EYE-02 Mobile Security Camera

External powering , application note

Introduction

EYE-02 is powered from AC power and it has internal back-up battery. The back-up battery is suitable in case of AC power failure. Internal battery can operate the camera for approximately one day. When you use MIP detector the internal battery can operate the camera for about 10 hours. If you use also internal infra-red light to take pictures at night the back-up time will decrease to about 6 hours.

In remote locations where no AC power is available you can power the camera by external battery. You will need to replace the external battery from time to time. When such replacement is difficult (e.g. the location is hard to reach) you can charge external battery by solar panel.

Contents

1 Powering camera from external battery

1.1 Where powering from external battery will help

Monitoring construction site

Let us say your company does construction works in location where electricity is not available yet. You need to monitor the tools and machinery so that they do not get stolen at night. You will use EYE-02 camera powered by external battery. If there is any intruder at night camera will inform you about it.

You can also use EYE-02 as monitoring device. Camera will be sending you pictures every hour and you will see how the works are going on.

Picture 1: Camera monitoring machinery at construction site

Guarding wood in forest

Your company harvests trees in a forest. You need to store the logged trees for two weeks in a forest before you process the trees further. You will use the EYE-02 camera powered by external battery. The battery will be strong enough to power the camera for the two weeks until you transport the logged wood to the saw. If anyone comes to the wood logs you will know about it, camera will send you a report.

Picture 2: Camera monitoring wood logs

1.2 Camera configuration

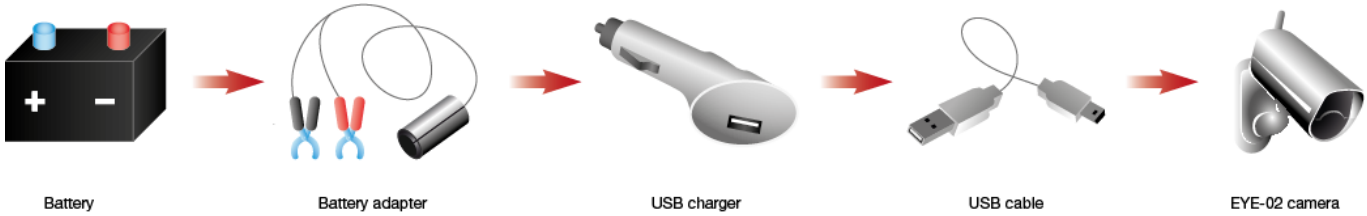
If you decide to to use your camera with external powering, first configure the camera.

a. Connect to your camera in www.jablotool.com;
b. Select **Settings**, **Advanced**, **Back-up & Restore**;
c. Select **Restore configuration** and load the file External-power.INI; loading the file will make these changes:
   Camera will detect motion by PIR detector, this will *Wake camera up*.
   MIP detector will be *Active after wake-up* by the PIR detector.
   Capturing video in Sleep mode and Pre-alarm recording will be disabled.
   Such configuration will reduce the number of unintended alarms and optimize the camera consumption.
d. Select **Settings**, **Change data plan** and confirm that camera can use data.

You can change the settings in JabloTool (select Settings, Advanced, Detectors). To enable pre-alarm recording of EyeSee follow the steps a. to d., in step c. load the file Pre-alarm.INI.

1.3 What you need

To power EYE-02 camera from external battery you need an external battery, battery adapter, USB car charger and USB cable.



Picture 3: Installation scheme of camera powered by external battery

1. Battery

We recommend deep-cycle lead-acid batteries. Deep cycle batteries (also called traction batteries) are more suitable for deep discharge than car batteries. How long will battery power the camera for? This depends on

a. Battery voltage; we will assume 12V battery.
b. Battery capacity; bigger capacity means longer period of powering the camera. Please note that battery with larger capacity is heavier (battery with capacity 100Ah weighs about 23 kilograms).
c. Camera consumption; higher consumption means smaller period of powering the camera. Camera consumption depends on camera configuration.

i. When you configure camera as we recommend in Chapter 1.2 you will calculate the battery capacity by this formula:

$$Battery\ capacity = Days * 2$$

Example: To power the camera for 10 days you will need battery with capacity 20Ah.

ii. When you use the recommended configuration and switch the MIP detector to *Always active* or enable pre-alarm recording camera consumption will increase. You will calculate the battery capacity by this formula:

$$Battery\ capacity = Days * 2{,}2$$

Example: To power the camera for 10 days you will need battery with capacity 22 Ah.

Needed capacity of external battery is higher in the second case. That is why we recommend the first option.

2. Car battery adapter

Connect adapter to the battery by alligator clips.

3. USB car charger

Connect USB car charger to the adapter. Car charger will convert the battery voltage (12V) to camera voltage (5V). You will plug USB cable supplied with the camera into the car charger. Camera will be powered via USB.

Picture 4: Battery adapter

Picture 5: USB car charger (5V)

Where to buy:

Deep cycle battery 12V, 26Ah – type HZY12-26EV, buy here

Car battery lighter adapter – up to 8A, Pro car BST KUPPLUNG, buy here

USB car charger – adapter from 12V to 5V, buy here

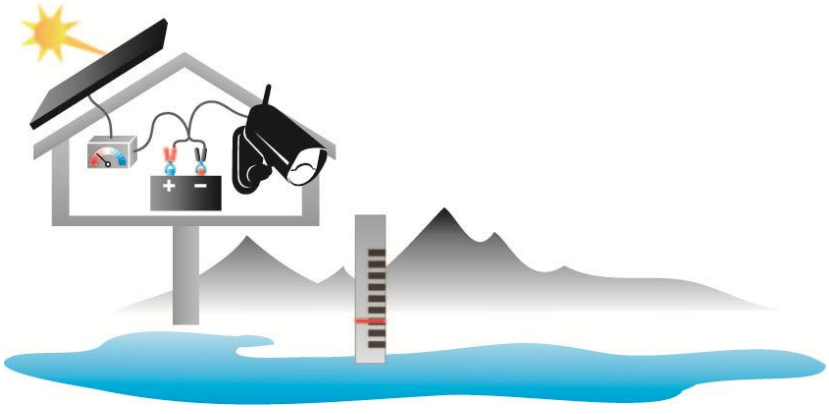
You can also find the parts in Google. Type the address of Google search engine in your country (e.g. www.google.co.uk), select Shopping and insert the description or type into the search field.

The USB connector at the back side of the camera is normally covered by rubber isolation. When you power camera via USB in outdoor environment we recommend to seal the USB connector by silicon.

2 Powering external battery from solar panel

2.1 Where powering from solar panel will help

Let us imagine that your company takes care of public rivers and lakes. You need to monitor the water level in reservoir up in the mountains. There is no electricity in the area. Powering the camera from external battery would involve a long journey to visit the camera and replace external battery. So you will power the external battery by solar panel. Camera will be sending you reports and you will not need to visit the location. Anytime you can look at the current picture from the camera.



Picture 6: camera monitoring water reservoir in mountains

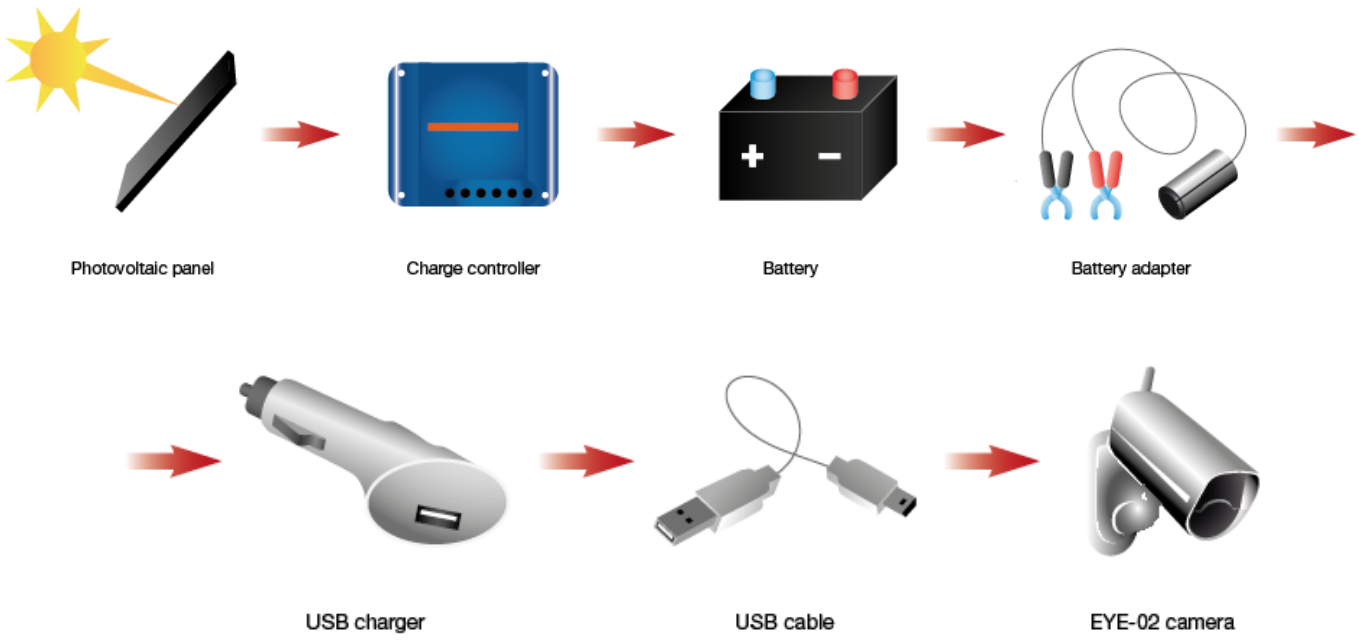
Protecting weekend cottage

You have a cottage which you visit during weekends. You do not have electricity there. Still, you would like to know about any intruders who may break in when you are away. You will install EYE-02 camera and power it from solar panel. If there is intruder in the cottage you will know about it. And you can connect to the camera remotely any time and see the current picture of your cottage or what the weather is like.

Picture 7: Camera in cottage powered by solar panel

2.2 What you need

To power camera from solar panel you need the same parts as for powering from external battery plus photovoltaic panel and charge controller.



Picture 8: Camera powered by solar panel: installation scheme.

1. Photovoltaic panel

Sometimes it is called simply “solar” panel. There are several panel types depending on what type of silicon cells it uses. But all of them use the same principle – they transform visible and invisible light from sun directly into electric energy. Solar panel should be able to power the camera for the whole year, even in winter when there is the least sunshine. In months with more sunshine the panel will also charge the external battery.

Find your location on the table below and you will learn how big panel you need.

Location	I_{opt}	P nominal $_{min}$ (W)	P nominal $_{opt}$ (W)
Athens	61°	13	17
Berlin	68°	46	62
Budapest	58°	31	41
Copenhagen	72°	62	82
London	71°	34	45
Madrid	66°	12	16
Moscow	68°	92	123
Paris	67°	31	41
Prague	62°	37	49
Rome	67°	13	18
Stockholm	75°	123	164

I_{opt} = Optimal inclination of the panel; all locations above are on the northern hemisphere, so the panel is always directed to the south. The inclination says how many degrees the panel is inclined upwards.

P nominal $_{min}$ = Minimum nominal power of panel in your location (in Wh a day). The panel will just power the camera in period with the least sunshine.

P nominal $_{opt}$ = Optimum nominal power of panel in your location (in Wh a day). The panel will provide power even when intensity of sunshine decreases below the statistical level.

We assume that camera is configured as we recommend in Chapter 1.2. In case the MIP detector is switched to Always active (in www.jablotool.com select Settings, Advanced, Detectors) or pre-alarm recording is enabled (select Settings, Advanced, Advanced video settings) the camera consumption will increase by 17% in comparison to recommended configuration. Then multiply the nominal power in your location by constant 1,17.

Solar panel will provide such power if it is not dirty and it is not covered by shadow or snow . If you use solar panel in location with snowfall make sure the snow does not stay on the solar panel. You can cover the panel by a roof. If your panel is covered by shadow you will need to use more powerful panel. The longer the time of shadow the more powerful panel you will need.

2. Charge controller

This unit controls flow of electricity between panel, battery and appliance. It also controls that battery is charged correctly.

Depending on how “clever” the controller is, it can also display how much the battery is currently charged, how much energy has been collected from the sun and other values that are useful especially in time when you are testing and adjusting your system.

We strongly recommend using charge controller with maximum power point tracker (MPPT). You will minimize the loss of energy which flows through the controller. Charge controllers with MPPT lose about 10% of energy, charge controllers without MPPT lose about 50% of energy.

Where to buy:

Solar panel (30W) –Victron Energy, SPM30-12, find your distributor here,

Solar panel (50W) – Victron Energy, SPM51-12, find your distributor here,

Solar panel (80W) – Victron Energy, SPM81-12, find your distributor here,

Charge controller – BlueSolar MPPT 75/15, find your distributor here.

3 Appendices

3.1 Camera consumption

When camera is configured as we recommend in Chapter 1.2 its consumption is approximately 0,75 W. We consider the following components of camera consumption:

Idle camera
Camera consumes electricity if it is in WATCH or SLEEP mode without doing anything else. We assume camera is outdoor and it is configured to Outdoor profile and it is switched to WATCH mode. PIR detector wakes camera up, MIP detector is active after wake-up. Capturing of video in Sleep mode and pre-alarm recording are disabled.

Infrared illumination
You probably use integrated infrared (IR) illumination at night. The consumption of IR light depends on how many hours you use it per day. Keep in mind you have to count on the worst situation – probably long winter nights. In the consumption we calculate with **16 hours a day** during which camera uses its IR illumination.

Alarm reports
In most situations you do not need to add alarm consumption to total daily consumption, because you do not expect that you will have unintended alarms. And possible real alarm caused by intruder can be easily covered from camera internal battery.

In rare case if you expect that camera will make ALARMs frequently (you watch gate and you want to register each car passing by in e-mail) you have to add also consumption for the ALARMs reporting. Multiply the value in table by number of alarms.

We assume that camera is placed outdoor. From time to time it makes alarm when for example animals pass by. We expect 3 alarms daily. When there is alarm camera sends the alarm report (300kB of data) to Cloud storage since its data is enabled in JabloTool.

We assume you will use Messenger to send SMS, MMS or emails from the camera. JabloTool Messenger will send these reports instead of the camera. For more information see Jablocom website.

Camera in recommended configuration	Consumption during one day
Idle camera in Watch mode	0,34 W
+ Infrared illumination active	+ 0,6 W per 1 hour of IR illumination
+ 1 ALARM report	+ 0,0006 W per 1 alarm report
Total	**0,75 W**

Example:

Camera consumption = IDLE + 16 hours of infrared illumination a day + 3 alarms a day

Camera consumption = 0,35 + 0,6 * 16 hours / 24 hours per day + 3 * 0.0006 = 0,75 W

The consumption of camera is 0,75 W**.**

Influence of MIP detector on camera consumption	
Daily consumption in recommended configuration	0,75W
MIP detector is Always active or pre-alarm recording is enabled	+ 0,13 W
Total	**0,88 W**

Permanent activation of MIP detector increases the camera consumption by 17% from 0,75 W to 0,88 W. We strongly recommend to use camera in its recommended configuration (see Chapter 1.2 for more information).

3.2 How big external battery you need to power camera

In Chapter 1.3 we showed how long an external battery can power the camera for. Using the formula below you can compute what back-up period your external battery should have.

$$\mathrm{B} = \frac{D * C * 24 * 1{,}25}{V} = \frac{D * 0{,}75 * 24 * 1{,}25}{V} = \mathrm{D} * 1{,}875$$

B = battery capacity (Ah)

D = how many days the camera should be powered for

C = camera consumption in recommended configuration (W)

24 = we multiply the camera consumption in W by 24 to obtain camera consumption in Wh a day.

V = battery voltage; we calculate 12V battery.

1.25 = constant that increases results is in equation because of losses of power in power adapter that converts battery voltage into camera voltage. Average efficiency of such adapters is about 80% so the battery capacity has to be 25% higher than the camera needs.

Example:

We presume that camera is configured as we recommend in Chapter 1.2 and we need that battery powers the camera for 5 days.

$$\mathrm{B} = \frac{5 * 0{,}75 * 24 * 1{,}25}{12} = 9{,}4\ \mathrm{Ah}$$

To power the camera for 5 days you will need battery with capacity 9,4 Ah.

3.3 How big solar panel you need to power camera

We computed the optimal inclination of panel[1]. We also know how much energy a 50W panel will produce during one day with average sunshine in each location[1] . We assume camera is configured in recommended configuration (see Chapter 1.2), so we can calculate the minimal and optimal power of solar panel for each location.

Location	I_{opt}	P location	P nominal min	P nominal opt
Athens	61°	145	13	17
Berlin	68°	40	46	62
Budapest	58°	60	31	41
Copenhagen	72°	30	62	82
London	71°	55	34	45
Madrid	66°	155	12	16
Moscow	68°	20	92	123
Paris	67°	60	31	41
Prague	62°	50	37	49
Rome	67°	140	13	18
Stockholm	75°	15	123	164

I_{opt} = Optimal inclination of the panel; these locations are on the northern hemisphere, so the panel is always directed to the south. The inclination says how many degrees the panel is inclined upwards. These values are computed for winter period when there is the least sunshine.[1]

P location = Average production of panel with nominal power 50W in the location during one day (Wh a day)[1]

P nominal min = Minimum nominal power of panel (Wh a day). The panel will just power the camera in period with the least sunshine.

P nominal opt = Optimum nominal power of panel (Wh a day). The panel provides power in access of the camera consumption. The panel will also charge external battery. Camera will remain powered even when the intensity of sunshine decreases below the statistical level.

To get the minimum power of panel for each location, we use the following formula:

$$P_{nominal\,min} = \frac{C * 24 * 1{,}4 * 50 * 1{,}5}{P_{location}} = \frac{C * 2520}{P_{location}}$$

C = Camera consumption (W)

24 = We multiply camera consumption in W by 24 to obtain camera consumption in Wh a day

1,4 = Constant of losses; about 10% of energy is lost in the charge controller. We recommend using charge controller with MPPT (maximum power point tracker). Charge controllers with MPPT lose about 10% of energy, whereas charge controllers without MPPT lose about 50% of energy.

About 25% of energy is lost when voltage from charge controller (12V) is transformed to camera voltage (5V).

1,1 * 1,25 = approx. 1,4

50 = the value P location corresponds to 50 W solar panel; to obtain the value for 1 W we need to divide $P_{location}$ by 50, which is equal to multiplying the fraction by 50;

1,5 = We calculate minimum alternative. The panel should supply energy by 50% in excess of camera consumption, we use constant 1,5.

Example of minimum alternative in Athens:

$$P_{nominal\,min} = \frac{C * 2520}{P_{location}} = \frac{0{,}75 * 2520}{145} = 13\,W$$

[1] Source: http://re.jrc.ec.europa.eu/pvgis/apps4/pvest.php

We will calculate the optimum alternative by increasing the supply constant from 1,5 to 2.

$$P_{nominal\ opt} = \frac{C * 24 * 1{,}4 * 50 * 2}{P_{location}} = \frac{C * 3360}{P_{location}}$$

Example of optimum alternative in Athens:

$$P_{nominal\ opt} = \frac{C * 3360}{P_{location}} = \frac{0{,}75 * 3360}{145} = 17\ W$$

3.4 Compute performance of solar system in your location

From previous chapters you know how to build your solar power plant in locations which we chose as examples. In this appendix you will learn how to compute the power of panel for your location. We computed the values based on Photovoltaic Geographical Information System. Follow its website http://re.jrc.ec.europa.eu/pvgis/apps4/pvest.php and select the tab Stand-Alone PV. In the example we use values in the optimum alternative ($P_{nominal\ opt}$) in Prague:

Enter your location	50.121”N, 14.343”E
Peak PV power (peak power of solar panel, see Chapter 3.3)	49 W
Battery voltage	12V
Capacity of your battery	100Ah
Discharge cutoff limit (level at which the charge controller should disconnect the battery)	0%
Module inclination (panel inclination; see Chapter 3.3)	62
Camera daily consumption (see Chapter 3.1)	C * 24 = 0,75 * 24 = 18 Wh a day
Orientation (orientation of solar panel); 0° stands for orientation to the south	0°

The system will show the percentage of days when external battery will be fully discharged and camera will not be powered. The system says:

Result for solar panel with power of 60W	
Number of days used for the calculation:	1827
Percentage of days with fully charged battery	84%
Average energy not captured due to full battery:	107 Wh/day
Percentage of days the battery became fully discharged:	0%
Average energy missing:	0 Wh/day

You can see that if you use the optimum alternative in Prague (49W panel) there will be enough power for the camera all year round. You can adjust the parameters and optimize the power of panel and battery capacity for your own location.

3.5 Powering EYE-02 camera in battery mode

Battery power mode extends the time for which camera is ON. When solar panel does not provide sufficient energy and external battery is discharged the charge controller will cut off the supply of electricity to the camera. Camera will then fall into „deep sleep“. When the power is recovered camera will return from the „deep sleep“ into normal operation.

Battery mode will extend the time for which the camera is powered by its internal battery. A fully charged internal battery can operate the camera in the „deep sleep“ for up to 30 days. However, number of camera functions is limited:

- Camera logs out of the GSM network. This means
  - you cannot reach the camera by calls or SMS commands,
  - you cannot connect to the camera in JabloTool,
  - Watchdog will report that communication with camera is lost.
- Camera switches off the radio receiver. It will not respond to the remote control (keyfob of Clicker), it will not communicate with other wireless peripherals;
- Camera sets its motion-in-picture detector (MIP) to be woken-up only by another detector. It means another detector must be activated so that MIP detector is woken up and active.

When there is alarm camera switches on the radio receiver and logs onto the GSM network for 2 minutes. It reacts to calls, SMS commands and remote control during these 2 minutes only. Once camera reports all alarms and answers all requests (e.g. SMS commands) it logs OFF from the GSM network and you cannot reach it from JabloTool, by call or SMS again.

To switch the camera to “deep sleep”, you need to set the Battery mode first.

a. Connect to the camera in www.jablotool.com
b. Select **Settings**, **Advanced**, **Advanced settings**, **Battery**.

Once you have set the Battery mode in JabloTool camera will switch to “deep sleep” when these conditions are met:

1. Camera is not powered by external source of power;
2. Camera has been in Watch mode for at least 60 seconds;
3. No detectors have been activated for at least 15 seconds;
4. No siren sounds for at least 15 seconds;
5. There are no reports to be sent.

If one of these conditions is not met then camera will return from “deep sleep” back to normal operation. This happens for example when external powering of camera is recovered or when you enter the watched area and activate one of camera detectors.

Battery mode** is not available for **EyeSee camera.