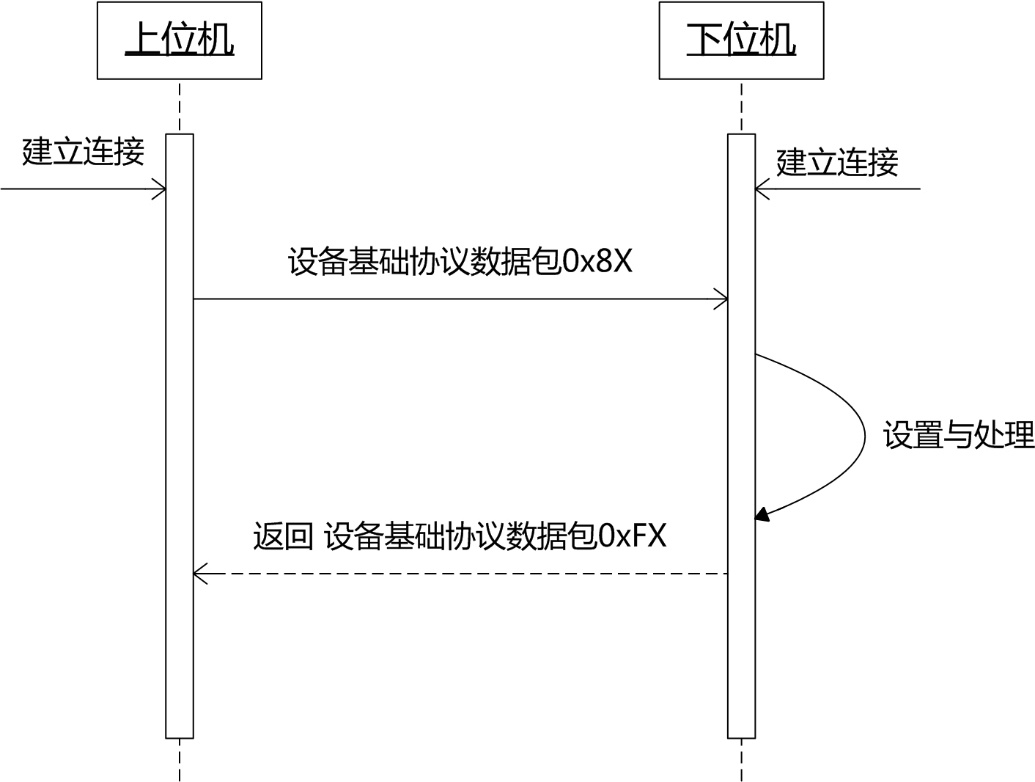
Notes: the ratio of measured to predicted value = measured value \* 100/ predicted value, the device will display the calculation result as an integer (rounding off), unit will be percentage (%).

附录A 设备基础协议通信序列图

Appendix A Device Basic Protocol Communication Sequence Diagram

设备基础协议 Device Basic Protocol

Upper Device



Return Device Basic Protocol Data Packet 0xFX

Device Basic Protocol Data Packet 0x8X

Set up and Process

Establish Connection

Establish Connection

Lower Device

# 附录B 数据传输协议序列图

# Appendix B Data Transmission Protocol Sequence Diagram

数据传输协议 Data Transmission Protocol

Upper Device



Process

Return Data Transmission Protocol Data Packet 0xEX

Data Transmission Protocol Data Packet 0x9X

Establish Connection

Establish Connection

Lower Device