

Communication Protocol of Pulse Oximeter V7.0

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1 Document layout description

Please do not randomly add spaces in the document (Of course, except for the English word segmentation)

Layout using styles,alignment, indent,and so on.

2 Protocol description

This protocol is used for pulse oximeter communicating with PC software.

[The protocol assumes that data sending is correct, and does not consider error detecting retransmission.](#)

2.1 Communication direction

Two-way

2.2 Interface description

The communication between device and host computer uses the COM port (or virtual COM) or wireless mode.

COM port transmission parameters are as follows:

Baud rate:115200

Frame format:Start bit(1);Data bits(8);Stop bit(1);Check bit(no)

Wireless transmission ignores COM port transmission parameters.

3 Data format description

3.1 Byte description

8 bits of 1 byte from high to low are numbered 7,6,5,4,3,2,1,0.

3.2 Package format description

Data is Sended by package, and each package length which is decided by the data type is unequal.You can look-up table,and the package format is as a part of the protocol.

Package format is as follows in Table 1:

Byte	0	1	2	Following data
Synchronization bit	0	1	1	<i>All for 1</i>
Meaning	Data types	High-byte	Package	

Bit7 of data type byte is always 0, and the other byte Bit7 are always 1.

High-byte include the other byte bit7 data in the same package by order, and bit7 must be transferred from the high-byte before using the data.All packages are as this.

3.3 Package definition

3.3.1 Package types list

There are two kinds of package currently used,and they are uplink (From device to PC) and downlink(From PC to device).Uplink data packages code up from 0x01,and downlink data packages code down from 0x7E.

Package types are as follows in Table 2:

Type	Code	Data description (starting from byte 2)	Direction	Length	Frequency	Response
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				g t h		
Real-time data	0x01	Real-time data package(7byte)	Uplink	9	60 ± 2 Packages/sec	
Device identifiers	0x04	String(7byte)	Uplink	9	By request (send 1)	
User Information	0x05	User index number(1byte), string(6byte)	Uplink	9	By request (send 1)	
Storage start time(date)	0x07	User index number(1byte), Storage segment number(1byte),High-year, Lower-year, Month, Day	Uplink	8	By request (send 1)	
Storage start time(time)	0x12	User index number(1byte), Storage segment number(1byte), Hour, Minute, Second, Invalid byte	Uplink	8	By request (send 1)	
Storage data length	0x08	User index number (1byte), Data segment number,Low, The second lowest,The second highest, High (32-bit nonnegative)	Uplink	8	By request (send 1)	
Storage data	0x09	SpO2, Pulse rate, PI low, PI high	Uplink	6	Send data completely	
Storage data segment amount	0x0A	User index number, Segment amount	Uplink	4	By request (send 1)	
Command feedback	0x0B	Command, Reason code	Uplink	4	By request (send 1)	
Free feedback	0x0C	No	Uplink	2	Device is free currently	
Disconnect notice	0x0D	Reason code(Sent by the device to disconnect)	Uplink	3	When device disconnectes initiatively.	
PI identifiers	0x0E	Whether to support PI in real-time data	Uplink	3	By request (send 1)	

Storage data	0x0F	(SpO2 , Pulse rate) × 3	Uplink	8	Send data completely	
User amount	0x10	Total user number	Uplink	3	By request (send 1)	
Device notice	0x11	Device notice type (1byte), Notice information (6byte)	Uplink	9	Device send initiatively or by request (send 1)	
Storage data identifiers	0x15	User index number (1byte), Data segment number (1byte), PI identifiers(1byte), Retention four (\ 0)	Uplink	9	By request (send 1)	
Device time	0x16	Hour (1byte) ,minute (1byte) , second (1byte)	Uplink	5	By request (send 1)	
Device date	0x17	Year(2 digits higher) (1byte) , Year(2 digits lower) (1byte) , month (1byte) , day (1byte) , week (1byte)	Uplink	7	By request (send 1)	
Control commands	0x7D	Command, Additional information	Downlink	9	Send by demand	The following text

1Adjacent bytes are separated by a comma "," in this form of "Data Description" column.

Note:

1 Device notice command:

Device sending initiatively means the device can take the initiative to send,by request means PC software ask for the information by demand.

2 Storage start time command: If device do not support the command,send 0x00.Invalid bytes (considering the processing efficiency of device,there increases 1 byte), sending 0x00.

3 The high-year of the storage start time is the first two numbers of year and the low-year is the last two numbers(The same to synchronize device time.). For example: 2010, high-year is 20 and low-year is 10.

Others (including the data length(0x08), storage data(0x09),PI of real-time data(0x01)) relate to the situation of high and low bytes of data are high byte, low byte.For example: storage data length is 32-bit non-negative data, and low byte is the low 8 bits binary value, the second lowest is the bits 9~16 binary value, the second highest is bit17~24 binary value, highest is high 8 bits binary value.

For example: data length is 86031(00000000 00000001 01010000 00001111).

Low:15 (00001111), the second lowest:80(01010000), the second highest: 01 (00000001), high:00(00000000)

4 The PI identifiers of storage data identifiers(0x15) is 0xA1 if with PI or 0xA0 if without PI.

3.3.2 Interpretation of the data fields

3.3.2.1 Real-time data package(Table 3)

Byte	Bit	Data specification	Remarks
2	0~3	Signal strength for pulsate	Values: [0,8], 8 default if larger than 8.
	4	1 = Searching time is too long, 0 = OK	Show 'Searching' (change as multiple languages).
	5	1 = Low SpO2, 0 = OK	Ignoring
	6	1 = Pulse beep flag	Pulse beep tips
	7	1 = Probe errors, 0 = OK	If probe errors,show 'Finger Out' and pulse waveform data is 0x40 (decimal value 64).
3	0~6	Pulse waveform data	Values: [0,0 x7F]. Real-time display
	7	1 = Searching pulse, 0 = OK	Show 'Searching'
4	0~3	Bar graph (stand for pulsate case)	Values: [0,15]. Real-time display
	4	0: PI data is valid 1: PI data is invalid	Response should be the same with package of 0x0E
	5-7	All for 0	Reservations, meaningless
5	0~7	Pulse rate	Valid data range(0,254]bpm(If over the range ,the data is disposed as invalid data(0Xff) and display as '---.'
6	0~7	SpO2	Valid data range(0.100]%(If over the range ,the data is disposed as invalid data(0X7f) and display as '---.'
7	0~7	Low-PI	Valid data range(0.00,22.0]%(If over the range ,the data is disposed as invalid data(0Xff) and display as '---.') PI here is 100 times the real value.
8	0~7	High-PI	

[If data or probe errors, pulse rate is 0Xff,and SpO2 is 0x7F, and PI is 0xFFFF for default.](#)

3.3.2.2. String data segment

C strings-namely,the string array ends by '\ 0' (ASCII).And it only accept English letters (either capital or lowercase), numeral and underline.

3.3.2.3. Reasoncodes data segment(Table 4)

Value	Meaning
0x00	Completed operation
0x01	Shutdown device
0x02	Exchange users
0X03	Recording

0X04	Failure to delete the storage data
0X05	Nonsupport
0XFF	Unknow reasons

3.3.2.4 PI identifiers(Table 5)

Value	Meaning	Note
0x00	PI is valid	Bit4 of byte 4 in real-time data should be 0, or else,the data is abandoned.
0x01	PI is invalid	Bit4 of byte 4 in real-time data should be 1, or else,the data is abandoned.

3.3.2.5.Storage data (0x0F)

The device without PI data should send 0x0F instead of 0x09 package and if the last data is less than 4 bytes,it should be complemented to 4,free to choose data(0 is the best).

3.3.2.6.Device notice (Table 6)

Device notice type(1byte)	Notice information(6 byte)						Note
	byte2	byte3	byte4	byte5	byte6	byte7	
0x01	Storage data identifiers	0x00	0x00	0x00	0x00	0x00	Storage data identifiers(byte 3): 0x01,storage data 0x00,no storage data
Reservations							

3.3.2.7. Command data segment(Table 7)

Value	Meaning	Additional message (byte number)	Response data package(code)
0xA1	Ask for continuous real-time data	No	Real-time data(0x01)
0xA2	Stop sending real-time data	No	Free feedback(0x0C)
0xA3	Ask for storage data segment amount	User index number(1), Counter from 0	Storage data segments(0x0A)
0xA4	Ask for storage data length	User index number(1) + data segment number(1)	Storage data length (0x08)
0xA5	Ask for storage start time	User index number(1) + data segment number(1)	Storage start time(0x07,0x12)
0xA6	Ask for storage data	User index number(1) + data segment number(1)	Storage data(0x09 or 0x0F)
0xA7	Stop sending storage data	No	Free feedback (0x0C)
0xAA	Ask for device identifiers	No	Device identifiers(0x04)
0xAB	Ask for user information	User index number(1)	User information(0x05)
0xAC	Ask for whether to support	No	PI identifiers(0x0E)

	PI in Real-time data		
0xAD	Ask for user amount	No	User amount(0x10)
0xAE	Delete storage data	User index number(1) + data segment number(1)	Command feedback (0x0B)
0xAF	Inform device being connected	No(send once per 5sec)	No
0xB0	Ask for storage data identifiers	No	Storage data identifiers of device notice(0x11)
0xB1	Synchronize device time	Hour ,Minute ,Second (each 1 byte)	Command feedback (0x0B)
0xB2	Synchronize device date	High-year,Low-year,Month,Day, Week(each 1 byte)	Command feedback (0x0B)
0xB6	Ask for storage data identifiers	User index number(1) + data segment number(1)	Storage data identifiers(0x15)
0xB7	Ask for resuming leave-factory setting	No	Command feedback (0x0B)
0xB8	Ask for device time and device date	No	Send device time (0x16) Send device date (0x17)

Note:

1. The storage data segment amount of the device which do not support several segments storage,should be 1, and the segment number is 0 when asked for.
2. When deleting storage data,if the segment number is 0Xff, delete all the data of appointed user.
3. For the command which the device can't identify(Which not listed in the command table), the device should reply command feedback package(0x0B),and the reason code is 0x05, figuring out not supporting the command.
- 4.The control commands package length is 9 bytes, and the un-use byte is 0x00(Adjust it to 0x80 after packaged).
5. When synchronizing device time,the device reply feedback package(0x0B).The reason code is 0x00 if synchronizing successfully or 0x05 if not supporting the command.
- 6.When synchronizing device date,the week byte is as follows,
0x00: Sunday;0x01: Monday;0x02:Tuesday;0x03:Wednesday;
0x04:Thursday;0x05:Friday;0x06:Saturday.
- 7.When synchronizing device date and time, synchronize date(0xB2) first and synchronize time later.
8. Ask for device time and device date ,send device date (0x16) first and send device time (0x17) later.

3.4. Additional instruction

1.If the real-time data and storage data cannot be sent simultaneously at present.When changing data,PC software must send order to stop the former data sending ,then ask for another(real-time or storage)data package.

2.The data package except storage data package can be asked for when device is sending real-time data.

3.No other data package can be asked when device is sending storage data.

4.Before asking for storage data,PC software should ask for user index, data segment, data length and storage start time.

5.PC software will disconnect communication immediately with the device if cannot receive reply within 1 second.

3.5 Sending data demonstration

Request	Send order(Hex)	Frequency	Answer
Ask for sending real-time data	7D 81 AF 80 80 80 80 80 80	One time every 5 seconds	Real-time data package (0x01)
	7D 81 A1 80 80 80 80 80	Send one time	