



## ZHY-K Processor Communication Protocol

V1.52

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## 1. Communication Protocol Format Introduction

### 1.1 Communication Protocol Format

Start	Address	Frame length	Command Class	Command Code	Data Package	Check	End
0x02	ID	0xLL 0xHH	*	*	...	CS	0x03

#### Notes:

- 1) Address field: The address is a single byte, with the device address up to 32. The highest bit 7 is the data frame direction flag (0: Master to device; 1: Device to Master), if the data frame address received by slave device does not match the local device or the data frame direction flag is incorrect, this data frame will be directly discarded. The broadcast address is 0x00 (used when forgetting the address value).
- 2) Frame length field: The frame length field is 2 bytes, including command class, command code, and data package length. The low byte goes first, and high byte behind.
- 3) If there is multi-byte type data in the data content, such as u16, int16, u32, int32, etc., the low byte of the data should be before the high byte.
- 4) CS check field: The check data content excludes the start, end and check fields. Using cyclic redundancy check, the check algorithm is as follows:

```
typedef unsigned char BYTE;
BYTE CheckSum(BYTE* pData, unsigned short nLength)
{
    BYTE uchLRC = 0;
    for(int i = 0; i < nLength; i++)
    {
        uchLRC += pData[i];
    }
    return uchLRC;
}
```

### 1.2 Data Escaping

In the network communication, if the data package sent by processor to the Master includes 0x02 and 0x03 (excluding the head and the end) , then the data need to be escaped.

**Note:** When Master sends data package to Processor, the Master doesn't need to escape the data. Specific escaping rules are as follows

Before escaping	After escaping	Remarks
0x02	0x1b 0xe7	
0x03	0x1b 0xe8	
0x1b	0x1b 0x00	

For example:

If processor's IP is 192.168.1.3, Master's IP is 192.168.1.3, port number is 6992. When Master queries processor's network parameters, reply data package of processor is:

0x02 0x31 0x0d 0x00 0x51 0x50 0x02 0xc0 0xa8 0x01 0x1b 0xe8 0x50 0x1b 0x00 0xc0 0xa8 0x01 0x1b 0xe7 0x23 0x03.

The red part of the above example is the value after escaping, and their corresponding original data are 0x03, 0x1b and 0x02 respectively.

## 1.3 Universal Response Frame

Start	Address	Frame length	Command Class	Status Code	Check	End
0x02	ID	0xLL 0xHH	'A'	0xFF:Correct command 0x00:Checking error 0x01:Invalid command 0x02:Storage failure 0x03:Parameter error 0x06:Length error	CS	0x03

Unless particularly stated, the processor should response with this command.

## 2. Detailed Protocol

### 2.1 Communication Conventions

- a) 232 communication
  - Communication BPS: 115200bps
  - Data length: 8 bit
  - Stop bit: 1 bit
  - Check bit: No check
- b) 485 communication
  - Communication BPS: 115200bps
  - Data length: 8 bit
  - Stop bit: 1 bit
  - Check bit: No check
- c) TCP/IP
  - Communication interface: 10/100M self-adaption
  - Communication protocol: TCP/IP
  - Default server address: 192.168.0.2
  - Default server port number: 25032

## 2.2 Detailed Protocol

### 2.2.1 Set Parameters

Master (PC) sends:

Start	Address	Frame Length	Command Class	Command Code	Data list (List 1-1)		Check	End
0x02	ID	0xLL 0xHH	W	P	Parameters PN	Data package	CS	0x03

List 1-1 Data list

Parameters PN	Data package				Remark
0x01	u8 NewID Note: NewID range 1≤NewID≤127				Set Shelve IP , return back by [Universal response frame]
0x03	SN	Name	Variable name	Remark	Set goods parameters, return back to parameters setting response are specified in <b>Instruction ①</b>
	1	Aisle number	u8 good_aisle_num		
	2	Aisle PN	u8 aisle_id	Goods parameters of single aisle	
	3	Weight of single goods	u16 goods_wei		
	4	Current goods quantity	u16 goods_nums		
	5	allowable deviation percentage	u8 dev_perc		
	6	Sentenced to stability threshold	u8 stable_Ths		
	<b>Note:</b> 1. During parameters setting for single aisle, good_aisle_num=0 , following content is parameters for single aisle goods; 2. During parameters setting for all aisles, good_aisle_num>0, following content contains multiple aisles goods parameters information(In accordance with single aisle parameters’ order); 3. good_aisle_num data range: good_aisle_num≤64 , factory default number: good_aisle_num=10; 4. goods_wei data range≥10, factory default is 100;				

	5. dev_perc data range: 0-5, whose corresponding meaning is 3%, 5%, 10%, 20%, 30%, 50%, factory default value is 2; 6. stable_Ths data range is 255 ≥ range ≥ 2, factory default value is 2.			
0x04	<b>SN</b>	<b>Name</b>	<b>Variable name</b>	Set parameters for information automatically report. Return back by [Universal response frame].
	1	Automatically reporting aisle status enable setting	u8 send_sta_enable	
	2	Aisle Status reporting interval	u8 send_sta_val	
	3	Automatically reporting heartbeat enable setting	u8 send_HB_enable	
	4	Heartbeat reporting interval	u8 send_HB_val	
	5	Automatically reporting goods information enable setting	u8 send_goodsmsg_enable	
	6	Automatically reporting Lock status enable status	u8 send_lock_enable	
	7	Lock status reporting interval	u8 send_lock_val	
	8	Automatically reporting aisle weight enable setting	u8 Aisle_Weight_Enable	
	9	Automatically reporting sensor weight enable setting	u8 Sensor_Weight_Enable	
<b>Note (see next page)</b>				

	<b>Note:</b> 1.send_sta_enable data range is 0, 1 , whose corresponding meaning is Not enabling, enabling. Factory default value is 0; 2.send_sta_val data range is 10-60, unit is second, factory default value is 10; 3.send_HB_enable data range is 0, 1 , whose corresponding meaning is Not enabling, enabling. Factory default value is 0; 4.send_HB_val data range is 10-60, unit is second, factory default value is 5; 5.send_goodsmsg_enable data range is 0, 1 , whose corresponding meaning is Not enabling, enabling. Factory default value is 0; 6.send_lock_enable data range is 0, 1 , whose corresponding meaning is Not enabling, enabling. Factory default value is 0; 7.send_lock_val data range is 1-5, unit is second, factory default value is 1. 8.Aisle_Weight_Enable data range 0、1 , whose corresponding meaning is Not enabling, enabling. Factory default value is 0; 9.Sensor_Weight_Enable data range 0、1 , whose corresponding meaning is Not enabling, enabling. Factory default value is 0;											
0x05	<table><tr><th>SN</th><th>Name</th><th>Variable name</th></tr><tr><td>1</td><td>Aisle number</td><td>u8 aisle_num</td></tr><tr><td>2</td><td>Unit QTY for single aisle</td><td>u8 platform_type</td></tr></table> <p>platform_type data range is 1, 2, 4, which means how many weighing unit in a single aisle.</p>	SN	Name	Variable name	1	Aisle number	u8 aisle_num	2	Unit QTY for single aisle	u8 platform_type		Set platform type, return back by [Universal response frame].
SN	Name	Variable name										
1	Aisle number	u8 aisle_num										
2	Unit QTY for single aisle	u8 platform_type										
0x06	u8 aisle_id Data range is ≤ aisle_num, Value 0x00 as result means take net weight for all aisles. Take other value except 0x00 as result means take net weight for single aisle.		Response frame is specified in <b>Instruction ②</b>									
0x07	<table><tr><th>SN</th><th>Name</th><th>Variable name</th></tr><tr><td>1</td><td>Aisle PN</td><td>u8 aisle_id</td></tr><tr><td>2</td><td>Current goods QTY</td><td>u16 goods_nums</td></tr></table>	SN	Name	Variable name	1	Aisle PN	u8 aisle_id	2	Current goods QTY	u16 goods_nums		Set current goods QTY for an aisle, return back by [Universal response frame].
SN	Name	Variable name										
1	Aisle PN	u8 aisle_id										
2	Current goods QTY	u16 goods_nums										
0x08	u8 door_crl data range: 0,1.value 0 means lock door and 1 means unlock door.		Door lock control, return with general response frame									
0x09	u8 CurTime[12], setting system current time, ASCII code; Eg.2019,Dec.,9th,14:14:00 value is 191209141400											
0x0A	u8 output1_ctrl,1 <sup>st</sup> input status, data range:0x00-0x01, 0x00 is relay open, 0x01 is relay close. u8 output2_ctrl,2 <sup>nd</sup> input status, data range:0x00-0x01, 0x00 is relay open, 0x01 is relay close.											

## Instructions:

### ① Set goods parameters response

Start	Address	Frame length	Command Class	Command Code	Data			Check	End
0x02	ID	0x07 0x00	W	P	0x03	u32 goods_set_sta	u32 hgoods_set_sta	CS	0x03

#### Note:

goods\_set\_sta and hgoods\_set\_sta are u32 type data(8 bytes in total), each bit stand for one unit setting parameters status, 1 means success, 0 means fail. The maximum number of units they can support in total are 64. The lowest bit of goods\_set\_sta is the 1st unit, the highest bit is 32nd unit. The lowest bit of hgoods\_set\_sta is the 33rd unit, the highest bit is 64th unit.

### ② Stripping response

Start	Address	Frame Length	Command Class	Command Code	Data				Check	End
0x02	ID	0x08 0x00	W	P	0x06	u8 aisle_num	u32 tar_station	u32 htar_station	CS	0x03

#### Note:

1. aisle\_num is aisle QTY on the shelf/bin;
2. tar\_sta and htar\_sta are u32 type data(8 bytes in total), each byte means each unit stripping status, 1 means success, 0 means fail. The maximum number of unit they can support in total is 64 units. The lowest bit of tar\_sta is the 1st unit, the highest bit is 32nd unit. The lowest bit of htar\_sta is the 33rd unit, the highest bit is 64th unit.



## 2.2.2 Get Data

a) Query parameters data and computing data

Master (PC) sends:

Start	Address	Frame Length	Command Class	Command Code	Data List (List 1-2)		Check	End
0x02	ID	0xLL 0xHH	Q	P	Parameter PN	0x00	CS	0x03

Processor responds:

Start	Address	Frame Length	Command Class	Command Code	Data List (List 1-2)		Check	End
0x02	ID	0xLL 0xHH	Q	P	Parameter PN	Data package	CS	0x03

### List 1-2 Query Command data package

Parameter PN	Function and Data Package	Remark																					
0x01	Read shelf ID, return back to data package which is shown as Parameter 0x01 in List 1-1.																						
0x02	Read network parameter, return back to data package which is shown as Parameter 0x02 in List 1-1.																						
0x03	Read Cargo configuration parameters, return back to data package which is shown as Parameter 0x03 in List 1-1.																						
0x04	Read system configuration parameters, return back to data package which is shown as Parameter 0x04 in List 1-1.																						
0x05	<p>Inquiry cargo information, return back to data package shown as below:</p> <table border="1"> <thead> <tr> <th>SN</th><th>Name</th><th>Variable Name</th></tr> </thead> <tbody> <tr> <td>1</td><td>Aisle PN</td><td>u8 aisle_id</td></tr> <tr> <td>2</td><td>Current cargo weight</td><td>int32 currW</td></tr> <tr> <td>3</td><td>Current cargo QTY</td><td>u16 currNum</td></tr> <tr> <td>4</td><td>Last cargo weight</td><td>int32 lastW</td></tr> <tr> <td>5</td><td>Last cargo QTY</td><td>u16 lastNum</td></tr> <tr> <td>6</td><td>Sensing unit stabilization state</td><td>u8 stable_state</td></tr> </tbody> </table> <p><b>Note:</b></p> <ol style="list-style-type: none"> <li>1. Aisle PN shall be no more than Aisle Qty.</li> <li>2. In network communication and RS232 communication, if the cargo information reporting is enable, the cargo information can be reported automatically.</li> <li>3. The weight data is signed int type.</li> <li>4. The Sensing unit stabilization state:0 is stable, 1 is unstable, 2 is lost connection.</li> </ol>	SN	Name	Variable Name	1	Aisle PN	u8 aisle_id	2	Current cargo weight	int32 currW	3	Current cargo QTY	u16 currNum	4	Last cargo weight	int32 lastW	5	Last cargo QTY	u16 lastNum	6	Sensing unit stabilization state	u8 stable_state	
SN	Name	Variable Name																					
1	Aisle PN	u8 aisle_id																					
2	Current cargo weight	int32 currW																					
3	Current cargo QTY	u16 currNum																					
4	Last cargo weight	int32 lastW																					
5	Last cargo QTY	u16 lastNum																					
6	Sensing unit stabilization state	u8 stable_state																					

0x06	<b>No.</b>	<b>Variable Name</b>	<b>Name</b>
	1	u8 aisle_num	aisle
	2	Int32 Ch1_weight	1#aisle weight
	3	Int32 Ch2_weight	2#aisle weight
	...	...	...
<p>Note:</p> <ol style="list-style-type: none"> <li>The qty of weight data in data package equal to qty of aisle. The weight data is signed int type.</li> <li>In network communication and RS232 communication, if the aisle weight information reporting is enable, the aisle weight information can be reported automatically. Default interval is 1sec.</li> </ol>			
0x07	<b>No.</b>	<b>Variable Name</b>	<b>Name</b>
	1	u8 Loadcell_num	Qty of load cell
	2	Int32 Lc1_weight	load cell 1# weight
	3	Int32 Lc2_weight	load cell 2# weight
	...	...	...
<p>Note:</p> <ol style="list-style-type: none"> <li>Load cell qty is related to aisle qty. If 1 aisle is composed of 1 load cell, the load cells qty is equal to aisle qty. If 1 aisle is composed of 2 load cells, the load cells qty is twice of aisle qty.</li> <li>The qty of weight data in data package equal to qty of load cells.</li> <li>In network communication and RS232 communication, if the load cell weight information reporting is enable, the load cell weight information can be reported automatically. Default interval is 1sec.</li> </ol>			
0x08	<p>Read real time error status (system, RTC, memory, addressing board and sensor error)</p> <p>Refer the data subfields marked in in <b>datas</b> datastructure in Query error log article (See page 12).</p>		

## b) Query status

Master (PC) sends:

Start	Address	Frame Length	Command Class	Command Code	Data List (List 1-3)		Check	End
0x02	ID	0xLL 0xHH	Q	S	Parameters PN	0x00	CS	0x03

Processor responds:

Start	Address	Frame Length	Command Class	Command Code	Data List (List 1-3)		Check	End
0x02	ID	0xLL 0xHH	Q	S	Parameters PN	Data package	CS	0x03

List 1-3 Query command parameter data list

Parameters PN	Function and Data Package	Remark																					
0x01	<p>Inquiry unit communication status, upload the data package shown as below:</p> <table border="1"> <thead> <tr> <th>SN</th><th>Name</th><th>Variable Name</th></tr> </thead> <tbody> <tr> <td>1</td><td>Unit QTY</td><td>u8 loadcell_num</td></tr> <tr> <td>2</td><td>Unit status</td><td>u32 ch_sta u32 hch_sta</td></tr> </tbody> </table> <p>Note:</p> <p>1. ch_sta and hch_sta are u32 type data(8 byte in total), each bit indicate one unit status, 1 means load cell online, 0 means offline. The Maximum qty they support in total are 64 units. The lowest bit of ch_sta indicates the 1st unit, the highest bit indicated the 32nd unit. The lowest bit of hch_sta indicates the 33rd unit, the highest bit indicated the 64th unit.</p> <p>2. In network communication and RS232 communication, if the load cell communication status reporting is enable, the load cell communication status can be reported automatically. Interval is set by variable send_sta_val.</p>	SN	Name	Variable Name	1	Unit QTY	u8 loadcell_num	2	Unit status	u32 ch_sta u32 hch_sta	In network communication, if status is enable to be actively reported, the weighing unit communication status can be actively reported. Report frequency is depended on send_sta_val.												
SN	Name	Variable Name																					
1	Unit QTY	u8 loadcell_num																					
2	Unit status	u32 ch_sta u32 hch_sta																					
0x02	<p>Inquiry lock status. The upload data package is following:</p> <table border="1"> <thead> <tr> <th>No.</th><th>Name</th><th>Variable Name</th></tr> </thead> <tbody> <tr> <td>1</td><td>Door status</td><td>u8 door_sta</td></tr> <tr> <td>2</td><td>Lock status</td><td>u8 lock_sta</td></tr> </tbody> </table> <p>Note:</p> <p>1. door_sta value range:0 and 1.0 means close, 1 means open;</p> <p>2. lock_sta value range:0,1,2.0 means lock, 1 means unlock, 2 means error.</p> <p>3.In network communication and RS232 communication, if the lock status reporting is enable, the loack status can be reported automatically. Default Interval is 1 sec. Interval is set by variable send_lock_val.</p>	No.	Name	Variable Name	1	Door status	u8 door_sta	2	Lock status	u8 lock_sta	Lock error is door close status is detected but the lock status is unlock.												
No.	Name	Variable Name																					
1	Door status	u8 door_sta																					
2	Lock status	u8 lock_sta																					
0x05	<p>Query IO port status, the uploaded data package is as below:</p> <table border="1"> <thead> <tr> <th>No.</th><th>Name</th><th>Variable Name</th></tr> </thead> <tbody> <tr> <td>1</td><td>Input 1 status</td><td>u8 input1_sta</td></tr> <tr> <td>2</td><td>Input 2 status</td><td>u8 input2_sta</td></tr> <tr> <td>3</td><td>Input 3 status</td><td>u8 input3_sta</td></tr> <tr> <td>4</td><td>Input 4 status</td><td>u8 input4_sta</td></tr> <tr> <td>5</td><td>Output 1 status</td><td>u8 output1_sta</td></tr> <tr> <td>6</td><td>Output 2 status</td><td>u8 output2_sta</td></tr> </tbody> </table> <p>Note:</p> <p>1、input1_sta data range is 0x00-0x01, 0x00 is low input, 0x01 is high input, the rest 3 inputs are same as input 1.</p> <p>2、output1_sta data range 0x00-0x01, 0x00 is relay open, 0x01 is relay close. Input 2 data range is same as input 1.</p>	No.	Name	Variable Name	1	Input 1 status	u8 input1_sta	2	Input 2 status	u8 input2_sta	3	Input 3 status	u8 input3_sta	4	Input 4 status	u8 input4_sta	5	Output 1 status	u8 output1_sta	6	Output 2 status	u8 output2_sta	
No.	Name	Variable Name																					
1	Input 1 status	u8 input1_sta																					
2	Input 2 status	u8 input2_sta																					
3	Input 3 status	u8 input3_sta																					
4	Input 4 status	u8 input4_sta																					
5	Output 1 status	u8 output1_sta																					
6	Output 2 status	u8 output2_sta																					

## c) Query software version status

Master (PC) sends:

Start	Address	Frame Length	Command Class	Command Code	Data	Check	End
0x02	ID	0xLL 0xHH	Q	V	0x00	CS	0x03

Processor response:

Start	Address	Frame Length	Command Class	Command Code	Data	Check	End
0x02	ID	0xLL 0xHH	Q	V	string version_msg	CS	0x03

Note: version\_msg is character string with variable length, such as Version ZHY-K(BJ)V1.0.20180428\_R or ZHY-K(BJ)V1.0.0001.20180520\_Bat.

## d)Query error log

485/Platform sending:

Start	Address	Frame length	Command Class	Command Code	Data	Check	End
0x02	0x01	0x04 0x00	Q	E	2byte reading qty	CS	0x03

Terminal response:

Start	Address	Frame length	Command Class	Command Code	Data	Check	End
0x02	0x81	2+Datas2 length	Q	E	See Datas2	CS	0x03

Datas2:

Function	Data		Remark
Order number	1 Byte	The order number of current log record	Response according to FILO rule.
Total qty	2 Bytes	the log records qty in total.	
System error	1 Byte (*)	bit0 normal error, 1:error 0:No error bit1 serious error, 1:error 0:No error	
RTC	1 Byte (*)	bit0 initialization error, 1:error 0:No error bit1 reading time error, 1:error 0:No error	
memory		Bit2 initialization error 1:error 0:No error Bit3 reading error 1:error 0:No error Bit4 writing error 1:error 0:No error	
Addressing board		Bit5 Handshake error 1:error 0:No error	

Load cell #1 error	4 Bytes	1# load cell real time weight	
	1 Byte (*)	bit0 zero error 1:abnormal 0:normal bit1 overload 1:abnormal 0:normal bit2 cable broken 1:abnormal 0:normal bit3 lost connection 1:abnormal 0:normal	
.....	.....	.....	
Load cell #N error	4 Bytes	N#load cell real time weight	
	1 Byte (*)	bit0 zero error 1:abnormal 0:normal bit1 overload 1:abnormal 0:normal bit2 cable broken 1:abnormal 0:normal bit3 lost connection 1:abnormal 0:normal	
Error time	14 Bytes	When the error happened in year, month, date, hour, min and sec.	14 bytes ASCII code, formate :2019051 1141329

**Note:**

The data subfield marked with '\*' will be used for command to read real time error status.

## 2.2.3 Heartbeat Package (Used in Network Communication)

Processor sends:

Start	Address	Frame Length	Command Class	Command Code	Data	Check	End
0x02	ID	0x03 0x00	H	B	H	CS	0x03

**Note:**

In Network communication, if processor's Heartbeat is enabled to be actively reported, the Heartbeat package will be actively reported. Report frequency is dependant on send\_HB\_val parameter.

Master (PC) responds:

Start	Address	Frame Length	Command Class	Command Code	Data	Check	End
0x02	ID	0x03 0x00	H	B	0x00	CS	0x03

## 2.2.4 Reset

Master (PC) sends:

Start	Address	Frame Length	Command Class	Command Code	Data	Check	End
0x02	ID	0x03 0x00	R	R	0x00	CS	0x03

Slave (Processor) response:

Start	Address	Frame Length	Command Class	Command Code	Data	Check	End
0x02	ID	0x03 0x00	R	R	0x00	CS	0x03

**Note:** After getting reset command, slave will response firstly then restart software.

## 2.2.5 Restore Factory Settings

Master (PC) sends:

Start	Address	Frame Length	Command Class	Command Code	Data	Check	End
0x02	ID	0x03 0x00	R	P	0x00	CS	0x03

Slave responds:

Start	Address	Frame Length	Command Class	Command Code	Data	Check	End
0x02	ID	0x03 0x00	R	P	0x00	CS	0x03

**Note:** when slave machine get the restore factory setting command, it will store setting according to the following parameters:

No.	Parameter name	Remark
1	ID	
2	IP info	The IP information cannot be used for result judgment. The supporting configuration software is required to modify the IP parameters
3	Cargo parameter	
4	Information reporting parameters	

## 2.2.6 Ethernet Port Upgrade

### 1. Upgrade process

- When the processor get upgrade command from the Master, it will judge if it's available to upgrade and send response to Master.
- If the Master get response command of confirmation, it will subpackage the firmware and send firmware data package by order.
- In upgrade process, processor will only follow command related to upgrade. If Master sends any other command, processor will send invalid command back.
- If the firmware package receiving fail, the processor will send resending command to Master, Master will resend failed receiving package after it get resending command.
- When all packages are received, the processor confirm package receiving success by sending finishing receiving command.
- The processor restart automatically, then it judge upgrade result. If it's success, processor send upgrade success command, if not, the processor send upgrade failure command.

### 2. Upgrade command

#### a) Master (PC)

Start	Address	Frame length	Command Class	Command Code	Data	Check	End
0x02	ID	0x17 0x00	P	R	byte0 : 0x01 upgrade request byte1-byte15: upgrade version Byte16-byte19: total length Byte20: total package number	CS	0x03
		Subject to the actual length	P	D	Package number(begin with 1)+ data package+ CRC16 check(only for data package)		
		0x03 0x00	P	S	0x00 upgrade interruption 0x01 all package are sent		

b) Slave (Processor) responds:

Start	Address	Frame length	Command Class	Command Code	Data	Check	End
0x02	ID	0x03 0x00	P	R	0x01 available upgrade 0x02 version is too old 0x03 file parameter is not correct 0x04 package storage failure	CS	0x03
		0x03 0x00	P	N	0x01 next package		
		0x03 0x00	P	L	0x01 resending current package		
		0x03 0x00	P	S	0x00 upgrade stop 0x01 finishing receiving 0x02 upgrade success 0x03 upgrade failure		

**Note:**

Every 1024 bytes of the upgrade data package is a package. The number of packages to be sent depends on the size of the binary file divided by 1024. When the length of the last packet is not enough to 1024byte. Modify the frame length to the actual length before sending.

The upgrade version number must be greater than the current version number, or it cannot be upgraded.

The format of the upgrade version number is 'x.x.xxxx.xxxxxx', like '1.0.0000.190517'. In comparing, it's needed to compare the large version '1.0' firstly and the small version '0000'.

- End -