User Manual

ST4250

Suntech International Ltd.

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Disclaimer

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Warning

Our customers are required to be aware that connecting the wire inputs can be hazardous to both of the installer and your vehicle’s electrical system(s) if not done by an experienced installer. This document assumes you are aware of the inherent dangers of working in installing the device on the vehicle(s) and the machinery.

Document Amendments

When it comes to the firmware version column with specific firmware number, any amendment(s) on the comments column should be made on this relevant firmware version (and the versions thereafter). Before applying any changes made in this protocol, you are required to make sure that you have upgraded the firmware suitable for the specified version.

1. Introduction

ST4250

The ST4250 is a vehicle tracking and controlling device. It is designed to collect location data through GPS technology, various vehicle conditions through event lines, and interact remotely with its server by using GPRS/LTE Cat M-1 technology.

In order to make the vehicle tracking system work, device should be configured and installed properly on a vehicle whose geographical position and/or state is desired to be remotely monitored and/or controlled.

Please note that this User Manual is for the standard model. In case specific requirements are incorporated into this Manual, such a manual applies only for the case.

For overall operation including installation, in addition to the 'Device Manual', users should refer to other documents such as Parameter Manual, Commands Manual, Reporting Manual and so on.

2. Overview

Main function of device installed on a vehicle is to report vehicle location and status to its monitoring server at predefined interval and to deliver command coming from the server for activating any appliance connected to the device.

2-1. Operation modes

The device works in one of the four (4) operation modes below.

- Parking(Idle) mode:
  - ✓ This mode is operational when 'Ignition' is OFF for duration longer than the pre-defined time.
  - In the parking (idle) mode, the device can get into special modes for power saving like 'Sleep mode' and 'Deep sleep mode'. These power saving modes are described in more details in the end of this document.
- Driving mode:
  - ✓ This mode starts when 'Ignition' of the vehicle is ON.
- Idle mode:
  - ✓ The speed and movement of the vehicle are not detected.
- Speeding mode:
  - ✓ Vehicle movement is detected and the vehicle speed exceeds the limited speed..

2-2. Reports sent by device

There are 3 types of report/response sent by device to the server as follows:

- ✓ Reports (Status / Alerts)
- ✓ Keep-alive report,

2-3. Parameter change

Parameters which have already been set on the device can be changed via GPRS/LTE CAT M-1 or via SMS or via RS232 connected with PC if a user needs to do so. Some controlling functions can also be implemented in the same way.

2-4. Features

Key features of the ST4250 device are as follows:

- Unifed Protocol

- ✓ Support standard report format fixed to all models.
- ✓ Customer can select only the data they want from the data included in the report, so that they can configure their own report format.

- Multiple Modes

- ✓ Customer can set up multiple modes of operation so they can see more detailed routes as needed.
- ▪ Each operation mode consists of PARKING/DRIVING/IDLE/SPEEDING

- PROFILE

- ✓ By introducing the concept of profile. It is possible to selectively use a preset profile for each mode.
- ▪ Each profile consists of "Time interval, Travel distance, Travel angle" setting value.

- ✓ Detailed travel route can be confirmed.
- ▪ Because DEVICE judges the three conditions together and reports, you can check the detailed route of the vehicle.

- Power Saving Modes (Power Down Modes)

- ✓ The device can save power consumption of the battery by using one of two modes such as Sleep Mode or Deep Sleep Mode.

- Event Lines

- ✓ Device has 1 output lines, 1 input lines and one ignition line.
  Please refer to Chapter 3-1

- LED Indicators

- ✓ The LEDs indicate GPRS/LTE CAT M-1 and GPS status. It is helpful to check what error(s) and why such an error has occurred.
  Please refer to Chapter 3-4

- Maintenance server support

✓ Upgrading Firmware by Over The Air (Firmware OTA)

- Checking Status of Main Power Source

Device recognizes its connectivity with the main power source (i.e. vehicle's battery) and is able to inform the server about status on whether or not the main power line is disconnected. The device is also able to inform the server about the voltage level status of the main power source and informs the server in case the voltage level of the main power source drops down below the pre-set value. This function is applicable to battery-installed device models only.

- Alerting Battery Error

Device sends an alert when a battery charging error occurs. This function is applicable only to the device models available with back-up battery.

3. DETAILED DESCRIPTION ON EVENT LINES AND FEATURES

3-2. Immobilizer

If output type is set to 'Immobilizer' or 'Immobilizer & Auto Active' and you connect this line to immobilize the vehicle, the Output line can use the immobilizer.

When the device receives command to activate the immobilizer output, one of the 2 options ('Active' or 'Inactive') will be selected.

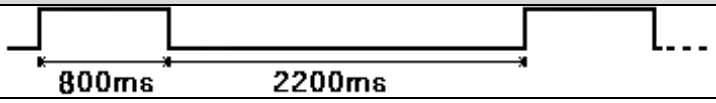
Once the command is sent to enable the immobilizer function of vehicle, the effect will only take once the ignition is turned off. At that point the vehicle will be immobilized until the command is sent to disable the function.

In a case that the Output type is set to 'Immobilizer & Auto active', the output is activated automatically as long as the vehicle is parked.

3-3. Alert of Buzzer

In a case that the Output type is set to 'Buzzer', the buzzer alerts. The following table shows such cases:

3-3-1. Related with over-speed

Condition	Alert Pulse	Meaning
Over-speed (Out = Buzzer)		When vehicle's speed exceeds the over-speed value.

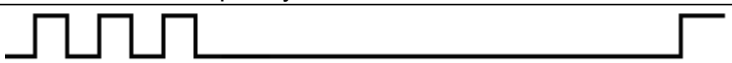
3-4. Indication with Two(2) LEDs

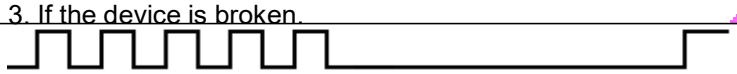
RED LED indicates GPS status and blue LED indicates GPRS/LTE CAT M-1 status while the device is not processing call.

3-4-1. Red LED for GPS

GPS	Blink Count	Meaning
Normal	1	
No Fix	2	 **<Probable Situations>** 1. If power is on, GPS chipset tries to find position for some minutes. 2. If device has weak connectivity with GPS network or if it has no GPS signal position. 3. If GPS connectivity with a device is weak.
GPS Chipset Error GPS Antenna Error	4	 **<Probable Situations>** 1. If GPS antenna is disconnected. 2. If GPS antenna or socket of GPS antenna is broken. 3. If device is broken.

3-4-2. Blue LED for GPRS/LTE CAT M-1

GPRS/LTE CAT M-1	Blink Count	Meaning
Normal	1	
Server Com. Error	2	 **< Probable Situations >** 1. If the server or network parameter is wrong. 2. If the server is closed. 3. If there is a temporary network barrier.
GPRS/LTE CAT M-1 Com. Error	3	 **<Probable Situations >** 1.If network parameter is wrong. 2. If SIM is blocked and it is impossible to use GPRS/LTE CAT M-1 session. 3. If there is a temporary network barrier.

		4. If device receives weak GPRS/LTE CAT M-1 signal. 5. If GPRS/LTE CAT M-1 connectivity with a device is weak.
No Network	4	 **< Probable Causes>** 1. If GPRS/LTE CAT M-1 antenna is disconnected. 2. If GPRS/LTE CAT M-1 antenna or socket of GPRS/LTE CAT M-1 antenna is broken. 3. If the device is broken.
SIM PIN Locked	5	 **<Probable Situation >** 1. If SIM PIN is enabled.
Cannot Attach NW	6	 **< Probable Situations>** 1. If device receives weak GPRS/LTE CAT M-1 signal. 2.If GPRS/LTE CAT M-1 connectivity with a device is weak.
No SIM	7	 **< Probable Situations >** 1. If there is no SIM or if SIM is not inserted properly. 2. If SIM or SIM socket is broken.
SIM PUK Locked	8	 <Probable Situation > 1. If SIM PUK is enabled.

3-5. Power Saving

The device can save power consumption of the battery by using one of two modes such as Sleep Mode or Deep Sleep Mode. If PWR_DN is set with '1' or '2' and report interval in parking mode is made every 10 minutes or longer than 10 minutes to enable the devices to process power down while the vehicle is in parking situation.

However, there are some restrictions in processing power down:

- When GPS signal is not fixed, the device can start to process power down after trying to fix for 5 minutes.
- If communication with the server fails continuously, the device processes Deep Sleep after trying to make communications for 8 minutes.
- While the device is in deep sleep, it cannot process charging the backup battery.

Device turns off LED and sends a status report and a related alert before entering the power-down functionality.

The device terminates power down either when ignition is ON. In such cases, the device sends related alert and status string, instead.

- Sleep

Device turns off only GPS part and GPRS/LTE CAT M-1 part enters Sleep. Even for time of Sleep, all communication with the server works normally and the device can receive SMS or call always. Average of Sleep current is lower than 10mA and this current may be increased under weak GPRS/LTE CAT M-1 condition.

- Deep Sleep

Device turns off GPS and GPRS/LTE CAT M-1 part. For the time of Sleep, all communication with the server is impossible and it cannot receive any SMS messages, either. Device turns on GPRS/LTE CAT M-1 session every max. 30 minutes. However, the device cannot receive SMS or call while it is in Deep Sleep. Average current during Deep Sleep mode is around 5mA (non-battery version).

3-6. BackupBattery

The device has a backup battery in order to be prepared for any emergency cases when the main power source is removed or sabotaged. When the vehicle is stolen and power of device is removed, the backup battery starts working as a replacement power source for the main power source (the vehicle's battery).

The device was designed to keep backup battery staying as effective as possible all the time. Charging the backup battery starts if voltage of the backup battery goes below 4,2V.In a parking mode, charging the backup battery is hold when the main power source gets consumed down to 90% of the normal voltage level.

The charging algorithm for the backup battery has a protection against over-voltage, abnormal charging current and high temperature.

In addition, the device alerts about battery error if the backup battery cannot be charged.

3-7. Motion Sensor

<About How to activate Motion Sensor>

- Ignition ON (Driving)

The sensor mode goes to collision detection mode. So, if the vehicle has a car accident, the accident may bring about a big impact of which value is higher than that of the specified collision threshold (COLL_THRES). In this case the device will be reporting a collision message to the server.

After a collision is made against the vehicle, the sensor will be disabled for a while (30 seconds) so as to avoid sending to the server the same message as the first one repeatedly.

- Ignition OFF (Parking)

'Ignition Off 'situation means that the vehicle is in state of parking and that the sensor goes to 'parking mode'(shock or movement detection mode).

In this situation, if there is a shock made on the vehicle by somebody, the device will report a shock message to the server. The device will also exit from the power down mode if the device has been in power down mode.

After triggering an event such as a shock or a movement, the sensor will be disabled for a while (for 30 seconds) so as to avoid sending to the server the same message as the first one repeatedly.

<About Threshold>

- Collision Threshold

Our recommendation is 0.7 but it is only for reference value obtained from our field testing made on real vehicles (nearby gear).The value may vary in a real situation depending upon driving manner or condition of road. So, you need to check this value.

- Shock Threshold

Our recommendation is 0.04 but it is only for reference value obtained from our field testing made on real vehicles (nearby gear).Motion sensor is installed on an inside part of the vehicle's body to measure sensitivity value(s) created by vibration and shock impact given to the vehicle. Value of this sensitivity varies because it depends on what body part of the vehicle the motion sensor is installed.

Shock Threshold is also used for checking movement of vehicle. So, the device may not be able to recognize if a shock threshold value is too high. You need to consider these kinds of factors measurable under realistic environment when you also adjust the values.

State	Detection			Exit from Power down			Reporting about:		
	Motion	Shock	Collision	Motion	Shock	Collision	Motion	Shock	Collision
Parking	ON	Enable	X	Exit	Exit	Exit	X	Enable	X
Driving	OFF	OFF	Enable	X	X	X	X	X	Enable

<Notes>

- ON: Activation.
- OFF: Deactivation.
- Enable: Enable or Disable by setting.
- X: Please, do not care.

For setting method, please refer to “Motion Sensor Parameter Settings”.

[Caution]: Basically, the device checks any motions in parking mode(Ignition Off). It does not care about the enable flags such as COLL_EN or SHOCK_EN. This means that, if the device senses any motion (movement) created in the power down mode, it will exit from the power down mode as if a creature would wake up from sleeping suddenly. So, if you want to check the power down mode to save power consumption of the backup battery, DO NOT give any impacts to the vehicle.

3-8. Protection of Vehicle Battery

For a period of duration that the vehicle has been in a parking mode for a long time by consuming vehicle’s battery down to a very low level, the device starts entering the Deep Sleep Mode automatically. This situation happens because the device intends to prevent vehicle’s battery from wasting power. In this case, the device alerts with ALERT_ID 14 before entering the deep sleep mode, and exits from the deep sleep mode either when ignition line goes to ‘ON’ or until the voltage level is increased sufficiently.

The vehicle’s battery level for protection can be changed by making a Command. Refer to Voltage control parameters section.

3-9. Storage of Reports un-sent

Device has maximum storage capacity of the un-sent reports in such cases as follows:

- 3,000 reports (**),
- 1024 bytes for the response that the command has required the device to respond with as command response

  Note (**):

  Due to bad report-routing environment, device could not make a real-time based reporting. For example, the reporting router does neither run properly, is nor connected properly. In such a situation there might be a report which has consequently failed to arrive in the server successfully after making several attempts to send the report to the server. In that case, the device stores such a report for a while until such environment (e.g. GPRS/LTE CAT M-1 network) gets back to normal to enable the device to try to send the report to the server again.

  When ‘reports’ start being accumulated, max 3000 reports can be hold in the buffer storage of the device. If those ‘reports’ are triggered out to the server, the oldest report is erased first and a new report is buffered if the buffer is completely full of those reports. And then, a new status report enters (FIFO: First In First Out as a sequential system).

REVISIONS

Rev. No.	Date	Modifications were made on:	Writer
Rev. 1.00	2020-07-27	Draft a manual	KSH
Rev. 1.01	2020-09-28	Changed model name	SJSONG

- End of the Document -

Caution
Modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

IMPORTANT NOTE:
FCC RF Radiation Exposure Statement: This equipment complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.
FCC Compliance Information : This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

*. Caution
- Don't use USB Connect. USB Connect is only use for production.
- This product is fixed to the vehicle.
- Backup battery is used when the vehicle power is off.

Contain FCC ID: XMR201910BG95M3