

Advantages of Power over Ethernet

The use of Gigabit Ethernet (GigE) cameras in industrial environments is rapidly becoming more simple and affordable. And for the first time, cameras that support Gigabit Ethernet also support Power over Ethernet (PoE). This functionality provides data and power to the camera over a single cable. When using PoE in GigE cameras it is now possible to create a simple, cost-effective camera system.

Based on their technical and economic advantages, cameras based on Gigabit Ethernet can be used in virtually any field these days. From a technical perspective, the advantages that have helped to make the Gigabit Ethernet interface so successful in recent years remain strong. Two characteristics in particular stand out and are worth mentioning: maximum allowed cable lengths of up to 100 meters and a high 100 megabyte per second data rate that supports high frame rates in all default resolutions. From an economic perspective, Gigabit Ethernet offers clear advantages due to the lower cost of the overall system. This cost advantage is accomplished via affordable standardized accessories and the often very attractive price positioning of Gigabit Ethernet cameras. And with Power over Ethernet technology, which is available for all Ethernet cameras, and particularly GigE cameras, even more savings can be achieved.

The One Cable Solution - Low Installation and Maintenance Costs

With Power over Ethernet, cameras can be connected with only one cable; the need for a separate power supply cable becomes obsolete. A single standard GigE cable can easily be used both to transmit power to the camera and to establish a network connection. Because the network signals and the power supply voltage travel down completely separate dedicated pairs within the cable, there is no loss in data bandwidth. Users no longer need specific, expensive cables for the power supply and this can result in a considerable cost reduction for larger camera systems.

In addition, the overall electrical design complexity of the installation is reduced because fewer cables must be used in the system. When the lower cable complexity is coupled with the automatic IP addressing schemes usually available, it means that a robust, multi-camera system is easier for a user to install and maintain. System costs can be minimized from the start

and future costs for maintenance and possible upgrades can be considerably reduced. All told, the system becomes more robust, reliable, efficient, and easier to maintain.

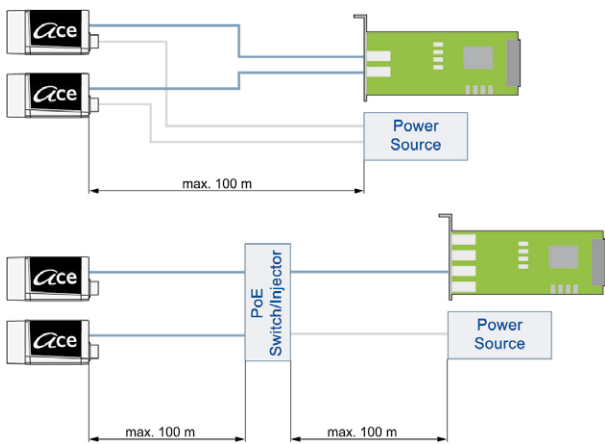
Flexibility for Robotics

One of the main application fields for the new PoE cameras is the field of robotics. In robotics, three things are important: easy and robust installation, low costs, and small size. Power over Ethernet meets the first two requirements from the start - only one camera cable is needed, so installation becomes easier and more cost effective. The size of cameras equipped with Power over Ethernet, however, has been an obstacle for a long time. But today, there are small GigE cameras on the market that match the footprint of the typical analog camera in use.

System Layout and Required Accessories: Injectors, Power over Ethernet Network Cards and Switches

In principle, the integration of PoE capable GigE cameras with a PC is very simple. A Gigabit Ethernet card or a Gigabit Ethernet port on the computer's motherboard is sufficient to make the network connection between a GigE camera and the computer. To provide the necessary power for the camera, an additional PoE power injector is required. This injector is placed between the camera and the computer and is connected using a standard GigE network cable. An injector typically costs about as much as the separate power supply needed by GigE cameras that don't work with PoE. This kind of connection can be used to connect a single GigE camera to a computer.

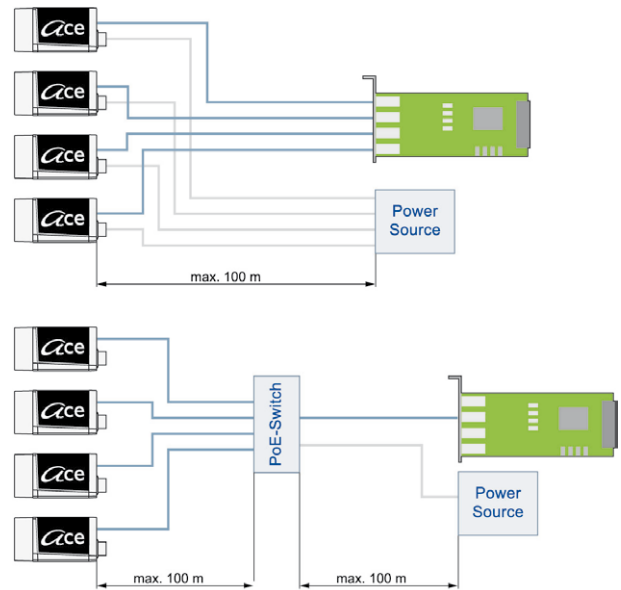
There is also a new possibility that uses dedicated expansion cards for the computer. These cards are supplied with voltage by the computer and provide Power over Ethernet connections directly to the camera, i.e., without the need for an additional injector. Currently, these cards are equipped with two Gigabit Ethernet ports, which means that more than one camera can be connected directly to a PC. Since the majority of applications need only one or two cameras, these PC cards are the perfect solution for a simple, cost-effective, one or two camera setup. At the moment, PoE Gigabit Ethernet cards are a bit more expensive than comparable cards without PoE. However, prices are expected to drop in the future.



Classic system layout with two cameras.

For systems with more than two cameras, network switches are a good option for connecting multiple cameras to one computer. Generally, many cameras can be connected to one switch, and in many cases, these switches provide 12 or more GigE ports. In the field, however, only four to six cameras can typically send image data at the same time when they are connected to a single switch. This restriction results from the fact that the bandwidth available to the switch is limited to the Gigabit Ethernet transmission capacity of about 100 Megabyte per second. In principle, more than six cameras can be connected as long as they do not all transmit images at the same time.

Network switches are also available with PoE functionality. In this case, the cameras are directly supplied with voltage from the switch. Even low-cost PoE equipped switches support automatic recognition of PoE capable devices such as a camera and will automatically supply power when it is connected. Although Power over Ethernet switches are slightly more expensive than switches without PoE, the overall solution is much more cost-effective compared to a conventional Gigabit Ethernet solution because no extra cables are needed for the power supply.



System layout using several cameras are often connected via network switches. Recently, network switches with PoE functionality have become available, making the need for additional power cables obsolete.

Result

Over the last few years, Gigabit Ethernet has become successfully established as the standard interface for digital cameras in the low cost camera segment. With the advent of Power over Ethernet technology, Gigabit Ethernet has become even more attractive as an interface for industrial cameras and is accelerating this trend. In particular, this movement is happening because PoE takes into account the strong pricing pressures inherent in the segment and considerably simplifies installation. Up to now, the need for only a single cable was a strong argument for FireWire cameras. But this advantage has been weakened by PoE, and PoE is opening new application possibilities, for instance, in robotics.

Advantages at a Glance

- Easy and robust installation
- Low costs
- Inexpensive Accessories
- Cable lengths up to 100 m
- High data rate of 100 megabytes per second
- High frame rates at all standard resolutions