

LumelWay

EA-450

USER MANUAL



Version 2014.03.21

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I. Product introduction



The EA-450 driver fatigue alarm system is the most advanced non-contact method to capture infrared images of people's eyes and the PERCLOS algorithms alerts the driver in time to protect your life and property.

The EA-450 is small and intelligent, it does not block your vision, the base rotates as needed, the installation is very easy, and it can be installed right on the dashboard. The EA-450 has a highly integrated infrared camera, a computer, image processing unit and alarm. The EA-450 technology is protected by over ten patents.

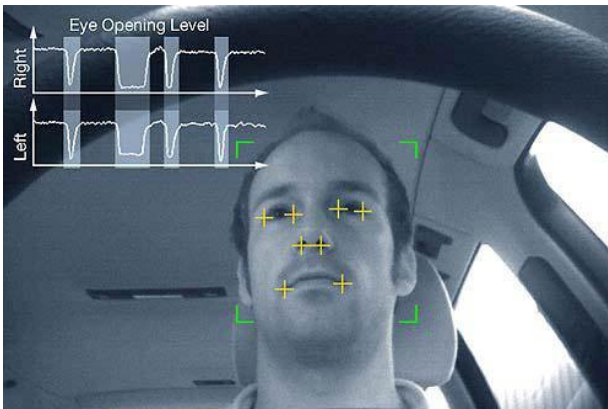
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II. Alarm theory

A driver may not be aware that they are in danger due to fatigue. A driver might feel they must continue driving. Our driver fatigue alarm system reminds the driver that he/she is in a dangerous state. The EA-450 uses a PERCLOS algorithm to analyze the driver's fatigue level.

The state of the driver's eyes is constantly analyzed. The human retina reflects infra-red light in a manner that can be used to determine the eye's condition. This varies just prior to falling asleep. The EA-450 knows you are falling asleep before you close your eyes.

If the EA-450 determines the driver is in a dangerous state a sharp voice will alert the driver.





III. Features

- Works around the clock, both in the dark or the sun.
- Works with sunglasses or prescription glasses.
- Leading face recognition technology, patented PERCLOS algorithms to warn the driver.
- Patented mesh membrane pupil detection technology detects open but sleepy eyes.
- In addition to fatigue driving, if the driver does not focus on driving the system will respond.
- Intelligent high-speed recognition, the system can identify when you are in an urban areas or on the expressway, the system will automatically raise the alarm sensitivity on expressway.
- Compact, easy to install, will not affect the driver's field of view.
- Automatic sensitivity control, when the driver barely moves, the system will automatically raise the sensitivity. If he often turns his head, the alarm sensitivity will be automatically lowered, to reduce false alarms.
- Facial feedback indicator, the green light is on when the angle between lens and human face is proper.



IV. Functional process

Two seconds after power is turned on, the green light will flash. At night the red infrared LEDs can also be seen. After 30 seconds, the system goes into the active state. The green light means your eyes are open, the light is off when your eyes closed, or not in view. When it is first installed, you adjust the position according to green light.

The EA-450 will remind the driver before entering a dangerous driving status. The human retina will become less and less sensitive to the light outside, the artificial intelligence software inside the system is detecting the status continuously, and it will give an audible alarm to remind the driver take a rest.

The EA-450 can also detect a distracted driver, such as talking with back-seat passengers, adjusting dashboard controls, reading, texting, picking up items on the floor, and give audible reminders to prevent accidents .

The EA-450 response time is typically 2-3 seconds. Detecting items like looking at the mirror for too long, the alarm reaction time is longer and then the alarms will sound.

TUNING

While sitting in the normal driving position, power up the EA-450. After two seconds the EA-450 will emit a power-on tone and light the STATUS INDICATOR for one second, after which the STATUS INDICATOR will either dim, flicker, or go off -- depending upon the extent to which the EA-450 recognizes the driver's eyes. Adjust the pan and tilt of the EA-450 unit to maximize the amount of time that the STATUS INDICATOR remains on.

ALERT STATUS



To be able to perform its function, the EA-450 requires a brief period to become familiar with the driver's face before entering ALERT status. For most drivers, the EA-450 will enter ALERT status after about a minute or so of normal driving. For drivers that wear eyeglasses, the unit may take as long as 5 minutes to enter the ALERT status. Thereafter, the EA-450 will respond within two seconds to signs of fatigue or inattention. If the EA-450 is unable to recognize the driver's gaze, it will set the PORTRAIT output low after 30 seconds, letting the monitoring center know that the unit's view of the driver has been obstructed.

WARNING METHOD

Upon detecting signs of fatigue or distraction, the EA-450 warns the driver to "Pay Attention to the Road" while simultaneously sending a message to the server.

If the driver brings his gaze back to the road or to the EA-450 immediately, the EA-450. However, if the driver fails to respond quickly to the warning, the EA-450 will set off an audible alarm sufficient to startle the driver.

During initial testing the EA-450 may at first seem less responsive than expected. The EA-450 uses Video Analytics to recognize the characteristics of fatigue and distraction, taking into account conditions such as facial motion and pupil dilation together with eye closure. The unit will not respond as quickly to eye closure where conditions associated with fatigue or distraction are not present. (i.e., significant movements or continuous talking immediately preceding eye closure). Under other eye closure conditions the unit will warn in about 4-7 seconds. The sensitivity and speaker volume are preset by the server for typical conditions. If local conditions require different settings, please contact technical support.



V. Power requirements

- Automobile power can range from 8 to 36 Volts, suitable for both 12V and 24V car batteries.
- Very low power consumption, average current is less than 100mA in 12V systems and 60mA in 24V systems, similar with leakage from the battery. A 1.0 amp fuse is optional. The absolute maximum voltage is 35 volts.
- Power should be disconnected when the vehicle is off.

VI. Attention:

- Do not open or repair the device.
- Do not operate the system while driving.
- Please handle carefully, do not drop.
- Do not use cleaning agents to clean the machine.
- Keep away from water or moist conditions.
- Do not rip, bend or squeezed the wiring.
- The EA-450 does not recognize a person who has only one eye, white eyebrows, rough scars or wrinkles around eyebrows.
- If the temperature in the car is too high the EA-450 may enter a sleeping mode to avoid damage, the system will re-start when cool.
- If the temperature is well below freezing, the device may not start immediately; wait for the cabin to warm up.



VII. Product History

Researchers at Carnegie-Mellon University, working with the National Highway Traffic Safety Administration, developed the PERCLOS algorithm to measure eye closure rates.

VIII. Special legal statement:

Driver fatigue alarm system is only a warning product, and does not absolutely guarantee your driving safety. Please be advised that EA-450 is not responsible for any driving accident.



Appendix 1: Software Commands

1. Software for EA450 RS232 communication, Version 1.6, Oct 17, 2013
 - 1.1. Voltage levels: +/- 12 volts (see MAX3232 spec).
 - 1.2. Baud: 115,200 bps, N, 8, 1
 - 1.3. Frame Structure

2 Bytes	1 Byte	N Byte(s)	1 Byte
Frame header	Command	DATA	CRC
Byte ₁ Byte ₂	Byte ₃	Byte ₄ : Byte _{N+3}	Byte _{N+4}

Table 1

- 1.4. CRC = SUM(Byte₁ : Byte_{N+3}) only report last Byte. i.e. AA 75 55 40 0D 01 15 0E 20 05. Converting Hex to Decimal , summing Decimal, Converting back to Hex
 - 1.4.1. (Hex) AA+75+55+40+0D+01+15+0E+20 = (Decimal) 170+117+85+64+13+01+21+14+32 = (Decimal) 517.
 - 1.4.2. 517 converts to **205** in Hex. Report **05** has the CRC
- 1.5. All values below are listed in Hex, 0xNN
- 1.6. Frame Header: AA 75
- 1.7. Commands:

Direction	Command	Data	CRC	Description
To host	51	00 04 51 51 51 51	B8	Fatigue Alarm has triggered.
To camera	55	Speed Year Month Date Hour Minute	calc	Send current time & speed data (every 10 seconds). Do not send while retrieving images. Speed: 00-FE, Km/hr, FF=no GPS Year: 00-FF, 2000+Year,

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				<p>2013=0D Month: 01-0C, Feb=02 Date: 01-1F, 18th=12 Hour: 00-17, 24 hour clock, 5 PM = 11 Minute: 00-3B</p>
To host	55	04 05 Idle MaxSpeed MinSpeed Status	calc	<p>Idle: 00-FF, minutes without detecting the driver MaxSpeed: 00-FF km/hr. i.e. 0x3C=60km/hr. A speeding warning is spoken when the speed received is above this level. MinSpeed: 00-FE, Minimum speed to start Fatigue monitor. Echo data from 0x85 command back to host. Status: Status byte Bit0: Dormant Bit1: Alarm blocked by MinSpeed Bit2: Alarm triggering, up to 15 sec. Bit3: Driver not detected, use to determine of camera is blocked or mis-directed. Bit4: Sensitivity, 0 = 2.5 sec, 1 = other Bit[6:5]: {Any, 20, 30, 45} km/hr min speed default.</p>



				Set to 11 = 45 Km/hr. Hardware default is used, only if MinSpeed=FF Bit7: Voice alarm sent for no driver detected
To camera	56	56 56 56 Type 00 00	calc	Type =0xF5 for Immediate image (CRC=6C), 0xF6 for last Alarm image (CRC=6D)
To host	56	Total PicSize 00 00 Type 0D Image	calc	Total: Two Bytes: total file size, 5+16+PicSize PicSize: Two Bytes: i.e. 0A 0C = 2572 bytes Type: 0xF5 for Immediate image, 0xF6 for Alarm image Image: Image data, JPEG, 160x120, compressed, < 4KB
To camera	8A	8A 8A 8A 8A 8A 8A	E5	Prepare camera for data
To camera	83	83 83 83 83 83 Sensitivity	calc	Alarm Sensitivity Control. Preceded by 8A Sensitivity: approximate delay time to alarm 02: 2.2 seconds 03: 2.9 04: 3.7 05: 4.5 06: 5.3 07: 6.1 08: 6.9 09: 7.7



				0A: 8.5 0B: 15 seconds FF: Factory default
To camera	84	84 84 84 84 84 Volume	calc	Volume Control. Proceeded by 8A Volume: 00: Speaker Off 01: Low 02: High FF: Factory default
To camera	85	85 85 85 85 85 MinSpeed	calc	Set minimum speed to alarm. Proceeded by 8A MinSpeed: 00-FE, km/hr. i.e. 0x14=20km/hr
To camera	86	86 86 86 86 86 MaxSpeed	calc	Set maximum speed (speeding) alarm. Proceeded by 8A MaxSpeed: 00-FF km/hr. i.e. 0x3C=60km/hr

Table 2

EA-450: Made In the USA and China

Booklet: Printed in USA