Outdoor Asset Tracker

**Featuring LoRaWAN®**

AT101

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 disassembled or remodeled in any way.

❖ In order to protect the security of the device, please change the device password when first configuration. Default password is 123456.

❖ The device is not intended to be used as a reference sensor, and Milesight won't should responsibility for any damage which may result from inaccurate readings.

❖ Do not place the device close to objects with naked flames.

❖ Do not place the device in where the temperature is below/above the operating range.

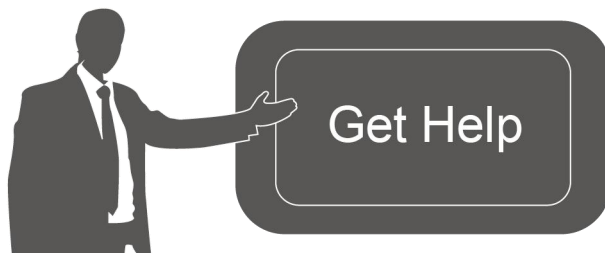❖ Make sure all batteries are newest when install, or battery life will be reduced.

Declaration of Conformity

AT101 is in conformity with the essential requirements and other relevant provisions of the CE, FCC, and RoHS.
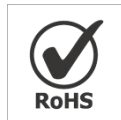
Get Help

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
June 19, 2023	V 1.0	Initial version

Contents

1. Product Introduction

1.1 Overview

AT101 is an exceptional outdoor tracker that utilizes GNSS and Wi-Fi AP MAC Address Scanning to provide highly accurate positioning data. Additionally, it has tilt and temperature sensors for more extensive data collection and application in various scenarios. The device is designed with IP67 and IK09 ratings to cater to different environments.

AT101 collaborates with standard LoRaWAN® gateway and mainstream LoRaWAN® network servers with low power consumption, allowing it to operate for over 15 years with twice-daily reports. By integrating with Milesight LoRaWAN® gateway and Milesight IoT Cloud solution, users can remotely and visually manage all sensor data.

1.2 Features

● Equipped with highly-accurate GNSS positioning and cooperate with Wi-Fi positioning

● Equipped with NTC temperature sensor to enable environment detection

● Built-in 3-axis accelerometer sensor to monitor device tilt status and movement

● Support IP67 and IK09 rating protections for harsh environment application

● Built-in replaceable batteries and works for up to over 15 years without replacement

● Provide integrated structure and anti-theft design for wireless and safe deployment

● Incorporate UV protection to be suitable for outdoor environments.

● Support geofencing for targeted messaging to secure the assets and area

● Multiple and switchable modes provide motion tracking, periodic tracking, and timing tracking

● Store locally 1,300 historical records and support retransmission to prevent data loss

● Equipped with NFC and Bluetooth for easy configuration

● Function well with standard LoRaWAN® gateway and network servers

● Compatible with Milesight IoT Cloud

2. Hardware Introduction

2.1 Packing List
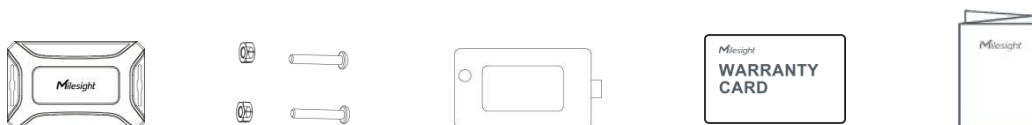
| 1 × AT101 Device | 2 × Mounting Kits | 1 × 3M Tape | 1 × Warranty Card | 1 × Quick Guide |

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

2.2 Hardware Overview

NFC Area

Mounting Holes

Tamper Button
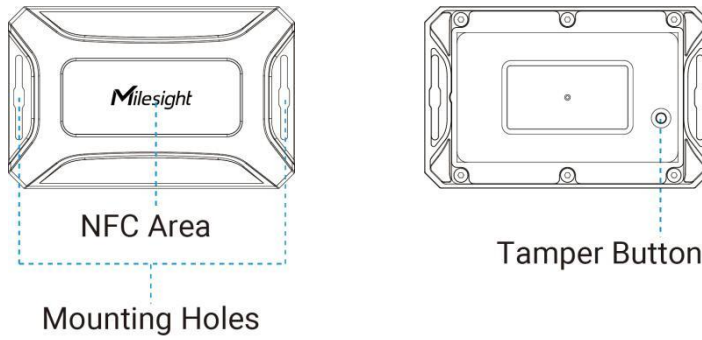
2.3 Dimensions (mm)
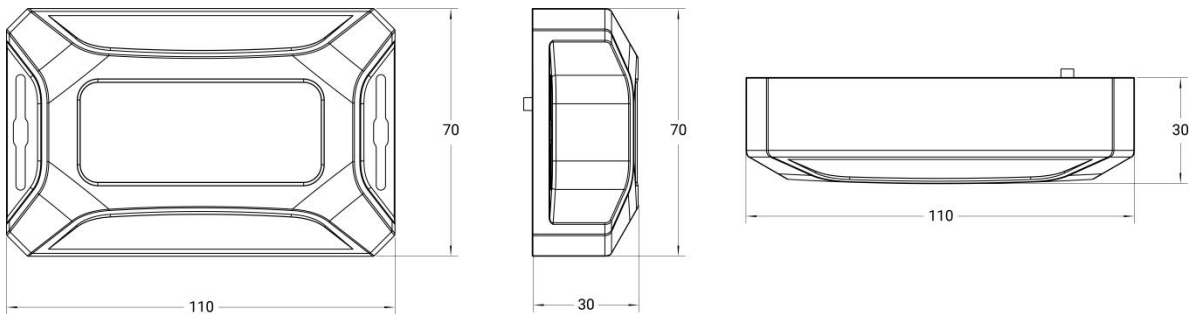
2.4 Power Button

AT101 can be switched on/off via NFC. Besides, users can use internal power button to switch on/off and reset the device manually.

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

3. Operation Guide

3.1 NFC&Bluetooth Configuration

AT101 can be configured via NFC or Bluetooth.

NFC Configuration:

1. Download and install **Milesight ToolBox** App from Google Play or App Store.
2. Open **Milesight ToolBox** App, tap **NFC Read** button and enable NFC on the smartphone.
3. Attach the smartphone with NFC area to the device to read the basic information.

4. Basic information and settings of devices will be shown on ToolBox if it's recognized successfully. You can switch on/off, read and write the device by tapping the button on the Apps. In order to protect the security of devices, password validation is required when configuring via unused phone. The default password is **123456**.

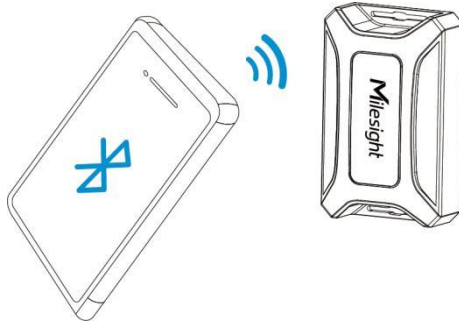| Status	Setting	Maintenance
SN		6745D19027970000
Model		AT101-470M
Device EUI		24E124745D190279
Firmware Version		V1.1
Hardware Version		V1.1
Device Status		ON
Join Status		Activated
Reading Mode		NFC

Note:
1) Ensure the location of smartphone NFC area and it's recommended to take off phone case.
2) If the smartphone fails to read/write configurations via NFC, keep the phone away and back to try again.
3) AT101 can also be configured by dedicated NFC reader provided by Milesight IoT or you can

configure it via TTL interface inside the device.

Bluetooth Configuration:

1. Download and install **Milesight ToolBox** App from Google Play or App Store.
2. Enable Bluetooth on the smartphone, then open **Milesight ToolBox** App.
3. Tap **BLE Read** button to scan the devices and select the one to connect. The default Bluetooth name is AT101-XXXXXXX(5th to 11st of device SN) and the default login password is 123456. If the device is off, please turn on the device via NFC first.

4. Basic information and settings of devices will be shown on ToolBox if it's connected successfully. You can read and write the device by tapping the button on the Apps. In order to protect the security of devices, password validation is required when configuring via unused phone.

Note:

1) If the Bluetooth password is entered for over 1 min, please re-enter the password.
2) The waiting interval will be increased gradually if the failed password attempts reach for 5 times continuously.
3) The Bluetooth connection will be terminated if there's no data interaction within 3 minutes. It

will request to connect again.

4) The device can connect to only one phone via Bluetooth. For example, if the device is connected to smart phone A via Bluetooth, the connection will be terminated after it is connected to smartphone B.

3.2 LoRaWAN Settings

Device EUI

24E124329C425039

* APP EUI

24e124c0002a0001

* Application Port   — 85 +

Join Type

OTAA ▼

* Application Key

****

LoRaWAN Version

V1.0.3 ▼

Work Mode

Class A ▼

RX2 Data Rate

DR0 (SF12, 125 kHz) ▼

RX2 Frequency

505300000

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 mode 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.
LoRaWAN Version	V1.0.2, V1.0.3, V1.0.4 are available.
Work Mode	It's fixed as Class A.
RX2 Data Rate	RX2 data rate to receive downlinks.
RX2 Frequency	RX2 frequency to receive downlinks. Unit: Hz
Channel	Enable or disable the frequency to send uplinks.

* Support Frequency

EU868

868.1

868.3

868.5

863

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.

Examples:

1, 40: Enabling Channel 1and 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

Enable Channel Index ⓘ

8-15

Index	Frequency/MHz ⓘ
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

Spread Factor	If ADR is disabled, the device will send data via this spread factor.
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.
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 network server to adjust data rate of the device.
Tx Power	Transmit power of device.

Note:

1) Please contact sales for a 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.

3.3 Positioning Settings

Go to **Device > Setting > Positioning Settings** to set the positioning strategy and related settings.

Parameters	Description
Positioning Strategy	Select the strategy for each time's positioning. **GNSS Positioning:** locate the device position via GNSS. This mode is used on outdoor open environment. **Wi-Fi Scan:** locate the device position via Wi-Fi scan. This mode is used on crowded streets or indoor environment. **Wi-Fi Scan&GNSS Positioning:** locate the device position via Wi-Fi scan first; if this failed, switch to GNSS to locate again. This mode will consume

	the most power.
	Note: When Wi-Fi scan is failed, the device will still upload the Wi-Fi scan results.
Positioning Timeout	When the device fails to scan for a sufficient numbers of Wi-Fi BSSID within this timeout, it will stop scanning.
Number of BSSID	The number of BSSID which the device needs to upload each positioning.
GNSS Positioning Duration	When the device fails to get location via GNSS within this duration, it will stop locating. Default: 3 mins, range: 1~5 mins.

3.4 General Settings

Go to **Device > Setting > General Settings** to change the reporting interval, etc.

Work Mode

Timing Mode ▼

Reporting Time Point

Time Point 1   16:20   ⊕

Data Storage ⓘ   🟢

Data Retransmission ⓘ   🟢

Change Password   ⚪

Parameters	Description
Work Mode	Select the work mode to report location data to network server.
Data Storage	Disable or enable reporting GNSS data storage locally. (see section 3.5.2 to export data)
Data Retransmission	Disable or enable data retransmission. (see section 3.5.3)
Change Password	Change the NFC or Bluetooth password for ToolBox App or software to access this device.

Periodic Mode: report data periodically.

Work Mode

Periodic Mode ▼

Reporting Interval   - 1440 + min

Parameters	Description
Reporting Interval	The interval to locate the device position. After located, the device will report the data to network server. Default: 1440 mins, range: 1~1440 mins

Motion Mode: report data according to device motion status.

Work Mode

| Motion Mode | ▼ |

| Reporting Interval | - | 1200 | + | min |

| The Duration of Motion ⓘ | - | 10 | + | s |

| The Duration of Stationary ⓘ | - | 10 | + | min |

| Reporting Interval during Motion / min ⓘ | ⚪ |

Parameters	Description
Reporting Interval	The interval to locate the device position when device is in stationary. After located, the device will report the data to network server. Default: 1440 mins, range: 1~1440 mins
The duration of Motion	When device is detected to move beyond this duration, it will locate the device position and upload a location data packet.
The duration of stationary	When device is detected to stop moving beyond this duration, it will locate the device position and upload a location data packet.
Report Interval during Motion/Min	The interval to locate the device position when device is in motion. After located, the device will report the data to network server.

Timing Mode: report data as scheduled. Ensure the device time is synced via ToolBox before switching to this mode.

Work Mode

| Timing Mode | ▼ |

Reporting Time Point

| Time Point 1 | 16:20 | ⊕ |

Parameters	Description

Reporting Time Point	One device can set at most 5 time points of every day to report data on Timing Mode.

3.5 Advanced Settings

3.5.1 Threshold Settings
Geofence:

When GNSS positioning is enabled, AT101 supports to set a round geofence range. AT101 will detect whether the location is within the radius range of preset coordinates. If the device is out of the range, it will upload threshold alarm packets; if it returns back to the range, it will upload a threshold alarm dismiss packet.

Note: after Geofence is enabled, it only works after next positioning.

Parameters	Description
Get Current Coordinates	Get current device coordinates for reference.
Radius/m	The geofence radius based on the coordinates. **Note:** The alarm is activated when the device is located 10 meters further than the set radius value; the alarm is dismiss when the device is located 10 meters closer than the set radius value.
Alarm Reporting Interval	After the threshold is triggered, the device will locate according to this reporting interval to detect if the threshold is still triggered.
Alarm Reporting Times	Alarm packet reporting times if the threshold is still triggered.

Tilt Threshold:

When the offset angle of any axis is more than 20° based on initial surface, the device will upload a tilt alarm packet; when offset angle of all 3 axis is within 20° based on initial surface, the device will upload an alarm dismiss packet.

Parameters	Description
Deflection Angle	Enable or disable to upload tilt alarm and alarm dismiss packets.
Setting	Click to set current position of device as initial position.
Clear	Change the initial position back to (0.00°, 0.00°, -90.00°)

Note: after writing **Setting** or **Clear** configuration, click **Read** to read the device to check if the initial position changes successfully.

3.5.2 Data Storage

AT101 sensor supports storing 1,300 data records locally and export data via ToolBox App. The device will record the GNSS data according to reporting interval even not joining to network. It will not record Wi-Fi scanning data locally.

1. Go to **Device > Status** of ToolBox App to click **Sync** to sync the device time.
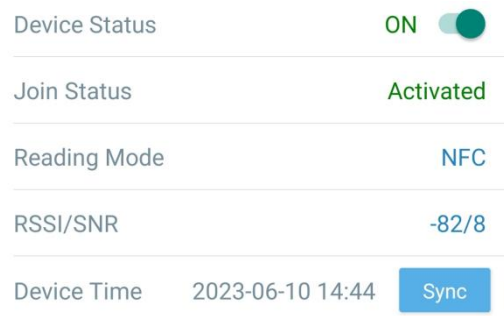
2. Go to **Device > Setting > General Settings** of ToolBox App to enable data storage feature.

3. Go to **Device > Maintenance** of ToolBox App, click **Export**, then select the data time period and click **Confirm** to export data. The maximum export data period on ToolBox App is 14 days.
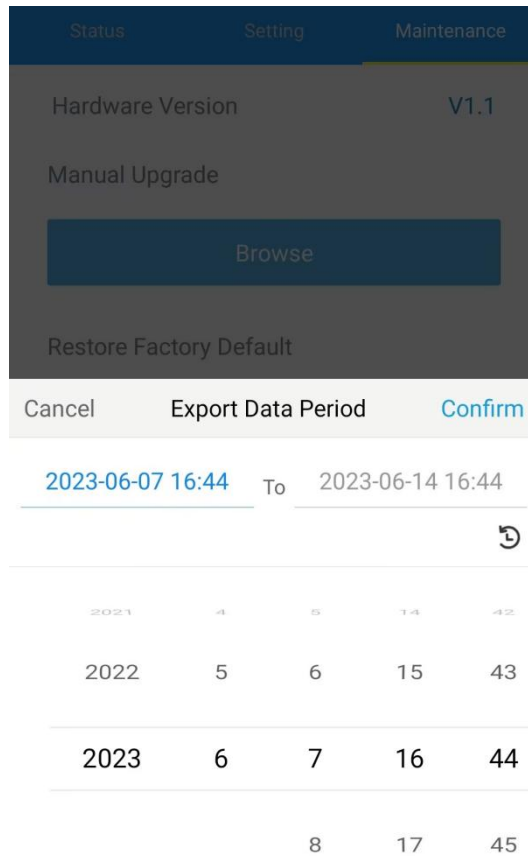
4. Click **Data Cleaning** to clear all stored data inside the device.

3.5.3 Data Retransmission

AT101 sensor supports data retransmission to ensure the network server can get all data even if 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 specifying time range, refer to section 5.3.

● 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 device re-connects the network.

Here are the steps for retransmission:

1. Go to **Device > Setting > General Settings** to enable data storage and data retransmission feature.

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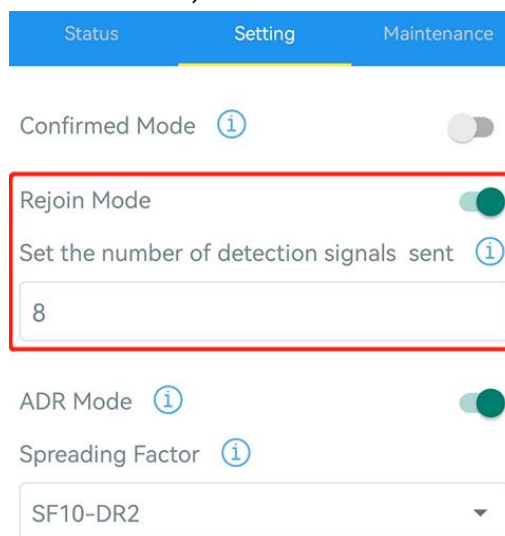nkCheckReq MAC packets to the network server regularly to check if the network is disconnected; if there is no response for 8+1 times, the join status will change to de-active and the device will record a data lost time point(the time to join the network).

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

Note:

1) If the device is reboot or re-powered when data retransmission is not completed, the device will re-send all retransmission data again after device is reconnected 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 "20ce", please refer to section 5.3.

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

3.6 Maintenance

3.6.1 Upgrade

1. Download firmware from Milesight website to your smartphone.

2. Open Toolbox App, go to **Device > Maintenance** and click **Browse** to import firmware and

upgrade the device.

Note:

1) Operation on ToolBox is not supported during a firmware upgrade.

2) Only Android version ToolBox supports the upgrade feature.

Status	Setting	Maintenance

SN   6745D19027970000

Model   AT101-470M

Firmware Version   V1.1

Hardware Version   V1.1

Manual Upgrade

Browse

3.6.2 Backup

AT101 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 which saved in the smartphone and click **Write**, then attach to another device to write configuration.

Template

Q

New Template

Please enter template name

AT101-470M_20230614

Cancel	OK

Save as a New Template

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

configurations.
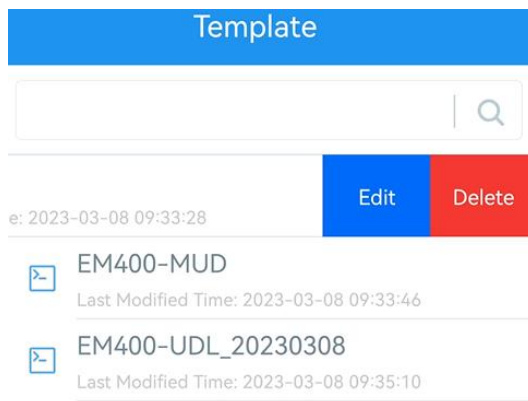
3.6.3 Reset to Factory Default

Please select one of following methods to reset device:

Via Hardware: Hold on power button (internal) for more than 10s.

Via ToolBox App: Go to **Device > Maintenance** to click **Reset**.
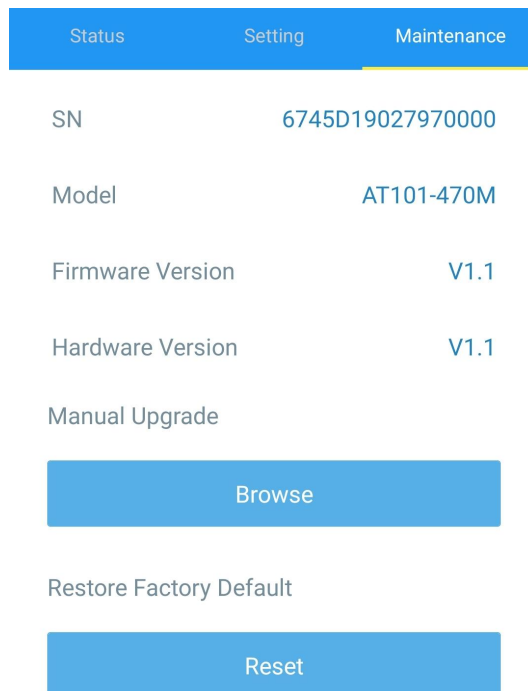
4. Installation

Fixed by 3M Tape:

Paste 3M tape to the back of device, tear the other side and attach it to the measured object. (Align the hole with the tamper button when pasting)
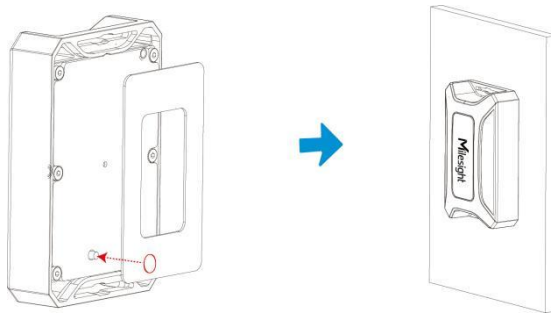
Fixed by Mounting Kits:

1. Drill two holes on the measured object according to the location of device mounting holes.

2. Put the device on the object, fix it to the object with two mounting screws and and screw the bolts into the mounting screws from the other side of the object.
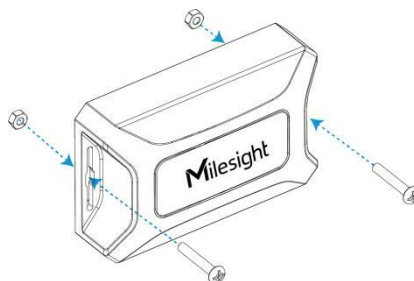
5. Device Payload

All data are based on 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 please find files on https://github.com/Milesight-IoT/SensorDecoders.

5.1 Uplink Data

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
	0f (Device Type)	00: Class A, 01: Class B, 02: Class C
	16 (Device SN)	16 digits
01	75(Battery Level)	UINT8, Unit: %
03	67 (Temperature)	INT16, Unit: °C
04	88 (GNSS Location)	Byte 1-4: latitude*1000000

		Byte 5-8: longitude*1000000
		Byte 9: Geofence + motion status
		Geofence(Bit 7-4): 0=within geofence, 1=out of geofence, 2=geofence disabled, 3=unknown
		Motion status (Bit 3-0): 0=unknown, 1=start moving, 2=in motion, 3=stop moving
		Note: If the device fails to get GNSS data, the latitude or longitude will show FFFFFFFF.
05	00 (Device Position)	00: Normal (Offset angle < 20°) 01: Tilt (Offset angle ≥ 20°)
06	d9 (Wi-Fi Location)	9 Bytes, Byte 1: id(00~FF), it will plus one every scan Byte 2-7: Wi-Fi BSSID (MAC address) Byte 8: RSSI, unit: dBm, INT8 Byte 9: Motion status, 00=unknown, 01=start moving, 02=in motion, 03=stop moving **Note:** If the device fails to get scan results, it will upload all as FF.
07	00(Tamper Status)	00: Device installed (Tamper button pressed) 01: Device un-installed (Tamper button released) **Note:** tamper status packet is fixed as confirmed packet.
83	67(Temperature)	Temperature (2 Bytes) + Alarm Status(1 Byte) Temperature: unit -- °C Alarm Status: 00 -Alarm dismiss 01 -Alarm
84	88 (GNSS Location)	Byte 1-4: latitude*1000000 Byte 5-8: longitude*1000000

		Byte 9: Geofence + motion status
		Geofence(Bit 7-4): 0=within geofence, 1=out of geofence, 2=geofence disabled, 3=unknown
		Motion status (Bit 3-0): 0=unknown, 1=start moving, 2=in motion, 3=stop moving
		Note: If the device fails to get GNSS data, the latitude or longitude will show FFFFFFFF.

Examples:

1. Device information: report once whenever join the network.

ff0bff ff0101 ff166745d19027970000 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)	745d190279 70000	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)

2. GNSS uplink: report when position strategy is GNSS positioning.

017564 03670a01 050001 0488debc770108ff080720					
Channel	**Type**	**Value**	**Channel**	**Type**	**Value**
01	75 (Battery)	64 => 100%	03	67 (Temperature)	f8 00 => 00 f8 = 248 * 0.1 =24.8 °C
Channel	**Type**	**Value**	**Channel**	**Type**	**Value**
05	00 (Device Position)	01=Tilt	04	88(Location)	Latitude: debc7701=>01 77 bc de=24624350/1000000=24.624350 Longitude: 08ff0807=>07 08 ff 08=118030088/1000000=118.030088 20=Geofence

					disable, motion unknown

3. Wi-Fi scan uplink: report when position strategy is Wi-Fi scan.

<table>
<tr><td colspan="6">017564 03671201 050001 06d90024e124f5b797b300 06d90024e124ff0004c800 06d90024e124f319a8c100 06d9000650c20eaa8dc500 06d90024e124f721c4b900</td></tr>
<tr><th>Channel</th><th>Type</th><th>Value</th><th>Channel</th><th>Type</th><th>Value</th></tr>
<tr><td>01</td><td>75 (Battery)</td><td>64 => 100%</td><td>03</td><td>67 (Temperature)</td><td>12 01 => 01 12 = 274 * 0.1 =27.4 °C</td></tr>
<tr><th>Channel</th><th>Type</th><th>Value</th><th>Channel</th><th>Type</th><th>Value</th></tr>
<tr><td>05</td><td>00 (Device Position)</td><td>01=Tilt</td><td>06</td><td>d9 (Wi-Fi Location)</td><td>ID:00 BSSID: 24e124f5b797 Signal: b3=-77 dBm 00=unknown</td></tr>
<tr><th>Channel</th><th>Type</th><th>Value</th><th>Channel</th><th>Type</th><th>Value</th></tr>
<tr><td>06</td><td>d9 (Wi-Fi Location)</td><td>ID:00 BSSID: 24e124ff0004 Signal: c8=-56 dBm 00=unknown</td><td>06</td><td>d9 (Wi-Fi Location)</td><td>ID:00 BSSID: 24e124f319a8 Signal: c1=-63 dBm 00=unknown</td></tr>
<tr><th>Channel</th><th>Type</th><th>Value</th><th>Channel</th><th>Type</th><th>Value</th></tr>
<tr><td>06</td><td>d9 (Wi-Fi Location)</td><td>ID:00 BSSID: 0650c20eaa8d Signal: c5=-59 dBm 00=unknown</td><td>06</td><td>d9 (Wi-Fi Location)</td><td>ID:00 BSSID: 24e124f721c4 Signal: b9=-71 dBm 00=unknown</td></tr>
</table>

4. Geofencing threshold alarm: when geofence is enabled, report when device goes out of geofence or goes into geofence.

	84887dbe7701e600090711	
Channel	**Type**	**Value**
84	88(Location)	Latitude: 7dbe7701=>01 77 be 7d=24624765/1000000=24.624765 Longitude: e6000907=>07 09 00 e6=118030566/1000000=118.030566 11=Out of Geofence, start moving

5. Tamper alarm: report tamper status and last location when tamper status changes. The location information are GNSS coordinates or Wi-Fi scan results depending on positioning strategy.

070001 0488ffffffffffffffff30					
Channel	Type	Value	Channel	Type	Value
07	00(Tamper Status)	01= unistalled	04	88(Location)	Latitude/longitude: FFFFFFFF 30=unknown

6. Tilt threshold alarm: report when deflection angle is enabled and device position changes.

050001		
Channel	Type	Value
05	00(Device Position)	01=Tilt

7. Temperature threshold alarm: report temperature and last location when the abrupt change of temperature is greater than 5 °C.The location information are GNSS coordinates or Wi-Fi scan results depending on positioning strategy.

8367220101 0488ffffffffffffffff30					
Channel	Type	Value	Channel	Type	Value
83	67 (Temperature)	Temperature: 22 01 =>01 22 = 290 * 0.1 = 29°C Alarm Status: 01= Alarm	04	88(Location)	Latitude/longitude: FFFFFFFF 30=unknown

5.2 Downlink Commands

AT101 supports downlink commands to configure the device. Application port is 85 by default.

Channel	Type	Description
ff	10 (Reboot)	ff
	17 (Time Zone)	2 Bytes, UTC timezone * 10
	71 (Positioning Strategy)	00: GNSS Positioning 01: Wi-Fi Scan 02: Wi-Fi Scan&GNSS Positioning
	3c (GNSS Positioning Duration)	1 Byte, unit: min
	2d (Wi-Fi Scan)	3 Bytes, Byte 1: 00 Byte 2: Number of BSSID Byte 3: Positioning Timeout , unit:s

	66 (Work Mode)	00: Periodic Mode 01: Motion Mode 02: Timing Mode
	8e (Reporting Interval)	3 Bytes, Byte 1: 00=Periodic mode reporting interval, 01= Motion mode reporting interval Byte 2-3: reporting interval time, unit: min
	13 (Report Interval during Motion)	3 Bytes, Byte 1: 00 = Disable; 01 = Enable Byte 2-3: report interval, unit: min
	58 (Duration of Motion and Stationary)	4 Bytes, Byte 1: 00=motion, 01=stationary Byte 2: 05 Byte 3-4: duration, unit: s
	8a(Reporting Time Point)	3 Bytes, Byte 1: time point from 00~04 Byte 2-3: minute
	68 (Data Storage)	00: disable, 01: enable
	69 (Data Retransmission)	00: disable, 01: enable
	6a (Data Retransmission Interval)	3 Bytes Byte 1: 00 Byte 2-3: interval time, unit:s range: 30~1200s (600s by default)
	7e (Geofence Setting)	4 Bytes, Byte 1: 00=disable, 01=enable Byte 2-3: Alarm reporting interval, unit: min Byte 4: Alarm reporting times
	88 (Geofence Coordinates)	8 Bytes, Byte 1-4: latitude*1000000 Byte 5-8: longitude*1000000
	89 (Geofence Radius)	4 Bytes: Radius*100, unit: m
	62 (Set Initial Position)	ff: set current position as initial position fe: set the initial position to (0.00°, 0.00°, -90.00°)

87 (Tamper Alarm)	00 = Disable; 01 = Enable
8f (Bluetooth)	00 = Disable; 01 = Enable

Example:

1. Set time zone as UTC-2.

ff17ecff		
Channel	**Type**	**Value**
ff	17	ec ff => ff ec = -20 the time zone is UTC-2

2. Set position strategy as GNSS positioning.

ff7100		
Channel	**Type**	**Value**
ff	71 (Positioning Strategy)	00: GNSS Positioning

3. Set periodic mode reporting interval as 1200 minutes.

ff8e00b004		
Channel	**Type**	**Value**
ff	8e (Reporting Interval)	00=Periodic mode reporting interval b0 04 => 04 b0 = 1200 minutes

4. Reboot the device.

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

5. Set report time point as 20:00.

ff8a04b004		
Channel	**Type**	**Value**
ff	8a(Reporting Time Point)	Time point: 04 b0 04=>04 b0=1200 minutes=20:00

6. Set the geofence coordinates.

ff88 7dbe7701e6000907		
Channel	**Type**	**Value**
ff	88 (Geofence Coordinates)	Latitude: 7dbe7701=>01 77 be 7d=24624765/1000000=24.624765 Longitude: e6000907=>07 09 00 e6=118030566/1000000=118.030566

5.3 Historical Data Enquiry

AT101 supports sending downlink commands to enquire historical data for specified time point or time range. Before that, ensure the device time is correct and data storage feature was enabled to store the data.

Command format:

Channel	Type	Description
fd	6b (Enquire data in time point)	4 Bytes, unix timestamp
fd	6c (Enquire data in time range)	Start time (4 bytes) + End time (4 bytes), Unix timestamp
fd	6d (Stop query data report)	ff
ff	6a (Report Interval)	3 Bytes, Byte 1: 01 Byte 2: interval time, unit: s, range: 30~1200s (60s by default)

Reply format:

Channel	Type	Description
fc	6b/6c	00: data enquiry success 01: time point or time range invalid 02: no data in this time or time range
20	ce (Historical Data)	Data time stamp (4 Bytes) + Longitude (4 Bytes)+ Latitude (4 Bytes)

Note:

1. The device only uploads no more than 300 data records per range enquiry.

2. When enquiring the data in time point, it will upload the data which is the closest to the search point within the reporting interval range. For example, if the device's reporting interval is 10 minutes and users send command to search for 17:00's data, if the device find there is data stored in 17:00, it will upload these data. If not, it will search for data between 16:50 to 17:10 and upload the data which is the closest to 17:00.

Example:

1. Enquire historical data between 2023/6/15 15:45:00 to 2023/6/15 15:55:00.

fd6c 7cc18a64 d4c38a64		
Channel	**Type**	**Value**
fd	6c (Enquire data in time range)	Start time: 7cc18a64=> 648ac17c = 1686815100s =2023/6/15 15:45:00 End time: d4c38a64 => 648ac3d4 =

		1686815700s =2023/6/15 15:55:00

Reply:

fc6c00		
Channel	**Type**	**Value**
fc	6c (Enquire data in time range)	00: data enquiry success

20ceccc28a64e60009077dbe7701			
Channel	**Type**	**Time Stamp**	**Value**
20	ce (Historical Data)	ccc28a64 => 648ac2cc => 1686815436s = 2023-6-15 15:50:36	Longitude: e6000907=>07 09 00 e6=118030566/1000000=118.030566 Latitude: 7dbe7701=>01 77 be 7d=24624765/1000000 =24.624765

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