Smart Wall Socket

Featuring LoRaWAN®

WS51x

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 the device password when first configuration. The default password is 123456.

❖ The device is intended for indoor use only. Do not place the device where the temperature is below/above the operating range.

❖ Do not overload the maximum capacity to avoid damaging the device.

❖ Do not place the device close to naked flames, heat sources (such as oven or sunlight), cold sources, liquid, and objects with extreme temperature changes.

❖ Use the device in a clean environment only. Dusty or dirty environments may prevent the proper operation of this device.

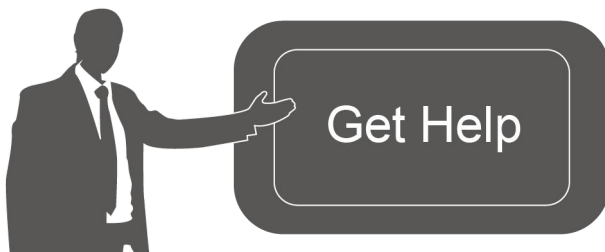❖ The device must never be subjected to physical shocks or strong vibration.

Declaration of Conformity

WS51x is in conformity with the essential requirements and other relevant provisions of the CE, FCC, and RoHS.

Copyright © 2011-2023 Milesight. All rights reserved.

Get Help

For assistance, please contact
Milesight technical support:
Email: iot.support@milesight.com
Support Portal: support.milesight-iot.com
Tel: 86-592-5085280
Fax: 86-592-5023065
Address: Building C09, Software Park III, Xiamen 361024, China

Revision History

Date	Doc Version	Description
July 15, 2023	V 1.0	Initial version

Contents

1. Product Introduction

1.1 Overview

WS51x is an in-wall smart socket panel with a stylish and minimalist design that combines power control and electricity consumption statistics features. It can intelligently manage appliances and promote the scientific use of electricity. The product offers various power control methods, such as local button control and remote control through wireless LoRaWAN® network communication. WS51x is compatible with Milesight's LoRaWAN® gateway and IoT Cloud solution, which allows for remote monitoring and control via a webpage or mobile App, triggered by other Milesight sensors. Designed for in-wall installation, WS51x has broad applications in smart homes, smart offices, smart campuses, and other scenarios.

1.2 Features

- Turn on/off devices and create delay switch-on/off schedules remotely
- Collect current, voltage, power, electrical consumption and support overload protection
- Elaborate structural and safety door design for both safe usage and convenient installation
- Easy configuration via NFC
- Function well with standard LoRaWAN® gateways and network servers
- Standard LoRaWAN® technology
- Compatible with Milesight IoT Cloud
- Support Milesight D2D protocol to enable ultra-low latency control without gateway
- Support multicast for control in bulk

2. Hardware Introduction

2.1 Packing List
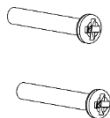
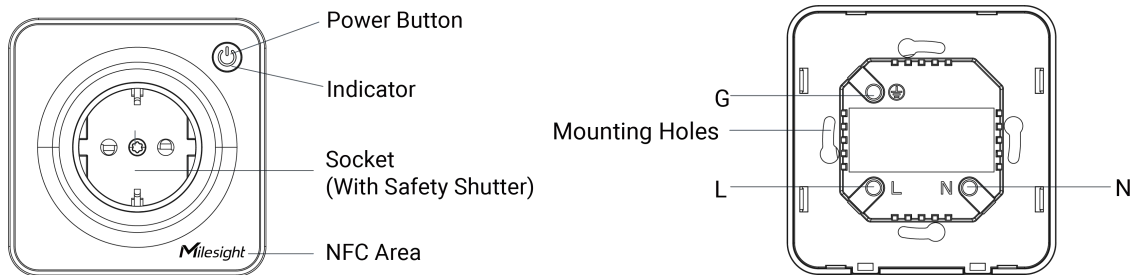| 1 × WS51x Wall Socket | 2 × Mounting Screws | 1 x Quick Start Guide | 1 x Warranty Card |

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

2.2 Hardware Overview

Power Button

Indicator

Socket
(With Safety Shutter)

NFC Area

G

Mounting Holes

L

L   N   N

Note: Product appearance will differ according to socket types.

2.3 Power Button and LED Patterns

| Function	Action	LED Indicator
Open the socket to supply power	Press the power button.	Off → On
Close the socket to supply power		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 on.
2) If WS51x still fails to join the network after 32 join requests, the LED will stop blinking.
3) Reset operation is not affected even if the button lock is enabled or the LED indicator is disabled.

2.4 Dimensions (mm)

EU Type:

86.28

45.8

60

35

86.28

60
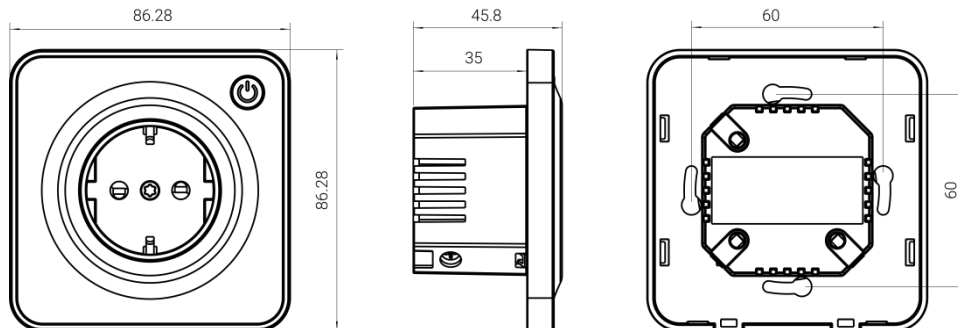
FR Type:
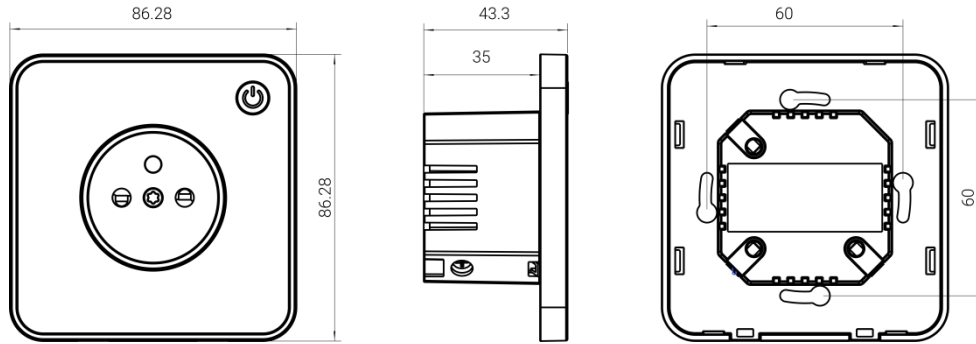
3. Installation

Installation Note

❖ The installation and maintenance must be conducted by a qualified service person and should strictly comply with the electrical safety regulations of the local region.

❖ In order to realize the best data transmission, ensure the device is within the signal range of the LoRaWAN® gateway and keep it away from metal objects and obstacles.

❖ Ensure the breaker is powered off during the installation.

❖ Do not dig the screw holes on the enclosure of this device, otherwise it will break this device.

❖ The nominal cross-sectional area of electrical wires should be not more than 2.5 mm^2, otherwise the wires will be easy to drop from the device.

❖ It is suggested to mount the socket with default mounting screws. If using other screws, ensure the width of screw head is not more than 9mm, otherwise it will break the device.

❖ Ensure the width of socket box is more than 40mm.

❖ Do not leave any object inside the socket box during installation.

Installation Steps

1. Ensure the circuit has been turned off and the old socket has been removed.

2. Open the face plate of WS51x wall socket.

3. Loose the screws next to the holes and connect corresponding wires to the WS51x socket.
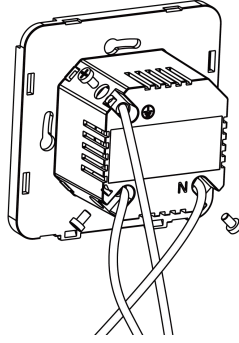
4. Fix the socket to the socket box with mounting screws, then attach the face plate back onto the socket.
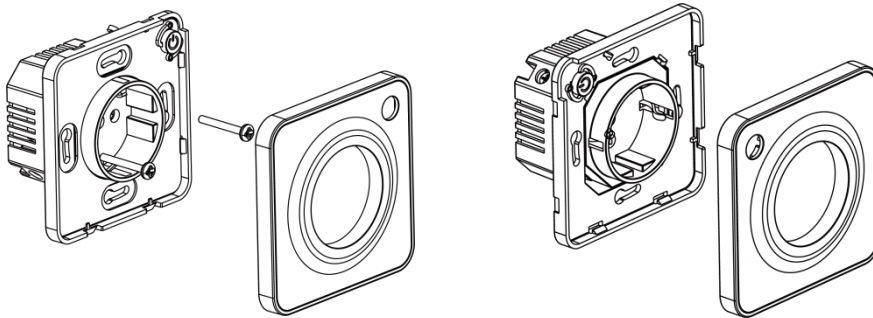
4. Operation Guide

4.1 NFC Configuration

WS51x can be configured via an NFC supported mobile phone.

1. Download and install "Milesight ToolBox" App from Google Play or Apple App Store.

2. Enable NFC on the smartphone and open Milesight ToolBox.

3. Attach the smartphone to the NFC area of the socket, click **NFC Read** to read device information.
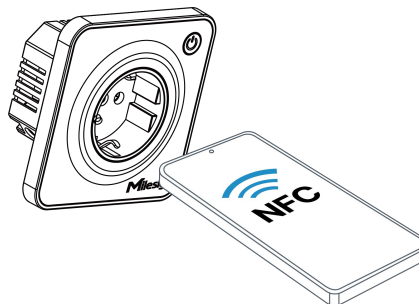
4. Basic information and settings of WS51x socket will be shown on the ToolBox if it's recognized successfully. You can read and configure the device by tapping the **Read/Write** button on the App. In order to protect the security of devices, password validation is required when first configuration. The default password is **123456**.

Note:

1) Ensure where is the NFC area on your smartphone, and it's recommended to take off the phone case.

2) If the smartphone fails to read/write configurations via NFC, keep the phone away and back to try again.

3) WS51x can also be configured by ToolBox software via a dedicated NFC reader provided by Milesight IoT.

4.2 LoRaWAN Settings

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

4.2.1 Basic Settings

WS51x supports basic configurations like join type, App EUI, App Key and other information. You can also keep all settings unchanged by default.

Device EUI
24E124148C371943

* APP EUI
24e124c0002a0001

* Application Port   – 85 +

Join Type
OTAA

* Application Key
****

LoRaWAN Version
V1.0.3

Parameters	Description
Device EUI	Unique ID of the device which can also be found on the label.
App EUI	The default App EUI is 24E124C0002A0001.
Application Port	The port used for sending and receiving data, the default port is 85.
Join Type	OTAA and ABP modes are both available.
Application Key	The default Appkey for OTAA mode is

	5572404C696E6B4C6F52613230313823.
Device Address	The default DevAddr for ABP mode is the 5th to 12th digits of SN.
Network Session Key	The default Nwkskey for ABP mode is 5572404C696E6B4C6F52613230313823.
Application Session Key	The default Appskey for ABP mode is 5572404C696E6B4C6F52613230313823.
LoRaWAN Version	V1.0.2 and 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
Confirmed Mode	If the device does not receive ACK packet from network server, it will resend data once.
Rejoin Mode	Reporting interval ≤ 35 mins: the device will send a specific number of LinkCheckReq MAC packets to the network server every reporting interval or 2*reporting interval to validate connectivity; If there is no response, the device will re-join the network. Reporting interval > 35 mins: the device will send a specific number of LinkCheckReq MAC packets to the network server every reporting interval to validate connectivity; If there is no response, the device will re-join the network. Only OTAA mode supports rejoin mode.
Set the number of packets sent	When rejoin mode is enabled, set the number of LinkCheckReq packets sent. Note: the actual sending number is **Set the number of packets sent** + 1.
ADR Mode	Allow the network server to adjust the data transmission rate of the device.
Spread Factor	If ADR is disabled, the device will send data via this spread factor.
Tx Power	Transmit power of the 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.

4.2.2 Frequency Settings

Select supported frequency and channels to send uplinks. Make sure the channels match the LoRaWAN® gateway.

Note: When **Single-Channel Mode** is enabled, only one channel can be selected to send uplinks and the ADR will not work. Please enable Single-Channel Mode if you connect the device to

DS7610.

If device frequency is one of CN470/AU915/US915, you can enter the index of the channel that you want to enable in the input box, making them separated by commas.

Examples:

1, 40: Enabling Channel 1 and Channel 40

1-40: Enabling Channel 1 to Channel 40

1-40, 60: Enabling Channel 1 to Channel 40 and Channel 60

All: Enabling all channels

Null: Indicates that all channels are disabled

4.2.3 Multicast Settings

WS51x supports setting up several multicast groups to receive multicast commands from the network server, then users can use this feature to control devices in bulks.

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

Parameters	Description
Multicast Address	Unique 8-digit address to distinguish different multicast groups.
Multicast McNetSkey	32-digit key. Default values: Multicast Group 1: 5572404C696E6B4C6F52613230313823 Multicast Group 2: 5572404C696E6B4C6F52613230313824 Multicast Group 3: 5572404C696E6B4C6F52613230313825 Multicast Group 4: 5572404C696E6B4C6F52613230313826
Multicast 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.
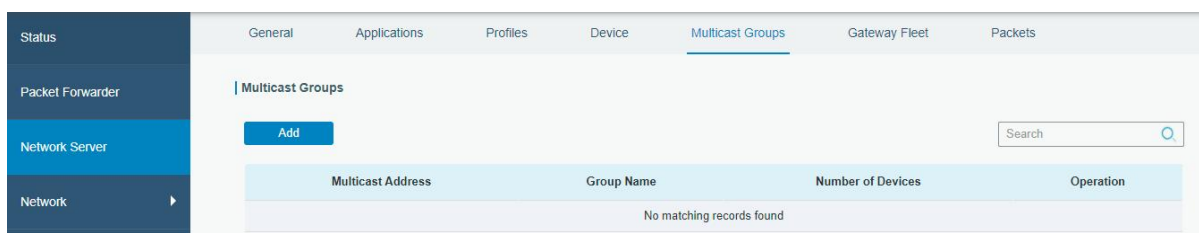
Fill in the multicast group information the same as WS51x settings, and select the devices which you need to control, then click **Save**.

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 that belong to this multicast group.

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

4.3 General Settings

Reporting Interval   -   2   + min

LED Indicator

Power Consumption (i)

When Power is Restored, Socket

Return to Previous Working State

Button Lock

Overcurrent Alarm /A

Overcurrent Protection /A (i)

10

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. This will not affect the blinks when you hold on the button to reset the device.
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	If the device is powered off and restored, the device will switch on or off according to this parameter.
Button Lock	If enabled, the power button will not be allowed to turn on/off the socket.
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.

4.4 Milesight D2D Settings

Milesight D2D protocol is developed by Milesight and used for connection among Milesight devices without gateway. When D2D setting is enabled, WS51x can work as the Milesight D2D agent device to receive commands from Milesight D2D controller devices or work as Milesight D2D controller device to send commands to trigger D2D agent devices.

1. Ensure the RX2 datarate and RX2 frequency in LoRaWAN settings are the same as the D2D controller device.

2. Enable D2D Agent Settings, and define a unique D2D key to be the same as the setting in 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, turn off or reverse the button as below. WS51x supports 16 control commands at most.
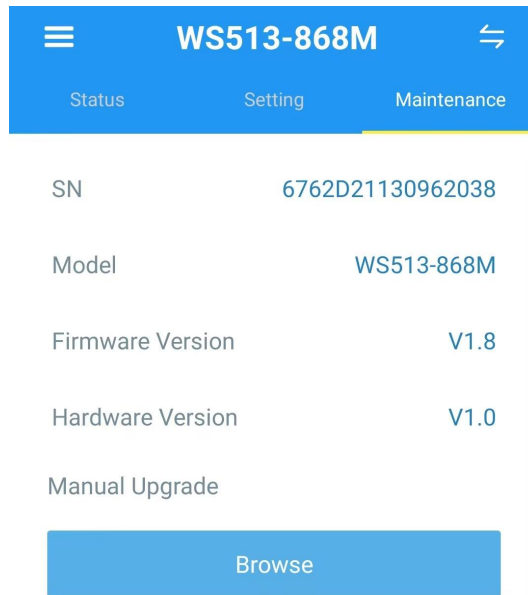

4.5 Maintenance

4.5.1 Upgrade

1. Download firmware from Milesight official website 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 the upgrade.

2) Only Android version ToolBox supports the upgrade feature.

4.5.2 Backup

WS51x 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.
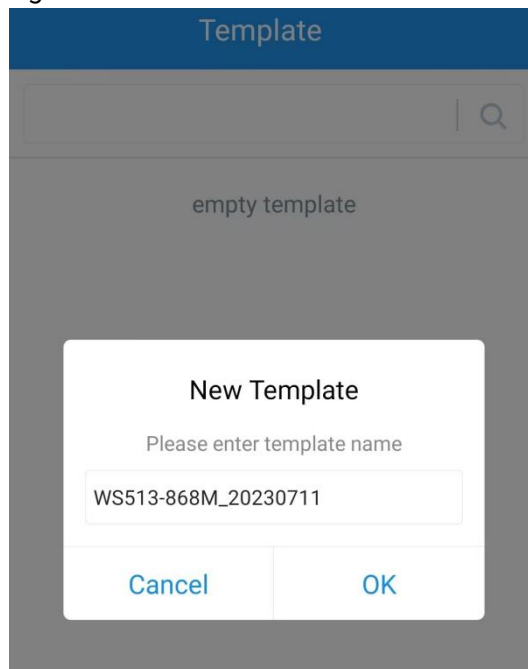
Note: Slide the template item to the left to edit or delete it. Click the template to edit the configurations.

4.5.3 Reset to Factory Default

Please select one of the following methods to reset the device:

Via Hardware: Hold on power button for more than 10s until LED indicator blinks.
Via ToolBox App: Go to **Device > Maintenance** to tap **Reset**, then attach smartphone with NFC area to the device to complete the reset.

5. 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.

5.1 Basic Information

WS51x reports basic information of the device whenever it joins the network.

Channel	Type	Description
ff	01(Protocol Version)	11=>V1.1
	09 (Hardware Version)	01 40 => V1.4
	0a (Software Version)	01 14 => V1.14
	0b (Power On)	Device is on
	16 (Serial Number)	Serial number of this device, 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:

ff0bff ff0101 ff166762d21130962038 ff090100 ff0a0108 ff240000 ff30010a ff250000 ff2601					
Channel	**Type**	**Value**	**Channel**	**Type**	**Value**
ff	0b (Power On)	ff (Reserved)	ff	01 (Protocol Version)	01(V1.0)
Channel	**Type**	**Value**	**Channel**	**Type**	**Value**
ff	16 (Serial Number)	6762d21130 962038	ff	09 (Hardware Version)	0100 (V1.0)
Channel	**Type**	**Value**	**Channel**	**Type**	**Value**
ff	0a (Software Version)	0108 (V1.8)	ff	24(Overcurrent Alarm)	00=disable 00=0A
Channel	**Type**	**Value**	**Channel**	**Type**	**Value**
ff	30 (Overcurrent Protection)	01=enable 0a=10A	ff	25 (Button Lock)	00 00=disable
Channel	**Type**	**Value**			

ff	26 (Power Consumption)	01=enable			

5.2 Sensor Data

WS51x reports socket status and electrical data according to reporting interval (20 mins by default). Besides, when the socket status changes, the device will upload the status immediately.

Channel	Type	Description
03	74 (Voltage)	UINT16, Unit: V Resolution: 0.1 V
04	80 (Active Power)	UINT32, Unit: W
05	81 (Power Factor)	UINT8, Unit: %
06	83 (Power Consumption)	UINT32, Unit: Wh
07	c9 (Total Current)	UINT16, Unit: mA
08	70 (Socket Status)	00: Close/Close by Command, 10: Close by button 01: Open/Open by Command, 11: Open by button

Examples:

1. Periodic package

087001 058164 07c90200 0374b208 068301000000 048001000000					
Channel	**Type**	**Value**	**Channel**	**Type**	**Value**
08	70 (Socket Status)	01 => Open	05	81 (Power Factor)	64=> 100%
Channel	**Type**	**Value**	**Channel**	**Type**	**Value**
07	c9 (Current)	02 00=>00 02=2mA	03	74(Voltage)	b2 08=>08 b2=2226 Voltage=2226 *0.1=222.6V
Channel	**Type**	**Value**	**Channel**	**Type**	**Value**
06	83(Power Consumption)	01 00 00 00=>00 00 00 01=1 Wh=0.001 kWh	04	80 (Active Power)	01 00 00 00=>00 00 00 01=1 W

2. Socket status change

087011		
Channel	**Type**	**Value**
08	70 (Socket Status)	11 => Open by button

5.3 Downlink Commands

WS51x supports downlink commands to configure the device. The application port is 85 by default.

Channel	Type	Description
08	-	00 00 ff-Socket close, 01 00 ff-Socket open
ff	03 (Set Reporting Interval)	2 Bytes, unit: s
	10 (Reboot Device)	ff
	22 (Add Delay Task)	**Byte 1:** 00 **Byte 2-3:** delay time, unit: s **Byte 4:** 10-close, 11-open Note: WS51x 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)	0000-disable, 0080-enable
	26 (Power Consumption)	00-disable, 01-enable
	27 (Reset Power Consumption)	ff
	28 (Enquire Electrical Status)	ff
	2f (LED Indicator)	00-disable, 01-enable
	30 (Overcurrent Protection)	Byte 1: 00-disable, 01-enable Byte 2: current threshold
	a5 (Socket Status Reverse)	01

Examples:

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 = 1200 s = 20 minutes

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

ff22003c0011		
Channel	**Type**	**Value**
ff	22	Byte 1:00

	(Add Delay Task)	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. Reboot the device.

ff10ff		
Channel	**Type**	**Value**
ff	10 (Reboot Device)	ff (Reserved)

7. Disable the LED indicator.

ff2f00		
Channel	**Type**	**Value**
ff	2f (LED Indicator)	00=disable

-END-