



User Manual

GPS&GPRS CONTAINER TRACKING  
SYSTEM

CTS100 SERIES

11/18/2008

Version 2.1

## I. BRIEF INTRODUCTION

Container Tracking System utilizes the GPS and GPRS functions in one unit. You can monitor the container or the vehicle location and set the system remotely. In addition, the unit will send event report if any trigger occurs.

The standard report sent by the unit includes the information: (1) unit's ID, (2) status, (3) time, (4) GPS's latitude and longitude, (5) speed, (6) direction, (7) battery level, (8) device's status, (9) event number, and (10) report configuration parameters.

The reporting mode can be categorized as 'normal' mode, and 'power saving' mode. In normal mode, the GPS will always be activated while moving, and it can be shut off the GPS when stop (for power saving purpose). To enable the maximum power saving, user can choose "power saving mode". In this mode, the GPS will be activated only when there is a report to send while moving. The report parameters can be set from the PC setup program. CTS100 can be set to go in sleep mode (while not moving); the system will cut the power of GPS module in order to save power. With build-in 3-D acceleration sensor, CTS100 can select related reporting modes with respect to it is moving or not.

The device has built-in 4 circular, 5 rectangular and 20 point Geo-fence; it will send the report to the server if the Geo-fence event is triggered.

The UNIT must be initialized by PC setup program in order to make communication with the remote server /call center. There are four main sections that allow users to program the device, (1) User detail (Device ID, server IP, and port, GPRS APN...) (2) Geo-fence (4 circular, 5 rectangular and 20 point Geo-fence) (3) Report (Time, Distance, speed, Low battery ...) (4) Trigger report (Tamper, Door)

When there is no GPRS service or the server close. The unit will send short message to the preset number. The max number of SMS message (monthly usage) and the monthly renew date can be set from the pc setup program or the remote setup program. Only 1 SMS number can be set. The reports sent via the SMS will be out again via GPRS after a valid GPRS connection is made.

CTS100 can be configured by the PC setup program or the Over-the-Air (OTA) commands / or remote program. The unit can communicate with the server via UDP or TCP protocol. The protocol can be selected from the PC-setup program or remote server commands.

Flash memory for recording reports up to 900 reports. It can be read out from the PC setup program via serial port.

Using built-in real time clock to identify the report time, when GPS signal is lost. Hence, if the report is received with "LAST KNOWN" message, the time in the report will be the real time clock, but the GPS position will be the last known valid GPS position.

Three LED indicate the status of the system:

Power indicator: When the unit power on, the led will flash 1time/3sec by green. If the power has low status, the LED will change to red, and the red LED will keep on when charging mode. Even battery charge finished, the power LED will change to green. If tamper switch is triggered, the power indicator will flash twice continuously; if door sensor is triggered, the power indicator will flash 5 times continuously

GPS indicator: LED is GREEN when the unit has acquired a valid GPS signal, and it will flash when the unit is searching GPS signal.

GSM/GPRS indicator: Orange LED will flash when the device is connected to the server with valid GPRS connection. It will stay continuously on when it is in GSM mode. It will stay off if there is no GSM reception.

Note that the GSM/GPRS and GPS LED's indication will not be valid until the system goes to the working mode, normally 30 seconds after power on.

## II. The main unit's housing with Strong Magnetic Gives You Easy Instant Install Placement!

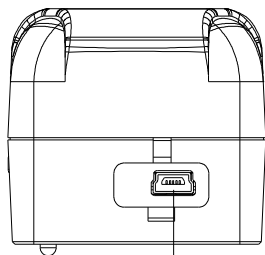
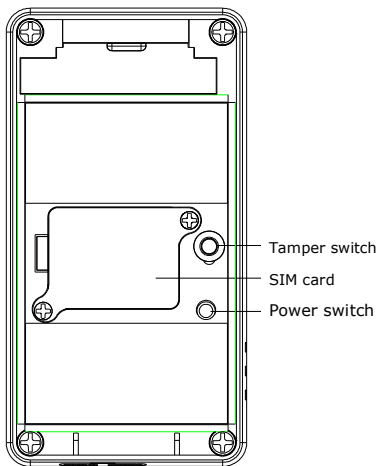
Just like we put you in control on how and when your CTS100 reports to you with your own online controls, we also put YOU in control of how you want your CTS100 installed on any container or vehicle.

In addition, the unit has built-in door magnetic sensor, it used to detect the container door status.

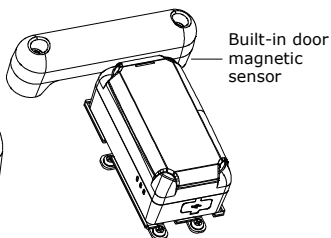
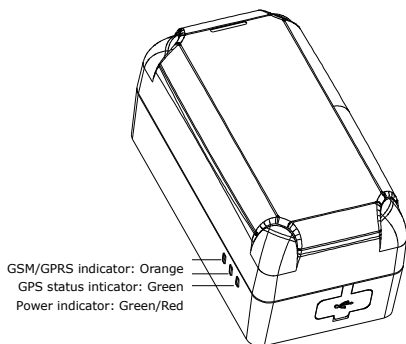
## III. BASIC FUNCTIONS

FUNCTIONS	APPLICATIONS
GPS	GPS receiver will output a complete position, velocity, and time (PVT) solution in the NMEA Version 3.0 protocol.
GPRS, SMS	GPRS use standard TCP or UDP communicate protocol. If the GPRS service is failed, the SMS mode will be turned on for emergency use.
Button	Power switch
PC-setup	Initialize the unit and program the device, including Network APN, server IP address, user message, report control, and Geo-fence setting, etc ... Note that Network APN and server IP details must be set before the installation.
Standard Report	Automatic report for tracking purpose: Fixed time report Fixed distance report Trigger report
History data store	900 reports can be saved in unit and read from server and pc-setup

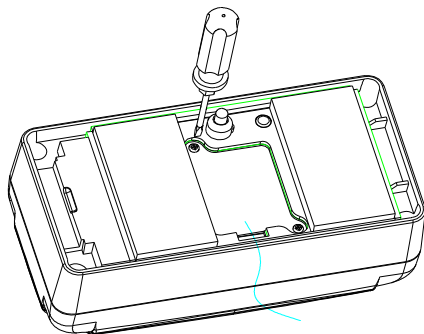
#### IV. PANEL INSTALLATION



USB port

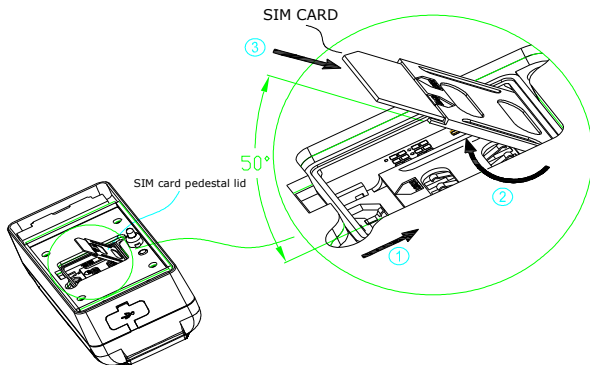


## SIM card inserting guide:

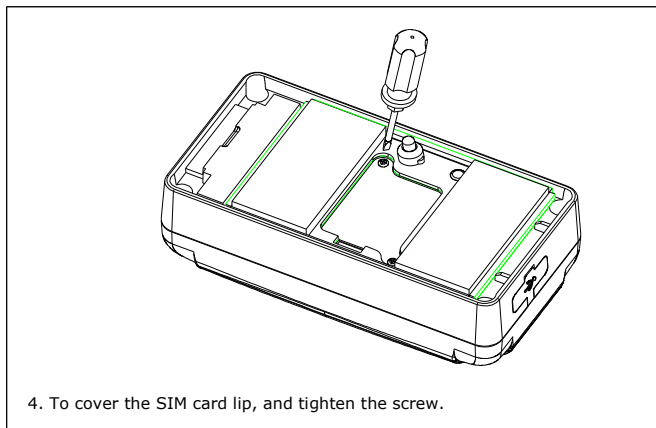
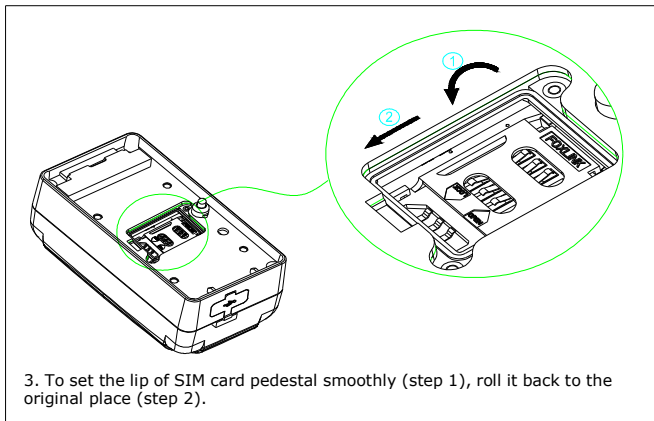


SIM CARD LID

1. Using screwdriver to screw the screw, take out the SIM card lid.

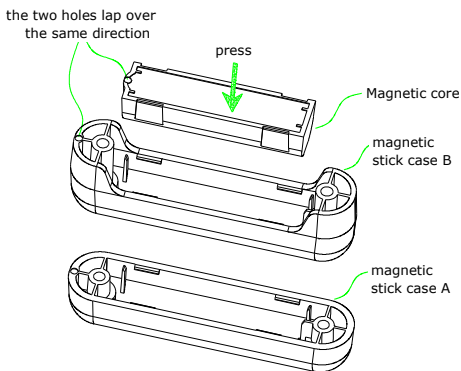


2. To jog SIM card pedestal lid (step 1), then opened it about 50° (step 2) inserting SIM card (step 3)

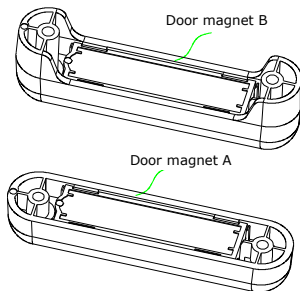


## CTS100 magnetic stick installation guide

- a) Press the magnetic core into magnetic stick case. (To choose case A or B base on needed height)

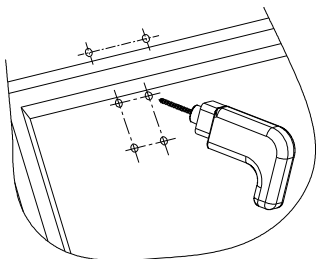


- b) Done

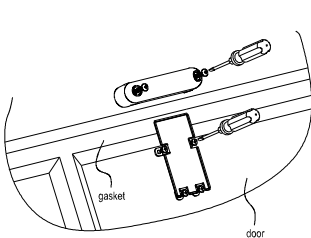


## CTS100 Installation guide (Project one: vehicle doors with gasket)

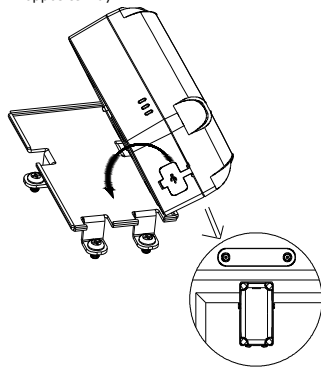
a) Drill adequate screw hole for holder and magnetic pillar.



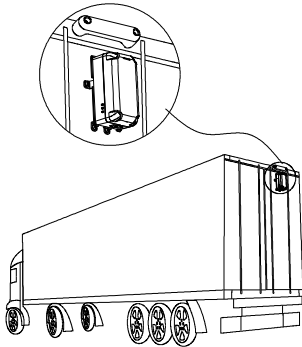
b) Fix holder and magnetic pillar in appropriate position.



c) Please see the following picture, when install the CTS100, please put one side of it on the holder, then turn it to make the whole underside flat with the holder, when disassembly, please take it down on the opposite way.



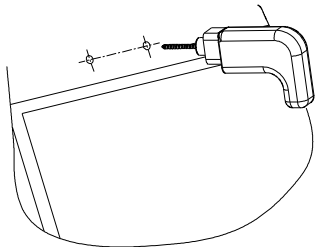
d) Done



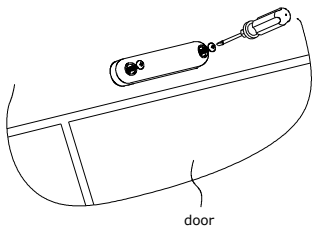
## CTS100 Installation guide (Project two: vehicle doors without gasket)



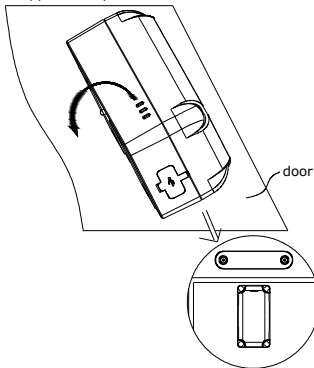
a) Drill adequate screw hole for magnetic pillar.



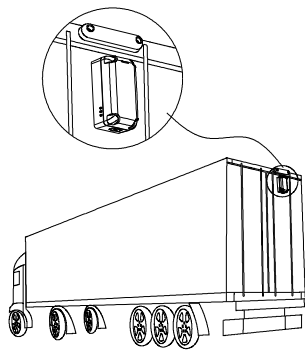
b) Fix magnetic pillar in appropriate position.



c) Please as follow picture, when install the CTS100, please put one side of it on the door of the car, then turn it to make the whole underside flat with the door, when disassembly, please take it down on the opposite way.



d) Done



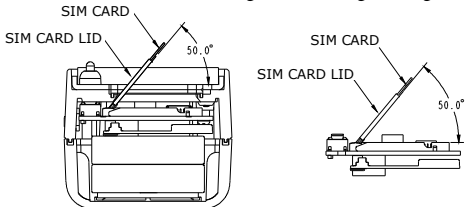
## V. PC SETUP AND SYSTEM INITIATION

#### PC setup Procedure:

- 1.) Connect the standard RS232 cable to the DB9 port.
- 2.) Open the PC setup program.
- 3.) Select the correct COM port for communication.
- 4.) Click "OK" to start the program
- 5.) Power on the device.

Note that, if the connection fails, please check the cable connection is secured correctly.

Note: Turnover SIM card lid angle as following drawing.



#### A. LOGIN dialog window

Connect UNIT DB9 port to the PC serial port with a standard serial cable. Select the COM port, and click "OK".

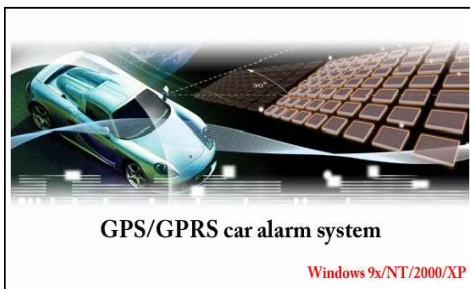


Note that: it is necessary to power on the device soon after starting the PC setup program. PC setup program will detect the hardware for 60 seconds. If no hardware is detected, it will exit.

During the opening up screen shown as below, user can press "Esc" key to terminate the program.

#### B. Version No. Checking

The below interface will last until correct UNIT Version No. is checked. (You should run this program before turn on power of UNIT)



### C. MAIN INTERFACE

#### 1. [User detail]:

The screenshot shows the 'User Detail' window of the CTS100 software. It includes the following fields and sections:

- Version:** [Empty field]
- SIM PIN:** [Empty field]
- IMEI:** [Empty field]
- Device ID:** [Empty field]
- Device Password:** [Empty field]
- Connect Mode:** Radio buttons for  GPRS mode and  SMS mode.
- GPRS login information:**
  - APN:** [Empty field]
  - User Name:** [Empty field]
  - Password:** [Empty field]
- Server information:**
  - TCP IP Address: [Empty field] Port: [Empty field]
  - UDP IP Address: [Empty field] Port: [Empty field]
- SMS:**
  - Primary SMS number:** +123456789
  - Max SMS(1-65535):** [100]
  - Renew date(1-28):** [1]
- Export History Record:**
  - To Text
  - To Excel
  - Export** button

At the bottom of the window, there is a toolbar with buttons: Initialize, Request All, Request, Apply, Apply All, Load..., Save..., Add to Database, and Exit.

**SIM PIN:** [Empty input field]

If the SIM card is password protected, user can input the “SIM PIN” window to set password of SIM Card.

IMEI

357262006738137

IMEI: Any operate with 'request or request all' after GPRS power on, the module series number will display automatically, otherwise it displayed with space.

Device ID:

Device Password:

Set UNIT ID and UNIT password of for the device.

Connect Mode

GPRS mode

SMS mode

To select communication with GPRS or SMS, when select SMS communication; the GPRS login information and server information are reverse video.

GPRS login information:

APN:

User Name:

Password:

Set Access Point Name (APN), User Name, Password. The maximum length of the APN, User name and Password is 49 characters.

Server information:

TCP IP Address:

192.168.192.168

Port:

99999

UDP IP Address:

Port:

TCP/UDP address and Port number of alarm center being set, UNIT will send message to these address.

Note that either TCP or UDP should be selected.

Note: the IP address and port must input correctly, otherwise it will cause fail to make a call.

SMS

Primary SMS number:

Max SMS(1-65535):  Renew date(1-28):

Set the primary SMS Number of the server. The unit will send reports to the server if GPRS connection is failed.

Setup the max number of the SMS can be sent out from the unit every month. By default, it will be renewed by the first date of every month.

Export History Record

To Text

To Excel

UNIT can save 900 reports (900-1). Click 'Export' button can export them with Excel or Text format.

Initialize Request All Request Apply Apply All Load... Save... Add to Database Exit

“Initialize” button: clear all data in UNIT.

Request All: read out the whole existing setting from CTS100.

Request: read out the setting in the current page.

Apply: transfer the setting to CTS100 in the current pages.

Apply All: transfer the whole setting to CTS100.

Load: load the saved configuration files.

Save: save the current configuration setting to a file.

Add to database: Add the current configuration to database

“Exit” button: exit PC-Setup to main program.

## 2. [Geo-fence]:

CTS100

User Detail Geofence Report Alarm

Circular Type Origin Format Example : N2446.5321E12120.4231

No.	Origin	Radius Km
<input type="checkbox"/> 1.		
<input type="checkbox"/> 2.		
<input type="checkbox"/> 3.		
<input type="checkbox"/> 4.		

Point Type, Format Example : N2446.5321E12120.4231

No.	Point	Send	Ignore
1.		<input type="radio"/>	<input checked="" type="radio"/>
2.		<input type="radio"/>	<input checked="" type="radio"/>
3.		<input type="radio"/>	<input checked="" type="radio"/>
4.		<input type="radio"/>	<input checked="" type="radio"/>
5.		<input type="radio"/>	<input checked="" type="radio"/>
6.		<input type="radio"/>	<input checked="" type="radio"/>
7.		<input type="radio"/>	<input checked="" type="radio"/>
8.		<input type="radio"/>	<input checked="" type="radio"/>
9.		<input type="radio"/>	<input checked="" type="radio"/>
10.		<input type="radio"/>	<input checked="" type="radio"/>
11.		<input type="radio"/>	<input checked="" type="radio"/>
12.		<input type="radio"/>	<input checked="" type="radio"/>
13.		<input type="radio"/>	<input checked="" type="radio"/>
14.		<input type="radio"/>	<input checked="" type="radio"/>
15.		<input type="radio"/>	<input checked="" type="radio"/>
16.		<input type="radio"/>	<input checked="" type="radio"/>

Rectangular Type Format Example : N2446.5321E12120.4231

No.	Upright point	Downleft point	Send	Ignore
1.			<input type="radio"/>	<input checked="" type="radio"/>
2.			<input type="radio"/>	<input checked="" type="radio"/>
3.			<input type="radio"/>	<input checked="" type="radio"/>
4.			<input type="radio"/>	<input checked="" type="radio"/>
5.			<input type="radio"/>	<input checked="" type="radio"/>

Initialize Request All Request Apply Apply All Load... Save... Add to Database Exit

Circular Type Origin Format Example : N2446.5321E12120.4231

No.	Origin	Radius Km
<input type="checkbox"/> 1.		
<input type="checkbox"/> 2.		
<input type="checkbox"/> 3.		
<input type="checkbox"/> 4.		

### Four Circular Geofence

Circular Geofence must set origin and radius:

Origin format :N2446.5321E12120.4231;

N2446.5321 is latitude, E12120.4231 is longitude.

Radius from 0.1 km to 1000km.

Rectangular Type Format Example : N2446.5321E12120.4231

No.	Upright point	Downleft point	
1.	<input type="text"/>	<input type="text"/>	<input type="radio"/> Send <input checked="" type="radio"/> Ignore
2.	<input type="text"/>	<input type="text"/>	<input type="radio"/> Send <input checked="" type="radio"/> Ignore
3.	<input type="text"/>	<input type="text"/>	<input type="radio"/> Send <input checked="" type="radio"/> Ignore
4.	<input type="text"/>	<input type="text"/>	<input type="radio"/> Send <input checked="" type="radio"/> Ignore
5.	<input type="text"/>	<input type="text"/>	<input type="radio"/> Send <input checked="" type="radio"/> Ignore

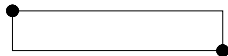
Five rectangular geofence:

Set two points position, the point format is N2446.5321E12120.4231;

User can set the reports send or ignore:

Send: report will send out immediately if generation

Ignore: cancel reports.



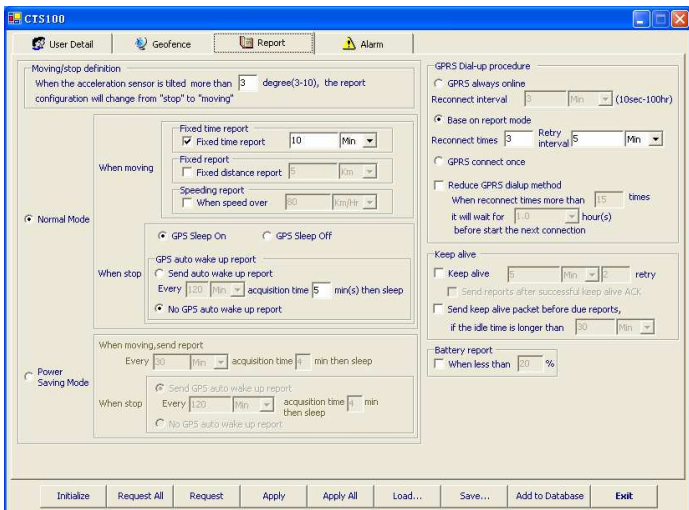
With two points, generate one rectangle. Unit will detect whether in rectangle. When unit enter or leave rectangle, will send one message out.

Point Type, Format Example : N2446.5321E12120.4231

No.	Point	
1.	<input type="text"/>	<input type="radio"/> Send <input checked="" type="radio"/> Ignore
2.	<input type="text"/>	<input type="radio"/> Send <input checked="" type="radio"/> Ignore
3.	<input type="text"/>	<input type="radio"/> Send <input checked="" type="radio"/> Ignore
4.	<input type="text"/>	<input type="radio"/> Send <input checked="" type="radio"/> Ignore
5.	<input type="text"/>	<input type="radio"/> Send <input checked="" type="radio"/> Ignore
6.	<input type="text"/>	<input type="radio"/> Send <input checked="" type="radio"/> Ignore
7.	<input type="text"/>	<input type="radio"/> Send <input checked="" type="radio"/> Ignore
8.	<input type="text"/>	<input type="radio"/> Send <input checked="" type="radio"/> Ignore
9.	<input type="text"/>	<input type="radio"/> Send <input checked="" type="radio"/> Ignore
10.	<input type="text"/>	<input type="radio"/> Send <input checked="" type="radio"/> Ignore
11.	<input type="text"/>	<input type="radio"/> Send <input checked="" type="radio"/> Ignore
12.	<input type="text"/>	<input type="radio"/> Send <input checked="" type="radio"/> Ignore
13.	<input type="text"/>	<input type="radio"/> Send <input checked="" type="radio"/> Ignore
14.	<input type="text"/>	<input type="radio"/> Send <input checked="" type="radio"/> Ignore
15.	<input type="text"/>	<input type="radio"/> Send <input checked="" type="radio"/> Ignore
16.	<input type="text"/>	<input type="radio"/> Send <input checked="" type="radio"/> Ignore

20 point Geo-fence areas can be set. When UNIT is out of these predefined zones, a report will be generated.

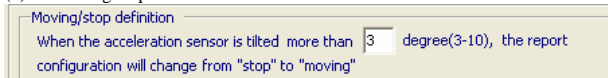
3. [Report]:



Report setup can be configured in this section. To activate the function(s), please select “√” in checkbox and fill in data in the textbox. There are 2 modes for the CTS100, first is the Normal mode, and second is the Power saving mode. In normal mode, the GPS will be always activated if CTS100 is in moving state. However, if in Power saving mode, CTS100 will turn off the GPS power if there is no report to send.

Note: that user can configure the wake up report if the device is in “stop” (not moving) state.

### (1) Moving/stop definition



#### Acceleration sensor:

To determine whether CTS100 is moving or not, user can select the sensitivity of the “acceleration sensor”. It is distinguished by the tilt angle of the device. If the unit tilted more than the degree set here, CTS100 will be in moving mode. Otherwise, it will be in stop mode. The smaller the parameter of degree for the sensor set in pc-setup is, the higher the sensitivity is. Otherwise, the result is the opposite.

### (2) Fixed time report



Fixed time report

Fixed time report    10    Min

Parameters: On/Off, and time.

(3) Fixed distance report

Fixed report

Fixed distance report    5    Km

Parameters: on/off, and distance

(4) Speeding report: (min. speed is 0.1 km/Hr, max. speed is 1000 km/Hr)

Speeding report

When speed over    80    Km/Hr

Parameters: On/Off, and speed (min. distance is 0.1 km, max. distance is 1000 km).

(5) GPS wake up report:

GPS Sleep On     GPS Sleep Off

GPS auto wake up report

Send auto wake up report

Every 120 Min acquisition time 5 min(s) then sleep

No GPS auto wake up report

While the device is in stop status, user can let the GPS go to sleep mode for power saving. If select GPS sleep ON, user can setup the wake up report configuration/ or NO GPS wake up report.

IF select GPS SLEEP OFF, CTS100 will follow the report-sending rule in “When Moving” section.

(6) Power saving mode

While in Power saving mode, CTS100 will cut off the GPS power if there is no report to send.

Power Saving Mode

When moving, send report

Every 30 Min acquisition time 4 min then sleep

When stop

Send GPS auto wake up report

Every 120 Min acquisition time 4 min then sleep

No GPS auto wake up report

Report configuration will be listed as:

The fixed time report while moving: the unit will wake up automatically and enter moving

work mode to search GPS signal and send fix time report when moving sleep is time out, unit will enter moving sleep mode 30 seconds later. Note: unit will search GPS signal at first and then send report. The unit will send A report if unit searched valid signal at once; the unit will send L report if unit searched invalid signal during 120 seconds of unit wakened up, the unit will send A report when unit searched valid signal, unless unit enter sleep mode again or unit power off, the unit will no way to send A report.

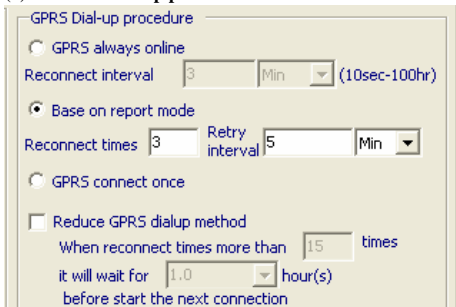
The unit will enter moving sleep mode again if unit auto wake up and can not search valid GPS signal during the moving work time which user setting.

Wake up report or no GPS wake up report while stopped. In this mode, in order to save power, unit will cut power of GPS, only wake up GPS at the time of send report.

Note: unit will enter stop mode if unit detect the tilt sensor isn't triggered (or the trigger angle so smaller than predetermine time) within 4 minutes during unit in moving sleep mode

When unit entered stop sleep mode: GSM can work normally, GPS power off, the fix reports can not send out. When unit in power saving mode, unit can not detect GPS signal, the circular and rectangular geofence will send out maybe not in time, and the point geofence report maybe can not send out.

#### (7) GPRS dial-up procedure



The screenshot shows a software window titled "GPRS Dial-up procedure" with the following settings:

- GPRS always online  
Reconnect interval: 3 Min (10sec-100hr)
- Base on report mode  
Reconnect times: 3, Retry interval: 5 Min
- GPRS connect once
- Reduce GPRS dialup method  
When reconnect times more than 15 times  
it will wait for 1.0 hour(s) before start the next connection

##### 1) GPRS always one-line

Parameters: Reconnect interval

While using this mode, when the unit can not searched GPRS signal, system will reconnect GPRS interval a preset value. (e.g.: 1minute)

##### 2) Base on report mode

Parameters: Max. reconnect times, reconnect interval

While using this mode, the unit will connect to the server when there is a report to send. If

the first connection is failed, it will retry to connect to the server up to the max. reconnect times. Each retry will be separated by the reconnect “interval”.

### 3) GPRS connect once

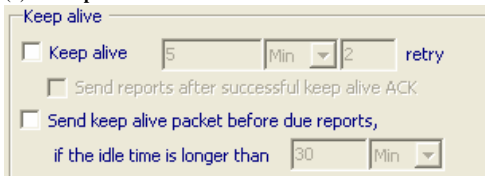
While using this mode, the unit will connect to the server when there is a report to send (but only try once). If it is not successful, the report will be stored and sent out in the next successful connection. Disconnect GPRS connection when report sending is completed.

### 4) Reduce GPRS dialup method

Parameters: On/Off, Max. reconnect times, connect delay

If this method is used, the unit will reduce the GPRS dial-up connection when the dial-up is failed after number of times. User can define the delay time for the unit before try to reconnect to the server. If there is trigger report, the unit will connect to server immediately.

## (8) Keep alive



### Keep alive procedure

Parameters: On/Off, and interval / retry times. In order to keep connection in GPRS network, the unit can be set to send short keep alive report to the server in order to prevent the disconnection from the mobile service provider.

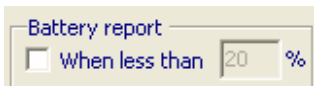
Send reports after a successful keep alive ACK. Parameters: On/Off.

If you select this function, all the reports will only be sent out after a successful keep alive ACK. (So if your keep alive time is shorter then select this function will be OK.) This function is very useful while using UDP to prevent report lost.

Send a keep alive packet right before a due reports if no data stream within certain time: Parameters: On/Off, and idle time.

Some GSM provider might cut connection, if there is no data within certain time. It might result report lost in this “fake connection” duration. For example, you can set parameters in this region, ex 20 mins. (it means if the unit did not send any data in this 20 mins (including keep alive or normal reports) ), then it will send a keep alive packet to check if the GPRS connection is valid or not. If not, it will actively reconnect to GPRS network.

## (9) Low battery report

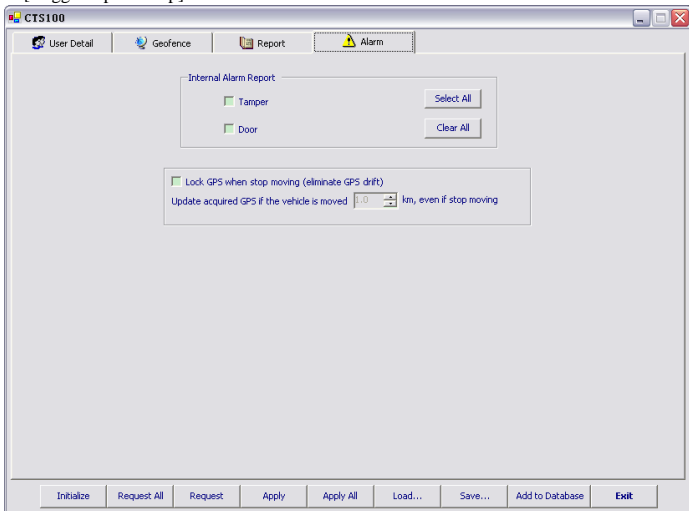


Low battery warning report (to alert user when the external battery level is low)

Parameters: On/Off, and warning battery level for report. For example, 30 to represent 30% lower level report.

The system will ignore the parameter with a value '0' to prevent continuous non-stop reporting. Low battery, unit will cut power of GPS, only call function will be activated.

#### 4. [Trigger report setup]



The unit has built-in door magnetic sensor and tamper switch, user can select if send report when the door sensor and tamper switch has triggered.

1. door sensor :It will send out event reports when door on or off.

2. Tamper switch: the tamper switch is used to check the box of host, when the box of host is moved over, it will send out a relevant report.

Lock GPS when stop moving (eliminate GPS drift)

Update acquired GPS if the vehicle is moved  km, even if stop moving

Parameter: on/off, kilometer

When acc off, unit will lock GPS, the kilometer is the radius of protecting vehicles, if vehicle moved away the range, unit will unlock GPS.

## SPECIFICATIONS

### Physical Parameters

Enclosure dimensions (mm)	96(L)*50(W)*42(H)
Unit Weight	About 400g

### Electrical

Operating current	52mA
Voltage (Recharge)	5V – 16V
Current (Recharge)	770mA
Current (sleep)	2-15mA

### Battery

	Battery type	Battery capacity	Charge type
Battery	Lithium 3.7V	3600mAh	Built-in charge circuit

### GPS\*

Channels	20 parallel tracking
Frequency	L1-1575 MHz
Sensitivity	
Tracking	-159 dBm
Acquisition (Cold start)	-142 dBm
Position accuracy (Horizontal)	<2.5m CEP autonomous
	<2.0m CEP SBAX
Time to first fix	
Hot start 1	<1s
Warm start 2	<32s
Cold 3	<35s

Standard GPS software	
NMEA message switchable	GGA, GSA GSV, VTG, RMC, GLL

### **GPRS\***

Frequency Range (MHz) (Be used in CTS100MT/ CTS100FT/CTS100ST)	850/900/1800/1900
Frequency Range (MHz) GPRS* (Be used in CTS100XT)	900&1800&1900 or 850&1800&1900
GPRS connectivity (Be used in CTS100MT/ CTS100FT/CTS100XT/CTS100ST)	GPRS multi-slot class 10 GPRS mobile station class B
SIM card interface (Be used in CTS100ST)	1.8V/3.0V
SIM card interface (Be used in CTS100MT/ CTS100FT/CTS100XT)	3V
Antenna Impedance (Be used in CTS100MT/ CTS100FT/CTS100XT/CTS100ST)	50ohms

### **IO Connection**

POWER SWITCH

### **Communication**

	GPRS \SMS\RS232\USB
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### **Environmental**

Operating Temperature	-20°C to +55°C
Storage Temperature	-40°C to +85°C

### **Accessories**

1. Internal battery
2. Magnetic sensor
3. PC setup cable

## **FCC FOR CTS100XT**

15.21

### **Federal Communications Commission (FCC) Statement**

**You are cautioned that changes or modifications not expressly approved by the part responsible for compliance could void the user's authority to operate the equipment.**

15.105(b)

### **Federal Communications Commission (FCC) Statement**

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

### **Operation is subject to the following two conditions:**

- 1) this device may not cause interference and
- 2) this device must accept any interference, including interference that may cause undesired operation of the device.

### **FCC RF Radiation Exposure Statement:**

1. This Transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.
2. 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.