

# Avoiding Ground Loops in Vision Systems

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## About ground loops

Unsuitable connections can lead to different potentials between the camera system GND and the environmental shield/chassis GND caused by ground loops. This can damage the camera and the connected devices or cause malfunctions.

- Avoid potential differences between the camera housing and GND.
- All wiring must be done by authorized personnel, according to the corresponding technical standards.
- You may mount the camera electrically isolated.
- Read the description in this document carefully.

## Uncritical setup

Ground loops are a general risk of setups with any camera that is connected using non-isolated I/Os, such as GPIOs. However, an environmental setup is uncritical if no devices powered by PELV (Protective extra low voltage) are involved.

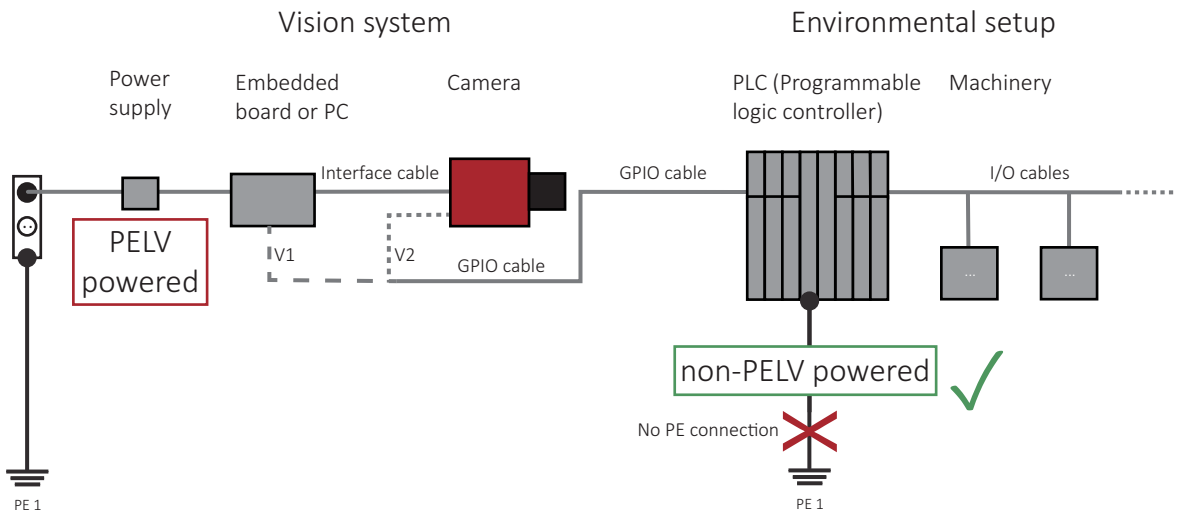


Figure 1: No ground loop in an environmental setup **without** PELV-powering

Gray line	Cable connection
V1	I/Os connect through the embedded board to the camera
V2	I/Os connect directly to the camera
<b>Black line</b>	PE ground

In [Figure 1](#), only the power supply for the embedded board or the PC is PELV-powered. Therefore, no ground loop is possible. The following section is about ground loops between PELV-powered devices and how to avoid them.

## Ground loop explanation

### Ground loops can occur only for camera applications including both

- PELV-powered devices in the vision application
- Use of camera GPIOs

With the figures on the following pages, you can easily recognize if ground loops may occur for your application.

## Abbreviations

PE	Protective earth
PELV	Protective extra low voltage
PLC	Programmable logic controller, such as Siemens SIMATIC

## Ground loop factors

<b>PELV power</b>	PELV power supplies are used to better protect the user from injuries and death. Power supplies used for embedded boards and PCs are PELV type.
<b>Camera ground</b>	Camera ground connects to <ul style="list-style-type: none"><li>• Camera chassis ground</li><li>• PE of the embedded board or PC that connects to<ul style="list-style-type: none"><li>- PELV power supply.</li></ul></li></ul>
<b>PELV devices</b>	PELV-powered devices in the environment of the machine application bear the risk of a ground loop.
<b>PELV ground</b>	The PELV power supply's output zero conductor is connected to the ground of the device. Through the line power supply, this PE conductor is connected to earth.
<b>High voltage</b>	On PE, high voltage up to 2500 V can occur, caused by, for example: <ul style="list-style-type: none"><li>• Machine defects in the environmental setup</li><li>• Friction from ground movements or moving machine parts</li><li>• Chemical processes in the ground.</li></ul>

## Ground loop risks

<b>Critical setup</b>	If a device of the environmental setup has a PELV power supply, it is connected to PE as is the power supply of the embedded board or PC; a ground loop is created.
<b>Material damage</b>	High voltage can destroy the camera or connected devices, such as the embedded board or PC, or peripherals.

## Setup causing a ground loop

### Ground loop: GPIOs and PELV devices

In [Figure 2](#), a camera uses non-isolated GPIOs, while PELV-powered devices are part of the environmental setup. In this case, avoid ground loops with a barrier isolator. See [Setup to avoid ground loops](#) on page 4.

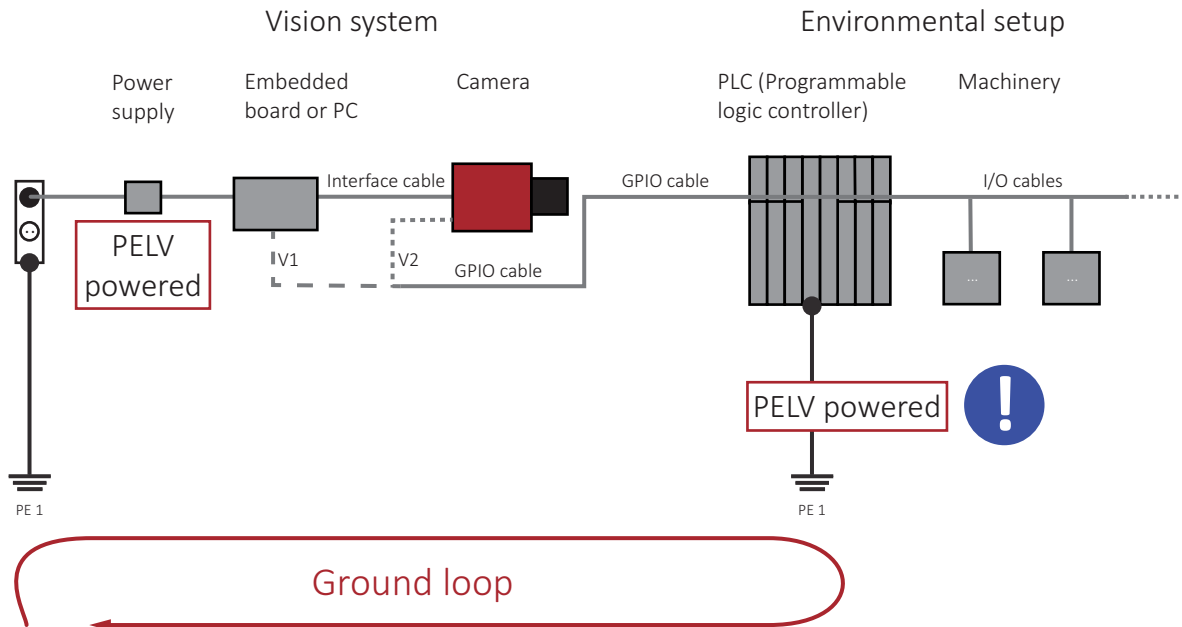


Figure 2: Ground loop when using GPIOs

<b>Gray line</b>	Cable connection
V1	I/Os connect through the embedded board to the camera
V2	I/Os connect directly to the camera
<b>Black line</b>	PE ground
<b>Red line</b>	Ground loop

## Setup to avoid ground loops

### No ground loop: GPIOs and barrier isolator

Using a **barrier isolator** is one solution among several solutions to avoid ground loops. In [Figure 3](#), a barrier isolator between non-isolated GPIOs of the camera and the environmental setup avoids ground loops.

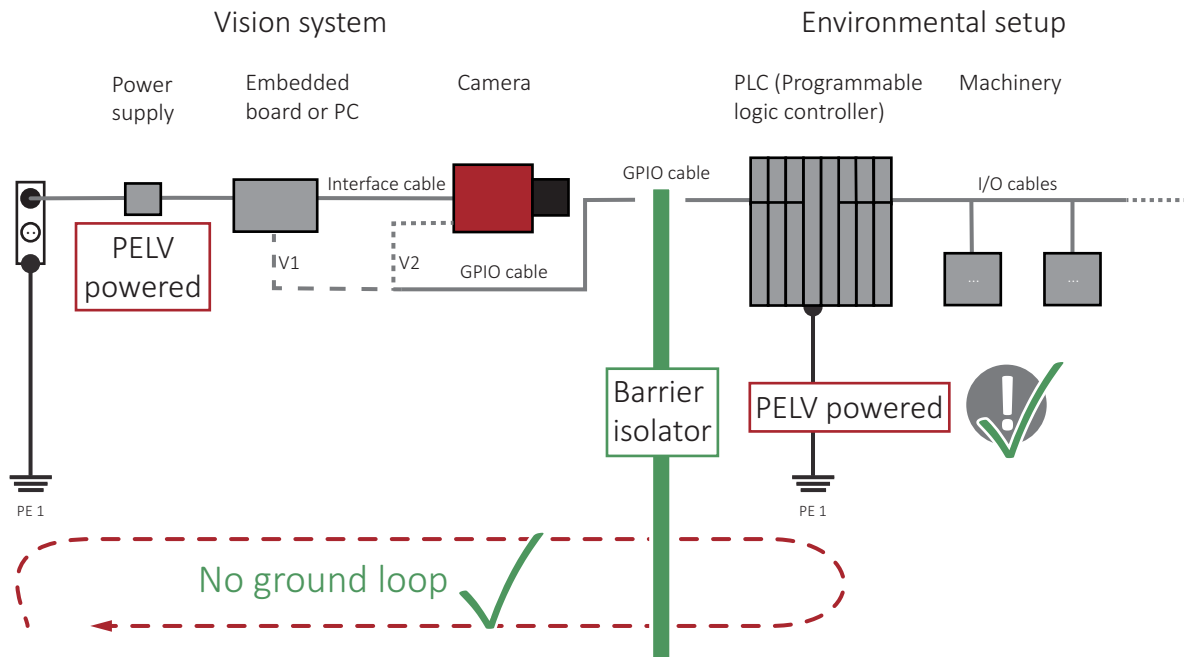


Figure 3: No ground loop when using GPIOs and a barrier isolator

<b>Gray line</b>	Cable connection
V1	I/Os connect through the embedded board to the camera
V2	I/Os connect directly to the camera
<b>Black line</b>	PE ground
<b>Red line</b>	Ground loop
<b>Green rectangle</b>	Isolator avoiding ground loops

## Contact

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