



SWS501 Smart Bin Sensor TCP Protocol_NB-IoT

V2.6
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Changed

V2.6 Replace 16bits 0 with IMEI; Add command 0x0H for NB-IoT version; Add command 0x0L for BG95 version;

V2.4 Update uplink format. Add example, and delete command 0 x 0E;

V2.3 Add example of data reported; And command 0 x 0E; Add type of GPS data;

instructions;

V2.5 Increase downlink acknowledgement (0x03 type) data information, and downlink

V2.2 Add RSRP information of uplink data ,terminal downlink ACK information format and terminal downlink commands format;

V1.0 Modify uplink data format;

V2.1 Initial version;

Confidential



Index

1 Special Notification	4
2 Terms	4
3 Sensor Work Flow	4
4 Terminal Uplink Data Format	5
4.1 Field Definition	5
4.1.1 Packet Head	5
4.1.2 Forced Bit	5
4.1.3 Device Type	5
4.1.4 Report Data Type	5
4.1.5 Packet Size	6
4.1.6 Payload	6
4.1.7 Packet Tail	9
4.2 Example	9
5 Terminal Downlink Command	11
5.1 Terminal Downlink Command Format	11
5.2 Detailed Command	12
5.2.1 0x01 Setting Cycle Upload interval	12
5.2.2 0x02 Setting Full alarm threshold	12
5.2.3 0x03 Setting Fire alarm threshold	13
5.2.4 0x04 Setting Fall alarm threshold	13
5.2.5 0x05 Setting Battery alarm threshold	13
5.2.6 0x06 Setting server1 address	14
5.2.7 0x07 Select the server	14
5.2.8 0x08 Setting the cycle detection time	14
5.2.9 0x09 Switch function setting	15
5.2.10 0x0C Setting server2 address	15
5.2.11 0x0D Setting APN	16
5.2.12 0x0H Setting Band(only for NB-IoT module)	16
5.2.13 0x0L Set network(Only for BG95 module)	17



1 Special Notification

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2 Terms

Uplink packet :the packet from sensor to server is names as uplink packet.

Downlink packet : the packet from server to sensor is named as downlink packet.

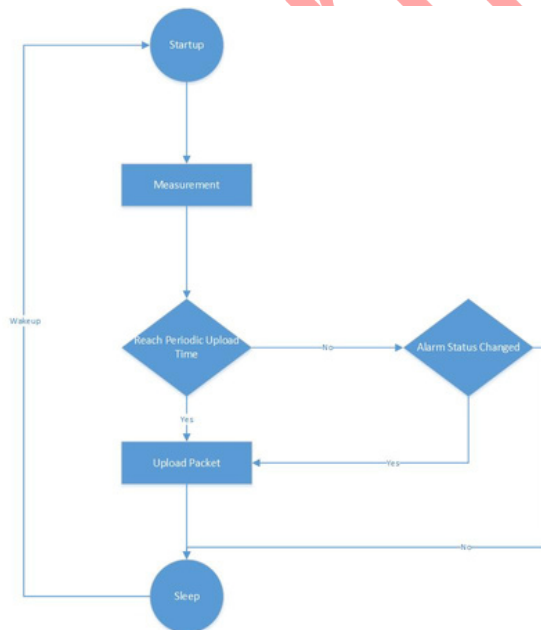
Cyclicdetectiontime : the time for sensor cyclicly sleep/wakeup, unit is minutes, default10minutes.

Periodicuploadtime :the time for periodic uploading setting, unit is minutes, default is 24hours.

3 Sensor Work Flow

Below are work flow of the sensor. It sleep/wake up at the **cyclic detection time**. While **periodic upload timing** comes or alarm status changed, it will upload packet.

The above alarm status change includes height alarm change or battery alarm change. Any of them alarm status change will trigger upload.



4 Terminal Uplink Data Format

The communication way: TCP

Note: The data is sent by in hexadecimal.

Field	Packet head	Forced bit	Device type	Report data type	Packet size	Payload	Packet tail
Instruction	Packet head	Forced bit	Device type	Active reporting or answering	Packet length	Data content	Packet tail
Size	1byte	1byte	1byte	1byte	1byte	0-255byte	1byte

4.1 Field Definition

4.1.1 Packet Head

Packet head:0x80; length:1byte.

4.1.2 Forced Bit

Forced bit:0x00; length:1byte.

4.1.3 Device Type

Device type; 1byte,

Command	Device type
0x01	SWS501

4.1.4 Report Data Type

Report data type; 1byte,

Command	Type
0x01	Abnormal reporting type; Report the data when have status changed, such as changes from full to empty or from fall alarm to not fall alarm, etc.
0x02	Heartbeat data; Report 0x02 type data when restart or at upload interval.
0x03	Confirmation reply for downlink commands; Report this type data when restart or after executing the downlink command.



4.1.5 Packet Size

The size of the packet; 1byte, in hex. For example, report 0x1E means 30bytes.

4.1.6 Payload

Payload data format1 (data type 0x01 and 0x02)

NO.	1	2	3	4	5	6	7	8
Function	Height	GPS selection	Long	lat	TEMP	Reserved	Fall angle	Full status
Size	2byte	1byte	4byte	4byte	1byte	1byte	1byte	0.5byte
NO.	9	10	11	12	13	14	15	
Function	Fire status	Fall status	Power status	Battery voltage	RSRP	Frame count	DeviceID	
Size	0.5byte	0.5byte	0.5byte	2byte	4byte	2byte	8byte	

Payload field definition:

S/N	Function	Description	Example
1	Height	The height from sensor to garbage or the measured object; 2bytes, in hex; Unit: mm;	Report 0x060E means 1550mm
2	GPS selection	It indicates whether the data contains latitude and longitude information; 1bytes; Content: 0x00 or 0x01; 0x00 mean no GPS information; 0x01 means report GPS information.	
3	Long	Longitude; 4bytes, in hex, float single type(IEEE-754standard);	Report CD03E942 means 116.507423°
4	Lat	Latitude; 4bytes, in hex, float single type(IEEE-754standard);	Report EF272042 means 40.038998°
5	TEMP	Temperature; 1bytes; in hex, unit: °C	Report 0x10 means 16°C
6	Reserved	Reserved; 1byte;	
7	Fall angle	The relative angle of inclination of the device; 1 byte, in hex, unit: °;	Report 0x10 means 16°C
8-11	Full/ Fire/ Fall/ power status	Full/Reserved/Fall/powerstatus; Total 2byte <u>Full Status:</u> The upper four bits of the first byte are full status, 0x0X: NOT full battery normal.alarm, 0x1X: full alarm;	Report 0x10 means not full, not fire alarm, fall alarm and battery normal



		<u>Fire status</u> : The upper four bits of the first byte are fire status, 0xX0: NOT fire alarm, 0xX1: fire alarm; <u>Fall status</u> : The upper four bits of the second byte are fall status, 0xX0: NOT fall, 0xX1: fall alarm; <u>Power status</u> : The lower four bits of the second byte are power status, 0xX0: battery normal, 0xX1: battery lower alarm.	
12	Battery voltage	Battery voltage; 2 bytes, in hex; unit: 10mV;	Report 0x0E60 means 3680mV, 3.68V;
13	RSRP	Reference Signal Receiving Power; 4 byte, in hex; float single type (IEEE-754 standard);	Report 00C062C4 means RSRP is -907
14	Frame count	Frame counter, Number of packets reported after power-on; 2 bytes, in hex;	Report 000A means the tenth data after power-on
15	Device ID	Device ID, 1+IMEI; 8 bytes;	Report 18613110066348279 means IMEI is 8613110066348279

Payload data format2 (data type 0x03):

NO.	1	2	3	4	5	6	7
Function	FW	CycleTime	DetectTime	HThreshold	TThreshold	AThreshold	SIM No.
Size	2byte	1byte	1byte	1byte	1byte	1byte	8byte
NO.	8	9	10	11	12	13	14
Function	Fall mode	Ultra Range	Work mode	Server mode	IP&PORT1	IP&PORT2	DeviceID
Size	1byte	1byte	1byte	1byte	MAX50byte	MAX50byte	8byte

Payload field definition:

S/N	Function	Description	Example
1	FW	The firmware version number; 2 byte, in hex; The upper eight bits means the major version number, the lower eight bits means small version number;	Report 0216 means V2.22;
2	CycleTime	Periodic reporting interval;	Report 18 means



		1byte, in hex; Unit: hour;	24h our s;
3	DetectTime	Periodic detection interval; 1byte,in hex; Unit:min;	Report 0A means 10min;
4	HThreshold	Full(height) alarm threshold; 1byte, in hex; Unit: cm;	Report 1E means 30cm;
5	TThreshold	Temperature alarm threshold; Reserved; 1byte,in hex; Unit: °C;	Report 4B means 75°C
6	AThreshold	Fall(Angle)alarm threshold; 1byte,in hex; Unit: °;	Report 1E means 30°
7	SIM No.	1+IMSI, IMSI is the sim card No. 8bytes; For example, Report 1460111174736920, so the IMSI is 460111174736920	
8	Fall mode	Fall function switch; 1byte; Content is 0x00 or 0x01; 0x00:close fall function, 0x01:open fall function;	
9	Ultra Range	Ultrasonic range selection; 1byte; Content is 00,01 or 02; 00:112k, 01:75K, 02:40K version;	
10	Work mode	1byte; Content is 00, 01 or 02; 00: normal work mode;the cycle detection is opened; 01:cycle detection is closed; 02: demo mode; Sensor will report the data at detection interval.	
11	Server mode	1byte; Content: 00,01 or 02; 00:only report data to server1; 01: only report data to server2; 02: report data to server1 and server2 at the same time;	
12	IP&PORT1	Server1 address; Max50byte, in hex; For example, Report 3131352E3138332E33342E3130383 B1A213B means IP1: 115.183.34.108,PORT1:6689	
13	IP&PORT2	Server2 address; Max50byte, in hex; The format is the same with IP&PORT1.	
14	Device ID	Device ID,1+IMEI; 8bytes;	Report 18613110066348279 means IMEI is 8613110066348279



4.1.7 Packet Tail

Packet tail: 0x81; 1byte.

4.2 Example

For example1:

Upload data(data type 0x01,0x02):

800001011E0692001A0000000016E008027C40001186962703655111781

Description:

80: packet head;1byte

00: forced bit; 1byte

01: device type; 1byte;(01:SWS501)

01: report data type;

1E: packet size; 1E means 30bytes

0692: height; 0692 means 1682mm

00: GPS selection; 00 means no GPS function

1A: temperature; 1A means 26°C

00: Reserved.

00: angle value; 1bytes

0000: full status/fire status/fall status/battery status; 0000 means not full/no fire alarm/no fall alarm/battery normal

016E: battery voltage; 016E means 366, so the battery voltage is $366 \times 10\text{mV} = 3.66\text{v}$

008027C4: RSRP; means -670. **Calculation:** First change the 008027C4 to C4278000, then change it from float to dec, that is -670. You can refer to the online tool, http://www.binaryconvert.com/result_float.html?hexadecimal=C4278000

0001: Frame count; the first data after powered on;

1869627036551117:device ID; so IMEI is 869627036551117.

81:packet tail; 1byte

For example2:

Upload data(data type 0x01,0x02):

8000010126069201CD03E942EF2720421A0000000016E008027C40001186962703655111781

Description:

80: packet head;1byte 00: forced

bit; 1byte 01: device type; 1byte;

(01:SWS501). 01: report data type;

26: packet size; 1E means 38bytes.

0692: height; 0692 means 1682mm.

01: GPS selection; 01 means report GPS function

CD03E942: the Longitude is 116.507423; **Calculation:** First change the



CD03E942 to 42E903CD, then change it from float to dec, that is 116.507423. You can refer to the online tool,

http://www.binaryconvert.com/result_float.html?hexadecimal=42E903CD

EF272042: the Latitude is 40.038998.

1A: temperature; 1A means 26°C.

00: Reserved.

00: angle value; 1bytes.

0000: full status/fire status/fall status/battery status; 0000 means not full/no fire alarm/no fall alarm/battery normal.

016E: battery voltage; 016E means 366, so the battery voltage is $366 \times 10\text{mV} = 3.66\text{v}$.

008027C4: RSRP; means -670.

0001: Frame count; the first data after powered on;

1869627036551117: device ID; so IMEI is 869627036551117.

81: packet tail; 1byte

For example3:

Uploaddata(datatype0x03):

80000103410604180A1E4B1E1460047427709661010200003132302E39322E38392E3132323B23823B3135392E3133382E342E363B22B83B186962703655111781

Description:

80: packet head

00: Reserved; default 00

01: device type, SWS501

03: report type, downlink confirmed

41: the packet size is 29

0604: the version of hardware V6.4

18: upload time 24h

0A: detection time 10min

1E: The height threshold 30cm

4B: The temperature threshold 75°C

1E: angle threshold 30°

1460047427709661: 1+IMSI, So the IMSI is 460047427709661

01: the fall function is opened

02: Ultrasonic range is 40k version

00: work mode, normal work mode;

00: server mode, only report data to server1

3135392E3133382E342E363B22B83B : server 1 address, 120.92.89.122, 9090

3132302E39322E38392E3132323B23823B : server2 address, 159.138.4.6, 8888

1869627036551117: device ID; so IMEI is 869627036551117.

81: packet tail



5 Terminal Downlink Command

We can modify the SWS501 waste bin sensor's configuration through the downlink command or serial port, such as the upload interval, threshold and so on.

Command Direction: From server to waste bin sensor in hex.

Command Direction: From serial port to waste bin sensor in ASCII.

Note: only when the sensor is reporting, it can receive and execute the command.

If sensor is in sleep mode, it cannot receive command.

5.1 Terminal Downlink Command Format

Field	Packet head	Command type	Payload			Packet tail
Instruction	Packet head	The function of commands	Header	Command code	Content	Packet tail

Field Definition:

Packet Header: 0x80; length: 1 byte.

CommandType: 1 byte,

Command type	Instruction
0x02	Configure device parameters through the downlink

Payload:

1 Header: 0x9999.

2 Command code:

Command code	Function
0x01	Setting cycle upload time interval Setting
0x02	Full alarm threshold Setting Fire alarm
0x03	threshold Setting angle(fall) alarm
0x04	threshold
0x05	Setting battery alarm threshold
0x06	Setting the server1(IP1 and PORT1)
0x07	Select the server which sensor will report
0x08	Setting the cycle detection time



0x09	Switch function setting
0x0C	Setting the server 2 IP2 and PORT2) Set APN,
0x0D	the username and password of APN
0x0H	Setting band for only NB-IoT(Y702X) version
0x0L	Setting network search order for only BG95 module

3Content: please refer to part 3.2.

Packet Tail: 0x81, 1 byte.

5.2 Detailed Command

5.2.1 0x01 Setting Cycle Upload interval

Function: Set data cycle upload time interval;

Format

Field	Packet head	Command type	Payload			Packet tail
Instruction	80	02	9999 2byte	01	Content	81
Size	1byte	1byte		1byte	1byte	1byte

The content can be in the range of 01-168, unit: h (hours), in hex. The default is 24 hours.

Note: This command can reset the SWS501 bin sensor.

For example: set the upload time to 24 hours,

The command is 80029999011881

5.2.2 0x02 Setting Full alarm threshold

Function: Set full alarm threshold.

Format:

Field	Packet head	Command type	Payload			Packet tail
Instruction	80	02	9999	02	Content	81
Size	1byte	1byte	2byte	1byte	1byte	1byte

The content can be in the range of 15-255cm, unit: cm, in hex. The default is 30cm.

The command is 80029999021E81



5.2.3 0x03 Setting Fire alarm threshold

Function:Set fire alarm threshold.

Format:

Field	Packet head	Command type	Payload			Packet tail
Instruction	80	02	9999	03	Content	81
Size	1byte	1byte	2byte	1byte	1byte	1byte

The content can be in the range of 1-255,unit:°C, inhex. The default is75°C.

The command is 80029999034B81

5.2.4 0x04 Setting Fall alarm threshold

Function:Set fall alarm threshold

Format

Field	Packet head	Command type	Payload			Packet tail
Instruction	80	02	9999	04	Content	81
Size	1byte	1byte	2byte	1byte	1byte	1byte

The content can be in the range of 15-90,unit:°,inhex.The default is 30°.

The command is 80029999041E81

5.2.5 0x05 Setting Battery alarm threshold

Function:Set battery alarm threshold;

Format

Field	Packet head	Command type	Payload			Packet tail
Instruction	80	02	9999	05	Content	81
Size	1byte	1byte	2byte	1byte	1byte	1byte

The content can be in the rang eof 5-99, unit: %,inhex.The default is30%.

The command is 80029999051E81



5.2.6 0x06 Setting server1 address

Function:Set server 1 address, IP1 and port1;

Format

Field	Packet head	Command type	Payload			Packet tail
Instruction	80	02	9999	06	Content	81
Size	1byte	1byte	2byte	1byte	n	1byte

The content format: **IP1;PORT1;**

Note:Two English semicolons cannot be less.Otherwise it will go wrong!!!

Forexample: set the server1 address, IP:156.23.68.110 , PORT is 5000

The command from server to SWS501 sensor is The command from serial port to SWS501 sensor is 80029999**06156.23.68.110;5000;81**

5.2.7 0x07 Select the server

Function:Select the server which sensor will report

Format

Field	Packet head	Command type	Payload			Packet tail
Instruction	80	02	9999	07	Content	81
Size	1byte	1byte	2byte	1byte	1byte	1byte

The content can be 00,01 or 02, The default is server1, Content 00: select the server 1; sensor will report data to server1; Content 01: select the server 2;sensor will report data to server2;

Content02:select the server 1 and 2; sensor will report data to server 1 and server 2;

Forexample: set sensor only report data to server1,

The command is 80029999**070081**

5.2.8 0x08 Setting the cycle detection time

Function:Set the cycle detection time.

Format

Field	Packet head	Command type	Payload			Packet tail
Instruction	80	02	9999	08	Content	81



Size	1byte	1byte	2byte	1byte	1byte	1byte
------	-------	-------	-------	-------	-------	-------

The content can be in the range of 1-60, unit:min, inhex. The default is 10 min.

The command is 80029999080A81

5.2.9 0x09 Switch function setting

Function: Switch function setting

Format

Field	Packet head	Command type	Payload			Packet tail
Instruction	80	02	9999	09	Content	81
Size	1byte	1byte	2byte	1byte	1byte	1byte

The content can be 02, 0B/0C, 0A/09, 00/01, 05/06/0E, 18/19/1A/1B/1C

02: Restart sensor;

0B/0C: open/close echo function of the serial port;

0A/09: open/close fall function; **Note: This command(0A) can reset the SWS501 bin sensor.**

00/01: close/open GPS function; **Note: This command(01) can reset the SWS501 bin sensor.**

05/06/0E: set the work mode 0/1/2; work mode 0: normal work mode;

Work mode 1: close the detection function; Work mode 2: demo mode, waste bin sensor will report the data at cycle detection time when use demo mode. **Note: If report the data frequently, the battery will run out quickly. This command can reset the SWS501 bin sensor.**

18/19/1A/1B/1C: Set the country, 18->China, 19->America, 1A->Europe, 1B->Middle East,

1C->Austria (Only for BG95 module). **Note: This command can reset the SWS501 bin sensor.**

For example 1: turn the echo of serial port on,

The command is 80029999090B81

For example 1: open fall function

The command is 80029999090A81

For example 3: set the work mode 1

The command is 80029999090681

5.2.10 0x0C Setting server2 address

Function : Set server 2 address, IP2 and port2 ;

Format

Field	Packet head	Command type	Payload			Packet tail
Instruction	80	02	9999	0C	Content	81
Size	1byte	1byte	2byte	1byte	n	1byte



The content format: **IP2;PORT2;**

Note: Two English semicolons cannot be less. Otherwise it will go wrong!!!

Forexample:settheserver1address,IP:156.23.68.110 , PORT is 5000

The command from serial port to SWS501 sensor is 80029999**0C156.23.68.110;5000;81**

5.2.11 0x0D Setting APN

Function :SetAPN

Format

Field	Packet head	Command type	Payload			Packet tail
Instruction	80	02	9999	0D	Content	81
Size	1byte	1byte	2byte	1byte	n	1byte

The content format: **APN; USERNAME; PASSWORD;**

Note:Three English semicolons cannot be less.Otherwise it will go wrong!!!

Note:the user and password are leave blank when there is no user and password.

For example : set APN to internet, no user name and password,

The command from serial port to SWS501 bin sensor is

80029999**0Dinternet;;;81**

5.2.12 0x0H Setting Band(only for NB-IoT module)

Function: setting NB-IoT band

Default: 0-all enabled

Field	Packet head	Command type	Payload			Packet tail
Instruction	80	02	9999	0H	Content	81
Size Bytes	1	1	2	1	1	1

Content: 1byte, in hex,

0--all, 3--band3, 5--band5, 8--band8, 20--band20, 28--band28

Note: This command can reset the SWS501 bin sensor.



For example1:Setting band to band20,
Command: 800299990H1481

5.2.13 0x0L Set network(Only for BG95 module)

Function Set the network searching order and network selection

Note : This command only for bin sensor with BG95-M3 module.

Format :

Field :	Packet head	Command type	Payload			Packet tail
Instruction	80	02	9999	0L	Content	81
Size Bytes	1	1	2	1	4	1

Content: total 4bytes, Bytes 1 to 3 set the searching order, and the fourth byte sets the

network mode,

Searching order:

01: GPRS

02:CAT-M

03: NB-IoT

Network mode:

00: Automatic

01: only GPRS

02: only CAT-M

03: only NB-IoT

04: CAT-M and NB-IoT

Note:This command can reset the SWS501 bin sensor.

For example 1, the network searching order is NB-IoT/CAT-M/GPRS, network mode:auto,

The command: 800299990L0302010081

For example 2, the network searching order:NB-IoT/CAT-M/GPRS, network mode:only GPRS,

Thecommand:800299990L0302010181

Forexample3, the network searching order:NB-IoT/CAT-M/GPRS, network mode:only

NB-IoT,

The command: 800299990L0302010381