



Portable Socket

Featuring LoRaWAN[®]

WS523

User Guide



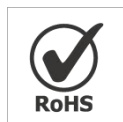
Safety Precautions

Milesight will not shoulder responsibility for any losses or damages resulting from not following the instructions of this operating guide.

- ❖ The device must not be modified in any way.
- ❖ In order to protect the security of the device, please change device the password when first configuration. The default password is 123456.
- ❖ In order to get best data transmission, ensure the device is within the signal range of the LoRaWAN® gateway and avoid the metal obstacles.
- ❖ Do not overload the maximum capacity in order to avoid the damage of the device.
- ❖ The device is intended only for indoor use. Do not place the device where the temperature is below/above the operating range.
- ❖ Do not place the device close to objects with naked flames, heat source (oven or sunlight), cold source, liquid and extreme temperature changes.
- ❖ Use the device only in clean environment. Dusty or dirty environments may prevent the proper operation of this device.
- ❖ The device must never be subjected to shocks or impacts.
- ❖ Use a dry, clean cloth to clean the device. Do not use strong chemicals or detergents which may damage the device.

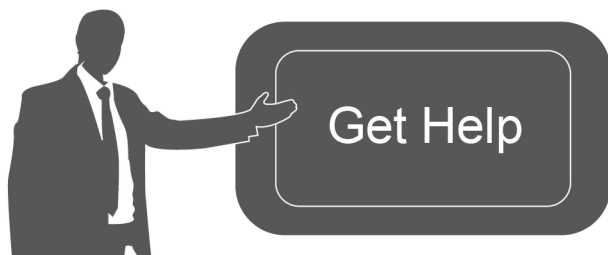
Declaration of Conformity

WS523 is in conformity with the essential requirements and other relevant provisions of the CE, FCC, and RoHS.



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Revision History

Date	Doc Version	Description
August 11, 2021	V 1.0	Initial version
October 25, 2021	V 1.1	<ol style="list-style-type: none">1. Add multicast feature2. Support RX2 configuration
January 10, 2022	V 1.2	Support power outage alert
January 9, 2023	V 1.3	<ol style="list-style-type: none">1. Add Milesight D2D Agent feature2. Add Single Channel mode3. Add reboot downlink command4. Add overcurrent protection feature

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1. Product Introduction

1.1 Overview

WS523 is a LoRaWAN® smart portable socket for the monitoring and control of electronic appliances. Supporting a variety of international socket types, WS523 can be used to turn on or off the electronic devices locally or remotely, to measure power consumption data, and even to send alarms in case of overcurrent events. Due to its intelligence, WS523 is suitable for wireless control of indoor lights, fans, heaters, machines, etc.

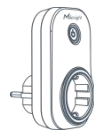
Power data is transmitted via LoRaWAN® protocol, and LoRaWAN® technology enables encrypted radio transmissions over long distances while consuming very little power. Also, users can check visualized data through Milesight IoT Cloud or through the user's own Application Server.

1.2 Features

- Plug & play experience
- Support a variety of international socket types
- Turn on/off devices and create timing switch-on/off schedules remotely
- Collect data of current, voltage, electrical consumption
- Support overload protection
- Up to 15 km communication range
- Easy configuration via NFC
- Standard LoRaWAN® technology
- Compatible with Milesight IoT Cloud and Milesight ToolBox

2. Hardware Introduction

2.1 Packing List



1 ×

WS523 Socket



1 ×

Quick Guide



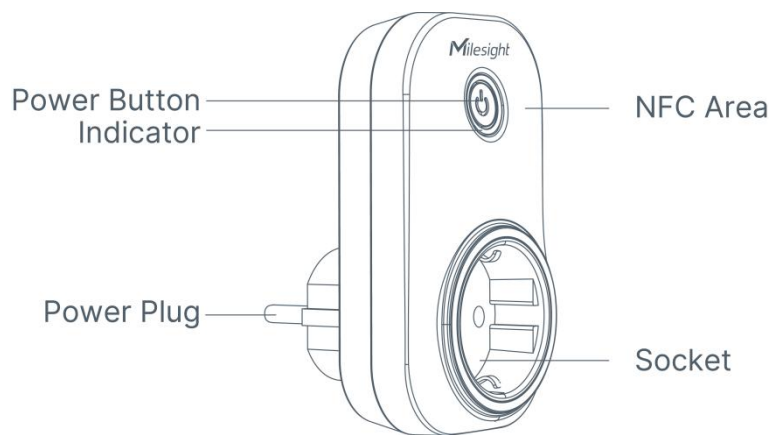
1 ×

Warranty Card



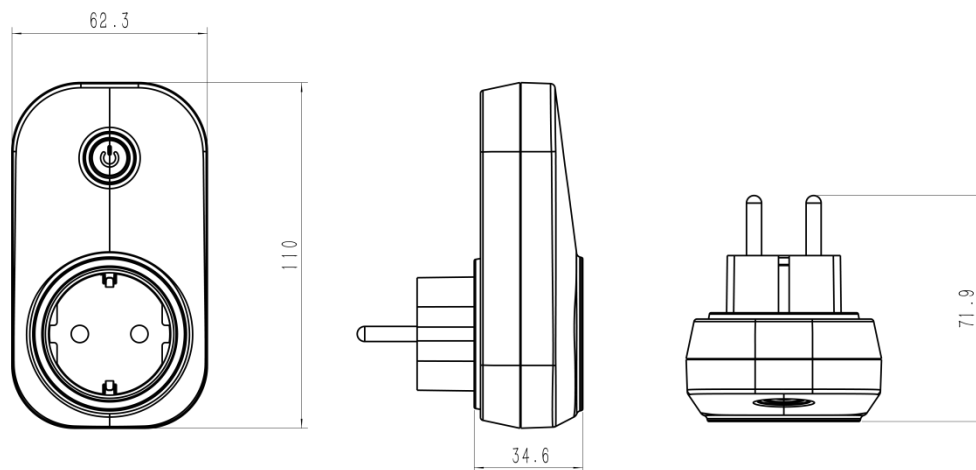
If any of the above items is missing or damaged, please contact your sales representative.

2.2 Hardware Overview



Note: The outlook will differ according to socket types.

2.3 Dimensions (mm)



Note: The plug size will a little differ according to socket types.

2.4 Power Button and LED Patterns

Function	Action	LED Indicator
Open the Socket	Press the power button.	Off → Static On
Close the Socket		Static On → Off
Network Status	Send join network requests.	Blinks once
	Join the network successfully.	Blinks twice
Reset to Factory Default	Press and hold the power button for more than 10s.	Quickly blinks

Note:

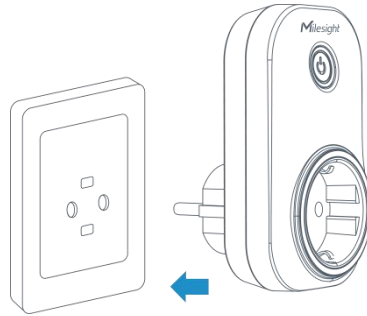
- 1) Network status will only display when LED is enabled and the socket powers on.
- 2) If WS523 still fails to join the network after 32 join requests, the LED will stop blinking.
- 3) Reset operation is not affected even button lock is enabled or LED indicator is disabled.

3. Operation Guide

3.1 NFC Configuration

WS523 can be configured via smartphone with NFC function.

1. Plug WS523 into a wall socket, then WS523 will switch on automatically.



2. Download and install “Milesight ToolBox” App from Google Play or App Store.
3. Enable NFC on the smartphone and launch Milesight ToolBox.
4. Attach the smartphone with NFC area to the device to read device information. Basic information and settings of the device will be shown on ToolBox App if it's recognized successfully. You can read and configure the device by tapping the Read/Write device on the App. In order to protect the security of the device, password validation is required when configuring via smartphone. Default password is **123456**.
5. Press the power button, WS523 portable socket will supply the electric power to other electronic appliances.



Note:

- 1) Check the NFC area of your smartphone and it's recommended to remove the phone case.
- 2) If the smartphone fails to read/write configurations via NFC, move the phone away and back to try again.
- 3) WS523 can also be configured on ToolBox via dedicated NFC reader provided by Milesight IoT.

3.2 LoRaWAN Settings

LoRaWAN settings are used to configure the data transmission parameters in LoRaWAN® network.

3.2.1 Basic Settings

WS523 supports basic configurations like join type, App EUI, App Key and other information. You can also keep all settings by default.

Device EUI

* APP EUI

* Application Port 85

Join Type

* Application Key

LoRaWAN Version

Parameters	Description
Device EUI	Unique ID of the device which can also be found on the label.
App EUI	Default App EUI is 24E124C0002A0001.
Application Port	The port used for sending and receiving data, default port is 85.
Join Type	OTAA and ABP modes are available.
Application Key	Appkey for OTAA mode, default is 5572404C696E6B4C6F52613230313823.
Device Address	DevAddr for ABP mode, default is the 5 th to 12 th digits of SN.
Network Session Key	Nwkskey for ABP mode, default is 5572404C696E6B4C6F52613230313823.
Application Session Key	Appskey for ABP mode, default is 5572404C696E6B4C6F52613230313823.
LoRaWAN Version	V1.0.2, V1.0.3 are available.
Work Mode	It's fixed as Class C.
RX2 Data Rate	RX2 data rate to receive downlinks or Milesight D2D commands.
RX2 Frequency	RX2 frequency to receive downlinks or Milesight D2D commands. Unit: Hz

<p>Channel Mode</p>	<p>Select Standard-Channel mode or Single-Channel mode. When Single-Channel mode is enabled, only one channel can be selected to send uplinks. Please enable Single-Channel mode if you connect device to DS7610.</p>												
<p>Channel</p>	<p>Enable or disable the frequency to send uplinks.</p> <p>* Support Frequency</p> <div style="border: 1px solid #ccc; padding: 5px; margin-bottom: 10px;"> <p>EU868</p> </div> <div style="display: flex; justify-content: space-between; align-items: center; margin-bottom: 5px;"> <input type="checkbox"/> <div style="display: flex; align-items: center;"> - 868.1 + </div> </div> <hr style="border: 0.5px solid #ccc;"/> <div style="display: flex; justify-content: space-between; align-items: center; margin-bottom: 5px;"> <input type="checkbox"/> <div style="display: flex; align-items: center;"> - 868.3 + </div> </div> <hr style="border: 0.5px solid #ccc;"/> <div style="display: flex; justify-content: space-between; align-items: center; margin-bottom: 5px;"> <input type="checkbox"/> <div style="display: flex; align-items: center;"> - 868.5 + </div> </div> <hr style="border: 0.5px solid #ccc;"/> <div style="display: flex; justify-content: space-between; align-items: center;"> <input type="checkbox"/> <div style="display: flex; align-items: center;"> - 863 + </div> </div> <p>If frequency is one of CN470/AU915/US915, enter the index of the channel that you want to enable and make them separated by commas.</p> <p>Examples:</p> <p>1, 40: Enabling Channel 1 and Channel 40</p> <p>1-40: Enabling Channel 1 to Channel 40</p> <p>1-40, 60: Enabling Channel 1 to Channel 40 and Channel 60</p> <p>All: Enabling all channels</p> <p>Null: Indicates that all channels are disabled</p> <p>* Support Frequency</p> <div style="border: 1px solid #ccc; padding: 5px; margin-bottom: 10px;"> <p>AU915</p> </div> <p>Enable Channel Index (i)</p> <div style="border: 1px solid #ccc; padding: 5px; margin-bottom: 10px;"> <p>8-15</p> </div> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Index</th> <th style="text-align: left;">Frequency/MHz (i)</th> </tr> </thead> <tbody> <tr> <td>0 - 15</td> <td>915.2 - 918.2</td> </tr> <tr> <td>16 - 31</td> <td>918.4 - 921.4</td> </tr> <tr> <td>32 - 47</td> <td>921.6 - 924.6</td> </tr> <tr> <td>48 - 63</td> <td>924.8 - 927.8</td> </tr> <tr> <td>64 - 71</td> <td>915.9 - 927.1</td> </tr> </tbody> </table>	Index	Frequency/MHz (i)	0 - 15	915.2 - 918.2	16 - 31	918.4 - 921.4	32 - 47	921.6 - 924.6	48 - 63	924.8 - 927.8	64 - 71	915.9 - 927.1
Index	Frequency/MHz (i)												
0 - 15	915.2 - 918.2												
16 - 31	918.4 - 921.4												
32 - 47	921.6 - 924.6												
48 - 63	924.8 - 927.8												
64 - 71	915.9 - 927.1												
<p>Spread Factor</p>	<p>If ADR is disabled, the device will send data via this spread factor.</p>												

Confirmed Mode	If the device does not receive ACK packet from network server, it will resend data once.
Rejoin Mode	Reporting interval \leq 30 mins: device will send specific numbers of LoRaMAC packets to check connection status every 30 mins; If no replies after specific packets are being sent, the device will re-join. Reporting interval $>$ 30 mins: device will send specific numbers of LoRaMAC packets to check connection status at every reporting interval; If no replies after specific packets are being sent, the device will re-join.
Set the number of packets sent	When rejoin mode is enabled, set the number of LinkCheckReq packets sent.
ADR Mode	Allow network server to adjust data rate of the device.
Tx Power	Transmit power of device.

Note:

- 1) Please contact sales representative for device EUI list if there are many units.
- 2) Please contact sales representative if you need random App keys before purchase.
- 3) Select OTAA mode if you use Milesight IoT Cloud to manage devices.
- 4) Only OTAA mode supports rejoin mode.
- 5) For -868M model, the default frequency is EU868; for -915M model, the default frequency is AU915.

3.2.2 Multicast Settings

WS523 supports setting up several multicast groups to receive multicast commands from network server and users can use this feature to control devices in bulks.

1. Enable Multicast Group on WS523, set a unique multicast address and keys to distinguish other groups. You can also keep these settings by default.

Multicast Group1

Multicast Address i

McNetSKey

McAppSKey

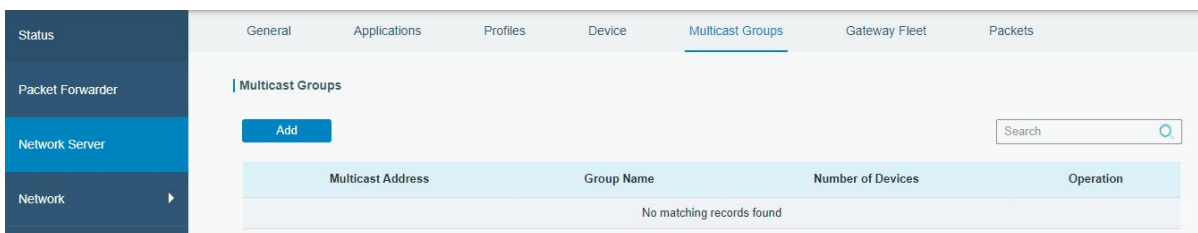
Multicast Group2

Multicast Group3

Multicast Group4

Parameters	Description
Multicast Address	Unique 8-digit address to distinguish different multicast groups.
McNetSKey	32-digit key. Default values: Multicast Group 1: 5572404C696E6B4C6F52613230313823 Multicast Group 2: 5572404C696E6B4C6F52613230313824 Multicast Group 3: 5572404C696E6B4C6F52613230313825 Multicast Group 4: 5572404C696E6B4C6F52613230313826
McAppSKey	32-digit key. Default values: Multicast Group 1: 5572404C696E6B4C6F52613230313823 Multicast Group 2: 5572404C696E6B4C6F52613230313824 Multicast Group 3: 5572404C696E6B4C6F52613230313825 Multicast Group 4: 5572404C696E6B4C6F52613230313826

2. Add a multicast group on the network server. Take Milesight UG6x gateway as example, go to **Network Server > Multicast Groups**, click **Add** to add a multicast group.



Fill in the multicast group information the same as WS523 settings, and select the devices which you need to control, then click **Save**.

Group Name	Light Control
Multicast Address	11111111
Multicast Network Session Key	5572404C696E6B4C6F526132
Multicast Application Session Key	5572404C696E6B4C6F526132
Class Type	Class C
Datarate	DR0 (SF12, 125 kHz)
Frequency	869525000 Hz
Frame-counter	0
Selected Devices	<div style="border: 1px solid #ccc; padding: 5px;"> <div style="background-color: #e0f0ff; padding: 2px; margin-bottom: 2px;">10_24E124136B261600 x</div> <div style="background-color: #e0f0ff; padding: 2px; margin-bottom: 2px;">24E124122A233246 x</div> </div>

General	Applications	Profiles	Device	Multicast Groups	Gateway Fleet	Packets								
Multicast Groups														
<div style="display: flex; justify-content: space-between; align-items: center;"> Add <input type="text" value="Search"/> </div> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Multicast Address</th> <th>Group Name</th> <th>Number of Devices</th> <th>Operation</th> </tr> </thead> <tbody> <tr> <td>11111111</td> <td>Light Control</td> <td>2</td> <td style="text-align: right;">✎ ✕</td> </tr> </tbody> </table>							Multicast Address	Group Name	Number of Devices	Operation	11111111	Light Control	2	✎ ✕
Multicast Address	Group Name	Number of Devices	Operation											
11111111	Light Control	2	✎ ✕											

3. Go to **Network Server > Packets**, select the multicast group and fill in the downlink command, click **Send**. The network server will broadcast the command to devices which belongs to this multicast group.

Note: ensure all devices' application ports are the same.

General	Applications	Profiles	Device	Multicast Groups	Gateway Fleet	Packets												
Send Data To Device																		
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Device EUI</th> <th>Type</th> <th>Payload</th> <th>Port</th> <th>Confirmed</th> <th></th> </tr> </thead> <tbody> <tr> <td><input type="text" value="0000000000000000"/></td> <td>ASCII</td> <td><input type="text"/></td> <td>85</td> <td><input type="checkbox"/></td> <td style="text-align: right;">Send</td> </tr> </tbody> </table>							Device EUI	Type	Payload	Port	Confirmed		<input type="text" value="0000000000000000"/>	ASCII	<input type="text"/>	85	<input type="checkbox"/>	Send
Device EUI	Type	Payload	Port	Confirmed														
<input type="text" value="0000000000000000"/>	ASCII	<input type="text"/>	85	<input type="checkbox"/>	Send													
Send Data to Multicast Group																		
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Multicast Group	Type	Payload	Port															
Light Control	hex	080100ff	85	Send														

3.3 General Settings

Go to **Device > Settings > General Settings** of ToolBox App to change the reporting interval, etc.

Reporting Interval 2 min

LED Indicator

Power Consumption ⓘ

When Power is Restored, Socket

Button Lock

Overcurrent Alarm /A

Overcurrent Protection /A ⓘ

Change Password

Parameters	Description
Reporting Interval	The interval of reporting socket status and electrical parameters. Default: 20 mins, Range: 1-1080 mins
LED Indicator	Enable or disable the light indicating in chapter 2.4 .
Power Consumption	Record the power consumption. If disabled, the device will stop recording and the power consumption value will stop updating.
When Power is Restored, Socket	If the device loses power and return to power supply, the device will switch the socket on or off according to this parameter.
Button Lock	If enabled, the power button status will freeze except reset.
Overcurrent Alarm	When current reaches the threshold, the device will send socket status and device electrical parameters.
Overcurrent Protection	When current reaches the threshold, the device will stop supplying power.
Change Password	Change the password for ToolBox App to write this device.

Note: even overcurrent alarm or overcurrent protection is disabled, the device will also stop supplying power when the current is over rated current by 30%, then send out an alarm packet.

3.4 Milesight D2D Settings

Milesight D2D protocol is developed by Milesight and used for connection among Milesight devices without gateway. When Milesight D2D setting is enabled, WS523 can work as the Milesight D2D Agent device to receive commands from Milesight D2D controller devices.


1. Ensure the RX2 datarate and RX2 frequency in LoRaWAN settings are the same as the controller device.
2. Enable D2D Settings, and define an unique D2D key to be the same as the settings in the Milesight D2D controller device.(Default D2D Key: 5572404C696E6B4C6F52613230313823)
3. Define a 2-byte hexadecimal control command (0x0000 to 0xffff) and command action. For example, you can configure a control command 1510 to turn on the button as below. WS523 supports at most 16 control commands.

D2D Settings

Enable

D2D Key

Control command 1
1510

Action Object
BUTTON 

Status
On

3.5 Maintenance

3.5.1 Upgrade

1. Download firmware from www.milesight-iot.com to your smartphone.
2. Open ToolBox App and click "Browse" to import firmware and upgrade the device.

Note:

- 1) Operation on ToolBox is not supported during upgrade.
- 2) Only Android version ToolBox supports the upgrade feature.

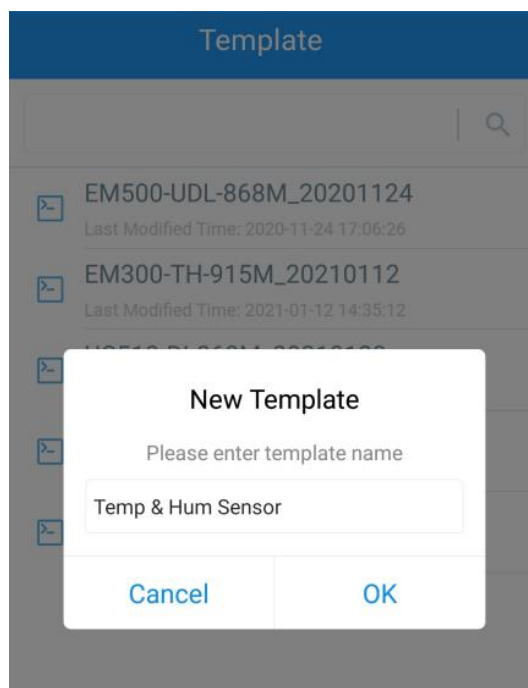
Status	Setting	Maintenance
SN	6148B13783621055	
Model	WS525-470M	
Firmware Version	V1.3-a12	
Hardware Version	V1.0	
Manual Upgrade		

[Browse](#)

3.5.2 Backup

WS523 supports configuration backup for easy and quick device configuration in bulk. Backup is allowed only for devices with the same model and LoRaWAN® frequency band.

1. Go to “Template” page on the App and save current settings as a template. You can also edit the template file.
2. Select one template file that saved in the smartphone and click “Write”, then attach it to another device to write configuration.



Note: Slide the template item to the left to edit or delete the template. Click the template to edit the configurations.

Template	
<input type="text"/>	<input type="text"/>
<input type="checkbox"/> EM500-UDL-868M_20201124 Last Modified Time: 2020-11-24 17:06:26	
<input type="checkbox"/> EM300-TH-915M_20210112 Last Modified Time: 2021-01-12 14:35:12	
<input type="checkbox"/> UC512-DI-868M_20210128 Last Modified Time: 2021-01-28 16:57:20	
<input type="checkbox"/> UC501-470M_20210201 Last Modified Time: 2021-02-01 11:29:43	
<input type="checkbox"/> M_20210208 Last Modified Time: 2021-02-08 16:44:37	<input type="button" value="Edit"/> <input type="button" value="Delete"/>

3.5.3 Reset to Factory Default

Please select one of the following methods to reset device:

Via Hardware: Hold on the power button for more than 10s until LED quickly blinks.

Via ToolBox App: Go to **Device > Maintenance** to tap **Reset**, then attach smartphone with NFC area to device to complete the resetting.

Status	Setting	Maintenance
SN	6148C37194391053	
Model	WS525-470M	
Firmware Version	V1.9-a2	
Hardware Version	V1.2	
Manual Upgrade		
<input type="button" value="Browse"/>		
Restore Factory Default		
<input type="button" value="Reset"/>		

4. Device Payload

All data are based on the following format (HEX), the Data field should follow little-endian:

Channel1	Type1	Data1	Channel2	Type2	Data2	Channel 3	...
1 Byte	1 Byte	N Bytes	1 Byte	1 Byte	M Bytes	1 Byte	...

For decoder examples you can find at <https://github.com/Milesight-IoT/SensorDecoders>.

4.1 Basic Information

WS523 reports basic information of device every time when it joins the network.

Channel	Type	Description
ff	01(Protocol Version)	01=>V1
	09 (Hardware Version)	01 40 => V1.4
	0a (Software Version)	01 14 => V1.14
	0b (Power On)	Device is on
	16 (Device SN)	16 digits
	24 (Overcurrent Alarm)	Byte 1: 00-disabled, 01-enabled Byte 2: current threshold
	25 (Button Lock)	00 00-disabled, 00 80-enabled
	26 (Power Consumption)	00-disabled, 01-enabled
	30 (Overcurrent Protection)	Byte 1: 00-disabled, 01-enabled Byte 2: current threshold

Example:

Channel	Type	Value	Channel	Type	Value
ff	01 (Protocol Version)	01(V1)	ff	16(Device SN)	6148b13783 621055
ff	09 (Hardware Version)	0100 (V1.0)	ff	0a (Software Version)	0103 (V1.3)
ff	24 (Overcurrent Alarm)	01=>Enabled 0a=10A	ff	30 (Overcurrent Protection)	01=>Enabled 0a=10A

ff	25(Button Lock)	00 80=>Enabled	ff	26 (Power Consumption)	01=>Enabled
----	-----------------	-------------------	----	------------------------	-------------

4.2 Sensor Data

WS523 reports electrical data according to reporting interval (20 mins by default) or when current reaches the overcurrent threshold.

Channel	Type	Description
03	74 (Voltage)	UINT16, Unit: V Resolution: 0.1V
04	80 (Active Power)	UINT32, Unit: W
05	81 (Power Factor)	UINT8, Unit: %
06	83 (Power Consumption)	UINT32, Unit: Wh
07	c9 (Current)	UINT16, Unit: mA
08	70 (Socket Status)	00: Close, 01: Open

Example:

087001 058129 07c91200 0374f508 068305000000 048001000000					
Channel	Type	Value	Channel	Type	Value
08	70 (Socket Status)	01 => Open	05	81 (Power Factor)	29=> 41%
Channel	Type	Value	Channel	Type	Value
07	C9 (Current)	12 00=>00 12=18mA	03	74(Voltage)	f5 08=>08 f5=2293 Voltage=2293 *0.1=229.3V
Channel	Type	Value	Channel	Type	Value
06	83(Power Consumption)	05 00 00 00=>00 00 00 05=5 Wh=0.005kWh	04	80 (Active Power)	01 00 00 00=>00 00 00 01=1 W

4.3 Power Outage Alert

WS523 will report an alert message when power supply of WS523 is disconnected. This feature only works with hardware version 1.2 and later.

ff3fff		
Channel	Type	Value
ff	3f (Power Outage)	ff(Reversed)

4.4 Downlink Commands

WS523 supports downlink commands to configure the device. Application port is 85 by default.

Channel	Type	Description
08	/	00 00 ff-close, 01 00 ff-open
ff	03 (Set Reporting Interval)	2 Bytes, unit: s
	10 (Reboot)	ff
	22 (Add Delay Task)	Byte 1: 00 Byte 2-3: delay time, unit: s Byte 4: 10-close, 11-open Note: WS523 supports adding only one task. Later command will cover previous command.
	23 (Delete Delay Task)	00 ff
	24 (Overcurrent Alarm)	Byte 1: 00-disable, 01-enable Byte 2: current threshold
	25 (Button Lock)	00 00-disable, 00 80-enable
	26 (Power Consumption)	00-disable, 01-enable
	27 (Reset Power Consumption)	ff
	28 (Enquire Electrical Status)	ff
	2f (LED Mode)	00-disable, 01-enable
	30 (Overcurrent Protection)	Byte 1: 00-disable, 01-enable Byte 2: current threshold

Example:

1. Open the supply of the socket.

080100ff	
Channel	Command
08	01 00 ff=>Open

2. Set reporting interval as 20 minutes.

ff03b004		
Channel	Type	Value
ff	03 (Set Reporting Interval)	b0 04=>04 b0=1200s =20 minutes

3. Add a delay task: open the socket after 1minute

ff22003c0011		
Channel	Type	Value
ff	22 (Add Delay Task)	Byte 1:00 Byte 2-3: 3c 00=>00 3c=60s=1min Byte 4: 11=>open

4. Delete the delay task

ff2300ff		
Channel	Type	Value
ff	23(Delete Delay Task)	00ff

5. Enable overcurrent alarm and protection and set current threshold as 10A.

ff24010a ff30010a					
Channel	Type	Value	Channel	Type	Value
ff	24 (Overcurrent Alarm)	Byte 1: 01=>enable Byte 2:0a=>10A	ff	30 (Overcurrent Protection)	Byte 1: 01=>enable Byte 2:0a=>10A

6. Reset power consumption

ff27ff		
Channel	Type	Value
ff	27(Reset Power Consumption)	ff (Reserved)

7. Reboot the device.

ff10ff		
Channel	Type	Value
ff	10(Reboot the device)	ff (Reserved)

-END-