Instruction Book of RDT401B

Driver State Monitor System

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I. Product Synopsis

RDT401B is a bran-new Driver ADAS Safety Monitor System based on the fifth generation of video based driver state analysis technology, which gives a warning of fatigue drive and kinds of dangerous driving behaviors by means of image recognition and driver's mental state analysis to decrease accidents caused by fatigue drive. Furthermore, RDT401B is also capable of sending abnormal data and videos via 4G network to an end-user platform management center to avoid occurrence of accidents by immediately taking effective measures.

1. Value of Fatigue Warning

Fatigue has long been an inevitable problem that is controlled to an extent for drivers, for example, when driving two hours at a speed of 100km/h, the driver has to struggle to stay awake on account of his lower levels physiological functions followed by inattention. In general, accident rates are extremely high when the driver drives more than 6 hours a day or is lack of proper rest, for example, only having a rest of less than four or five hours last night. In addition, with the popularity of smart phones, more and more drivers are used to playing his cellphone while driving, it also will cause a popularity of accidents.

A set of terrible statistics has already been reported, indicating that 72% of all accidents occur due to drivers themselves and 25~30% thereof are caused by fatigue drive; that 40% of all serious and fatal accidents are fatigue related; that 70% of all drivers will fall asleep at the wheel on the highway and specially happens to those who likes playing their cellphones while driving.

Therefore, it is a great value to eliminate fatigue at driving for sake of the drivers, families, companies, as well as the society.

2. Host introduction

- **Power supply and signal line interface**
  It works when power connectors are connected to corresponding power interfaces on the RDT401B device; the signal line includes video cable, communication line, etc.
- **SD card slot**
- **SIM card slot**
- **GPS&4G antenna terminal**
- **Bracket**

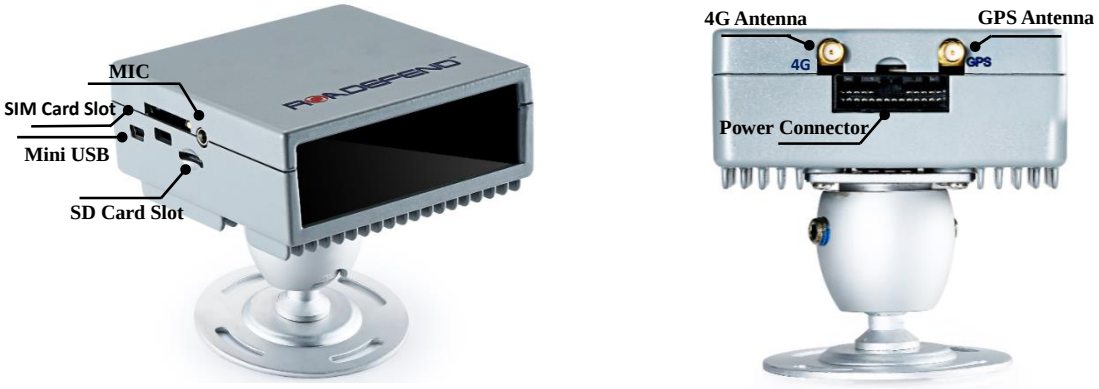


Figure 1. Schematic Diagram of Appearance of RDT401B Active Defense System

3. Product specifications

Table 1

RDT-401 product specifications							
Basic info.	Type	RDT401B	Functional information	Fatigue warning function	Working-hours	Daylight	Night
						●Yes	●Yes
	Product Size (mm)	95x90x35			Glasses support	Near-sighted eyeglass	Sun-glass
						●yes	●yes
	Weight (g)	400			Sensitivity settings	Automatic adaptability	
	Camera	High-sensitive night vision camera (capture)			Volume adjustment	SD card configuration /platform remote adjustment	
	Analog image output	Yes		Other functions	4G Communications	Alarm picture upload	
						Alarm video upload	
	Power supply	DC 9V~36V					
	Power	4W			GPS	Vehicle localization	
					RS232-1	communicating with RDT402	
					RS232-2/RS485	communicating with external devices	
					CAN	supporting CAN	

						communications

4 Function Instruction

1) All Kinds of Warning

The default starting speed is 15km/h for all below kinds of warning (except for the speeding warning)

Table 2

Warning Types	Description	Voice Reminder	Evidence Documents	Default Voice Switch
Distraction (level 1)	When the driver is found in the drowsiness state, or found bowing to look at the mobile phone and taking other actions, the device will issue a distraction warning.	“Attention ”	Picture	ON
Dangerous driving (level 2)	If the driver does not restore the normal driving posture after the distraction warning is triggered, a dangerous driving warning will be triggered.	“Take care, take care! du-du-du-du!”	Picture and small videos	ON
Cover Warning	Once the system is covered by some obstructions such as a towel, it will send a cover warning after 10s.	“Ding-ding”	Picture and small videos	ON
Face Missing Warning	When the driver's face departures or is terribly covered for more than 10s, it will trigger the off-site warning.	“Ding-ding”	Picture and small videos	ON
Look-Aside Warning	When the driver looks at the left or right side for more than 5s, it will trigger the looking-around warning.	"Do onot look aside"	Picture and small videos	ON
Smoking Warning	When the driver smokes while driving, it will	"Do not smoke"	Picture	OFF

	trigger the smoking warning.			
Calling Warning	When the driver holds a phone and keeps talking for more than 6s, it will trigger the phone warning.	"Please concentrate on driving"	Picture	OFF
Yawn Warning	When the driver yawns while driving, it will trigger the yawn warning.	"Please have a rest"	Picture	ON
Speeding Warning	When the vehicle's speed exceeds the set value, it will trigger the speeding warning.	"Your speed is over the limit, please slow down"	Picture	OFF

2) Sensitivity

Sensitivity is defined as the response time to trigger the distraction alarm.

a) In Test Model

After entering into the test model, the sensitivity will be fixed as 1 second.

b) In Normal Model

RDT401B can make a comprehensive judgment and adjust the sleepiness warning sensitivity automatically according to the vehicle speed, driving time period and the driver's driving behaviors etc., and the adjustment is made at an interval of [1s, 3s].

3) Driver Characteristics and Posture Self-calibration

After RDT401B is started and the vehicle speed exceeds **30km/h (which can be set)**, the system will enter a period of 45-second self-calibration (the calibration time is 10s in test mode). During this period, core parameters of the system will be calibrated according to individual characteristics and driving posture of the driver. Please keep a normal driving state in the process, please do not simulate fatigue and sleepiness. Furthermore, the device will not issue a looking around warning before the calibration is completed. After the calibration is completed, the device will send a reminder voice like "beep~beep" and the system can normally trigger a posture warning.

4) Analog Image Output

RDT401B provides real-time analog image output in NTSC or PAL format. The signal can be used to calibrate the orientation of installation, and can also be connected with almost all the popular Car DVRs (Digital Video Record) on the market to store the videos about the driver's driving. The standard output can be adjusted through a DIP switch 4#; the PAL system is default; and by dialing down, you can switch to the NTSC system.

5) Video Storage

RDT401B can store the driver's real-time driving behaviors into a high-speed TF (higher than Class 10) card by 3 minutes as a unit and the default is standard definition; for example, a 8G card can store videos for about 3 days' driving behaviors; its resolution can be configured as high definition storage (720P); and the SD card can support up to 256G.

6) 4G communications

RDT401B can transmit alarm information, alarm videos and other related data to the fatigue monitoring management platform via 4G communications for easy supervision and management.

7) Input/Output Interface

RDT401B supports three-channel I/O signal inputs, including two-way switching signals and one-way PWM speed signal. Meanwhile, it also support two-way switching signal outputs, which can control some accessory devices like the vibration cushion or refreshing smell generator to trigger relevant actions when the sleepiness warning happens.

8) Communication Interface

a) RS232

RDT401B has two-way RS232 output interfaces, one can be seamlessly integrated with ADAS forward active safety device RDT-402, and the other can communicate with another terminal devices.

b) CAN

RDT401B has an one-way CAN interface, which can receive the vehicle's CAN signal.

9) Alarm Events Recording

RDT401B can make a record for each alarm information, including the position, event, alarm type and the relevant file name of alarm video, etc.

10) Local Storage of Alarm Images

RDT401B will create folders with year.month.day in an SD card and store the alarm images of the day sorted according to types of fatigue warming (sleepiness, calling, smoking, etc.).

11) System Upgrade

The device is started by placing the upgrade package file in the TF card; and once you hear a voice like “beep, beep, beep” and the device is restarted, it means the device upgrade operation has been done.

Ⅱ. Installation Instruction

1. Installation requirements

Fix RDT401B by screws to lean to the right side (within a range of 30 degrees) in front of the driver and tilt up at an angle of 5~30 degrees; connect the lead terminal with the power supply wiring harness; and connect GPS antenna as well as 4G antenna.
RDT401B can be adapted to a distance range of 60 cm~120 cm, and it is advised that RDT401B should be installed at about 80 cm.

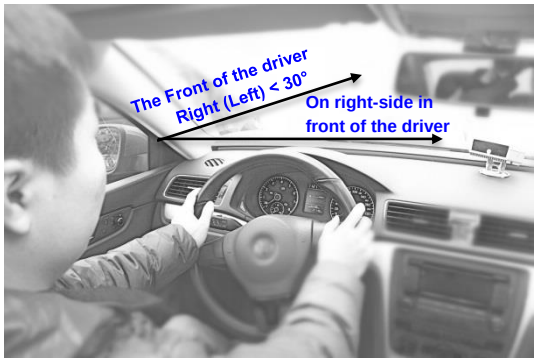


Figure 2. Top view of Installation

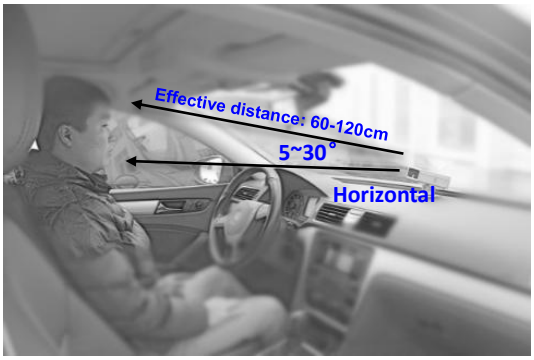
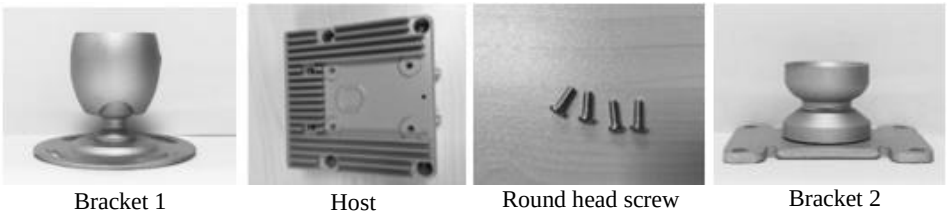


Figure 3. Side view of Installation

2. Product list

Table 3

Product List		
Serial No.	**Parts Name**	**Quantity**
①	Bracket1	1
②	Host	1
③	Round head screw	4
④	Bracket2	1
⑤	Wire harness	1
⑥	GPS Antenna	1
⑦	3G Antenna	1
⑧	Microphone and SOS button	1
⑨	Instruction book	1



Bracket 1 Host Round head screw Bracket 2

Figure 4. A schematic diagram of parts

3. Calibration

Adjust the angle of RDT401B up and down to ensure that the driver's face is in the center of the screen of an external display.

4. Work status

1) After the vehicle starts, RDT401B will start immediately; after about 8 seconds, it will make a sound indicative of start-up completion, indicating that the product is ready for work.
2) After the vehicle's speed reaches the set speed value, the product will enter the monitoring state, monitor the driver in real time, and issue fatigue warning; according to factory default settings, when the speed exceeds 15km/h, the device will start a state detection function (except for the type of posture warning) and when the speed exceeds 30km/h or more, posture calibration will be performed.
After the posture calibration is completed, all warnings can be triggered.
Notes: the starting speed of fatigue warning function for RDT401B is 15km/h.

5. Parameters Configuration for SD (TF) card

Through the system upgrade, you can adjust parameters of the device, such as volume, sensitivity, time zone.

III. Electrical Properties

Table 3

RDT-401 Electrical Properties	
Operating Voltage	+9V ~ +36V
Rated Power	4W
Max Power	5W
Operating Temperature Range	-20℃~ 70℃
Storage Temperature Range	-30℃~ 85℃
Working Humidity	0 ~ 90 RH%±5%

IV. Failures and Solutions thereof

If you experience the following problems when using the product, please resolve the failures with the aid of the following countermeasures.
The general problems that may have an impact on this product are as follows:

Table 4

Failures	Possible Causes	Solutions
No warning sounds when eyes are closed for a long time.	The driver's face is out of the visible scope of the camera or beyond the effective distance.	Referring to the Instruction Book, adjust the position or angle of the device placement.
	The vehicle is in a stopped state.	The fatigue warning function will be activated only when the vehicle's speed exceeds the set speed value.
	GPS satellite search fails.	Make sure that the GPS antenna is in good contact and that the top of the antenna or the location of the vehicle is not covered.
The device cannot boot up	The ACC and power supply are not well connected.	Make sure that the power supply wiring harness is reliably connected.
The fatigue warning is not sensitive.	The black Plexiglas in front of this product is too dirty.	Clean this brown and black Plexiglas.
	The installation distance is too close.	Install the product at an appropriate distance.
No warning is triggered when the driver looks around.	Calibration is not completed.	Maintain a correct posture for 10s in test mode and when hearing a beep-beep tone, you can test the posture warning.
The device is not on the line.	The SIM card is not inserted, or in arrears state.	Check the SIM card, start the device to hear a tone indicative of the successful network connection, when the device can be on the line.

1. Precautions:

1) Clean the black Plexiglas in front of this product for sake of the video capture and the product performance;

2) Make sure that the product is located at appropriate angle and is fixed firmly for the sake of the product performance.

V. Applicable Vehicles

Passenger and cargo transport vehicles, dangerous goods transport vehicles, mining vehicles, taxis and school buses and other vehicles.

VI. Friendly Reminder

1. Will you drive when you are in fatigue?

Fatigue driving is different from drunk driving, and people always choose to or have to drive even though they feel tired because they claim they are alert to fatigue or they are in a hurry sometimes. Therefore, there is inevitably the following problems:

The first problem: people will still choose to drive even though they are tired because they have to do so;

The second problem: the drivers think that they can control the fatigue. When having a sense of fatigue, a driver may argue that he can eliminate it through conventional methods such as, having a cup of coffee and other refreshing drinks, smoking, turning music volume up, opening windows, scratching his head, twisting his neck.

However, we should accept the fact that fatigue cannot be eliminated by means of relying on subjective thoughts of the driver with the aid of applying the above-mentioned methods to avoid falling asleep. Those irritating behaviors, such as smoking, increasing the volume of the radio, drinking coffee, opening windows cannot actually prevent “drowsiness–induced substance" from influencing the brain, and conversely, they cause paralysis to the driver.

Do you know? Drinking excessive coffee can cause insomnia, headaches, allergies and anxiety.

Do you know? It takes more than 10 minutes for caffeine to get into your blood system to finally generate a stimulus, so a cup of coffee would not have such a quick play as required but you have already fallen asleep. Also, if you have become accustomed to effects of caffeine, stimulating effects will be weaker.

Do you know? Opening the window and increasing the volume of the radio can indeed increase your alertness in a short time, but it will not last long.

2. RDT401B Benefits

RDT401B employs the method of combining the image recognition with the driving behavior analysis to give a well-intentioned warning when you are tired and inattentive. Once serious

fatigue occurs, the system will give you a wake-up call in time, which is a critical moment between life and death.

What a critical moment between life and death, seizing this moment, the wife can give her rushing husband a reminder;

What a critical moment between life and death,

seizing this moment, the driver will not worry about his safety;

What a critical moment between life and death,

seizing this moment, the passenger will not worry about his safety.

Hindsight is not our aim, what is important is to reduce tragedy.

VII. Security Warning

Before using the product, please be sure to carefully read the following precautions to ensure safety.

Warning 1: In order to put the fatigue warning system to be in good account, users of this product are responsible for the proper installation and the safe utilization of the system so as to ensure this product will not interfere with the normal operation of the vehicle and other vehicle safety devices, for example, this product shall not obstruct the driver's driving vision, which may cause accidents and injury.

- Do not install this product in a position where the driver's driving vision is obstructed.
- Do not install this product on top of airbag dashboard or at the area where the airbag deploys.
- Do not install this product in the position where passengers are prone to bumping into the product.

Warning 2: This fatigue warning system is just an ancillary product for safety aiming to reduce probability of accidents caused by driver fatigue, thereby reducing losses caused by driver fatigue. Drivers themselves are still responsible for the normal operation of the vehicle, so they shall not rely on this product to keep driving in the case of severe fatigue.

VIII. User Notice

- The product is powered on; and after the vehicle travel speed reaches the speed value (default 15Km/h) for triggering the fatigue warning function, the product will enter the normal working condition.
- The product can effectively reduce the probability of accidents caused by driver fatigue, but cannot eliminate the symptoms of driver fatigue, so the driver needs to consciously have a rest in order to completely eliminate fatigue symptoms.
- The user needs to cooperate and know that our product needs to access the signal, such as power supply, GPS antenna, and 4G antenna.

FCC Statement：

Any Changes or modifications not expressly approved by the party responsible for compliance could void the user’s authority to operate the equipment.

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.

FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator& your body.