TBS-220 Geomagnetic Vehicle Detector

User Guide

Vision：1.0

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Content

1 Overview

TBS-220 geomagnetic vehicle detector, which is fully compatible with LoRaWAN technology, adopts advanced magnetic sensor and signal detection algorithm, is used to detect parking spaces. Parking spaces which equipped with TBS-220 can be monitored. It takes about 6~8 seconds to detecting car presences and send parking spaces status (battery information, alarm information, detecting information) through LoRaWAN network to backend. TBS-220 is usually used in smart parking projects which helps to improve the utilization rate of parking spaces, and helps drivers to find parking spaces easily. TBS-220 designed for car parks where drilling is not allowed, the vehicle detector can be easily fixed onto the road surface, replacement can be done easily by removing the detector, once installed no maintenance is required for years. It can easily be installed in on-street parking spaces or off-street parking spaces

2 Key Features

- High detection accuracy
- Compatible with LoRaWAN™ specification
- Flexible configuration for detecting sensitivity and heart-beat intervals
- Long battery life
- Surface mount, easy to install

3 Main Function

- Report parking spaces status regularly
- Low battery power alarm
- Detector failure alarm
- Reset and calibration automatically or manual
- Magnetic stripe switch

4 Scenarios

- On –street parking slots
- Off-street parking slots
- Others

5 Specification

Form 1 Specification

Operating frequency	433MHz/470MHz/780MHz/868MHz/920MHz
Standards	LoRaWAN™（Class A）
Maximum transmit power	14 dBm

Communication distance	1000 m
Vehicle detecting accuracy	99%
Response time	6 s
Calibration	Power-on calibration, command calibration
Parameters configuration	Detect threshold, heart-beat intervals
State monitor	Low-voltage alarm, failure alarm.
Power supply	Built-in 3.6 V lithium battery
Power switch	External magnetic strip switch
Life duration	3 years
Resistant	5 ton
Protection level	IP68
Operating Temperature	-40℃~85℃
Operating Humidity	10%~100%
Size	Diameter 150 mm, height 25.5 mm
Weight	380g

6 Dimensions

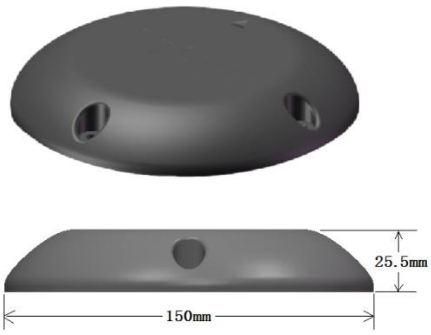


Figure 1 product dimensions

7 Installation

7.1 Installation Prerequisites

1. Perform installations during daylight hours, and reduce the time you are exposed to traffic.

2. Please pay attention to road safety and wear orange safety cloths.

3. Wear appropriate attire: eye protection, gloves, ear protection, hard hat.

4. Tools:

- Rulers: Measuring the installation position , and check the hole depth;
- Paint: Mark the installation position;
- Coring bit;
- blower: blow away the powder caused by drilling;

7.2 Product check

Bring out TBS-220 and confirm the appearance is OK.

Note: there is groove located on the detector's surface, where there is a magnetic strip (as a power on/off switch) hidden inside the tape. Please remove the tape after installation, it will power on the detector automatically.

Figure 3

If the detector need to be powered on or calibration, please place the magnetic strip on the groove and stay for 10 seconds, and then remove the magnetic strip .

7.3 Drill 4 holes

a) Find and mark the center of the desired detector location. Shown as figure 4:

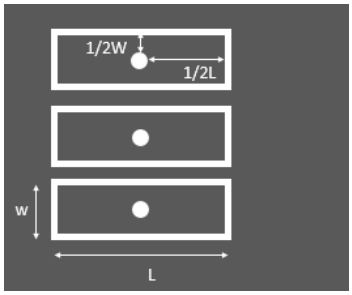


Figure 4 the desired location

b) core 4 holes (approximately 8 mm in diameter, and 60mm deep) into the road. As shown in figure 5.

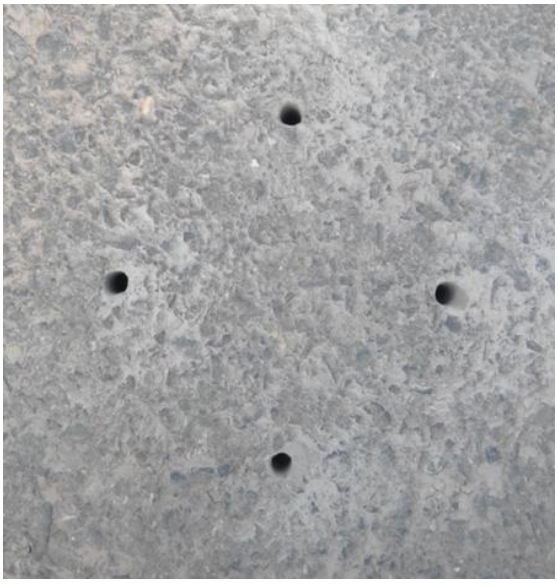


Figure 5 drill 4 holes

7.4 Install 4 expansion crews

Install four expansion crews on the TBS-220, as shown in figure 6.

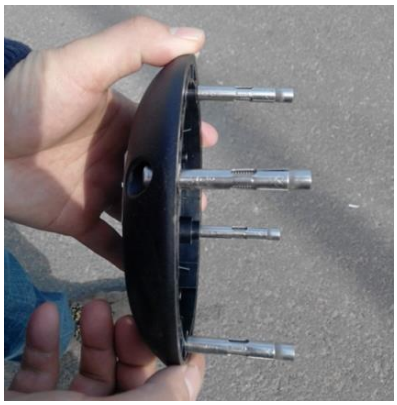


Figure 6 install 4 expansion screws

7.5 Place the vehicle detector

Place the vehicle detector into the surface, make sure 4 expansion screws direct to 4 holes and keep the TBS-220 bottom is close to the road surface, using hexagonal screwdriver to tighten the screws and fix the TBS-220. as shown in Figure 7.

Figure 7

Note : keep the triangle-shaped label on the product surface is directed to where the vehicle entering or leaving. The triangle-shaped label is located as following figure 8:

Figure 8 : triangle shaped label

8 Calibration

8.1 Power-on and Calibration

1. After take off the magnetic strip, it will take 3 minutes to finish calibration automatically, To ensure finish calibration successfully, please check there is no vehicle and other metal objects within 1 meter around the detector, if failure, the detector need to calibration again.
2. After calibration , the detector will report parameters to network server(application server) once every 1 minute, if need to configure command, network server or application server can send the downlink command frame. If network server or application server do not need send the command, the vehicle will enter the normal work mode automatically after 2 minutes.
3.Note that if do the calibration through command, keep there is no car in slot. If there is a car in slot, the calibration will be failure.
4. If the detector works abnormal, please do the calibration through downlink command . if it is not solved, you can power off by manual ,that is place magnetic stripe in the groove located on the detector's surface for 10 seconds, then remove the magnetic strip.

8.2 Command Calibration

Please refer to Clause 9.1.3.

9 Interface

9.1 Application data interface

The application data interface includes 5 applications data frames:

1.Uplink status frame

2.Uplink parameters frame

3.Downlink command frame

4.Downlink data frame (use in firmware upgrade)

5.Uplink data confirm frame (use in firmware upgrade)

9.2 Uplink status frame (UpStatusFrame)

Uplink status frame is the information reported to application server, including the slot information (occupied or empty), battery information, failure information and working status information. The intervals of the uplink status frame is 12 hours by the factory setting, and the frames have retransmission mechanisms.

Frame format:

Bit / Byte	7	6	5	4	3	2	1	0
0	FrameType							
1	FrameCount				Status			
2	ParkFlag	BatteryLevel						

3	Reserved
4	FrameEnd

Frame field description :

Field Name	Length (bits)	Description
FrameType	8	Frame type, 0xab
FrameCount	4	Frame count, Every report of frame, the count plus 1 automatically, if retransmission frame, the count do not plus 1.
Status	4	Parking slot status: '0' indicates that the parking slot is empty '1' indicates that the slot is occupied '2' indicates that heartbeat report '3' indicates there is strong-magnetic interference '4' indicates low-voltage alarm '5' sensor detector failure (IC information is readable) 'F' sensor damage (IC information is not readable)
ParkFlag	1	'0' indicates the slot is empty '1' indicates the slot is occupied
BatteryLevel	7	Battery capacity (percentage), range: 00 ~ 100(%) ' 00' indicates 2.0V '100' indicates 3.6V The battery capacity updates once every 24 hours
FrameEnd	8	Frame end, '0xae'

9.3 Uplink Parameters Frame (UpParaFrame)

After power on , the detector will send uplink parameters frame with retransmission mechanisms. The parameters include hardware type, software type, heartbeat intervals etc.

Frame format as bellows:

Byte \ Bit	7	6	5	4	3	2	1	0
0	FrameType							
1	HWVersion			SWVersion				
2	/	WM	HeartbeatInterval			Sensitivity		

3	Reserved
4	FrameEnd

Frame field description：

Field name	Length （bits）	Description
FrameType	8	Frame type, ‘0xac’
HWVersion	3	Hardware version
SWVersion	5	Software version
WM	1	Working mode ‘0’ indicates low power mode ‘1’ to be defined
HeartbeatInterval	3	Heartbeat intervals: ‘0’ indicates no heartbeat ‘1’ indicates 1 hour ‘2’ indicates 2 hours ‘3’ indicates 5 minutes ‘4’ indicates 12 hours (default) ‘5’ indicates 24 hours ‘6’ indicates 30 seconds ‘7’ indicates 1 minute
Sensitivity	3	Detection sensitivity, 8 level adjustable, when sensor is power-on, the sensitivity is 4 by default.
FrameEnd	8	Frame end, ‘0xae’

9.4 Downlink Command Frame (DownCmdFrame)

Application server send downlink command frame to modify detector’s parameters. There are two ways to send the downlink command frame:

1.After detector power on and finish calibration , detector wait for the downlink command frame.

2.The application server send downlink command frame to network server/ gateway. Detector can receive the command frame in receive window when detector is sending the uplink status frame.

Frame format：

Bit / Byte	7	6	5	4	3	2	1	0
0	FrameType							

1	Reset	/	ParaInq	Upgrade	SetHBI	SetSens	Calib	SetWM
2	CalibMode	WM	Sensitivity			HeartbeatInterval		
3	Reserved							
4	FrameEnd							

Frame field description:

Field name	Length （bits）	Description
FrameType	8	Frame type ‘0xad’
Reset	1	Detector reset command： ‘0’ Normal ‘1’ reset
ParaInq	1	Query the parameters of detector, ‘1’ is effect, The detector send uplink parameter frame
Upgrade	1	Update the firmware, ‘1’ is effect, detector enter upgrade status
SetHBI	1	Set heartbeat intervals, ‘1’ is effect, detailed description in section “ Heartbeat interval.”
SetSens	1	Set the sensitivity, ‘1’ is effect ,detailed description in section “ Sensitivity”
Calib	1	Calibration command, ‘1’ is effect, detailed description in section “CalibMode”
SetWM	1	Set the working mode, ‘1’ is effect, detailed description in section ‘ WM’
CalibMode	1	‘0’ indicates calibrate when slot is empty ‘1’ indicates calibrate when slot is in occupied
WM	1	Working mode ‘0’ indicates low power mode . ‘1’ to be defined
Sensitivity	3	Detection sensitivity, 8 level adjustable, when sensor power-on, the sensitivity is 4 by default
HeartbeatInterval	3	Heartbeat intervals: ‘0’ indicates no heartbeat ‘1’ indicates 1 hour

		‘2’ indicates 2 hours ‘3’ indicates 5 minutes ‘4’ indicates 12 hours ‘5’ indicates 24 hours ‘6’ indicates 30 seconds ‘7’ indicate 1 minute
FrameEnd	8	Frame end, ‘0xae’

9.5 Downlink data frame

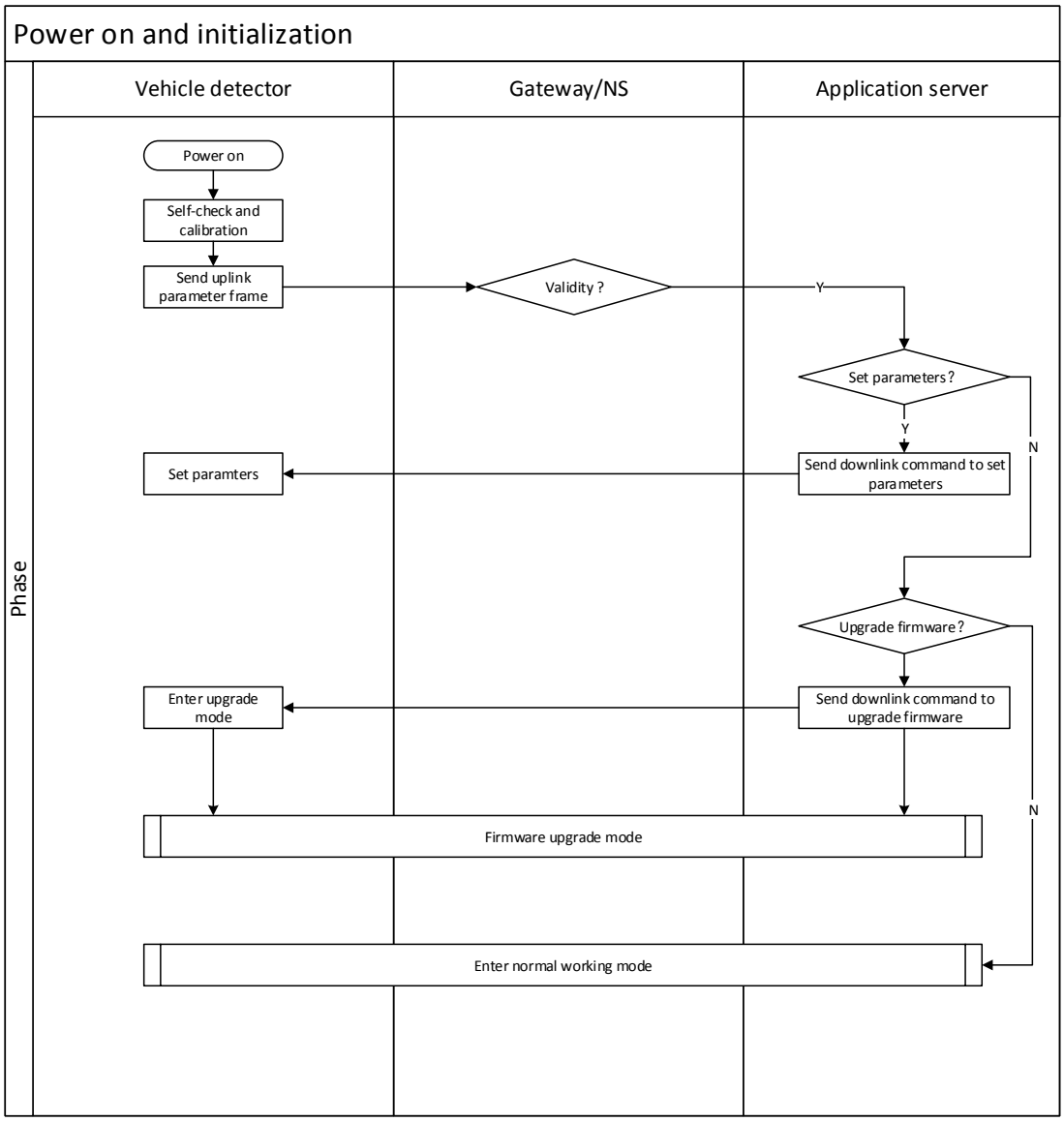
Used to the upgrade vehicle detector, the frame do not define yet.

9.6 Uplink confirm frame

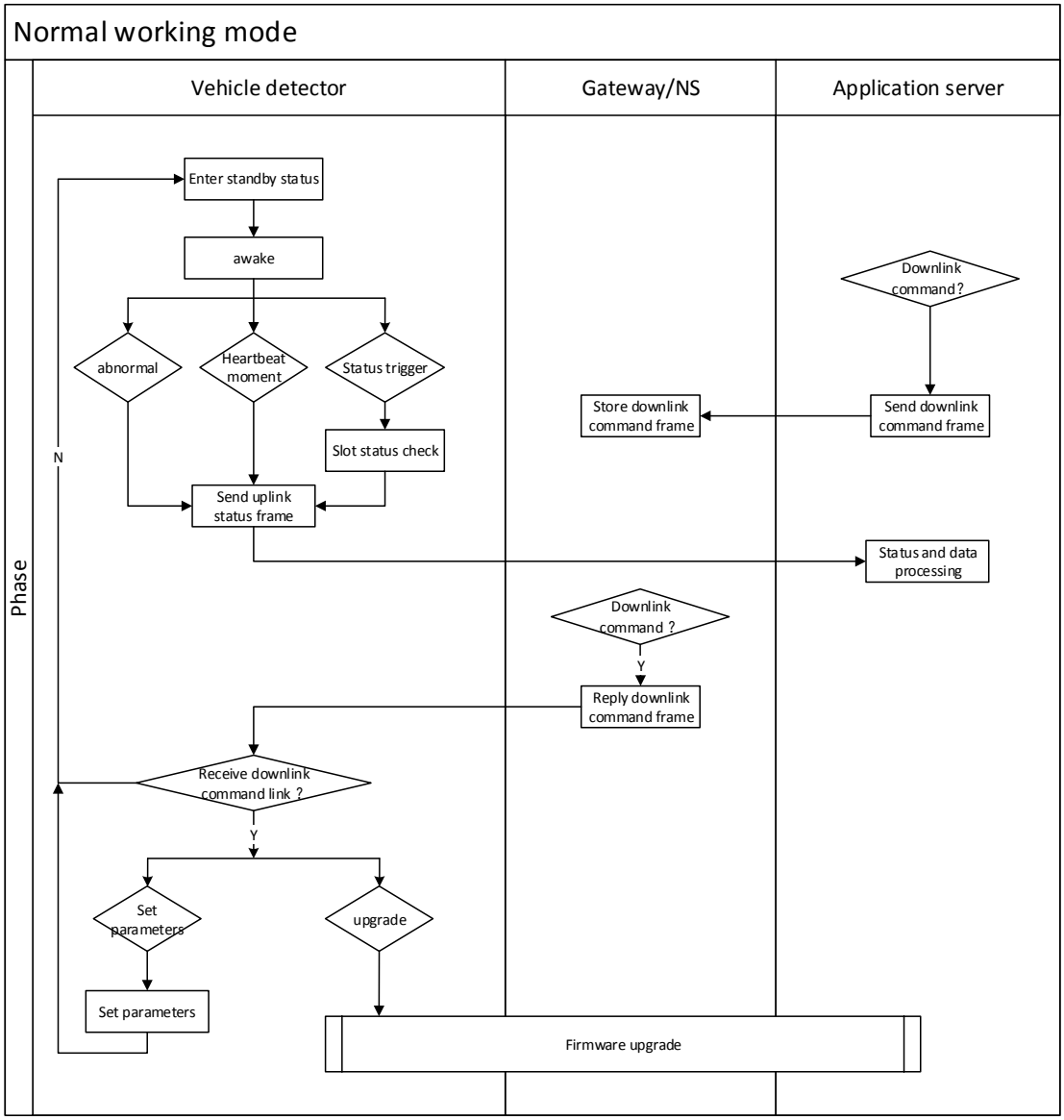
Used to confirm if the upgrade is done, the frame do not define yet.

10 Workflow

10.1 Power on and initialization



10.2 Normal Work mode



11 Trouble Shooting

Form 2 Trouble shooting

Failure	Reason analysis	Solution
The slot is occupied, but it indicates “empty” in platform sometimes.	The value of sensitivity is low	Increase sensitivity though downlink command clause 9.1.3
Slot is occupied, while it indicates “ empty “ in platform all the time	The sensor is damaged.	Change the sensor.

The slot status is opposite of the platform indicates	There is a car in slot when do the calibration.	Power on again and do calibration , or finish calibration though downlink command.
	There is magnetic interference around.	power on again and do calibration , or finish calibration though downlink command.
The slot is empty, but it indicates “occupied” in platform	Disturbance of magnetic filed.	Check surroundings , remove the interference sources.
	Detector affected by strong magnetic interference , can not auto recover.	Power on again and do calibration. or finish calibration through downlink command.
Can not receive the uplink information of long time	Low battery	Change the detector
	Detector has been destroyed or there is a magnetic above the detector.	Need on-site troubleshooting