**AM4100 Palm Monitor Communication Protocol**（**V1.1**）

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一、Transmissionmedia

Bluetooth 4.0，5.0

二、Communication Protocol

|  |  |  |  |
| --- | --- | --- | --- |
| Package Head | Package Length | Package Content | CheckSum |
| 0x55 0xAA | N | A1，A2，...，An | SUM |

1、Package Head: 0x55 0xAA, 2 fixedbytes；

2、Package Length: Total bytes exclude “Package Head”, “Package Length” and “CheckSum”, N = n + 2, (n is the subscript of An), range:3~255

（ Package Content length is more than or equal to 1）, 1 byte;

3、Package Content: composed by REAL data, more information is decrypted below，nbytes;

4、CheckSum: SUM = ~（N+A1+A2+...+An）， “~” means NOT (Negation operator)，1 byte;

三、Package Content

1. **PC Host→Module（Down-stream Command）**

|  |  |  |
| --- | --- | --- |
| **TYPE** | **A1（Command ID）** | **A2（Command Param）** |

|  |  |  |
| --- | --- | --- |
| **ECG Test** | 0x01 | Param |
| **NIBP Test** | 0x02 | Param |
| **SPO2 Test** | 0x03 | Param |
| **TEMP Test** | 0x04 | Param |
| **ECG Wave Gain** | 0x07 | Param |
| **ECG Filter Mode** | 0x08 | Param |
| **NIBP Patient Mode** | 0x09 | Param |
| **NIBP Preset Cuff Pressure** | 0x0A | Param |
| **NIBP Static Pressure Calibrate** | 0x0B | Param |
| **NIBP Static Pressure Bias Setup** | 0x0C | Param |
| **TEMP1 Bias Setup** | 0x0D | Param |
| **RESP Wave Gain** | 0x0F | Param |
| **IRTEMP Mode** | 0xF8 | Param |
| **IRTEMPBias Setup** | 0xF9 | Param |
| **ECG Wave Output Enable** | 0xFB | Param |
| **Software Version Inquiry** | 0xFC | Param |
| **Hardware Version Inquiry** | 0xFD | Param |
| **SPO2 Wave Output Enable** | 0xFE | Param |
| **RESP Wave Output Enable** | 0xFF | Param |

**ECG Test（0x01）**：Enable/Disable ECG params output；

A2（CommandParam）：

0x00 Disable ECG Params Output ( 0x55 0xAA 0x04 0x01 0x00 0xFA )

0x01 Enable ECG Params Output ( 0x55 0xAA 0x04 0x01 0x01 0xF9)

**NIBP Test（0x02）：**Enable/Disable NIBP params output；

A2（Command Param）：

0x00 Disable NIBP Params Output (0x55 0xAA 0x04 0x02 0x00 0xF9 )

0x01 Enable NIBP Params Output (0x55 0xAA 0x04 0x02 0x01 0xF8 )

**SPO2 Test（0x03）**：Enable/Disable SPO2 params output；

A2（Command Param）：

0x00 Disable SPO2 Params Output (0x55 0xAA 0x04 0x03 0x00 0xF8)

0x01 Enable SPO2 Params Output (0x55 0xAA 0x04 0x03 0x01 0xF7)

**TEMP Test（0x04）**：Enable/Disable TEMP(Temperature) params output；

A2（Command Param）：

0x00 Disable TEMPParams Output (0x55 0xAA 0x04 0x04 0x000xF7)

0x01 Enable TEMPParamsOutput (0x55 0xAA 0x04 0x04 0x010xF6)

**ECG Wave Gain（0x07）：**Switch ECG wave gains;

A2（Command Param）：

0x01 x0.25 gain

0x02 x0.5 gain

0x03 x1gain

0x04 x2gain

e.g.0x55 0xAA 0x04 0x07 0x03 0xF1（0x03 x1 gain）

**ECG Filter Mode（0x08）：**Switch ECG filter mode;

A2（Command Param）：

0x01 operation mode，1 ~ 25Hz (3dB)

0x02 monitor mode， 0.5 ~ 75Hz (3dB)

0x03 diagnose mode， 0.05 ~ 100Hz (3dB)

e.g. 0x55 0xAA 0x04 0x08 0x02 0xF1 （0x02 monitor mode）

**NIBP Patient Mode（0x09）**：Switch NIBP patient mode;

A2（Command Param）：

0x01 adult mode（default settings）

0x02 child mode

0x03 neonate mode

e.g. 0x55 0xAA 0x04 0x09 0x01 0xF1 （0x01 adult mode ）

**NIBP Preset Cuff Pressure（0x0A）：** Setup NIBP preset cuff pressure before new test

A2（Command Param）：

|  |  |
| --- | --- |
| Patient mode | Preset cuff pressure range （mmHg） |
| Adult mode | 40~300 mmHg（default is 150） |
| Child mode | 40~210 mmHg（default is 100） |
| Neonate mode | 40~140 mmHg（default is 70） |

Notice：

1）、Due to the Preset cuff pressure value may be more than 255（1 byte Maximum value）, so A2 value = Preset cuff pressure／2，unit：mmHg

For example: If Preset cuff pressure is 280mmHg(adult mode), then the A2 value is 140mmHg(280mmHg/2)

2）、This command should be always send before a new test begin, if not, the module will use the last received value（During Power on use the default value）。

3）、The Preset cuff pressure should be always limit to the rang, if the value out of range, the default value will be used instead.

e.g. 0x55 0xAA 0x04 0x0A 0x4B 0xA6（Preset cuff pressure = 75（0x4B）x 2 = 150 mmHg）

**NIBP Static Pressure Calibrate（0x0B）**：This command should be Only used by Manufactory!

A2（Command Param）：

0x00 Stop calibrating operation

0x01 Execute NIBP static pressure calibrate

**NIBP Static Pressure Bias Setup（0x0C）：**This command should be Only used by Manufactory!

A2（Command Param）：

Bias value（Decimal numeric）：-50 ~ +50，is equal to -50mmHg ~ +50mmHg

Bias value = Module show value – calibrating value

For example: If the calibrating value is 180mmHg, and the module show value is 183mmHg, then the Bias value is +3mmHg.

**TEMP1 Bias Setup（0x0D）：**This command should be Only used by Manufactory!

A2（Command Param）：

Biasvalue（Decimal numeric）：-20 ~+20，is equal to -2.0℃ ~+2.0℃,precision is 0.1℃

Bias value = Module show value – calibrating value

For example: If the calibrating value is 37.0℃, and the module show value is 36.8℃, then the Bias value is -2.

**RESP Wave Gain（0x0F）：**Switch RESP(respirate) wave gains;

A2（Command Param）：

0x01 x0.25 gain

0x02 x0.5 gain

0x03 x1 gain

0x04 x2 gain

**IRTEMP Mode( 0xF8 ):** **This command should be Only used by Manufactory!**

A2（Command Param）：

0x00   body temperature mode ( 0x55 0xAA 0x04 0xF8 0x00 0x03 )

0x01   environment temperature mode ( 0x55 0xAA 0x04 0xF8 0x01 0x02 )

**IRTEMPBias Setup( 0xF9 ): This command should be Only used by Manufactory!**

A2（Command Param）：

Biasvalue（Decimal numeric）：-20 ~+20，is equal to -2.0℃ ~+2.0℃,precision is 0.1℃

Bias value = Module show value – calibrating value

For example: If the calibrating value is 37.0℃, and the module show value is 36.8℃, then the Bias value is -2.

**NIBP Leakage Test（0x10）：**This command should be Only used by Manufactory!

A2（Command Param）：

0x00 Stop NIBP leakage test

Pressure Execute NIBP leakage test and the Pressure value = Leakage Pressure／2, unit：mmHg

**ECG Wave Output Enable（0xFB）**：Enable/Disable ECG wave output;

A2（Command Param）：

0x00 Disable ECGwaveoutput ( 0x55 0xAA 0x04 0xFB 0x00 0x00 )

0x01 Enable ECGwaveoutput ( 0x55 0xAA 0x04 0xFB 0x01 0xFF )

**Software Version Inquiry（0xFC）：**Inquire the software version information;

A2（Command Param）：reserved ( 0x55 0xAA 0x04 0xFC 0x00 0xFF )

**Hardware Version Inquiry（0xFD）：**Inquire the hardware version information;

A2（Command Param）：reserved (0x55 0xAA 0x04 0xFD 0x00 0xFE)

**SPO2 Wave Output Enable （0xFE）：**Enable/Disable SPO2 wave output;

A2（Command Param）：

0x00 Disable SPO2 wave output (0x550xAA 0x04 0xFE 0x00 0xFD)

0x01 Enable SPO2 wave output (0x55 0xAA 0x04 0xFE 0x01 0xFC)

**RESP Wave Output Enable（0xFF）：**Enable/Disable RESP wave output;

A2（Command Param）：

0x00 Disable RESP wave output (0x550xAA 0x04 0xFF 0x00 0xFC)

0x01 Enable RESP wave output (0x55 0xAA 0x04 0xFF 0x01 0xFB)

2、 Module → PC Host（Up-streamCommand）

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **TYPE** | **A1** | **A2** | **A3** | **A4** | **A5** | **A6** | **A7** | **Fr（Pkg/sec）** |
| **ECG Wave** | 0x01 | I |  |  |  |  |  | 250 |
| **ECG Param** | 0x02 | ECG Status | HeartRate(L) | RespRate | ST Level | ARR code | HeartRate(H) | 1 |
| **NIBP Param** | 0x03 | NIBP Status | Cuff Pressure | Sys Pressure | Mean Pressure | Dia Pressure |  | 2 |
| **SPO2 Param** | 0x04 | SPO2 Status | Spo2Sat | PulseRate(L) | PulseRate(H) |  |  | 1 |
| **TEMP Param** | 0x05 | TEMP Status | TEMP1Integral | TEMP1 Decimal |  |  |  | 1 |
| [**BATTERY**](javascript:;) **Info** | 0x08 | Battery Percent | Battery Volt Byte Low | Battery Volt Byte High |  |  |  | 1 |
| **CNIBP Param** | 0X09 | IR\_Gain | IR\_ADC(lowest) | IR\_ADC(lower) | IR\_ADC(higher) | IR\_ADC(highest) |  | 100 |
| **SoftwareVersion** | 0xFC | ASCII byte 1 | ASCII byte 2 | ASCII byte 3 | … | ASCII byte n | … | N/A |
| **Hardware Version** | 0xFD | ASCII byte 1 | ASCII byte 2 | ASCII byte 3 | … | ASCII byte n | … | N/A |
| **SPO2 Wave** | 0xFE | Wave amplitude |  |  |  |  |  | 50 |
| **RESP Wave** | 0xFF | Wave amplitude |  |  |  |  |  | 50 |

**ECG Wave（0x01）：**

A2：I is the wave amplitude equal to Lead I, range is 0~250，send Frequency is 250 packages/second

**ECG Param（0x02）：**

A2: ECG Status：BIT0 is the LSB(least significant bit) and BIT7 isthe MSB((most significant bit))

BIT0： ECG signalintensity

* + 1. normal；
    2. weak；

BIT1： leadstatus

1. normal；
2. leadoff；

BIT3~BIT2： ECG wave gain

00： x0.25 gain；

01： x0.5 gain；

10： x1 gain；

11： x2 gain；

BIT5~BIT4： ECG filtermode

00： operation mode；

01： monitor mode；

10： diagnosemode；

BIT7~BIT6： reserved

A3: HeartRate：range is 15 ~ 350，unit：beat/second [ **Heart Rate = A3 + (A7 << 8)** ]

A4: RespRate： range is 5 ~ 150， unit： beat/second

A5:STLevel：signedchar，rangeis-100~+100,equalto–1mV~+1mV，eg：-75means-0.75mV，+55means+0.55mV

A6: ARR code(Arrythmiacode)：0x00(default) not support for this product.

**NIBP Param（0x03）：**

A2: NIBP Status：

BIT1~BIT0：NIBP Patient mode

00： adult mode；

01： child mode；

10： neonate mode；

BIT5~BIT2：NIBP Test Result；

0000 Test Finished（normal test）

0001 During test

0010 Test Stopped

0011 Over pressure protected

0100 cuff is too loose or unattached

0101 Test time out

0110 Test error occured

0111 Disturb found during test

1000 test result is out of range

1001 module is initializing

1010 module initiallized

BIT7~BIT6： reserved bits；

A3: Cuff Pressure： real cuff pressure = A3 x 2，unit：mmHg

A4: Sys Pressure：range is 0~250，unit：mmHg

A5: Mean Pressure：range is 0~250，unit：mmHg

A6: Dia Pressure：range is 0~250，unit：mmHg

Notice：

(1)、When module status is initializing, any operation command about NIBP will be ignored by module。

(2)、The Sys/Mean/Dia pressure is meaningful only if NIBP test result is 0000 Test Finished（normal test）.

**SPO2 Param（0x04）：**

A2: SPO2 Status：

0x00 normal

0x01 sensor is off

0x02 no finger insert

0x03 searching pulse signal

0x04 searching pulse signal is time out

A3: Spo2Sat： SPO2 saturation value, range is 0~100， If SPO2 Status is not 0x00(normal), the value is invalid and always be 127(0x7F)

A4: PulseRate Byte Low

A5: PulseRate Byte High

PulseRate = **A4 + ( A5 << 8 ).**

PulseRate：range is 15~350，If SPO2 Status is not 0x00(normal), the value is invalid and always be 65280(0xFF00)

**TEMP Param（0x05）：**

A2: TEMP Status：

BIT0 ~ BIT5：：

0x00 normal

0x01 TEMP1 sensor is off

BIT6：

0 ：temp

1 : irtemp

BIT7：RESERVE

A3: TEMP1 Integral：TEMP1 Integral part, range is 20~49

A4: TEMP1 Decimal：TEMP1 Decimal part, range is 0~9

Real temperature = TEMP Integral + （TEMP Decimal／10）

eg：if TEMP Integral = 37，and TEMP Decimal = 5，then the real temperatue = 37.5，unit：℃（centidegree）

Notice：

If TEMP Status is not 0x00(normal)，then the TEMP Integral and TEMP Decimal are both equal to 0 (invalid value)

[**BATTERY Info**](javascript:;) **(0x08):**

**A2: Battery Percent**

**A3: Battery Volt Byte Low**

**A4： Battery Volt Byte High**

**CNIBP Param(0x09): This command should be Only used by Manufactory!**

**A2: IR\_Gain means Infrared gain, range is 0~255.**

**A3: the lowest byte of the original ADC sample infrared light.**

**A4: the lower byte of the original ADC sample infrared light.**

**A5: the higher byte of the original ADC sample infrared light.**

**A6: the highest byte of the original ADC sample infrared light.**

**Software Version（0xFC）：**

A2~A8 are displayable ASCII bytes represent for software version

**Hardware Version（0xFD）：**

A2~A8 are displayable ASCII bytes represent for hardware version

**SPO2 Wave（0xFE）：**

A2: SPO2 Wave amplitude, that is SPO2 Plethymography value，range is 0~100

**RESP Wave（0xFF）：**

A2: RESP Wave amplitude，that isRESP Plethymography value，range is 0~250