Milesight

LoRaWAN[®] Controller UC50x Series

User Guide



Safety Precautions

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

- The device must not be remodeled in any way.
- Do not place the device close to objects with naked flames.
- Do not place the device where the temperature is below/above the operating range.
- Make sure electronic components do not drop out of the enclosure while opening.
- When installing the battery, please install it accurately, and do not install the reverse or wrong model.
- Make sure both batteries are newest when install, or battery life will be reduced.
- The device must never be subjected to shocks or impacts.

Declaration of Conformity

UC50x series 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: Email: <u>iot.support@milesight.com</u> Support Portal: <u>support.milesight-iot.com</u> Tel: 86-592-5085280 Fax: 86-592-5023065 Address: Building C09, Software Park III, Xiamen 361024, China

Revision History

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Date	Doc Version	Description
Dec. 9, 2021	V 2.0	Initial version based on hardware 2.0
June 16, 2022	V 2.1	Update 3.3V power output feature
Nov. 21, 2022	V 2.2	 Add RS485 byte order feature Add GPIO initial counting value modification feature
July 7, 2023	V 3.0	Initial version based on hardware 3.x

Contents

1. Product Introduction	. 5
1.1 Overview	.5
1.2 Features	. 5
2. Hardware Introduction	. 5
2.1 Packing List	5
2.2 Hardware Overview	. 6
2.3 Internal Interfaces	. 7
2.4 Dimensions (mm)	. 8
3. Hardware Adjustment	. 8
3.1 Antenna Installation (External Antenna Version Only)	
3.2 Hardware Switch	. 9
3.3 Back Cover Restore	10
4. Operation Guide	11
4.1 Log in the ToolBox1	11
4.1.1 NFC Configuration1	11
4.1.2 USB Configuration1	11
4.2 LoRaWAN Settings	12
4.2.1 Basic Settings1	12
4.2.1 Frequency Settings	14
4.2.3 Multicast Settings (UC501 Only)1	
4.3 Interface Settings	17
4.3.1 Basic Settings1	17
4.3.2 Analog Input	18
4.3.3 RS485	21
4.3.4 RS232	24
4.3.5 GPIO	25
4.3.6 SDI-12	27
4.4 Alarm Settings	
4.5 Data Storage	31
4.6 Data Retransmission	32
4.7 Maintenance	
4.7.1 Upgrade	33
4.7.2 Backup	34
4.7.3 Reset to Factory Default	
5. Device Installation	36
6. Milesight IoT Cloud Management	
7. Device Payload	39

1. Product Introduction

1.1 Overview

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UC50x series is a LoRaWAN® controller used for data acquisition from multiple sensors. It contains different I/O interfaces such as analog inputs, digital inputs, digital outputs, serial ports and so on, which simplify the deployment and replacement of LoRaWAN® networks. UC50x series can be easily and quickly configured by NFC or wired USB port. For outdoor

applications, it provides solar or built-in battery power supply and is equipped with IP67-rated enclosure and M12 connectors to protect itself from water and dust in harsh environments.

1.2 Features

- Easy to connect with multiple wired sensors through GPIO/AI/RS232/RS485/SDI-12 interfaces
- Long transmission distance up to 15 km with line of sight •
- Waterproof design including IP67 case and M12 connectors
- Solar powered and built-in battery optional •
- Quick wireless configuration via NFC •
- Compliant with standard LoRaWAN[®] gateways and network servers •
- Quick and easy management with Milesight IoT Cloud solution
- Supports multicast for control in bulk

2. Hardware Introduction

2.1 Packing List





2 × Data Cables

(30 cm)

1 × UC50x

Device





1 ×

Quick Guide

1 × Fixing

Screw

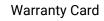


1 × Mounting

Bracket



1 ×





4 × Wall

Mounting Kits



1 × LoRaWAN[®]

Magnetic Antenna



2 ×

Hose Clamps



1 × Solar Panel Kit

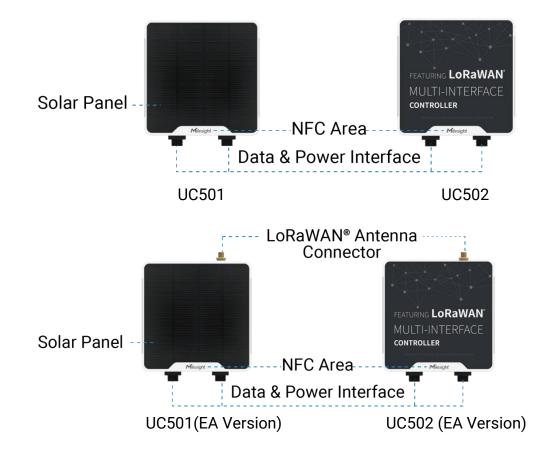
(Optional)

(EA Version Only)

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

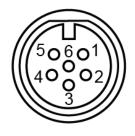
2.2 Hardware Overview

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Data Interface 1:

Pin	Description	
1	5V/9V/12V OUT (Switchable)	
2	3.3V OUT	
3	GND	
4	Analog Input 1	
5	Analog Input 2	
612	5-24V DC IN	



⁽ⁱ⁾ When both DC external power and batteries are connected, external power will be the preferred power supply option.

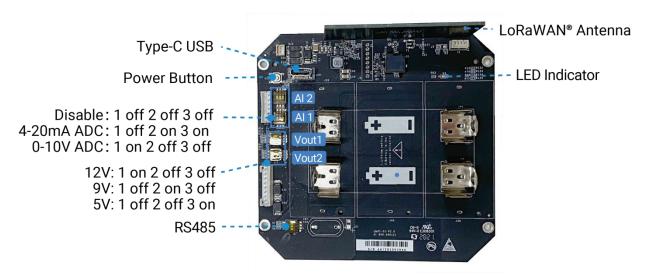
 $^{^{\}ensuremath{\otimes}}$ For UC502, the DC interface can't be to charge battery.

Data Interface 2:

Pin	Description		
1	5V/9V/12V OUT (Switchable)		
2	3.3V OUT		
3	GND		
4	GPI01		
5	GPIO2		
6			
7	RS232/RS485 (Switchable)		
8	SDI-12		
Pin	RS232	RS485	
6	TXD	А	
7	RXD	В	



2.3 Internal Interfaces



DIP Switch:

Interface	DIP Switch	
Power Output	12V: 1 on 2 off 3 off	
	9V: 1 off 2 on 3 off	
	5V: 1 off 2 off 3 on	
Angles Inc.	4-20mA ADC: 1 off 2 on 3 on	
Analog Input	0-10V ADC: 1 on 2 off 3 off	
RS485	Add 120 Ω resistor between A and B: 1 on 2 off 3 off	
	Add 1k Ω pull-up resistor on A: 1 off 2 on 3 off	
	Add 1k Ω pull-down resistor on B: 1 of 2 off 3 on	

Note:

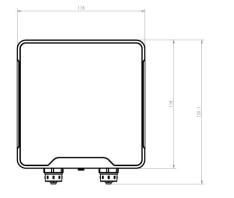
1) Analog inputs are set to 4-20mA by default, power outputs are set to 12V by default.

2) Power output on interface 1 is used for powering analog devices, power output on interface 2 is used for powering serial port devices and SDI-12 devices.

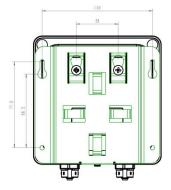
Power Button:

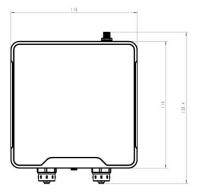
Function	Action	LED Indication
Turn On	Press and hold the button for more than 3s.	Off → On
Turn Off	Press and hold the button for more than 3s.	<mark>On →</mark> Off
Reset	Press and hold the button for more than 10s.	Blinks.
Check		Light On: Device is on.
On/Off Status	Quickly press the power button.	Light Off: Device is off.

2.4 Dimensions (mm)

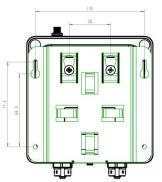












3. Hardware Adjustment

3.1 Antenna Installation (External Antenna Version Only)

8

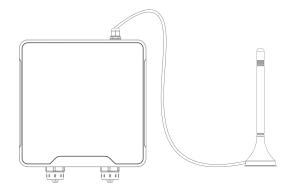
Rotate the antenna into the antenna connector accordingly. To ensure a good signal, it is suggested to follow below instructions:

1) The antenna should be installed vertically, with the magnetic base attached to a metal surface.

2) Keep the antenna away from walls and ensure there are no obstacles around it. It is suggested to place the antenna near windows when used indoors.

3) Maintain a distance of more than 50cm between antennas.

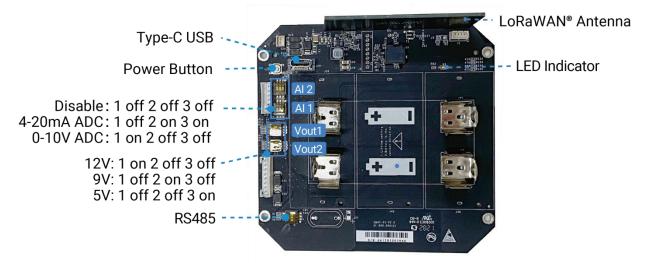
4) For better coverage, it is suggested to position the antenna higher.



3.2 Hardware Switch

The default work mode of analog input is 4-20mA, and the default voltage of power output is 12V. To adjust the setting, it is necessary to change the DIP switches as required. If the default settings suit your application, please skip this chapter.

Note: turn off the device before changing DIP switches.



DIP Switch:

Interface	DIP Switch
Power Output	12V: 1 on 2 off 3 off
	9V: 1 off 2 on 3 off
	5V: 1 off 2 off 3 on

9

Analog Input	4-20mA ADC: 1 off 2 on 3 on
	0-10V ADC: 1 on 2 off 3 off
RS485	Add 120 Ω resistor between A and B: 1 on 2 off 3 off
	Add 1k Ω pull-up resistor on A: 1 off 2 on 3 off
	Add 1k Ω pull-down resistor on B: 1 of 2 off 3 on

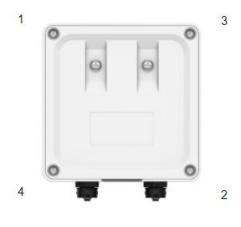
Note: Power output on interface 1 is used for powering analog devices, power output on interface 2 is used for powering serial port devices and SDI-12 devices.

3.3 Back Cover Restore

Please follow the instructions below to screw the back cover to ensure the waterproof of the device.

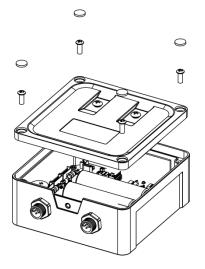
1. Ensure the sealing ring is properly installed around the device, free from stains or foreign matters.

2. Put the back cover onto the device with correct direction and fix the 4 screws with the order of cross (recommended torsion: $4.5 \sim 5$ kgf). When fixing the screws, initially tighten each to 80 to 90% of their full depth, and then fully tighten them all.



Screw Order

3. Fix the screw caps on the screws.



4. Operation Guide

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4.1 Log in the ToolBox

UC50x series can be configured via NFC or Type-C port. Please select one of them to complete configuration.

4.1.1 NFC Configuration

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

2. Enable NFC on the smart phone and launch Milesight ToolBox.

3. Attach the smart phone with NFC area to the device, click **NFC read** to read device information.

4. 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 first configuration. The default password is **123456**.



Note:

1) Ensure the location of smart phone NFC area and it's recommended to take off phone case.

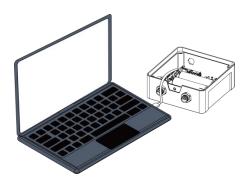
2) If the smart phone fails to read/write configurations via NFC, keep the phone away and back to try again.

3) UC50x series can also be configured by dedicated NFC reader, which can be purchased from Milesight IoT.

4.1.2 USB Configuration

1. Download ToolBox software from Milesight official website.

2. Open the case of UC50x and connect the UC50x to computer via type-C port.



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

Туре	General	•
Serial port	COM4	-
Login passw	ord	
Baud rate	115200	•
Data bits	8	<u> </u>
Parity bits	None	<u> </u>
Stop bits	1	<u>-</u>

4. After logging in the ToolBox, you can click **Power On** or **Power Off** to turn on/off device and change other settings.

	Status >	C P	Power On
Status	Model: Serial Number:	UC501-915 6412A4304414	
General	Firmware Version: Hardware Version: Device Status: Join Status: RSSI/SNR:	01.01 2.1 Of -	
((0)) LoRaWAN Settings	Battery: Channel Mask: Uplink Frame-counter: Downlink Frame-counter:	- - -	

4.2 LoRaWAN Settings

LoRaWAN settings is used for configuring the transmission parameters in LoRaWAN® network.

4.2.1 Basic Settings

12

UC50x supports basic configurations like join type, App EUI, App Key and other information. You can also keep all settings by default.

Device EUI	24E124454D100844
App EUI	24E124C0002A0001
Application Port	85
Working Mode:	Class A
LoRaWAN Version	V1.0.3
Join Type	OTAA 🔽
Application Key	*****
RX2 Date Rate	DR0 (SF12, 125 kHz 💌
RX2 Frequency	505300000
Spread Factor	SF10-DR2
Confirmed Mode)0
Rejoin Mode 🥝) 🛛
Set the number of packets sent	32 packets
ADR Mode	0
TXPower	TXPower0-19.15 dBn

Parameters	Description		
Device EUI	Unique ID of the device which can also be found on the label.		
App EUI	Default App EUI is 24E124C0002A0001.		
Analisation Dont	The port used for sending and receiving data, default port is 85.		
Application Port	Note: RS232 data will be transmitted via another port.		
	UC501: Class A and Class C are available;		
Working Mode	UC502: Class A.		
LoRaWAN Version	V1.0.2, V1.0.3 are available.		
Join Type	OTAA and ABP mode 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		

RX2 Data Rate	RX2 data rate to receive downlinks.
RX2 Frequency	RX2 frequency to receive downlinks. Unit: Hz
Spread Factor	If ADR is disabled, the device will send data via this spread factor.
O a u finne a d Ma da	If the device does not receive ACK packet from network server, it will resend
Confirmed Mode	data once.
	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
Deiein Mede	will re-join the network.
Rejoin Mode	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 packet sent + 1.
ADR Mode	Allow network server to adjust datarate of the device.
Tx Power	Tx power of the device.
packets sent ADR Mode	 validate connectivity; If there is no response, the device will re-join the network. When rejoin mode is enabled, set the number of LinkCheckReq packets sent. Note: the actual sending number is Set the number of packet sent + 1. Allow network server to adjust datarate of the device.

Note:

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- 1) Please contact sales for device EUI list if there are many units.
- 2) Please contact sales 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.

4.2.1 Frequency Settings

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

Basic		Channel				
	Index	Support Frequency : Frequency/MHz	EU868 Max Datarate		Min Datarate	
	0	868.1	5-SF7BW125	<u> </u>	0-SF12BW125	<u>_</u>
	1	868.3	5-SF7BW125	<u>*</u>	0-SF12BW125	*
	2	868.5	5-SF7BW125	<u> </u>	0-SF12BW125	<u> </u>
	3	0	5-SF7BW125	<u></u>	0-SF12BW125	<u></u>
	4	0	5-SF7BW125	<u> </u>	0-SF12BW125	<u>_</u>
	5	0	5-SF7BW125	*	0-SF12BW125	<u> </u>
	6	0	5-SF7BW125	<u> </u>	0-SF12BW125	<u> </u>
_	7		C OF 7DWKOC	_1	0.0540014405	-1

If 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

	Support Frequency :	AU915	
Enabled Channel Index: 0-7	1		
Channel Index	Frequency/MHz	Channel Spacing/MHz	BW/kHz
0 - 15	915.2 - 918.2	0.2	125
16 - 31	918.4 - 921.4	0.2	125
32 - 47	921.6 - 924.6	0.2	125
48 - 63	924.8 - 927.8	0.2	125
64 - 71	915.9 - 927.1	1.6	500

4.2.3 Multicast Settings (UC501 Only)

UC501 supports setting up several multicast groups to receive multicast commands from network servers and users can use this feature to control devices in bulks.

- 1. Set working mode as Class C.
- 2. Enable Multicast Group and set a unique multicast address and keys to distinguish other

groups. You can also keep these settings by default.

Multicast Group 1	
Multicast Aaddress	1111111
Multicast McAppSKey	******
Multicast McNetSKey	*****
Multicast Group 2	Ο
Multicast Group 3	
Multicast Group 4	O

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

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

Status	General	Applications	Profiles	Device	Multicast Groups	Gateway Fleet	Packets	
Packet Forwarder	Multicast Grou	ips						
Network Server	Add	l.					Search	Q,
		Multicast Address		Group Name		Number of Devices	Oper	ration
Network				No	natching records found			

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

MAKE SENSING MATTER

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Group Name				Configuration		
Multicast Address				1111111		
Multicast Network Session Key				5572404C696E6	B4C6F526132	
Multicast Application Session Key				5572404C696E6	B4C6F526132	
Class Type				Class C	~	
Datarate				DR0 (SF12, 125	ōkHz) 🗸	
Frequency				505300000		Hz
Frame-counter				0		
Selected Devices						
UC500 ×						
General Applications Payload Codec	Profiles	Device	Multicast Groups	Gateway Fleet	Packets	
Multicast Groups						
Add					Search	Q
Multicast Address	Group Name		Number	of Devices	Operation	
1111111	Configuration			1	2 ×	
Showing 1 to 1 of 1 rows						

4. Go to **Network Server > Packets**, select the multicast group and fill in the downlink command, then 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.

Status		General	Applications	Payload Codec	Profiles	Device	Multicast Groups	Gateway Fleet	Packets	
Packet Forwarder		Send Data To I	Device							
			Device EUI	Тур	De		Payload	Port	Confirmed	
Network Server		00000000	0000000	ASCII	~			85		Send
Protocol Integration	×									
		Send Data to N	lulticast Group							
Network	· ·		Multicast Group	Тур	be		Payload	Port		
System	•	Configura	ation	✓ hex	~	ff10ff		85		Send

4.3 Interface Settings

4.3.1 Basic Settings

17

Reporting Interval	1200 s
Collection interval	1200 s
Data Storage	?
Data Retransmission	0
Change Password	Ο
The device returns to the power supply state	Last working statu:

Parameters	Description
	Reporting interval of transmitting data to network server. Default: 1200s
Reporting Interval	(20 mins), Range: 10-64800 s.
	Note: RS232 transmission will not follow the reporting interval.
Collection Interval	The interval of collecting data when there is an alarm command (see
Collection Interval	section 4.4). This interval must be not more than reporting interval.
Data Storage	Disable or enable reporting data storage locally. (see section 4.5)
Data	Disable or enable data retransmission. (see section <u>4.6</u>)
Retransmission	
The device returns	
to the power supply	If the device loses power and return to power supply, it will be either on or
state	off, depending on this parameter.
	Change the password for ToolBox App to read/write this device or
Change Password	software to login.

4.3.2 Analog Input

1. Connect analog device to analog input ports on interface 1. If the analog device requires power from the UC50x, connect the power cable of analog device to the power output on interface 1.

2. Enable analog input and configure analog settings according to the requirements of the analog sensor.

Interface 1 (Pin1) 5/9/12V Output	8
Power Output Time Before Collect	1s
Power supply current	0.00 mA
Interface 1 (Pin2) 3.3V Output	8
Power Supply Mode	Continuous power supply
Power supply current	0.00 mA
Interface Name	Analog Input 1
Enable	
Analog Input Signal Type	4-20 mA
Osh	20.00
Osl	4.00
Unit	mA
Status	Fetch
Interface Name	Analog Input 2
Enable	0
Analog Input Signal Type	4-20 mA
Osh	20.00
Osl	4.00
Unit	mA
Status	

Parameters	Description			
	Enable 5V/9V/12V power output of interface 1 to supply power to analog			
	devices. It's 12V by default and you can change DIP switches to change			
Interface 1(Pin 1)	voltage.			
5V/9V/12V Output	Power Output Time Before Collect: power supply time before collecting			
	data for terminal device initialization. Range: 0-600s.			
	Power Supply Current: supply current as sensor required. Range: 0-60mA			
Interface 1(Din 2)	Enable 3.3V power output of interface 1 to supply power to analog devices.			
Interface 1(Pin 2) 3.3V Output	Power Supply Mode: Select "Continuous power supply" or "Configurable			
	power supply time".			

19

	Power Output Time Before Collect: power supply time before collecting
	data for terminal device initialization. Range: 0-600s.
	Power Supply Current: supply current as sensor required. Range: 0-60mA
Analog Input	4-20mA or 0-10V are optional. This only works when DIP switches has
Signal Type	changed.
Osh/Osl	Osh is the high limit of the scale and osl is the low limit of the scale for the scaled output value. After setting, the device will upload the scaled values.
Unit	The data unit of this sensor, it just displays on ToolBox for reference.
Fetch	Click to fetch current value of sensor.

Note: analog input scaling formula

Ov = [(Osh - Osl) * (Iv - Isl) / (Ish - Isl)] + Osl

This can also be rewritten as:

Ov = [(Osh - Osl)/(Ish - Isl)/(Ish - Isl)] + Osl

The variables are pertinent to the scaling formula:

Ov = scaled output value

lv = analog input value

Osh = high limit of the scale for the scaled output value

Osl = low limit of the scale for the scaled output value

Ish = high limit of the scale for the analog input value

IsI = low limit of the scale for the analog input value

For example, a analog wind sensor can us 4-20mA to point to 0-32 m/s, the corresponding variables are: Osh=32 m/s, osl=0 m/s, lsh=20mA, lsl=4mA.

When it measures 6mA, the real wind speed is Ov = [(32 - 0) * (6 - 4) / (20 - 4)] + 0 = 4 m/s.

3. For ToolBox software, click **Fetch** to check if UC50x can read correct data from analog devices.

Note: When you use power output to power analog devices, it only supplies power when reporting interval is coming. It's suggested to power slave devices with external power during the PoC test.

Interface Name	Analog Input 1	
Enable		
Analog Input Signal Type	4-20 mA	•
Osh	20.00	
Osl	4.00	
Unit	mA	
Status	0.000 mA	Fetch

For ToolBox App,

- a. Click **Collect** and attach smart phone to the device to collect data.
- b. Click **Fetch** and attach smart phone to the device to read the data.

Analog Input 1		
Analog input Signal Type		
4-20mA		•
Osh		
20.00		
Osl		
4.00		
* Unit		
mA		
Status	-	Collect

4.3.3 RS485

1. Connect RS485 device to RS485 port on interface 2. If the RS485 device requires power from UC50x, connect the power cable of RS485 device to the power output on interface 2.

2. Enable RS485 and configure serial port settings the same as RS485 terminal devices.

Enable	
Interface Type	RS485 (Modbus Master)
Interface 2 (Pin1) 5/9/12V Output	
Power Output Time Before Collect	1s
Power supply current	0.00 mA
Interface 2 (Pin2) 3.3V Output	O
Baud Rate	9600 🔽
Data Bit	8 bits 🔽
Stop Bit	1 bits 🔽
Parity	None 💌
Execution Interval	50 ms
Max Resp Time	500 ms
Max Retry Times	3
Modbus RS485 bridge LoRaWAN	2

Parameters	Description		
	Enable 5V/9V/12V power output of interface 2 to supply power to RS485		
	terminal devices. It's 12V by default and you can change DIP switches to		
Interface 2(Pin 1)	change voltage.		
5V/9V/12V Output	Power Output Time Before Collect: power supply time before collecting		
	data for terminal device initialization. Range: 0-600s.		
	Power Supply Current: supply current as sensor required. Range: 0-60mA		
	Enable 3.3V power output of interface 2 to supply power to RS485 terminal		
	devices.		
	Power Supply Mode: Select "Continuous power supply" or "Configurable		
Interface 2(Pin 2) 3.3V Output	power supply time".		
	Power Output Time Before Collect: power supply time before collecting		
	data for terminal device initialization. Range: 0-600s.		
	Power Supply Current: supply current as sensor required. Range: 0-60mA		
Baud Rate	1200/2400/4800/9600/19200/38400/57600/115200 are available.		
Data Bit	8 bit is available.		
Stop Bit	1 bit/2 bit are available.		

Parity	None, Odd and Even are available.
Execution Interval	The execution interval between each Modbus command.
	The maximum response time that the UC50x waits for the reply to the
Max Resp Time	command. If it does not get a response after the max response time, it is
	determined that the command has timed out.
Set the maximum retry times after device fails to read data f	
Max Retry Time	terminal devices.
	If this mode is enabled, network server can send any type of command to
Modbus RS485	RS485 device and RS485 device can only react according to server
bridge LoRaWAN	commands.
	Port: Select from 2-84, 86-223.

3. Click $\textcircled{\oplus}$ to add Modbus channels, then save configurations.

Channel Se	ttings		Fetch	All			
Channel ID	Name	Slave ID Address	Quantity Type	Byte Order	Sign Value		
1 •	1	1 0	1 Holding Register(IN	IT16) 🔽 AB 🝷		Fetch	\otimes
2 •	2	255 2	1 Coil	<u> </u>		Fetch	

Parameters	Description
Channel ID	Select the channel ID you want to configure from 16 channels.
Name	Customize the name to identify every Modbus channel.
Slave ID	Set Modbus slave ID of terminal device.
Address	The starting address for reading.
Quantity	Set read how many digits from starting address. It fixes to 1.
Туре	Select data type of Modbus channels.
Byte Order	Set the Modbus data reading order if you configure the type as Input Register or Holding Register. INT32/Float: ABCD, CDBA, BADC, DCBA INT16: AB,BA
Sign	The tick indicates that the value has a plus or minus sign.
Fetch	After click, the device will send Modbus read command to test if it can read correct values. Example: as this setting, the device will send command: 01 03 00 00 00 01 84 0A



4. For ToolBox software, click **Fetch** to check if UC50x can read correct data from terminal devices. You can also click **Fetch** on the top of list to fetch all channel data.

Note:

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1) When you use power output to power RS485 Modbus slave devices, it only supplies power when reporting interval is coming. It's suggested to power slave devices with external power during the PoC test.

2) Do not click Fetch frequently since response time to reply is differ for every terminal device.



For ToolBox App,

a. Tap every Modbus channel, click **Collect** and attach smart phone to device to collect data.

b. Click Fetch and attach smart phone to read the data. You can also tap Collect All and Fetch

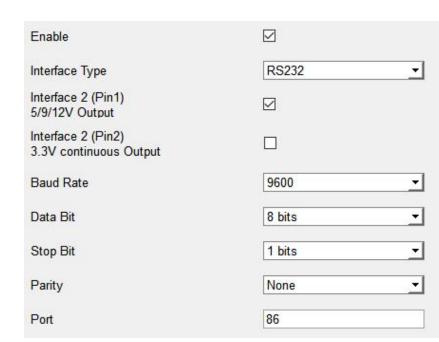
All to fetch all channel data.

← 1			
* Name			
1			
Slave ID	_	1	+
Address	_	0	+
Quantity			1
Туре			
Holding Register (INT32)			•
Byte Order			
ABCD			•
Sign			
Value	i i	Fe	tch

4.3.4 RS232

1. Connect RS232 device to RS232 port on interface 2. If the RS232 device requires power from the UC501, connect the power cable of RS232 device to the power output on interface 2.

2. Enable RS232 and configure serial port settings the same as RS232 terminal devices.



Parameters	Description
	Enable 5V/9V/12V power output of interface 2 to supply power to RS232
Interface 2(Pin 1)	terminal devices continuously . It is 12V by default and you can change <u>DIP</u>
5V/9V/12V Output	switches to change voltage. Only UC501 supports this feature.
	Power Supply Current: supply current as sensor required. Range: 0-60mA
Interface 2(Pin 2)	Enable 3.3V power output of interface 2 to supply power to RS232 terminal
3.3V Continuous	devices continuously.
Output	Power Supply Current: supply current as sensor required. Range: 0-60mA
Baud Rate	300/1200/2400/4800/9600/19200/38400/57600/115200 are available.
Data Bit	8 bit is available.
Stop Bit	1 bit/2 bit are available.
Parity	None, Odd and Even are available.
Port	The port used for RS232 data transmission.

4.3.5 GPIO

- 1. Connect devices to GPIO ports on interface 2.
- 2. Enable GPIO port and select the GPIO type as required.

Digital Input:

Digital input can be used to detect high or low status of devices.

Interface Name	GPIO 1
Enable	\checkmark
Interface Type	Digital Input1
Digital Input	Pull Down
Status	Low Setch

Parameters	Description
	Initial status of digital input.
Digital Input	Pull Down: rising edge will be triggered
	Pull Up/None: falling edge will be triggered
Fetch	Click to get current status of digital input.

Digital Output:

Digital output will send voltage signals to control devices.

Interface Name	GPIO 2	
Enable		
Interface Type	Digital Output2	
Status	Low	Switch

Parameters	Description
Fetch	Click to get current status of digital output.
Switch	Click to switch the digital output status to check if UC50x can trigger devices.

Pulse Counter:

Interface Name	GPIO 1			
Enable	\checkmark			
Interface Type	Counter 🗾			
Digital Input	Pull Down	1		
Digital Filter	⊘ ☑			
keep last value when power of	off			
Counter values	0	Refresh	Start	Clear
Modify the count values				

Parameters	Description	
	Initial status of counter.	
Digital Input	Pull Down: Increase 1 when detecting rising edge	
	Pull Up/None: Increase 1 when detecting falling edge	
Digital Filter	It's recommended to enable when pulse period is greater than 250 us.	
Keep last value	Keep the counted values when the device powers off.	
when power off	Reep the counted values when the device powers off.	
	Make the device start/stop counting.	
Start/Stop	Note: UC50x will send non-changable counting values if you do not click	
	Start.	
Refresh	Refresh to get latest counter values.	
Clear	Count the value from 0.	
Modify the count values	Set the initial counting value.	

4.3.6 SDI-12

1. Connect SDI-12 sensor to SDI-12 port on interface 2. If the SDI-12 device requires power from the UC50x, connect the power cable of SDI-12 device to power output on interface 2.

2. For ToolBox software, enable SDI-12 interface and configure interface settings to be the same as those of the SDI-12 sensors. For ToolBox App, go to **Device > Setting > SDI-12 Settings** and click **Read** to get current settings, then configure the settings.

	- <u>-</u>		
Interface 2 (Pin1)5/9/12V Output			
Power Output Time Before Collect	1	s	
Power supply current	10.00	mA	
Baud Rate	1200	<u> </u>	
Data Bit	7 bits	-	
Stop Bit	1 bits	-	
Parity	Even	<u> </u>	
Max Retry Times	3		
SDI-12 bridge LoRaWAN	2 🖬		
Port	? 80		

Parameters	Description
Interface 2(Pin 1)	Enable 5V/9V/12V power output of interface 2 to supply power to SDI-12

5V/9V/12V Output	sensors. It's 12V by default and you can change DIP switches to change	
	voltage.	
	Power Output Time Before Collect: power supply time before collecting	
	data for terminal device initialization. Range: 0-600s.	
	Power Supply Current: supply current as sensor required. Range: 0-60mA	
Baud Rate	1200/2400/4800/9600/19200/38400/57600/115200 are available.	
Data Bit	8 bit/7 bit is available.	
Stop Bit	1 bit/2 bit is available.	
Parity	None, Odd and Oven are available.	
Max Retry Time	Set the maximum retry times after device fails to read data from SDI-12 sensors.	
	If this mode is enabled, network server can send SDI-12 command to SDI-12	
SDI-12 bridge	device and the device can only react according to server commands.	
LoRaWAN	Port: Select from 2-84, 86-223.	

Note: When you use power output to power SDI-12 sensors, it only supplies power when reporting interval is coming. It's suggested to power sensors with external power during the PoC test.

- 3. Click $\textcircled{\oplus}$ to add channels, click **Read** to get the address of this sensor.
- 4. Click $\textcircled{\oplus}$ besides the **SDI-12 Command** tab to add SDI-12 commands as required by the sensor.
- 5. Click **Collect** to send the commands to get sensor data, then click **Fetch** to check the data.

Channel Se	ettings				Collect All
Channel ID	Name	Address	SDI-12 Command	Value	
1 -	1	0 Read	Write aM!;aD0!;	•	

Parameters	Description
Channel ID	Select the channel ID you want to configure from 16 channels.
Name	Customize the name of each channel to easily identify them
Address	Address of SDI-12 sensor, it is editable.
Read	Click to read the address of the SDI-12 sensor.
Write	Modify the Address and click to write a new address to SDI-12 sensor.
SDI-12 Command	Fill in the commands to send to sensors, one channel can add 16 commands at most.
Collect	Click to send commands to get sensor data.

	Note: Do not click frequently since response time to reply is differ for
	every terminal device.
Fetch	Click to display the data on the ToolBox.
Value	Show the collected value. If it read multiple values, it will be separated by "+" or "-".

For ToolBox App,

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- a. Tap every channel, click **Collect** and attach smart phone to the device to collect data.
- b. Click $\ensuremath{\textit{Fetch}}$ and attach smart phone to the device to read the data. You can also tap $\ensuremath{\textit{Collect}}$

All and Fetch All to fetch all channel data.

÷	Edit chan	nel	
Channel			
Channel 1			-
* Name			
1			
Address			
, i	Read	Write	
A			
SDI-12 Com	mand (i)		
aM!			
aD0!			Ξ
	\oplus		
Value		Co	llect
A+0.0+0+2	6.0		

4.4 Alarm Settings

UC50x supports configuring commands to send alarm packets to network server. Each device can be added 16 threshold alarm commands at most.

1. For ToolBox software, go to **Command** page, click **Edit** to add commands; for ToolBox App, go to **Device > Setting > Rule Engine** to add commands.

	Save
Configuration	Edit
	e
	e
	Configuration

2. Set an IF condition including the analog input values or RS485 Modbus channel values. When the value matches the condition, the device will report an alarm packet.

Note: the device will only send the alarm once. Only when the value turns back to normal and triggers the condition again, it will send a new alarm.

f Al2	<u></u>	·	
4-20mA -		5 mA	,
	Above Below Within		
	Change		

3. After setting all commands, click **Save**.

ID	Configuration	Edit	Delete
1	If ai2(4-20ma) is above 5.00. then report data package	e	Ē
2	If ai1(4-20ma) is within 4.00 - 6.00. then report data package	e	<u> </u>
3		e	Ē

MAKE SENSING MATTER

4.5 Data Storage

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UC50x series supports storing 600 data records locally and exports data via ToolBox App or ToolBox software. The device will record the data according to the reporting interval even if it is not connected to a network.

1. Go to Status of ToolBox software or Device > Status of ToolBox App to sync the device time;

Status >	
Model:	UC501-470M
Serial Number:	6454D2122042
Device EUI:	24e124454d212204
Firmware Version:	01.05
Hardware Version:	3.0
Device Status:	On
Join Status:	Activate
RSSI/SNR:	-73/4
Battery:	100%
Channel Mask:	000000000000000000000000000000000000000
Uplink Frame-counter:	169
Downlink Frame-counter:	0
Device Time:	2023-07-04 06:01:40 Sync

2. Go to **General > Basic** of ToolBox software or **Device > Settings > General Settings** of ToolBox App to enable data storage feature.

Data Storage	(?) 🔽
Data Storage	

3. Go to **Maintenance > Backup and Reset** of ToolBox software or **Device > Maintenance** of ToolBox App, click **Export**, then select the data time range and click **Save** to export data.

Note: ToolBox App can only export the last 14 days' data. If you need to export more data, please use ToolBox software.

Maintenance >

Upgrade	Backup and Reset			
Config Backup	ToolBox_v7	?	×	
Config File	Start	¢		rowse Import
Export Historical Data	End 2022/9/8 15:29 Cancel	€ Save		
	Cancel	Save	_	

4. Click **Clear** to clear all stored data inside the device if necessary.

4.6 Data Retransmission

UC50x series supports data retransmission to ensure the network server can get all data even if the network is down for some times. There are two ways to get the lost data:

- Network server sends downlink commands to enquire the historical data for specified time range, see *UC50x Series Communication Protocol;*
- When network is down if no response from LinkCheckReq MAC packets for a period of time, the device will record the network disconnected time and re-transmit the lost data after the device re-connects the network.

Here are the steps for data retransmission:

1. Enable data storage feature and data retransmission feature;

AI	
6454D1008441	
1200	
(?) 1200	
(?) 🖬	
⊘ ◙	
	6454D1008441 1200 (?) 1200

2. Enable rejoin mode feature and set the number of packets sent. Take below as an example, the device will send LinkCheckReq MAC packets to the network server regularly to check if the network is disconnected; if there is no response for 8+1 times, the join status will change to de-active and the device will record a data lost time point(the time to join the network).

Rejoin Mode	? 🖬	
Set the number of packets sent	8	packets

3. After the network connected back, the device will send the missing data, starting from the point in time when the data was lost, according to the reporting interval.

Note:

Milesight

1) If the device is rebooted or powered off during data retransmission and the process is not completed, the device will resend all retransmitted data again after reconnecting to the network;

2) If the network is disconnected again during data retransmission, it will only send the latest disconnection data;

3) The retransmission data format is started with "20", please refer to UC50x Series Communication Protocol.

4) Data retransmission will increase the uplinks and shorten the battery life.

4.7 Maintenance

4.7.1 Upgrade

ToolBox Software:

1. Download firmware from Milesight official website to your PC.

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

Note: Any operation on ToolBox is not allowed during upgrading, otherwise the upgrading will be interrupted, or even the device will break down.

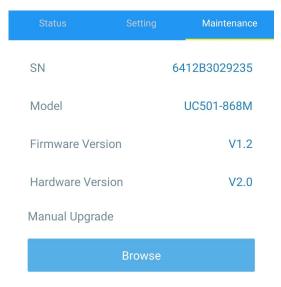
Upgrade	Backup and Reset		
Model:	UC501-470M		
Firmware Vers	sion: 01.03		
Hardware Vers	sion: 3.0		
Domain:	Beijing Server	<u>-</u>	
FOTA:	Up to da	late	
Local Upgrade		Browse Upgrade	

ToolBox App:

- 1. Download firmware from Milesight official website to your smart phone.
- 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.



4.7.2 Backup

UC50x devices support configuration backup for easy and quick device configuration in bulk. Backup is allowed only for devices with the same model and LoRaWAN[®] frequency band. Please select one of following methods to backup device:

ToolBox Software:

1. Go to **Maintenance > Backup and Reset**, click **Export** to save current configuration as json format backup file.

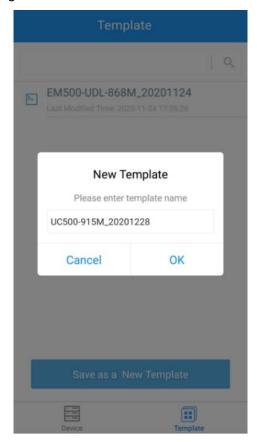
2. Click Browse to select backup file, then click Import to import the configurations.

Upgrade	Backup and Reset			
Config Backup	Ex	port		
Config File			Browse	Import
Restore Factor	y Defaults Re	set		

ToolBox App:

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 which saved in the smart phone and click **Write**, then attach to another device to write configuration.



4.7.3 Reset to Factory Default

Please select one of following methods to reset device:

Via Hardware: Open the case of UC50x and hold on power button more than 10s.

Via ToolBox Software: Go to Maintenance > Backup and Reset to click Reset.

Upgrade	Backup and Reset			
Config Backup	Exp	ort		
Config File			Browse	Import
Restore Factor	y Defaults Res	et		

Via ToolBox App: Go to Device > Maintenance to click Reset, then attach smart phone with NFC area to UC50x to complete reset.

Status	Setting	Maintenance
SN		6412B3029235
Model		UC501-868M
Firmware Versio	on	V1.2
Hardware Versi	Hardware Version	
Manual Upgrade	9	
	Browse	
Restore Factory	Default	
	Reset	

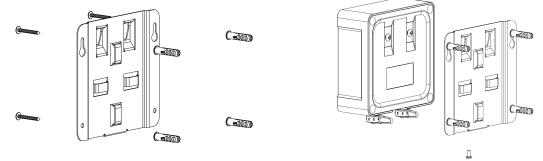
5. Device Installation

UC50x series support wall mounting or pole mounting. Before installation, make sure you have the mounting bracket, wall or pole mounting kits and other required tools.

Wall Mounting:

1. Fix the wall plugs into the wall, then fix the mounting bracket to the wall plugs with screws.

2. Put the device on the mounting bracket, then fix the bottom of the device to the bracket with a fixing screw. It's necessary to fix this bracket to device, or it will affect the signal.

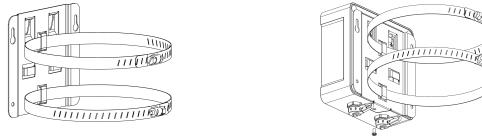


Pole Mounting:

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1. Straighten out the hose clamp and slide it through the rectangular rings in the mounting bracket, wrap the hose clamp around the pole. After that use a screwdriver to tighten the locking mechanism by turning it clockwise.

2. Put the device on the mounting bracket, then fix the bottom of the device to the bracket with a fixing screw. It's necessary to fix this bracket to device, or it will affect the signal.



6. Milesight IoT Cloud Management

UC50x series can be managed by Milesight IoT Cloud platform. Milesight IoT cloud is a comprehensive platform that provides multiple services including device remote management and data visualization with the easiest operation procedures. Please register a Milesight IoT Cloud account before operating following steps.

1. Ensure Milesight LoRaWAN[®] gateway is online in Milesight IoT Cloud. For more info about connecting gateway to cloud please refer to gateway's user guide.

O Dashboard	Devices		Gateways	+		
My Devices	Search		Q	⊘ Normal 1 💹 Offline 0 ⊗ In	active 0	+ New Devices
🖄 Мар		Status	Name	Associated Devices (Joined /Not Joined /Failed)	Last Updated	
if Triggers		at	UG Gateway	<u>0 / 0 / 0 Detail</u>	a few seconds ago	<u>ک ار ()</u>
Reports			6222A3243835			
Event Center 46						< 1 >
laring Center						

2. Go to **My Devices** page and click **+New Devices**. Fill in the SN of UC50x and select associated gateway.

* SN:	6412A5196409	
* Name:	UC501	
* Associated Gateway:	UG Gateway	\vee
* Device EUI:	24e124412A519640	
* Application Key:	5572404c696e6b4c6f52613230313823	

3. For UC501, click and go to **Basic Settings** to change class type the same as device settings.

Basic Settings	Interface Settings	Main	tenance	Log			Refresh	Shar
	*	Name:	UC501					
	* Application	on Key:	5572404c696e	6b4c6f526132303138	23			
	LoRaWAN CI	ass 🕧:	classC			V		
	Desc	ription :						
	* Reporting Inter	val Or	20			min		

4. After UC50x is online in Milesight IoT Cloud, click and go to **Interface Settings** to select used interfaces and customize the name, sign and formulas.

Note: Modbus channel settings should be the same as the configuration in ToolBox.

Dashboard	Devices / UC501 / Inter	ace Settings						
My Devices	Basic Settings	Interface Settings	Maintenance	Log				Refresh Share
а мар	Enable	Name Type		Custom N	lame		Current Value	Alarm Threshold
Triggers	GPIO_	1 Digital Inpu	t Low	Low	High	High		= Disable 🗸
 Reports Event Center 47 	GPIO_	2 Digital Outpu	ut Low	Low	High	High		= Disable v
Sharing Center	Enable	lame Type	Osh		Osl	Unit	Current Value	Alarm Threshold
Me	AI_1	4 - 20mA		4		mA	Ccy: - mA Min: - mA Max: - mA Avg: - mA	2
	AI_2	4 - 20mA		4		mA	Ccy: - mA Min: - mA Max: - mA Avg: - mA	2
	Channel ID Char	nnel Name Type	Sign	Raw Data 🕧	Formula 🤇	Value	Unit	Alarm Threshold Operation
	1 V	perature		HEX:- DEC:-				Σ Σ

7. Device Payload

UC50x Series use the standard Milesight IoT payload format based on IPSO. Please refer to the **UC50x Series Communication Protocol**; for decoders of Milesight IoT products please click <u>here</u>.

-END-