Milesight

Smart Current Transformer
Featuring LoRaWAN®
CT10x

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.

❖ 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.

❖ Do not overload the maximum capacity to avoid damage to 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.

❖ Keep the device away from water to prevent electric shock.

❖ Use the device opening clean and free of dust before installation. Dusty or dirty environments may prevent the proper operation of this device.

❖ Do not drop the device or subject it to physical shocks and strong vibration.

Declaration of Conformity

CT10x is in conformity with the essential requirements and other relevant provisions of the CE, FCC, and RoHS.

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For assistance, please contact Milesight technical support:

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Revision History

Date	Doc Version	Description
Jan 12, 2024	V 1.0	Initial version

Contents

1. Product Introduction

1.1 Overview

CT10x is a LoRaWAN® Smart Current Transformer for monitoring the energy and analyzing consumption remotely. CT10x provides multiple current options to suit energy monitoring and support sending threshold alarms. The compact size and clamp design allow it to be installed in any indoor space quickly and safely without de-energizing a facility, simplifying the installation and saving the cost. Compliant with Milesight LoRaWAN® gateway and Milesight IoT Cloud solution, CT10x can be monitored via webpage or mobile App remotely.
CT10x is widely used for energy motoring and billing in smart buildings, as well as for machine failure detection and prevention, etc.

1.2 Features

● Report the RMS current and accumulated current data by minutes

● High measuring accuracy with a sampling frequency of up to 3.3 kHz

● Self-powered, free from batteries or external wires

● Utilize a sampling rate of up to 1s for real-time monitoring and quick alarm response

● Compact size allows for installation in narrow scenarios

● Non-invasive clamp design ensures easy and safe installation without the need for power de-energizing

● Equipped with LED indicator to indicate working status and alarms

● Compliant with standard LoRaWAN® gateways and network servers

● Compatibility with Milesight IoT Cloud
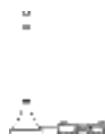
2. Hardware Introduction

2.1 Packing List
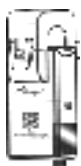
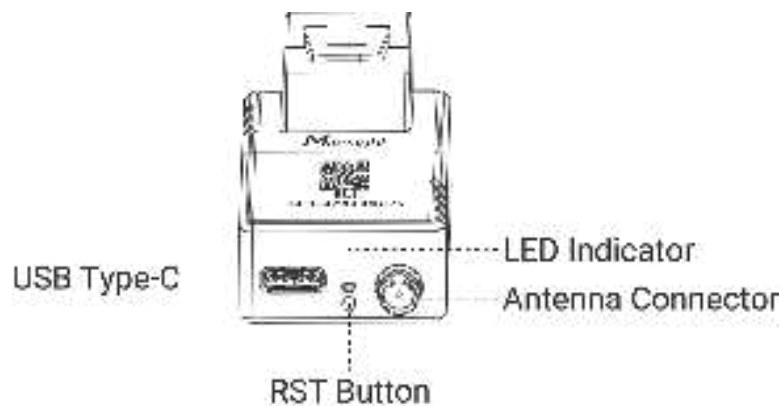| 1 ×	1 ×	1 ×	1 ×	1 ×
CT10x Current Transformer	LoRaWAN® Stubby Antenna	LoRaWAN® Magnetic Antenna (Optional)	Quick Guide	Warranty Card

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

2.2 Hardware Overview

2.3 Button and LED Indicator

Function	Action	LED Indicator
Normal Work	The device is functioning properly.	Blinking every 2s
Low Power Mode	The device measures and reports at reduced rate.	Blinking every 5s
Low Voltage Mode	The device only measures at reduced rate.	Blinking every 10s
Alarm	The current is over the threshold or measuring range.	Fast Blinking
Reboot	Quick press the RST button once.	Blinking Once

Note: if not blinking even the device is installed, it is possible that the start circuit of the cable is too small and will take some minutes to charge the device.
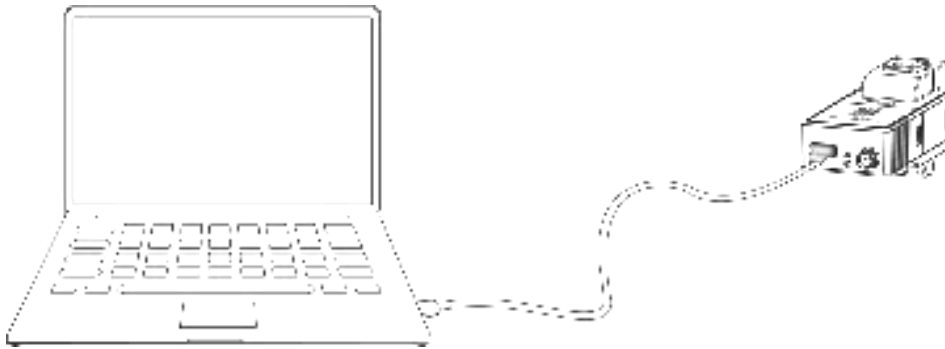
2.4 Dimensions (mm)
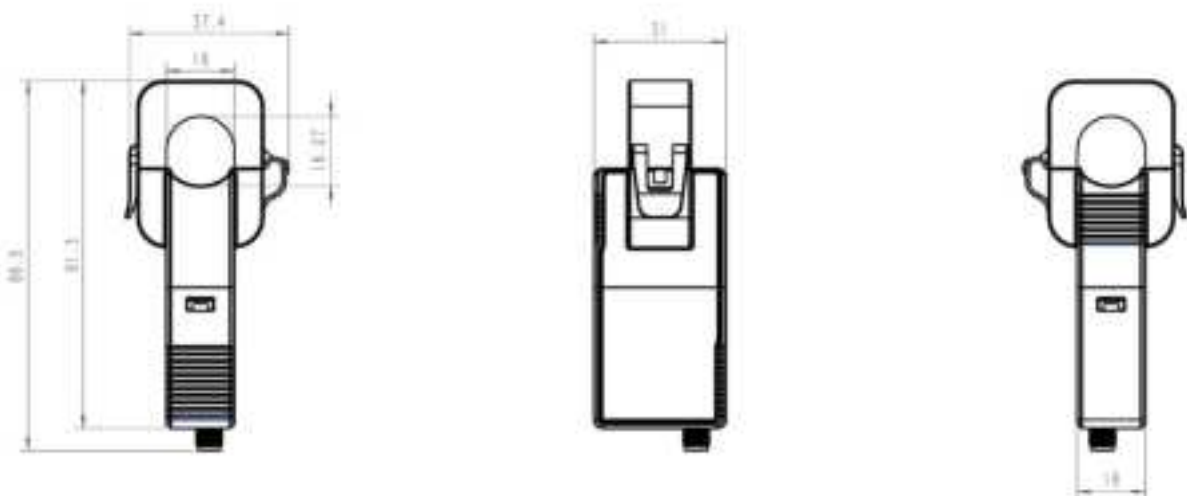
3. Operation Guide

3.1 USB Configuration

CT10x can be powered and configured via a Type-C port for configuration and debug.
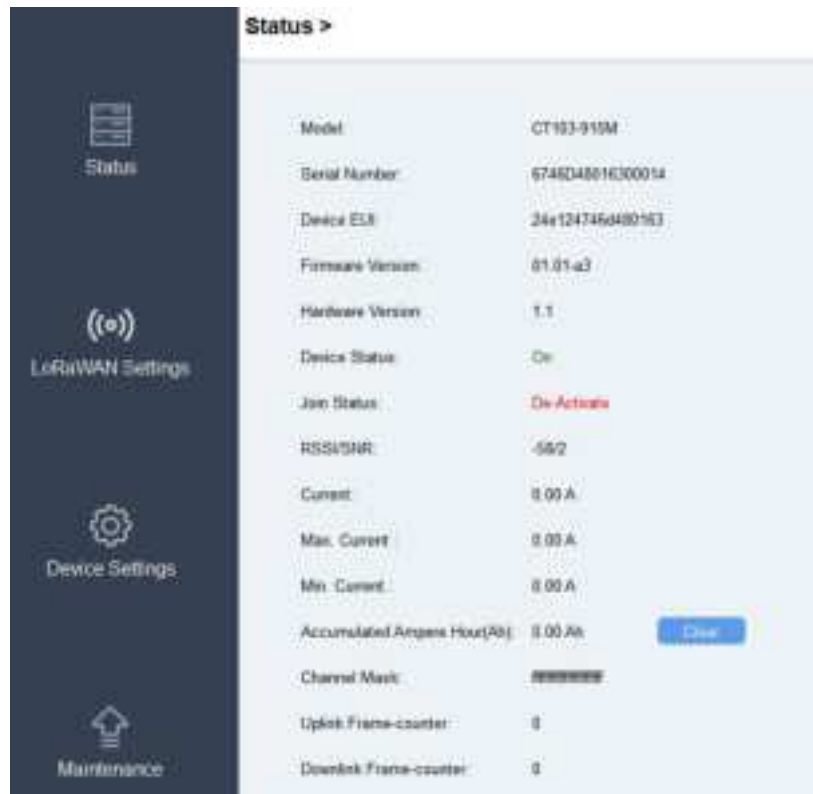
1. Download ToolBox software from Milesight website.

2. Connect the device to a computer via the Type-C port.

3. Open the ToolBox and select type as **General**, then click password to log into the ToolBox. (Default password: **123456**)

4. After logging into the ToolBox, you can check device status and change device settings.

3.2 LoRaWAN Settings

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

Basic LoRaWAN Settings:
CT10x supports basic configurations like join type, App EUI, App Key, and other information. You
can also keep all settings by default.

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 5th to 12th digits of SN.
Network Session Key	Nwkskey for ABP mode, default is 5572404C696E6B4C6F52613230313823.
Application Session Key	Appskey for ABP mode, default is 5572404C696E6B4C6F52613230313823.
RX2 Data Rate	RX2 data rate to receive downlinks.
RX2 Frequency/MHz	RX2 frequency to receive downlinks.
Spread Factor	If ADR is disabled, the device will send data via this spread factor.
Confirmed Mode	If the device does not receive the 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 every double 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.
Set the number of	When rejoin mode is enabled, set the number of LinkCheckReq packets sent.

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 rate of the device.
Tx Power	Transmit power of the device.

Note:

1) Please contact your sales representative for the device EUI list if there are many units.

2) Please contact your 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.

LoRaWAN Frequency Settings:

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

If the 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

3.3 General & Alarm Settings

Parameters	Description
Reporting Interval	The interval of reporting current data. Default: 10 mins, Range: 1 - 1440 mins Note: when the device is under low power mode, the interval is fixed as 30 minutes; when the device is under low voltage mode, the device will stop reporting. The working mode can be judged by LED indicator.
Change Password	Change the password of the device for ToolBox configuration.

Parameters	Description
Excessive Current Threshold	The maximum current threshold value.
Insufficient Current Threshold	The minimum current threshold value.
Alarm Reporting Interval (min)	The interval to report alarm packet after alarm triggers. This interval should be less than reporting interval.
Alarm Reporting Times	Alarm packet report times after alarm triggers.

Note: Overrange alarm is fixed as enabled, the alarm reporting interval is fixed as 5 minutes and the alarm reporting time is fixed as 3.

3.4 Maintenance

3.4.1 Upgrade

1. Download firmware from Milesight website to your PC.

2. Go to **Maintenance > Upgrade**, click **Browse** to import firmware and click **Upgrade** to upgrade the device.

3.4.2 Backup

CT10x 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 **Maintenance > Backup and Reset**, and click **Export** to backup the device configuration.

2. Click **Browse** to import the backup file, then click **Import** to load the configuration.
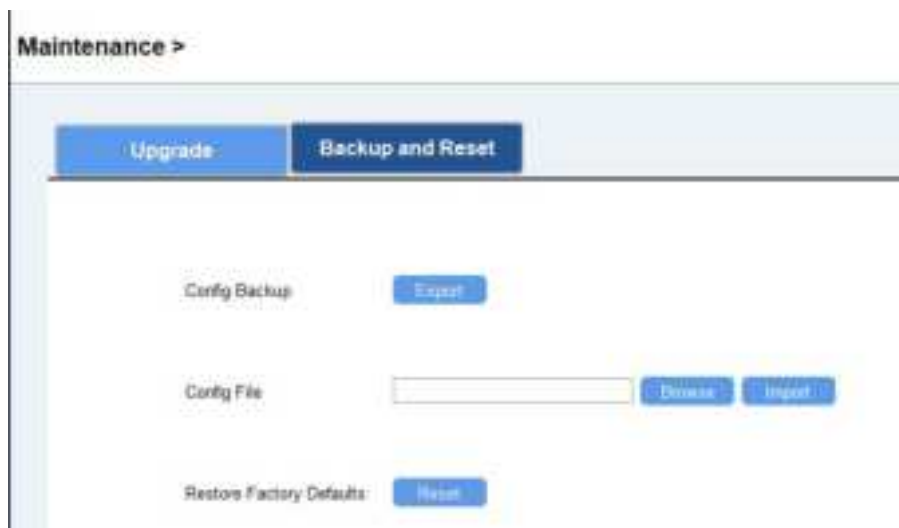
3.4.3 Reset and Reboot

Reset to Factory Default: Go to **Maintenance > Backup and Reset** of ToolBox, and click **Reset** to complete.

Reboot: Quick press the RST button once or send downlink command to reboot.

4. Installation

Antenna Installation

Rotate the antenna into the antenna connector. Ensure that the antenna is positioned vertically and is kept clear of metal objects and obstacles.

Note: Keep the device away from metal objects, obstacles, or areas with other electrical

equipment that may cause interference. If needed, consider opting for a magnetic antenna.
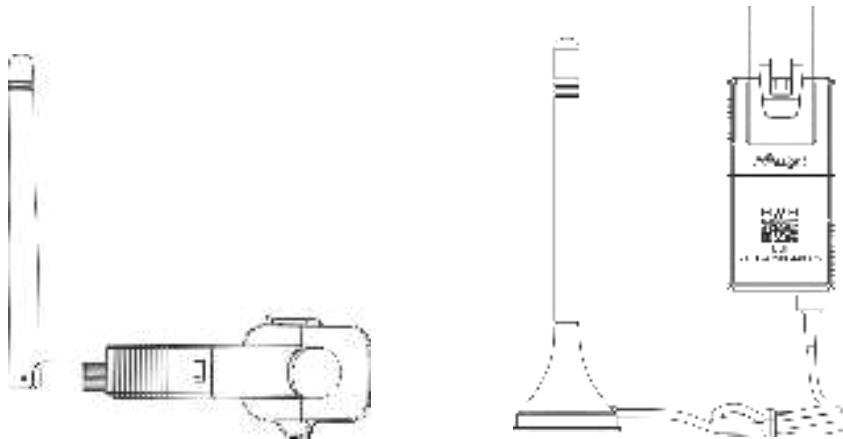
Transformer Installation

Open the current transformer to clip it around a single-phase wire. Then close the clip with a slight "click" sound to confirm a firm grip on the wire.
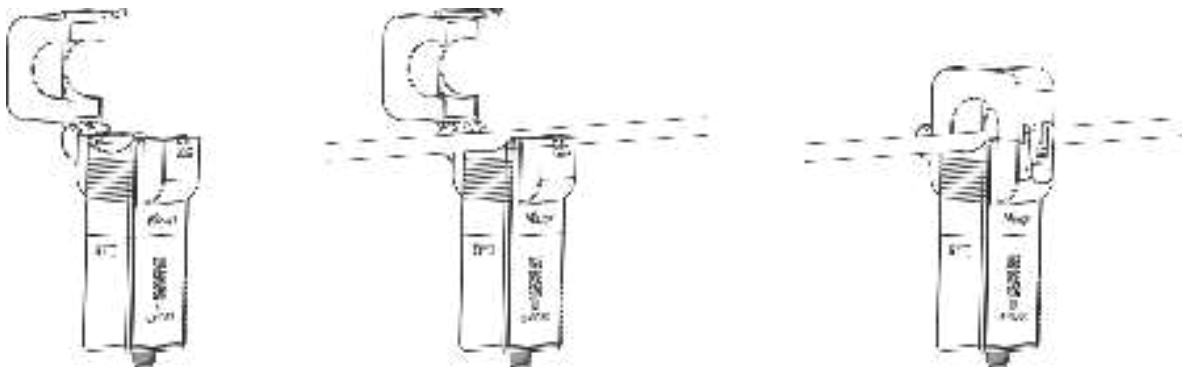
Note: Do not place Phase wire and Neutral wire within a single current transformer.

5. Communication Protocol

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

CT10x reports basic information of the device whenever it joins the network.

Channel	Type	Byte	Description
ff	01(Protocol Version)	1	01=>V1
	09 (Hardware Version)	2	02 10=>V2.1
	0a(Software Version)	2	01 01=>V1.1
	0b (Power On)	1	Device is on
	0f(Device Type)	1	00 = Class A, 01 = Class B, 02 = Class C
	16 (Device SN)	8	16 digits

Example:

ff0bff ff0101 ff166746d48016300014 ff090110 ff0a0101 ff0f00					
Channel	Type	Value	Channel	Type	Value
ff	0b (Power On)	ff (Reserved)	ff	01 (Protocol Version)	01 (V1)
Channel	Type	Value	Channel	Type	Value
ff	16 (Device SN)	6746d48016300 014	ff	09 (Hardware Version)	0110 (V1.1)
Channel	Type	Value	Channel	Type	Value
ff	0a (Software Version)	0101 (V1.1)	ff	0f (Device Type)	00 (Class A)

5.2 Sensor Data

Item	Channel	Type	Byte	Description
Total Current	03	97	4	UINT32/100, Unit: Ah, Resolution: 0.01 Ah **Note:** when it reaches to max value FFFFFFFF (42949672.95), it will clear to 0 automatically.
Current	04	98	2	UINT16/100, Unit: A, Resolution: 0.01 A **Note:** FFFF means collection failure.
Current Alarm	84	98	7	Max. Current (2B) + Min. Current (2B) + Latest Current (2B) + Alarm Status (1B) **Alarm Status:**

				Bit0=1: Threshold alarm
				Bit1=1: Threshold alarm dismiss
				Bit2=1: Overrange alarm
				Bit3=1: Overrange alarm dismiss
				Note: Max./Min. Current means the maximum or minimum value between last report and current report.

Example:

1. Periodic package: report as reporting interval (10 minutes by default).

039773020000 04980019					
Channel	Type	Value	Channel	Type	Value
03	97 (Total Current)	73 02 00 00=>00 00 02 73=627/100 =6.27 Ah	04	98 (Current)	00 19=>19 00=6400/100 =64A

2. Alarm or alarm dismiss packet:

8498 b80b d007 c409 01		
Channel	Type	
84	98(Current)	Max. Current: b8 0b=>0b b8=3000/100=30A Min. Current: d0 07=>07 d0=2000/100=20A Latest Current: c4 09=>09 c4=2500/100=25A Alarm Status: 01=>Bit1=1: Threshold alarm

5.3 Downlink Commands

CT10x supports downlink commands to configure the device. The application port is 85 by default.

Command	Channel	Type	Description
Reboot	ff	10	ff
Reporting Interval	ff	8e	00 + Interval Time(2B), unit: min
Threshold Alarm	ff	06	9 Bytes, CTRL (1B) + Min (2B) + Max (2B) + Alarm Reporting Times(2B) + Alarm Reporting Interval (2B) **CTRL:** 08 - disable 09 - below (minimum threshold)

			0a - over (maximum threshold)
			0b - within
			0c - below or over
			Max./Min. Threshold unit: A
			Alarm Reporting Interval unit: min
Clear Accumulated Current	ff	27	01 Note: when

Example:

1. Set reporting interval as 20 minutes.

ff8e 00 1400		
Channel	Type	Value
ff	8e (Reporting Interval)	14 00=>00 14= 20 mins

2. Reboot the device.

ff10ff		
Channel	Type	Value
ff	10 (Reboot)	ff

3. Enable current threshold alarm and set maximum threshold as 60A, reporting times as 2 and reporting interval as 5 minutes.

ff 06 0a00003c0002000500		
Channel	Type	Value
ff	06	CTRL:0a=Over maximum threshold Min: 00 00=0 Max: 3c 00=> 00 3c=60 A Alarm Reporting Times: 02 00=>00 02=2 Alarm Reporting Interval: 05 00=>00 05 =5 mins

-END-